

# Curing the Problems of Soil Compaction and Drainage

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Soil compaction, aeration and drainage are the more important problems which greenkeepers in many areas of the country have today. In the construction of most putting greens, for example, the architect usually provides adequate surface drainage to remove the water which would otherwise collect on the surface of the soil. He also uses the best knowledge that he has to take care of the internal drainage. In many cases the information has not been adequate to take care of all the situations that are involved.

It is now recognized that a continuous supply of oxygen has to be provided for most grass roots in turf areas if we are to maintain a healthy grass.

If soils are continually water-logged in the root zone, due to poor construction of the turf area, non-functioning tile, or a water table which is too close to the surface of the soil, an unhealthy turf will result, which is subject to disease and many other difficulties.

Let us examine some of the troubles which arise as a result of poor aeration or too much water. No doubt many of you have had trouble with the growth of algae, especially on putting greens. The growth of algae on soil nearly always indicates an excessive amount of moisture. This small green plant forming a scum on the surface of the soil cannot exist except under such conditions. Algae does not grow on a soil which drains well and absorbs water readily.

Another thing that commonly occurs is the difficulty that we have with the micro-organisms in the soil. I am not sure but what this isn't one of the most serious difficulties with respect to poor aeration and poor drainage. The thing that happens to organisms—and the fungi—is that they do not function to the advantage of the grass if the soil is poorly aerated and lacks oxygen.

The grass plant is dependent upon a continual supply of plant nutrients, some of which are released in the soil complex by these microorganisms. Where there is a deficiency of oxygen we may entirely change the microflora in the soil.

Instead of having, for example, micro-organisms that convert ammonia and com-

plex nitrogen compounds to nitrates which are available to the grass, we may get a reversal of the process, where the nitrates which are present in a well aerated soil are converted back to nitrites, and even further down the scale of reduction, on down to ammonia and other products. A very small amount of nitrite in some of our soil may prove to be very toxic. We have observed this on a number of occasions. We have worked out techniques for determining or testing the nitrite content of grasses in soils, and we find that wherever we have a very small amount of nitrite present we may get what we call sun-scald, and we may have other difficulties occurring, and in many cases the killing of the grass.

At the Univ. of California, Berkeley, in Dr. Hogan's laboratory, he was able to show that plants lacking adequate oxygen supply were not able to absorb potash. This is another one of the elements in which we are very much interested in our fertilizer. They have shown in Dr. Hogan's laboratory, and it has been proven in other laboratories as well, that when soils are waterlogged, if they lack oxygen, then the plant does not have the ability to absorb potash.

## Potash Solves One Problem

We have had golf courses in the Midwest where we have been able to apply potash in solution on areas which are badly waterlogged, and where the grass was showing what we chose to call sun-scald. We were able to spray a very weak solution of muriate of potash on some of those greens, and within just a matter of a few days they recovered. In other words, they turned dark green and the plants again became fairly healthy.

This, of course, is just a temporary way out of taking care of the situation. If you supply an excess of potash the plants are able to get enough of it to make their growth in spite of a low oxygen supply. It is true, I am sure, that many of our grasses have a greater tolerance for this type of condition than others, but our bents, which have naturally a rather shallow root system, where we are clipping them so close, are dependent upon the nutrient supply in the surface soil. By supplying in this case

a small amount of potash in solution, they recovered.

It is a very serious situation on some of our golf courses where waterlogged soils exist.

It is, therefore, quite clear that there are many difficulties associated with poor aeration, which makes it difficult for the greenkeeper to maintain high quality turf. The poor aeration may be due to the use of heavy clay soils on the surface, which are easily compacted or leveled, making them impervious to water.

Such a condition has been found to prevail on some courses on the West Coast, even under high rainfall conditions. Such a compacted zone on the surface may prevent the absorption of water below the surface inch or two of soil; this means that you have a saturated surface layer of soil quickly drying out after watering or a rain, with a reserve of water at greater depths.

This is a condition that frequently prevails on greens where you have those so-called dry spots. They are dry in spite of the heavy watering or rainfall.

Another condition resulting in poor aeration is a layer of very porous material close to the surface of the soil. This is one of the things that all of the soil scientists do not agree on, but I think it is one which

is very serious on many of our courses, is very serious on some athletic fields, and exists under other turf conditions.

We had the idea a few years ago that the way to maintain a good putting surface or a good turf area was to put a layer of sand, gravel, or some other material under our top soil. In many cases that top soil was put on only a few inches thick above the sand or gravel layer.

The thing that actually happens under those conditions, and is particularly serious on putting greens, where you are watering every day or every few days, or where you are dealing with a high rainfall region, is that the only water which will drain out of that surface soil layer is the free water. We have to get beyond the water holding capacity of that surface soil before the water will drain out of it. That simply means that the lower layer of that surface soil area is almost continuously saturated with water, particularly under putting green conditions.

