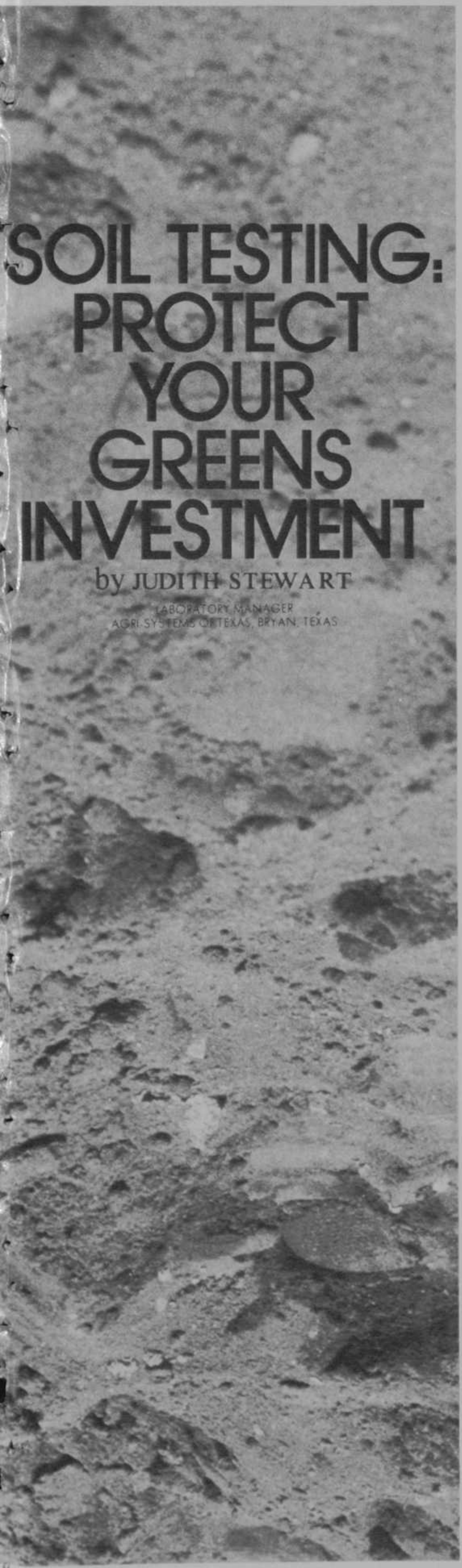

SOIL TESTING: PROTECT YOUR GREENS INVESTMENT

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Considering that $10,000 may be invested in one green, a superintendent should know enough about soils testing to realize its value

My occupation is the physical testing of soils and organic materials to be included in the top 14 inches of golf course greens. The usual reactions to this statement are: 1) Huh? or 2) Why? I answer the second question with an explanation of basic soil physics, a brief statement on the proper culture of turfgrass and the disclosure that an average green costs $10,000 and a bad seedbed mixture can make it useless within a few months.

It would be nearly impossible here to list all the factors involved in a soils analysis. Every situation varies. Two recent samples, one from the St. Louis area and one from central Texas, are typical of the problems we run into, so I will use them as examples.

The plastic-bagged samples from St. Louis included a very good sand, which is noted as expensive, a sand with too much material over 5mm. (but which is preferred, because it is cheap), an extremely silty soil, and bags of reed sedge peat and sphagnum peat moss. Incidentally, peat is the correct name for everything except sphagnum, which is a moss. The sphagnum is ruled out immediately; the fibers are too long to mix well and it breaks down more rapidly than other types of peat.

The first step in processing is to dry the sand and the soil. The soil is then pulverized. A mechanical analysis using the Bouyoucos hydrometer method reveals that it contains 41.7 per cent silt, 22.6 per cent clay and 35.7 per cent sand. There is too much silt in this sample. Clay particles will aggregate, forming a larger stable particle with less tendency to drift. Some silt particles will be enveloped in the clay aggregate as long as the balance is roughly equal. If there is considerably more silt than clay, as in this case, the clay will bind some of it, but the remainder will gradually be washed to the bottom of the seedbed mixture. There it will form a layer less permeable than concrete. Water ceases to drain properly and the grass dies. This can occur in less than a year after the putting green is completed.

