When Should Golf Greens Be Aerated?

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WHEN should golf greens be renovated or aerated? This problem confronts some greenkeepers every season. It was discussed at the time of the Greenkeepers Short Course, Purdue University, February 26-28, 1945. The routine procedure for aerating the greens at the Elk's Country Club course at Lafayette, Indiana, was described.

Grass roots need oxygen to function properly and support a healthy turf growth. When the turf is properly fertilized the roots grow in proportion to the shoots and form dense mats on the greens. The greens are composted frequently, and this combination of composting and root mats creates conditions at times unfavorable for the best functioning of the roots. In addition some greens are not well drained. The grass in low spots on the greens may suffer at times. Ice and snow may accumulate in spots and under conditions of alternate melting and freezing, may affect the aeration of the roots and cause troublesome conditions in the greens soil adverse to the best functioning of the roots.

Importance of Cutting Turf Sod Annually

In order to minimize these troubles, the procedure used at the Elk's Club course at Lafayette, Indiana, is to thoroughly aerate all of the greens each spring by cutting the turf and roots in strips an inch and a half wide and approximately an inch deep. The device used to accomplish this cutting of the turf is shown in Fig. I, and its operation is illustrated in Fig. IA. It was originally used by Harry Allspaw, present greenkeeper at the Purdue University Golf Course. The machine was made by Truman Harvey, Dyer Road, Lafayette, Indiana. The contraption has paid big returns to the club in helping to maintain excellent greens during the past several years. Every year the greens-turf roots are cut and the immediate composting permits the rapid entry of air and

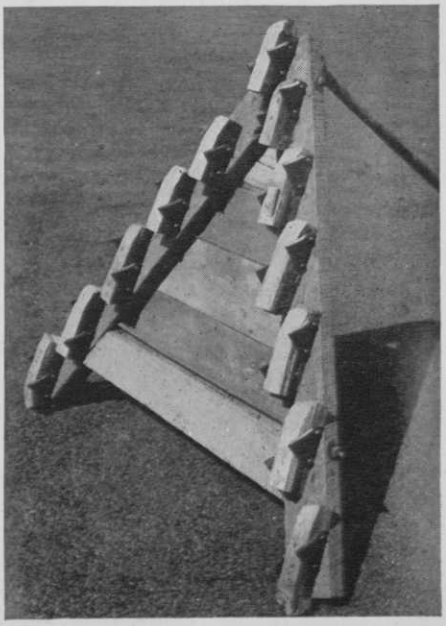

Fig. I.—Bottom side of turf cutter. Sickle bar blades are screwed to blocks 1½" wide and nailed to framework. The blades cut the turf approximately 1" in depth. The device is weighted down by a man who guides it as it is pulled across the greens by a long rope attached to a tractor. Light in weight it is carried back to starting point for each trip across the green. A swath of turf 36" wide is air conditioned each time across.

Fig. IA.—A tractor, moving backwards draws and helps to guide the turf cutter across the green.

water to them. All roots are within three quarters of an inch to these compost materials after this treatment.

How to Determine When Greens Soil Needs Better Aeration

In a recent article* the method for measuring the effective penetration of oxygen into soils is described. Although the method was used chiefly on corn soils, the technique is equally serviceable in studying soils under grass on golf greens or elsewhere. When diagnosing turf troubles presumably due to poor aeration, it is necessary to make comparative studies of the soil under good grass as well as the troubled areas. With a suitable soil sampler, Fig. II, obtain a soil plug from a good area and one from the affected area for the comparative study.

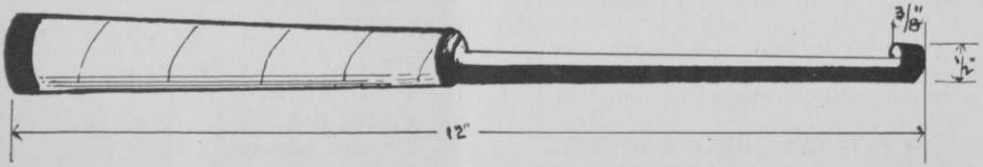

Fig. II.—This illustrates soil sampler made from grip end of discarded steel shafted club. Cut shaft 12" to 14" long. Remove grip cover up to within 6" and with emery wheel grind out section of shaft as shown. A 3/8" sharpened collar cuts the plug for soil tests.

Samples of the soil from each are tested for acidity and for available phosphates and potash. In addition quick tests for ferric and ferrous iron are made on samples from freshly exposed surfaces to determine the depth of effective penetration of oxygen (air) into the soil under the turf. In all soils there are compounds of iron which are relatively sensitive to supplies of available oxygen.

When oxygen in the soil is abundant ferric iron compounds are found. When the supply of oxygen is deficient it is lost from the ferric-iron compounds to the bacteria causing decomposition of organic matter and ferrous-iron compounds are found. Thus, when ferric iron only is found there is sufficient oxygen for the grass roots to breathe (respiration) normally as well as for bacterial activities. But when the ferrous forms of iron are found an oxygen deficiency for grass roots exists and *aeration* or *renovation of the greens soil is needed.*

Because of these interesting interrelationships between ferric and ferrous iron and the needs for oxygen in adequate amounts for the grass roots, tests for ferric and ferrous iron in the greens soils are used to indicate the sufficiency of oxygen for all needs. When greens are composted with organic matter and high nitrogen fertilizers in excess of the immediate needs of the grass plants, it sometimes happens during excessive watering of the greens in hot weather that the oxygen supply to the roots becomes inadequate to meet their requirements for respiration. As stated above, bacteria and other soil organisms which decompose organic matter compete with the roots for oxygen under poor drainage conditions and the roots are either suffocated or at least badly damaged. The green shoots above the affected roots then accumulate the sugars which should have been used by the suffocated roots. The shoots may become invaded by fungi — and these troubles above ground show up. We often treat with chemicals the above-ground portions of the plants for fungous troubles but overlook the more important parts, the roots, under ground. A simple procedure to diagnose these poor aeration soil conditions is as follows:

Chemicals Needed

The chemical test solutions required for these tests are:

Solution A—Hydrochloric acid (HCl). Dilute CP acid, one part acid to 4 parts distilled water by volume.

