"MAIR SOUND-HONEYMAN"

by Stanley J. Zontek Green Section Director, Northeast Region

This cry rang out for years from the wise ole tongue of Old Tom Morris, Superintendent of the famous St. Andrew's golf course in Scotland from 1865 to 1904. He was urging Mr. Honeyman, his foreman, to add more sand top-dressing to the greens. Even then it was understood that the better soil aeration and drainage resulting from sandy soils was better for all-around good grass growth . . . and golf.

It was true then and it is true now. All it took was several long decades for this information to filter down and be precisely identified and defined by soil scientists in terms of what is required for good putting green turf growth. These criteria are the amounts of sand, silt, clay, and organic matter needed to produce soil having good internal drainage, good aeration, water-holding capacity, bulk density, and proper particle sizes, all in proper balance.

These may well be part of the naturally occurring characteristics of the "links" and "green" land that make up the old course at St. Andrews. Remember, the natural soil there is greatly influenced by blowing sand and the natural sand dune accumulations, certainly not what makes up the native silt or clay-based topsoils in so many parts of this country. Loamy sand soils like this are seldom naturally occurring, especially over large areas, and if a soil like this cannot be found, then one must be made. Herein lies the basis of the USGA Green Section soil specifications for putting green construction.

It is interesting to note however, even today with our wealth of scientific and practical expertise on the subject, many people are still skeptical about rapidly draining very high (70 to 90 per cent) sand content soils. This is especially the case, it seems, in those areas of the country where the cool-season grasses are grown. This article will attempt to clarify this situation.

Why High Sand Content Soils?

Two of the most basic soil characteristics desired on golf course greens are good water infiltration and soil aeration. *The ability of water to move through a soil is imperative for good grass growth.* Good soil drainage and good soil areation usually go hand-in-hand. A deep, fibrous root system is usually a result of good soil aeration. Agronomically, the deeper the grasses' rooting system is, the healthier the turf. Compare this to shallow-rooted turf commonly experienced on heavy-soiled greens during the summer in many areas of the country. One can see and understand why shallow-rooted greens are prone to disease and wet wilt and must be carefully syringed and pampered to help "get them through" the summer stress period. Greens with good drainage and aeration, however, are *much* less prone to this type of injury and can actually survive the rigors of the summer season much easier than their heavy-soiled, slow-draining counterparts.

Other Benefits of Good Soil Drainage?

Simply stated, they are:

1—Less overall disease development.

2—Less frost heaving in the spring.

3—Less direct low temperature kill.

4—Less scald or wet wilt injury during heat stress.

5—Less soil salinity or salt accumulation problems in those more arid areas of the country where this is a problem.

On the other hand, poor soil drainage results in: a shallow root system; reduced turfgrass vigor and quality (more weeds?); poor soil aeration, increased disease activity; increased compaction; and greens slower to warm up in the spring. Some of these are interrelated, but the end result is usually the same—poor, expensive to maintain, hard putting greens with less than desirable putting surfaces during the peak summer playing season.

With golf turf management being what it is today, it is better to have more drainage in a green than not enough. You can always add more water to a green but you can't always get rid of it when you want to. Well-draining high sand soils do hold less water than their heavy-soiled counterparts, but this factor is no real management problem with modern irrigation systems in common use today. In reality, sandy greens may actually require less watering! With the grass' deeper and more fibrous root system, it has a greater reservoir area from which to draw water. Also, players are less likely to be disturbed by afternoon syringings.

What Are High Sand Content Soils?

Across the board recommendations on percentages of sand, soil, and organic matter in a putting green soil mixture is impossible. There simply is too much variation in the materials from one section of the country to another; indeed, from one sand pit to another. What is actually needed is a physical analysis of the materials on hand. It is essential if a predictable, well-performing putting green soil mix-

Matured soil nursery, prepared in advance of actual green construction using the same soil to desired sub-grade.

Stripping old green and removing soil to desired sub-grade.

Coarse sand layer being installed over the stone base continues to be an integral part of the construction procedure.

