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RESEARCH, The Michigan Turf Foundation and You

by JOHN LABOSKEY — GENESEE HILLS GOLF CLUB

Scientific research cannot be expected to endure without enthusiasm and support.

Agreeing that this statement is essentially correct, let's put the words "Enthusiasm and Support", into prospective.

Enthusiasm, must be the ingredient to motivate those who would explore the vast unknown, to find the reason, why, of things. It is their interest, it is their love a mystery enthusiasm that brings to light those precious answers. It is they who spend many long and seemingly endless hours correlating all the facts and figures by which we the laymen may find our way. The final object of their enthusiasm is truth.

Support, is that part of anything which holds it into place, by fixture or by strength and courage. Support then belongs to those who are not equipped to carry out the action themselves. The supporter or benefactor in truth becomes the beneficiary.

The research program being animated at the Michigan State University under capable, enthusiastic people deserves the whole hearted support of those who benefit throughout the Turf-World. Those Golf and Country Clubs who do not at this time find themselves supporting the efforts of this research program, which directly effects their clubs' turf quality and playability, must in all conscience feel they are dragging their feet.

Anyone who grows or maintains a plot of turf-grass, for whatever purpose, whether it be ornamental or objective to some particular use are the direct beneficiaries of research development in this field. It is therefore imperative that these beneficiaries be the benefactors.

175th BIRTHDAY OF THE CONSTITUTION

WE THE PEOPLE **of the United States, in order to form a more perfect Union, Establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the Blessings of Liberty to ourselves and our Posterity, do ordain and establish this Constitution for the United States of America.**

Modification of Soils for Green Construction and Top Dressing

By H. B. Musser

Professor Emeritus

The Pennsylvania State University

Soil modification is probably one of the most controversial subjects we are likely to meet at the present time in the entire field of turfgrass production and management. It is not surprising that this should be so. In the first place, the physical condition of the soil has a major impact on the quality of turf that can be produced under the intensive use to which it is subjected on many areas. And, if I may be permitted to digress for a moment, at this early stage of the discussion, it is coming to be recognized as deserving consideration on less intensively used areas than greens and tees, tennis courts, bowling greens and athletic fields. Everyone who has had experience in the field of lawn building, sooner or later encounters the fetish of topsoil. It may be acid and low in fertility, in poor physical condition, or loaded with weed seed, but it is topsoil and therefore must be used. In many instances physical conditioning materials could be used to improve the existing soil material at a fraction of the cost and with better results than by applying 4 to 6 inches of so-called topsoil.

Coming back to the relationship of the physical character of soils used for construction and top dressing of intensively used areas, and particularly for putting greens, to turf production, let's look at some of the things that are needed to assure a good putting surface. 1st. **Resiliency.** A good turf cushion is needed and must be maintained to provide part of the give, the springiness, that is necessary to hold a well played shot. But the soil underneath also must contribute to this. If it is too tight and firm we will be faced constantly with demands to keep it soft with watering; with all the problems of shallow roots, increased disease, wet wilt, and the other troubles that are the heritage of a constantly saturated soil.

2nd. **Resistance to Compaction.** In golf course terminology, compaction is the dirtiest of dirty words. Just what is it? Technically, it is the rearrangement of the particles of the soil mass in such a way that water and air movement are restricted. To fully understand what happens, we first must appreciate that soil particles are of two kinds — the individual particles (as a grain of sand), and granules made up of very fine individual particles loosely cemented together into clusters by the humic (organic) matter in the soil.

All soils are subject to some degree of compaction when pressure or any other force that will cause re-arrangement of the particles is applied to them. The tighter the particles can be squeezed together, the more the size of the openings between them is reduced, and consequently the slower the movement of water and air through them.

Coarse sands, having relatively uniformly particle size, will compact least. On the other hand, a sand with a wide range in particle size, from coarse to fine, may get very hard. The finer particles will arrange themselves in the openings between the coarser ones and the whole mass can become very tight. Fine sands also compact severely. The particles are very small and, at best, the openings between them are restricted. When they are compressed, they can block water and air movement very effectively.

When soils that are composed largely of clusters of very fine silt and clay particles become compacted, their hardness and impermeability is due to the break-up of the clusters. The resulting fine, individual particles then pack together to produce an even more serious condition than develops with fine sand.

No soil will compact seriously when dry. There must be enough moisture present to lubricate the particles so that they can slide on each other. And the vertical pressure caused by walking and equipment is not the only cause of this movement. The thrust of shoes and the vibration of power equipment often are the worst offenders. Of course, heavy rollers will cause more trouble than light ones, but even the lightest equipment will cause particle movement and cluster breakup in wet soil.