In some cases where you have a layer only two or three inches deep, it means that you are going to have to water more frequently and you are going to have to keep that water supply just in that surface two inches. Grass will probably not be able to draw appreciably on the water which is in the lower soil depths, because



### NEW EXPERIMENTAL PUTTING GREEN AT UNIV. OF MASS.

On May 23, an experimental practice putting green with nine holes was opened for play by Homer C. Darling of Juniper Hill Golf Course, President of the Mass. Section of the New England Turf Association, and Dr. Dale Sieling, Head of the Department of Agronomy. As part of a comprehensive turf research project now being conducted at the University of Massachusetts, the putting green is designed for experiments with bent grasses under playing conditions. Over 1000 rounds were played on the green by faculty and students on the week-end following opening. (L to R) L. S. Dickinson, director of the project; L. R. Parkinson, pres., Amherst GC; Homer C. Darling, pres., Mass. section, New England Turf Assn.; and Geoffrey Cornish, ass't to Prof. Dickinson.

you have broken the water column in that soil by putting in a layer of sand or a layer of gravel, close to the surface.

A layer of sand or gravel put at sufficient depth, of course, may be very valuable to keep soils drained. The inner face between the surface layer and the gravel underneath will be continually saturated in your putting green conditions.

If that layer is only five or six inches deep on the surface, then the water holding capacity of that soil, or the amount of water which is in the soil in that surface layer, is always above the maximum porosity limit of that particular soil. You have to keep that surface layer wet in order to keep the grasses from drying out, but very seldom do you reach a point where you have enough oxygen in the soil to keep the grasses healthy. This is a situation, I think, that very frequently prevails on some of our putting greens.

### Tile Drainage Function

Tile drainage is considered essential under most conditions in turf areas. That is particularly true on putting greens. It serves to remove the free water from the soil, that which is in excess of the water holding capacity of the soil.

I don't think we ever need to get the idea that our drainage tiles are doing any more than just draining the free water, the water which is beyond the capacity of that soil to hold. We have had the idea in a good many cases that our tiles tended to suck the water out of the soil. I think that is a misconception. The only water which will enter the tile is the water which is beyond the water holding capacity of the soil. That is a very important fact to keep in mind.

Tile properly spaced and installed can be very effective in providing for proper aeration of the surface soil. If, on the other hand, an impervious layer has been allowed to develop in a turf soil, then water may never reach the tile.

It doesn't make much difference just how good that surface soil may be. If you have a condition where that water column is broken, and do not give the free water in that surface soil an opportunity to go down to the drainage tile, then your tile may be almost useless. In one case I was on a course in Indiana where we had had almost continuous rain for a period of a week, and the greenkeeper said, "I just can't understand why my greens are so wet." They were just as waterlogged as anything possibly could be. I said, "Where are your tile outlets?" We went over and examined about a half dozen of those outlets on his green, and there was not a drop of water coming out of a single one of them. That was after about a week of very rainy weather. Unless we have a soil condition which will permit water to go

down to the tile, then tiles are almost useless.

How to obtain aeration of some of these areas is sometimes a very difficult problem. The use of the spiker, and other similar tools have been used in the past, with varying degrees of success. A more recent piece of equipment is the aerifier, which will remove plugs of soil from a depth of five or six inches, and at a very rapid rate. That is one of the main advantages, I think, of this new tool, that you can get over a large area in a very short time. The removal of these plugs permits air to enter the soil, and frequently permits more rapid absorption of water. On putting greens a top dressing with a high sand content should be used so as to permit continued access of air into the soil.

Another thing done by the aerifier or any method that we may use, such as the hollow tine fork, is that if you have some of these layers that have developed in your greens over a period of years the aerifier or a similar tool will tend to break through those layers and prevent this water from accumulating in a saturated layer about five or six inches below the surface, or wherever those layers occur. —Address before 1949 NGSA Convention, Los Angeles.

### Greenkeeper Should Have His "Day" Says Manager Burke.

Pat Burke, mgr., Smethport (Pa.) CC, writes GOLFDOM:

"The GOLFDOM article in May on "Modern Greenkeeping Sets Stage for Golf's Future" gave me a real bang. I hope that in some way the article is responsible for a better deal for the men who give us today's marvelous greens and well trimmed courses.

"Golf's 'forgotten man' is truly the average greenkeeper. He is shoved in the background and seldom receives the credit due him.

"At most clubs we have Pro's Day, Caddy Day, and other 'days' and I wonder why clubs of fine and appreciative sportsmen don't have days for greenkeepers."

### Putting Green for Caddies

An all-star putting clinic featuring Johnny Palmer, Horton Smith, Jimmy Thomson, and local professional Errie Ball was the highlight of recent ceremonies surrounding the dedication of a special putting green for caddies only at the Oak Park (Ill.) CC.

The new putting clock for the caddies is an added feature of the complete caddy program at Oak Park being carried out in conjunction with the Western Golf Assn. and its national program for the betterment of caddy facilities at all member clubs.