Ringing the green with plastic as an interface between native soil and new greens soil.

ture is expected. Such a soils laboratory supported by the Green Section, is located at Texas A&M University, Soil Physics Section, Soil & Crop Sciences Department, College Station, Texas 77843, under the supervision of Dr. Kirk W. Brown and Dr. Robert L. Duble.

It should be pointed out that the figures reported by the laboratory, especially those on infiltration rates, may be a little misleading. When a lab report says a particular putting green soil mixture will drain at a rate of four inches per hour, this is with no grass growing on it. With growing turf, this infiltration rate is effectively cut just about in half. Therefore, what initially may sound like a tremendous amount of water moving through a soil recommended by the lab report will, in the field, actually have a much lower infiltration rate in time.

One other point is interesting. As a Green Section spec soil mixture is prepared, extreme care must be exercised in the mixing. Every 10 per cent increase in the amount of silt and clay inaccurately added to the mix will again cut the infiltration rate in half. This is for every 10 per cent increase in silt or clay. It is therefore easy to understand why a soil mixture like the old standby 1-1-1 mix of soil, sand, and organic matter can cause summer problems. It simply contains far too much silt and clay for good internal drainage.

Experience Is A Good Teacher

Good soil drainage has been known and recognized for years in the more southern regions where the summers are regularly hot and humid. Experience *is* a good teacher. Bermudagrass greens in this part of the country had better drain well, because if they do not, grass simply cannot be grown on them. Where high infiltration rates do occur, good bermudagrass growth is the rule.

As the use of bentgrass on putting greens moves farther south, there is renewed interest in soils with even better drainage. Bentgrasses require greater infiltration rates than the bermudagrasses. If a particular green's internal drainage is not up to par, one can expect bentgrass problems during the summer.

Installing drain lines in the sub-grade.

Pea gravel over drain lines and sub-grade to form stone base.

Mixing tested Green Section specification soil for use on the new green.

Top soil spreading operation.

Final sodded green.

The rebuilding of greens may be necessary.

In the Transition Zone, good soil drainage is also critical. Depending on the season, one can experience either good weather with few turf problems, or else tropical heat and humidity. When this occurs, the extra water infiltration capacity of high sand content soils is essential if good putting green turf is to be maintained. In reality then, greens in the Transition Zone should be built to the same high water infiltration standards as more southern greens so that all weather occurrences can be readily handled. Many of the putting green turf problems in the Transition Zone can be directly traced to inadequate infiltration rates, especially during hot and wet summers.

In the northern cool-season grass regions, good soil drainage is usually considered not as critical as in the South or Transition Zones. At least this has been the general feeling. The summers seldom get as hot and humid or stay that way for as long a period of time. When it does occur, however infrequently, it is still difficult to accept turf loss on greens due to inadequate infiltration rates. Players are demanding better and better golfing conditions through the season and, weather permitting, even longer and longer golfing seasons. Better soil drainage is therefore becoming much more important and recognized in the northern areas of the country. Besides better summer performance, we believe it is a fact that greens built to the USGA Green Section Specifications can be used earlier in the spring and perhpas even later in the fall than other type greens. When heavy-soiled greens are wet and soft in the spring, high sand greens are firm.

Soil Mix Materials	Gravel >2 mm (>9 mesh)	Total Sand (9-300) mesh	Silt .002-.05 mm (<300 mesh)	Clay <.002 mm	Sand Fractions Very Coarse 1-2 mm (9-16 mesh)	Coarse 0.5-1 mm (16-32 mesh)	Medium 0.25-.5 mm (32-60 mesh)	Fine 0.1-.25 mm (60-140 mesh)	Very Fine 0.05-.1 mm (140-300 mesh)
	%	%	%	%	%	%	%	%	%
Sand	5.05	92.4	2.04	.51	7.9	21.0	46.7	14.8	2.0
Loam A	18.4	40.1	33.49	8.01	5.1	6.8	1.7	10.0	6.5
Loam B	2.4	42.9	44.93	9.77	4.2	9.0	11.2	9.8	8.7

