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SOILS FOR GREENS: THE PENDULUM SWINGS

After two decades, the consensus concerning putting green soil has shifted to an advocacy of 100 per cent sand. But despite the available data, the facts have not been fitted together to formulate a construction procedure that improves on the USGA specifications

Twenty years ago, the first putting green soils research was begun at Texas A&M University. Those first studies, carried out by Raymond Kunze as part of the research for his master's thesis, indicated the desirability of using much more sand than had been used previously in putting green soils. When this writer related the results of Dr. Kunze's work to groups at several turf conferences in 1956 and 1957, their reactions were extremely unfavorable. Many of the respected authorities in the turf field hastened to point out that there must be some faulty reasoning behind the results of these experiments, because common sense dictated that 80 per cent sand in a mixture was too much.

It was generally believed that the high sand content would cause greens to be hard, to be drouthy, to require much more frequent watering, to require much more fertilizer, to be slow to establish and to produce a weak turf. Many of these beliefs were at least partially justifiable, but the advantages of good drainage and a dry surface have outweighed the drawbacks associated with high sand content.

By 1960 enough research had been done to provide the basis for publishing an article in the United States Golf Assn. Journal describing a method of putting green construction in which porous soil mixtures were used. The method embodied the use of an underlying gravel layer to provide for quick drainage and a "textural barrier" provided by an interfacial effect between the soil mixture and the coarser underlying layer. This phenomenon of causing some gravitational water to accumulate above the interface where the two different textures meet helps to prevent drouthiness, excessive leaching of nutrients and, consequently, obviated the need for very frequent applications of water and nutrients.

This method quickly became known as the USGA Green Section specifications. It had been used widely in putting green construction and has been very successful.

Controversy stimulates additional research, and it seems likely that the controversy surrounding the validity of these early results may have been their most important contribution. A great many experiment station employees began their own experiments with soil mixtures. Inasmuch as fads or cycles operate with respect to the topics of research and scientific interest just as surely as they do in the world of fashion, it became the "in" thing to have a series of studies of soil mixtures.

Much valuable information has come from the studies carried out at Penn State, V.P.I., Michigan State, Purdue, Florida, Mississippi State, Texas A&M, Wisconsin, the University of California at Davis and other experiment stations. The great need now is to correlate the information from these sources and fit it into usable recommendations for the golf course builder.

Some of the research has dealt with amendments, some with sand particle sizes, some with methods of confining water in a sandy medium and some with the depth of the seedbed. Despite the amount of data available, the facts have not been fitted together to provide the basis for an entire construction procedure that represents an improvement over the method originally described in the USGA specifications.

The Purr-wick method described by Purdue investigators does represent a radical departure in construction procedures. It was predicated originally upon the use of a pure sand growth medium in which water and nutrients are confined within a plastic-lined pool. Thus, the only new method that has been propounded is now based on the other extreme, pure sand.

Based upon my experience, gained from evaluation of soils materials from all parts of the United States both in the laboratory and in the field, and upon experience, gained from green construction procedures during the golf course building process, I should like to offer the reader the following observations.

1. The USGA specifications continue to offer the only cohesive, workable set of procedures that have demonstrated the ability to

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provide consistently good results in the field.

2. Some deviations from the USGA specifications are permissible, if the builder is sufficiently familiar with water movement phenomena and the behavior of various soil materials. Examples: (a) The coarse sand layer that overlays the gravel blanket may be eliminated if the gravel contains a gradation of particle sizes sufficient to prevent soil materials from working down into the gravel; (b) depth of soil materials may be varied, if the texture of the soil mixture is changed—more porous mixtures must be shallower to prevent drouthiness whereas finer textured soil mixtures must be deeper to permit adequate drainage, which in turn evacuates large pores for the entrance of air.

3. In our experience of recommending soil mixtures, we have encountered a few complaints about slow drainage, but we have never had a complaint because water moved through a mixture too fast. As a result of our experience, we have tended to recommend even more porous mixtures. Hydraulic conductivity rates of five to seven inches an hour have been found desirable now, whereas our original top limit was 1½ inches an hour. The higher conductivity rates are necessarily accompanied by a shift in the pore space sizes. Non-capillary (large) pores increase in proportion to capillary (small) pores.

4. In many areas, naturally occurring sand deposits may offer a considerable saving to the builder. A "dirty" sand may contain sufficient salt and clay to permit its use without the addition of soil, if its natural silt-clay balance is in the range of 4 per cent to 9 per cent. Saving a step in the mixing procedure is very much worthwhile, particularly because the most acceptable soils, those with nearly equal proportions of silt to clay, are frequently difficult to mix evenly. There is danger in using a dirty sand without an analysis of particle sizes, however, because there is often enough silt and very fine sand to completely clog the

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drainage pathways.

5. Fine sands—those below .5mm. in diameter—seem to provide a more suitable medium for putting green growth than do the coarser, concrete grade sands. Large particles appear to cause damage from abrasion and bruising of plant tissues when traffic is imposed.

6. A variety of organic materials may be used. Peat of reed and sedge origin continue to be the standard by which other materials are judged. However, successful mixtures have been compounded using organic materials such as rice hulls, ground pine bark, composted cotton burrs, bagasse and well-rotted sawdust. Such materials are often waste products, and the chief cost is their transportation.

7. It is dangerous to guess at a soil mixture. An evaluation in a qualified laboratory will enable the builder or superintendent to know what is being put into a mixture.

8. Percentages of sand, silt and clay in a soil represent a starting point, but they alone are not sufficient to enable one to predict the behavior of a soil in a mixture. The plasticity of the clay is an important factor, as is the degree of aggregation of the particles. Insist on a complete test—not just a mechanical analysis.

9. After two decades of research effort by numerous scientists, we have noted a shift in concensus that spans the distance between ridiculing a suggestion that 70 per cent to 80 per cent sand would be needed in mixtures of some soils and an advocacy of 100 per cent sand in the Purr-wick method. It is my opinion that some soil in a mixture makes a worthwhile contribution. That soil may be a component of a dirty sand, mineral matter mixed with peat or it may be added as soil per se. We think additional experimentation will see the pendulum of opinion, based on facts, resulting from research, swing back to this position.

10. The fund of putting green soils information is growing, but there is enough available now to help formulate a soils mixture. One is foolhardy to guess, when he has the resources available which enable him to know. □

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