TURFGRASS SOIL MANAGEMENT RESEARCH REPORT - 1994

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SOIL TEST CORRELATION STUDIES

Most new putting green turfs are established on high sand content soils, normally a mix of sand and peat. These soils have very low cation exchange capacities, usually 4 me./100 gm or less and very low surface area. The result is these soils hold very low levels of nutrients making it difficult to raise soil tests in spite of fairly high levels of nutrient applications.

Generally, golf course superintendents understand that potassium will leach readily from these sands. However, phosphorus levels in new greens are normally very low as well. There have been several reports of phosphorus deficiencies on new greens. Unfortunately, phosphorus deficiency could be misdiagnosed as a disease which could lead to application of un-needed fungicide. A deficiency of phosphorus results in slow growth with a dark green to purplish green color. The pattern of discoloration often takes on the appearance of a disease. If severe deficiency occurs the grass will have a tan color in the spring as turf comes out of dormancy. By late summer the dark green/purplish coloration may disappear until next spring.

The best approach with sand greens is to utilize soil tests for phosphorus. Most phosphorus soil tests on sand greens will be fairly low, particularly on young greens. Because the soil tests are low and sands do hold much phosphorus it is best to apply phosphorus regularly during the season. This is usually most easily done by using a complete fertilizer which contains some phosphorus. While we want to be sensitive to concerns about leaching of phosphorus in ground or surface waters, it is important to be sure the turf has enough phosphorus to establish quickly, provide a firm, sturdy sod and tolerate the stress conditions which will occur. It is not necessary to use very low rates of phosphorus to reduce the rate at which annual bluegrass encroaches a creeping bentgrass green. Phosphorus level has no impact on how fast annual bluegrass moves into the green.

When the research plot area was expanded in 1992 we established new putting green plot areas on a mixture of 85% sand, 15% peat built to U.S.G.A specifications. Soil phosphorus tests averaged about 4 lbs. per acre, a very low level. Clear phosphorus deficiency symptoms were evident.

A study was initiated to evaluate the effect of phosphorus fertilization on soil tests and turf quality of a newly established Penncross creeping bentgrass putting green. Treatments listed in Table 1 were applied in 2 applications annually. Treatment 1 receives no P; treatment 2 receives 1 lb. P_2O_5 per 1000 sq. ft. annually; treatment 3 receives 2 lbs. annually; treatment 4 receives 4 lbs. annually; treatment 5 received 4 lbs. P_2O_5 in 1993 only; treatment 6 is treated at the rate recommended by the Bray P_1 soil test; and treatment 7 is treated at the rate recommended by the Olsen soil test. Plot size is 4 ft. by 12 ft. with 3 replications. The green is mowed at 3/16 inch.

Quality rating data are given in Table 1. As the turf comes out of the winter the check plot is essentially yellow in color. There are deficiency symptoms on plots receiving lower rates of P as evidenced by the low quality rating data

in May. As the growing season progresses the turf gradually recovers in plots with marginal phosphorus levels so that symptoms are evident only on the check plot and for the lowest rate of P treatment (August 5 rating date). Then as temperatures cool the turf begins to show deficiency symptoms again. This pattern occurred in both 1993 and 1994.

Phosphorus soil tests (Table 1) indicate that the available P levels are all very low except for treatment 4 which tested at 32 lbs. P per acre after having received 8 lbs. P_2O_5 per 1000 sq. ft. over the 2 year period. Treatment 5, which was treated only in 1993 has a P level about equal to treatment 3 which has received the same P level as treatment 5 after 2 years. These data point out the importance of applying P regularly throughout the year on new sand greens.

The potassium fertilization studies have continued on creeping bentgrass, Kentucky bluegrass and annual bluegrass. Rates of application of K_2O are none (check), 4, 8, and 12 lbs. per 1000 sq. ft. annually which are split into 2 lb. increments spread over the growing season. These studies were initiated in 1990. Plot size is 5 ft. by 7 ft. with 4 replications. Soil samples are collected in early November each year and analyzed for available K levels.

Data for the potassium soil tests on the loamy sand putting green for 1990 through 1994 are given in Tables 2 and 3 for the 0-3 and 3-6 inch depths, respectively. Tests for the check plots have remained consistently low over the years. These K levels are very low and should approach deficiency levels although there has been no evidence of wilting or loss of turf density through the years. It is interesting that the tests for treated plots have fluctuated somewhat from year to year with tests in both the 0-3 and 3-6 inch depths being slightly lower in 1994 than in earlier years. It is assumed there was greater leaching of K as a result of higher than normal rainfall during the growing season in 1994. In spite of the highest rates of application at 60 lbs. K_2O total for the 5 years there is a maximum the soil can hold in this loamy sand green. The excess K is leached from the surface into the 3-6 inch depth and beyond.

Soil K tests for 1990-1993 in the Kentucky bluegrass potassium fertilization study are given in Tables 4 and 5, respectively for the 0-3 and 3-6 inch depths. Note that much higher K levels are found in this loam soil which has a much higher cation exchange capacity. Still, there appears to be a maximum amount of K which the soil will hold with the balance leaching downward in the soil. Similar soil tests were found for the annual bluegrass plots growing on loam soil.