In preparing soil for a hydrometer test, we use a dispersing agent that breaks down existing clay aggregates. If this procedure is not done, the aggregated particles will behave like sand in the tests and will be recorded as sand. We also use a malt mixer to help break down these aggregates. Our experiments have shown conclusively that omitting either of these steps can mean a difference of as much as 26 per cent in the figures. That is trouble in anybody's book.

During the two hour wait between the first and second hydrometer readings, the two sands are sieved. Our screens come in millimeter sizes, beginning with 5mm., 2mm., 0.5mm., 0.25mm. and 0.125mm., and a catch pan that holds material less than 0.125mm. A good sand to be used with a good soil should have more than 50 per cent of its particles in the range of .25mm. to 1mm. These two sands break down like this:

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Retained on:	Expensive sand	Client's preferred sand
5 mm.	.4	8.4
2 mm.	4.8	12.3
1 mm.	17.9	31.7
0.5 mm.	36.8	30.8
0.25 mm.	32.6	10.4
0.125 mm.	6.4	4.1
Less than 0.125 mm.	1.1	2.3
	100.0%	100.0%

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In this case, the more expensive sand must be used with the silty soil. I have talked to the man who sent the sample and have found that no other soils are available. Even if both sands were acceptable by the normal criteria we use, the more expensive one must be used for this reason. Picture a large container full of basketballs. Now drop a handful of marbles into the container. The marbles wind up at the bottom. Now picture the container full of golf balls. Drop in the handful of marbles. The marbles stay almost where they were dropped.

The free silt in the soil corresponds to the marbles. In the sand in which larger particles dominate, the silt will have nothing to slow its drift and will travel immediately to the place where it can do the most harm. With the other sand, the larger proportion of small particles acts the same as the golf balls. Another disadvantage in using the less expensive sand is the mixing problems that occur with its use. The larger particles will invariably wind up on top of the mixture, which creates mowing, cup cutting and maintenance problems. In this case, the more expensive is less expensive.

The only possible mixture for these samples is seven parts sand, one part soil and two parts peat, by volume. Acceptable silt-clay ratios in a finished mix range from 4 to 9 per cent. This mixture's ratio will be about 6 per cent: 4 per cent silt and 2 per cent clay.

The materials are mixed in these proportions, placed in collard cylinders, tamped and soaked. After soaking, they are placed on a tension table and left until the weight of the sample reaches a level at which it will remain constant. This condition of moisture approximates "field capacity." The cylinders are then compacted and the collars removed. Compaction creates conditions similar, but not identical, to those in a putting green eight to 10 years old. The balance of organic material would be different after this period of time.

The compacted mixture is weighed and resaturated. When total saturation is achieved, the mixtures are weighed again and are placed on a permeameter. After permeability rates have been measured, the samples are oven dried and reweighed. The difference in saturated weight and field capacity is the percentage of non-capillary pores; the difference between field capacity and oven dry weight is capillary porosity.

This mixture has a permeability rate of 4.94 inches per hour, large pores comprise 22.45 per cent, small pores equal 20.62 per cent.

The sample from central Texas presents a very different set of problems. The people who sent the sample are on a tight budget, the local soil is a very heavy clay, good sand is very expensive. So is the peat moss. They did have a dirty sand available, and a choice of composed cotton burrs or fresh sawdust for organic material.

What we call "dirty" sand can be found in almost every part of the country. We are sometimes lucky enough to find that such a sand has a silt-clay ratio within the limits set for standard mixtures.

This dirty sand tests out as 92.4 per cent sand, 3.6 per cent silt and 4.0 per cent clay. Nearly perfect. Of the organic materials, the composted cotton burrs are best.

This mixture will consist of eight parts dirty sand and two parts composted cotton burrs. This saves a step in mixing; there are no clay lumps, which are difficult to distribute properly, and it is inexpensive. The final figures on this mixture are 5.26 inches an hour permeability, 23.8 per cent large pores and 20.11 per cent small pores.

A word should be added here that the permeability figures assume that 5.26 inches of water per hour are put on a green at one time. This is rarely done. One of the effects of greens built to the USGA specifications is that the different textural layers fill almost completely before passing into the next layer.

This is a strange business, requiring equipment, skill, knowledge, a loud voice and a considerable obstinancy. And we do not have all the answers. We find new ones daily. But we have seen vociferous opponents turn to believers and good friends, and in 10 years we have never had a complaint where our advice has been followed. □