3rd. **Permeability to Air and Water.** As previously noted, the establishment and maintenance of a good playing surface is directly related to the rate at which air and water can move into and through a soil. The extent to which it can be compacted must be considered in any program of modification to improve it, but this is not the whole story. If it were, we could handle it easily by using a pure, coarse sand for both the surface layer and top dressings on greens. Unquestionably, this would provide rapid absorption and movement of air and water. But we cannot afford to lose sight of the fact that our objective is to produce a high quality turf within practical maintenance limits. Too much and too fast air and water movement may complicate just as much as too little and too slow. We immediately run head-on into the difficulties of frequent watering to hold the turf, increased fertilization to compensate for higher leaching losses, and the practical difficulty of keeping enough moisture in the soil to avoid severe damage where winter desiccation is a problem.

The Nub of the Problem. It is generally conceded that most natural soils (except in rare cases) do not have the physical qualities that make them satisfactory for intensive use areas without modification. And so we come to the nub of the problem. How can we modify them so that they will have the needed resiliency and the greatest possible resistance to compaction, while retaining the ability to hold reasonable quantities of water and nutrients?

Must of us fully recognize the necessity of getting a satisfactory answer to this question. We understand the direct relationship between the quality of the soil used in the construction of a green and for top dressing, and the labor and expense of maintaining top quality turf. In addition, the number of new courses being built, of old ones being reconstructed, and the renaissance in the use of top-dressing — all have contributed to a recognition of the desirability, even urgency, of findng some sound basis for determining the kind and quantity of modifying materials that should be used.

In view of all this, it is only natural that efforts should be made to set up standards that would remove the elements of uncertainty and necessity for using personal judgment, from the preparation of soil mixtures. These efforts have centered largely on attempts to develop standard laboratory procedures to determine how a given soil mixture should be made. They are based primarily on the initial effects of varying quantities of modifying materials on the compactibility, porosity, water absorption, etc., of each soil that is studied.

Certainly, no one would question the desirability of having the best possible information on the material with which he must work. For example, a mechanical analysis of soil, showing the proportions of the various size particles in it and the extent of granulation, can be very helpful in determining the kind and quantity of materials that should be used to modify it. But it is useful only as a general guide and must be related to past experience and good judgment if it is to be worth anything. Whether an initial laboratory determination which seeks to set up arbitrary standards, based completely on the laboratory results, is the right answer, is subject to some very practical considerations.

1st. Will the mixture, as determined by arbitrary laboratory tests, act the same way in the field, when subjected to a wide range of environmental and use conditions, as it did in the laboratory? This is a question that can be resolved only by critical studies conducted over a long enough period to give us reasonable confidence in the results. In other words, we must have adequate correlation between laboratory results and what happens in the field.

2nd. Before laboratory results can be accepted as anything more than a general guide, we will have to have more assurance than we now have as to how long the recommended mixture will retain its desirable characteristics. Will a mixture determined to be optimum for compaction resistance, moisture, and air movement, etc., by an initial laboratory test, remain good under field conditions for a long enough time to make its use justifiable? Organic matter decomposes, soil aggregates break down, and so the entire character of the original mixture may change materially within a relatively short time.

3rd. The third practical question that must be considered is whether the extremely high quantities of sand or other inert materials that sometimes are recommended are realistic. Since it is recognized that as sand content increases, the ability of a soil to retain moisture and nutrients goes down, such recommendations attempt to compensate for this by adding organic matter and aggregated clay. As previously noted, the quantity and physical character of these materials may change materially within a relatively short time after they have been mixed into the soil. But an even more practical question is whether it might not be more desirable to accept the somewhat greater compaction which we know may come with a less extreme mixture. Such compaction usually is of a very shallow surface type and will be corrected readily by standard aeration and spiking operations. This could be less expensive and troublesome than attempting to keep moisture and nutrient levels in these extreme mixtures high enough to maintain good quality turf.

Good Judgment Still Necessary. Until such time as we have much better documented answers to such questions as these, a great deal of sound personal judgment still will be needed in determining just how a soil should be modified. Perhaps the best evidence for this, is in the hundreds of good greens on golf courses throughout the country, that have been functioning satisfactorily for years; none of which would meet presently proposed construction standards. And the further fact that where new greens have been built according to laboratory standards, about the same proportion are bad or mediocre as where construction was based on judgment and experience.