While these soil test correlation studies point out there is a maximum amount of nutrient which can be held in the soil it is important to follow reasonable fertilization programs. Do not use the high rates used in these studies. For sandy loams, loams and other soils with more clay, soil test recommendations should be provide adequate K for the turf. For sands and loamy sands, soil tests are not particularly helpful in predicting needs for K. For these soils we suggest using a ratio between N and K_2O as a basis for determining needs for potassium. If low annual N rates are applied (3 lbs. or less) use a ratio of $1N:1.5K_2O$. That is, if there are 2 lbs. N applied for the year, apply 3 lbs. K_2O annually. For 4-8 lbs. N annually, follow a $1N:1K_2O$. If more than 8 lbs. N are applied annually, use a ratio of $1N:0.75K_2O$.

CULTIVATION STUDIES

A study initiated in 1989 to evaluate the effect of timing of cultivation of an annual bluegrass fairway turf was continued in 1994. At the initiation of the study the grass was predominantly annual bluegrass. The cultivation treatments are given in Table 6. In past years there has been little difference in the quality of turf observed as affected by treatment. In 1994 some differences began to appear. On May 24 the amount of annual bluegrass in the plots was evaluated. Plots which had been aerified just after seedhead production in about mid-June or in late Fall had the highest amount of annual bluegrass. Those plots with the lowest amount of annual bluegrass were the untreated check and plots aerified in the early spring. The reader is cautioned however, that it is not possible to be sure about whether the greater annual bluegrass populations were a result of treatment or random encroachment of bentgrass into the plot area.

In September, several of the plots were exhibiting wilting symptoms. Plots with the most wilting were those which were the untreated check and in mid-September. Normally, the September treatment would have been made by the date of these ratings, but with the wilting symptoms appearing this cultivation treatment was delayed until late September. Treatments with the least wilting were those aerified during high stress in mid-July and after seedhead production in about mid-June. Based on these data it appears that the plots which have been aerified more recently exhibit the least wilting. Whether this hold true in the future will be determined by additional dry down periods in 1995. Even if this response is consistent cultivation during the prime golfing season would be considered unacceptable by many golfers because of surface disruption by core cultivation.

TALL FESCUE FAIRWAY COMPACTION STUDY

In past years we have reported on the study to evaluate the effect of compaction on a tall fescue turf mowed at 3/4 inch and maintained under fairway conditions. Treatments include low traffic (3 passes per week with a vibrating roller filled with water); heavy traffic (6 passes per week); and an uncompacted check. At the initiation of the study

Another study was on how cultivation practices affect annual bluegrass encroachment on a creeping bentgrass putting green. There was no effect of cultivation on the amount of annual bluegrass after one year. Treating with the Hydroject increased ball roll 20 cm (8 inches) immediately after treatment.

Other studies include the effect of Hydroject and other cultivation on rooting of sod on compacted subsoil and another on was initiated in August, 1994, to examine the effect of Hydroject treatments on the rooting of Kentucky bluegrass sod. No treatment was effective in improving rooting in this first study.

In 1995 we will be looking for a putting green which has about a 2-inch layer of sand topdressing overlying a native loam or clay loam soil below. A practice putting green or a nursery would be possible sites. If a golf course superintendent has such a turf condition which we could treat, please contact Paul Rieke.

MANAGEMENT OF SOD ON SUBSOIL

One of the studies in which there is great interest is the management of Kentucky bluegrass sod growing on compacted subsoils. We had hoped to initiate treatments this year, but because of regular and heavy rainfall through much of the growing season we were unable to finish the final smoothing process before beginning the studies. This plot area is in a very low part of the field plots at the Hancock Center. Obviously the soil does not drain and water collects on one portion of this research block.

IRRIGATION MODELING

Charles Kome is finishing his Ph.D. degree utilizing the plot area originally developed by Mike Saffel. While this project is not currently being funded by MTF, the plot area was developed with funds provided by the Foundation. Charles is utilizing data from these plots to study irrigation programming with the use of several different irrigation modeling programs.

Table 1. Bentgrass Green Phosphorus Fertilization Study
1994 Quality Ratings

Treatment	May 2	May 24	July 15	July 28	Aug. 5	Sept. 19	Pounds of Phosphorus per Acre 0-3" Depth	
							Fall 1993	Fall 1994
1	2.0 c	1.7 d	2.0 e	2.0 d	1.8 b	2.0 c	3.7 b	4.0 b
2	6.2 b	3.0 c	3.0 d	4.7 c	5.0 b	7.0 ab	4.0 b	3.3 b
3	7.5 ab	4.3 b	4.7 c	5.8 b	6.8 a	7.0 ab	5.0 b	8.3 b
4	7.8 a	7.0 a	5.7 b	6.8 a	6.5 a	6.7 b	12.3 a	32.3 a
5	7.2 ab	7.2 a	5.8 b	6.7 a	6.3 a	7.0 ab	14.7 a	9.3 b
6	6.7 ab	6.5 a	6.2 ab	7.3 a	6.5 a	7.0 ab	14.7 a	26.3 a
7	7.5 ab	6.7 a	6.7 a	6.7 a	7.0 a	7.3 a	11.7 a	29.3 a

Means followed by the same letter are not significantly different at the 5% level using the LSD mean separation test.

Treatments Applied On July 27 And September 19 in 1994.