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Physical Condition of Putting-Green Soils and Other Environmental Factors Affecting Greens

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The grasses on putting greens from which samples were taken are growing in very different environments from course to course. The type and quality of management also differs from course to course. The poorest green of one course is poor for one reason or several reasons, while the poorest green on another course may be poor for other reasons. The quality of greens is due to several factors. No one test can be made and conclusions as to the quality of the green drawn from this test. "Best" and "poorest" are relative terms, and the poorest green on one course may be better than the best green on another course.

The percolation of water through soil cores from the best and poorest greens did not show a statistical difference. There was a tendency for the best greens to have a higher percolation rate than the poorest greens. The extreme variation in percolation through samples from the same green would necessitate taking more than duplicate samples to confirm this difference.

Aeration porosity is thought to be a critical factor in putting greens. There is a strikingly smaller quantity of large pores in the upper part of the green than in the lower portions. This is undoubtedly due to compaction. The large pore space is squeezed out. The effects of compaction on large or aeration pore space apparently do not extend below a depth of about 3½ inches. Any machine that would loosen the soil to this depth would be beneficial, providing a good soil condition exists below.

Coarse sand increases the large or aeration pore space of soils, and for this reason it is an important constituent of soil mixture for putting greens. It is true that the water-holding capacity of a soil is lowered with additions of coarse sand; however, it is thought that water-holding capacity can be sacrificed economically for an increase in aeration porosity. Green soils used in this study with 40 per cent to 50 per cent of sand larger than 0.25 mm. do not appear to be oversupplied with coarse sand.

When large pore space is measured in 2-inch sections, no difference is apparent in the best and poorest greens. However, when large pore space is measured in a soil core 8 7/16 inches long, the best greens show a higher porosity than do the poorest greens. This illustrates the necessity of studying as large a section of the profile as possible.

There was a close positive correlation of organic matter and total pore space; however, a negative relationship existed between organic matter and large pore space. The poorest greens were higher in both organic matter and total pore space than the best greens. No advantage was apparent in greens with a high organic-matter content as total pore space was sufficiently high in greens with a low-organic-matter content. Caution should be used in adding organic materials to soil mixtures for putting greens. Greens apparently offer an unfavorable environment for beneficial soil micro-organisms, and added organic materials remain largely inactive. The high water-holding capacity of organic materials is likely to cause water-logging, particularly where these materials are concentrated.

The moisture content of the green soils, when sampled, was near the wet-plowing limit of cultivated soils, the moisture tension being very close to a pF of 2. It is thought that this degree of wetness is close to that which is commonly maintained in greens. A soil so high in moisture would be easy to compact. This moisture content is probably higher than optimum for the growth of plants. Better water management would give better turf and at less expense.

There was a close negative relationship between organic matter and volume weight. Volume weight is not a good measure of compaction for this reason and perhaps for other reasons. The reduction in large pore space is thought to be a better measure of compaction.

The soils of the greens were generally sandy loams, although they were often poorly mixed. A difference in particle sizes of the best and poorest greens was not apparent. Perhaps the poorest greens of some courses resulted from poor texture while other reasons were responsible for other poorest greens. Definite conclusions as to the best texture for soil mixtures for putting greens cannot be drawn from this study. However, it is thought that an ordinary loam topsoil, with coarse sand added until about 50 per cent of the resulting mixture is coarse sand, would make a satisfactory soil.

Textural layers are very common in greens. Moisture curves of soil cores are generally very erratic; however, cores from the poorest greens usually have more erratic curves than have cores from the

COMING EVENTS

April 23-24: Turf Conference and Field Day, Southeastern Turf Research Center, Tifton, Ga. G. W. Burton and B. P. Robinson.

June 9: Field Day, Central Plains Turf Foundation, Boys Town, Neb. L. E. Lambert and Harold W. Glissmann.

June 16: Field Day, Oklahoma Turf Association, Oklahoma A. & M. College, Stillwater, Okla. Roy A. Chessmore.