% Ash = 14.6

Mixes examined (Parts in Ten) Sand	Loam Soil	Humus Amendment	Bulk Density g/cm³	% Pore Space Cap.	Non-Cap.	Infiltration Rate-Inches of H_2O	Percent Moisture retention At Pressure Indicated 40 cm atm	1/3 atm	2/3 atm	1 atmo	3 atmo	6 atmo	15 pH	Mix.
	Loam A													
10	0	0	1.44	21.0	24.5	8.5	14.5	.49	.69	1.2	.54	.52		6.9
9	0	1	1.39	24.2	23.3	5.2	17.4	4.7	2.6	3.0	2.2	1.6		6.5
8	0	2	1.24	29.3	23.7	3.4	23.7	4.7	3.8	4.3	2.9	2.4		6.5
8	1	1	1.38	28.7	19.3	3.2	20.8	4.4	4.2	4.8	3.4	2.7		6.5
7	1	2	1.32	34.7	15.3	1.2	26.4	5.3	4.2	4.5	3.1	2.5		6.3
	Loam B													
8	1	1	1.42	29.5	16.5	2.9	20.8	8.0	8.6	4.3	3.2	2.4		6.2
7	1	2	1.28	35.1	16.9	.68	27.6	6.7	6.5	6.3	5.0	4.2		6.3

[1]Lime values indicate rates of pure calcium carbonate (100% neutralizing value) uniformly incorporated to a six-inch soil deposit. Adjust rate of application according to neutralizing value of material used and depth of soil to which it is applied.

This can measurably extend the golfing season in many parts of the country. Where play is on a fee basis, this can be all-important for revenue. Furthermore, early play should not be overlooked by private clubs. Members always chafe at the bit in the early spring to begin playing their favorite sport. High sand content greens can be ready for them.

A Success Story

In the spring of 1972 the Shorehaven Golf Club, of East Norwalk, Conn., decided on a long-range program of course renovation, including the reconstruction of some putting greens. The club wanted to replace the old, small, poorly constructed greens (high silt and clay content) with new and larger modern greens. Hopefully they would be easier to maintain, better for year-round play, and also able to handle the increased wear and tear. The size and soil problems of the older greens usually manifested themselves in terms of weed infestations, thin summer turf, and overly firm greens. There was a constant struggle every summer. After due consideration it was decided to construct the new greens to the USGA Green Section Specifications. To achieve this, samples of readily available sand, soil, and organic matter were sent to the then USGA-supported soils laboratory at Mississippi State University (now at Texas &AM University) for analysis. The results of the testing are shown in Figure 1.

From this testing, a mixture of eight parts sand and two parts humus was decided upon, although the 9-0-1 mixture also met requirements. The 8-0-2 mixture achieved the desired soil physical characteristics because, if you will note, the sand and peat had sufficient silt and clay in it so the addition of soil was not needed. Since sands, soils, and organic matters vary greatly from one area of the country to another, an analysis of this sort is a service certainly well worth the money.

Once the soil mixture was confirmed and accepted, the program actually got underway. There was a desire to make the Shorehaven green reconstruction as painless as possible. To shorten the time to reopening of the new greens, a sod nursery was constructed beforehand. The same soil mixture was used in the nursery as on the new green. Soil layering and different soil textures were avoided. The good turf on the new nursery set the stage for the actual remodeling and reconstruction of the green and surrounding bunker area. Where there is concern by the membership over inconvenience from a rebuilding program, consider the Shorehaven approach of using a sod nursery and the same soil mixture.

In Summary

Today more than ever, consistently good putting green turf is the result of good soil drainage, aeration and good management. The USGA Green Section Specifications for Putting Green Construction provide the physical essentials.

This however, is not the end of the story. It is one thing to see and read about a green being constructed and quite another to learn how well it grew grass through the season. How will this type of construction and maintenance compare to the maintenance of the older, more heavily-soiled greens at Shorehaven? This question will be answered by the Golf Course Superintendent who is now living with this green—Robert Phipps. His comments will appear in the January, 1977, issue of the USGA Green Section Record after over two full years experience with observing and maintaining this green. Stay tuned! His comments should be interesting.