Solution B—Potassium thiocyanate (KCNS). Dissolve 10 grams potassium thiocyanate in 100 ml distilled water.

Solution C—Potassium ferricyanide. ($K_3Fe(CN)_6$). Dissolve 0.5 gram in 100 ml distilled water.

Place all three solutions in separate bottles with droppers. They must be ready for quick service.

Tests for Ferric and Ferrous Iron

The soil tests for ferric and ferrous iron must be made within a very short time on samples from freshly exposed soil surfaces on the "plugs" of grass and soil cut from the greens under study.

Prepare a soil sampling device as shown in Fig. II. Use a discarded golf club with a steel shaft and cut the shaft 12 to 14 inches from the end of the grip. Then prepare the soil sampler as shown in Fig. II. The end of the tube should be at least a half inch in diameter. Sharpen the end of the tube and leave a collar about 3/8 inch in width. With an emery wheel cut the tube open approximately half way and up to the 6 inch grip. By pushing this device into the turf and soil you will obtain a plug of soil for the aeration soil tests. Remove soil samples, starting just below the grass mat, and test them im-

*G. N. Hoffer "Fertilized Corn Plants Require Well Ventilated Soils" Better Crops with Plant Food: 29, No. 1, January 1945, p. 6.

mediately for ferric and ferrous iron. You will note depth of root penetration, also the condition of the roots. Observe the layers resulting from the composting of the greens from year to year.

Test the samples one at a time from a fresh surface at each deeper level, by the following procedure:

1. Crease a 3 or 4 inch filter paper once.
2. Place two soil samples, approximately the size of a navy bean, on the filter paper as shown in Fig. III. Compress the samples and then add 2 drops HC1 test Solution (A) to each soil mass and fold paper back onto the treated soil.
3. Turn over the folded paper and test the wet underside of the paper at (a) with one drop of Solution B—(Ferric iron test); and one drop Solution C—(Ferrous-iron test) at (b). Fig. IV.

The results must be noted and recorded at once.

Fig. V. A reddish to deep red color at (a) indicates ferric iron. This means an adequate oxygen supply in soil for the grass roots.

Fig. VI. A bluish to deep blue color at (b) indicates ferrous iron. This means an oxygen deficiency for the roots. If both ferric and ferrous iron tests are obtained, the oxygen deficiency is relatively less important and the aeration difficulties may be more or less temporary.

Discussion of Tests

The importance of making the tests very quickly from newly exposed surfaces can be demonstrated by permitting additional samples to be exposed to air, particularly in the sunlight, for several minutes and then repeating the tests. A negative test for ferric iron soon becomes a positive one and shows the rapidity of the oxidation process in many soils.

When the tests for ferric iron are negative in the upper soil layers it indicates the need for soil renovation. Spiking the soil may correct the trouble. At the Elk's Club course it is preferred to cut the grass mats as described above.

These soil aeration tests along with the proper fertilization of the greens, as already described,* will contribute much to the understanding of the functioning and growth of grasses under the terrific conditions prevailing on golf greens where all of the traffic is concentrated during the playing season.

*Fertilizing Golf Greens—by G. N. Hoffer. Mimeo release from American Potash Institute, Inc., Branch Office, Lafayette, Indiana.

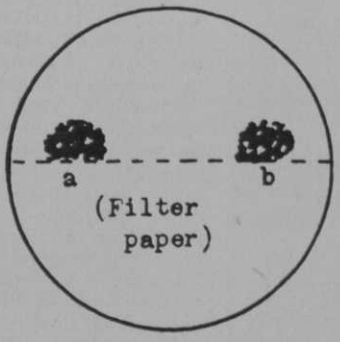

Fig. III.—Place soil samples on crease at (a) and (b). Add two drops acid-A to soils and fold tightly across center indicated by dotted lines.

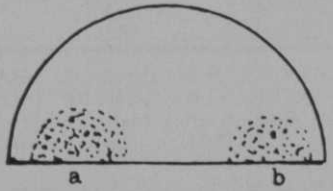

Fig. IV.—To wet areas apply one drop Sol. B to (a), and one drop Sol. C to (b).

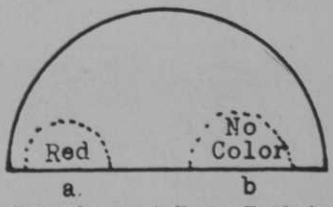

Fig. V.—Red color (a) indicates Ferric iron GOOD AERATION.

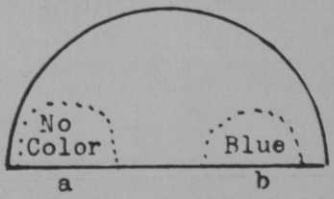

Fig. VI.—Faint red or no color at (a) and blue color at (b) indicates Ferrous iron . . . POOR AERATION.