August 17-23: Sixth International Grasslands Congress, Pennsylvania State College, State College, Pa. W. M. Myers, General Chairman, Plant Industry Station, Beltsville, Md.

August 20-21: Field Day, University of Rhode Island, Kingston, R. I. J. A. DeFrance.

September 3-4: Pennylvania Field Day, Pennsylvania State College, State College, Pa. H. B. Musser.

September: Field Day. Greater Cincinnati Golfers League and Cincinnati Golf Course Superintendents. (Date during week of September 22 and place to be announced.)

October 22-24: Third Turf Conference, Central Plains Turf Foundation and Kansas State College, Manhattan, Kan. William F. Pickett and L. E. Lambert.

December 1-3: Texas Turf Conference, Texas A. & M. College, College Station, Texas. James R. Watson.

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January 6-7: Turf Conference, Mid-Atlantic Association of Golf Course Superintendents and University of Maryland, Lord Baltimore Hotel, Baltimore, Md. E. N. Cory, Chairman.

February: 24th National Turf Conference and Show of the Golf Course Superintendents Association of America, Ambassador Hotel, Atlantic City, N. J. A. M. Brown, Box 106, St. Charles, Ill.

February 16-19: Turf Conference, Pennsylvania State College and Pennsylvania Turf Advisory Committee, State College, Pa. H. B. Musser.

best greens. The soil should be well mixed and free of layers. Moisture movement both up and down is hindered in layered soils.

The grasses of the best greens have a better root system than have those of the poorest greens. No conclusions could be drawn as to the effect of soil layers on the distribution of roots.

As a rule, the best greens are in more favorable locations than the poorest greens. In most instances air circulation is believed to be better around the best greens. More trees are found around the poorest greens, and tree roots are prevalent in these greens. If landscaping of a golf course makes it necessary to put trees near greens, the trees should be open types. Steps should be taken to see that all roots from trees are blocked from the green. Tree roots give the grass on greens much competition for water and minerals and make the control of these factors more critical.

The soil reaction is generally more alkaline or less acid than the optimum reaction for the growth of bent grass. Alkaline conditions are thought to be due to alkaline sand in topdressing materials and alkaline water for irrigation. The pH is higher in an area 4 to 8 inches from the surface than in an area 1 inch to 4 inches from the surface. It is also higher in the best greens than in the poorest greens. If a green is alkaline, acid fertilizers and acid topdressing should be used where possible.

Phosphorus is very high and potassium is low in most greens. This condition is probably due to the use of mixed fertilizer with a high ratio of phosphorus and relatively low ratio of potassium, as well as leaching and replacement reactions affecting the potassium supply. The phosphorus and potassium contents of the greens are positively correlated. Both phosphorus and potassium are higher near the surface than they are 4 inches to 8 inches down. Both are also higher in the poorest greens than in the best greens, probably because more fertilizer is applied to the poorest green in an effort to stimulate unhealthy turf. If mixed fertilizers are to be used on greens, one with a high ratio of potassium to phosphorus should be used. Perhaps a better solution is to use unmixed fertilizers as needed according to past experience or the results of soil and tissue tests.

The USGA Journal of June 1949 *reported results of study of cores of soil from best and poorest greens.*

Permeability of Various Grades of Sand and Peat and Mixtures of These With Soil and Vermiculite

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A review of the literature reveals that very little information is available on the permeability of mixtures of materials which are used in the construction of special-use areas such as golf greens. Since such areas are subjected to extreme conditions of management and use, information is needed on the effect of compaction on the permeability of materials that are used in their construction and maintenance.

During August, 1948, a preliminary survey was made on 10 golf courses in Oklahoma to obtain information on the physical characteristics of greens that have been in use for many years. The mechanical analyses of the samples collected showed that the average clay composition of the surface 6-inch layer was 5 per cent. Many of the greens contained less than 3 per cent of clay. Under these conditions it was not surprising to find occasional chlorosis, poor growth and moisture deficient areas.

Various soil-sand-organic mixtures have been suggested as being available for the growth of grass on greens, but little experimental information has been reported to verify these suggestions.

Since favorable air and water move-