If we concede that we are not yet in a position to substitute arbitrary laboratory methods for good judgment and practical experience, then it almost goes without saying, that the more information we can have on what we are working with, the better chance we will have of getting good results. Let's look at some of the things that can be of help.

Mechanical Soil Analysis. Since particle size (texture) and their arrangement (structure) have such an important effect on compactability and other characteristics, it will help, in deciding on the amount and kind of sand that should be used, to know what is already in the soil we will be modifying. Obviously, a soil which already has 40 to 50 percent of coarse particles in it will not require nearly as large additions as one where the percentage is lower. This is easy enough. But what of a soil that has a high content of fine sand? We can go only so far in adding coarse material to it, without losing other desirable qualities. If we know what we have to start with we can still produce a good mixture by keeping down the coarse sand and increasing the organic matter percentages we use. The organic material will act as a cushion between the sand particles and keep them from packing too tightly.

Which brings us to the point of recognizing that there are two classes of soil modifying materials. Those that affect soil texture by changing the proportions of various size particles in it, and those that condition it, by cushioning it and increasing its moisture and nutrient holding capacity. Sand and peat have been the most commonly used representatives of these two classes, so let's take a look at them.

Characteristics of Modifying Materials. Experience and experiments have demonstrated that a coarse grade of sand, which is relatively uniform in particle size (from 0.02 to 0.08 inches in diameter) is materially better than finer grades, or an ungraded product in which there is a wide size range. The ungraded type is particularly undesirable, especially if it has any material proportion of fines in it. When it is subjected to compaction, the fine particles move into the opening between the coarser ones and the whole mass becomes tight and hard. If this is the only kind that is available, it would be very wise to re-screen it before use to remove the fine fraction.

Peats also vary in character and quality. Most of the domestic products on the market are reed-sedge forms, while most imported types are moss peats. Reed-sedge peats are the products of partial decomposition of reeds and sedges and the moss peats come from bogs where the sphagnum mosses were the principal original vegetation. The reed-sedge forms are preferred—particularly for use in top dressings. They are heavier and will not float out of mixtures as badly as the lighter moss peats. They have a lower moisture absorptive capacity and so less water is needed to keep soil moisture at the proper level. They are more resistant to decomposition and will 'stay put' longer. And, unless they must be transported for long distances, they are much cheaper.

A good reed-sedge should have a moisture absorptive capacity of around 450 percent by weight and a minimum organic matter content of 90 percent. This eliminates the sedimentary peats or mucks that we often find in local bogs. These usually are composed of very finely divided organic matter and have a high content of fine textured mineral soil. Material of this kind is worse than useless for soil modification.

Obviously, this discussion does not anticipate making even a suggestion as to the exact ratios of sand, peat, and soil, that should be used in preparing a mixture. This still must be a matter of experience and judgment, fortified with the best information we can get on the quality of materials that we use. It is doubtful, however, whether sand additions ever should be above 60 to 65 percent by volume, except in very extreme cases.

Experience has taught us that we cannot use nearly as high volume of peat. When we get much beyond 15 percent there is danger that the soil will stay wet too long and become soggy. An exception to this is where a very light sandy soil must be modified to improve its water and nutrient holding capacity. In such cases we may be justified in using as much as 25 percent peat.

Before leaving the subject of modifying materials it might be of interest to examine some of the other products that have been suggested or are being promoted as substitutes for sand and peat. Natural organic materials that long have been used in place of peat include sawdust, raw sewage sludge, manures, tannery sludges, and various kinds of seed hulls. With the possible exception of rotted sawdust, these decompose rapidly when mixed with soil and their effects are much more short lived than peat. They are most valuable when composted in large volume with soil before being used.

More recently, we have been offered such materials as quenched blast furnace slag, calcined clays, and processed micas. All of these have certain desirable characteristics. They are more porous than sand and so will improve moisture holding capacity. They are not subject to the type of decomposition that reduces the organic matter. Unfortunately, as yet we have little or no information on how stable they may be mechanically. If they lose their coarse granular character or original structure when subjected to compaction, they become a liability rather than an asset. Some of them are expensive and, if we find that they must be used at rates comparable to sand and peat, they will be out of the question, economically. There is only one way to answer these questions. This is to compare them critically with standard materials. An attempt is being made to do this at Penn State. The slide I now show is an all-over view of the establishment phase of a field study of some of these materials. It is hoped that this study will provide needed information on the value of these products and how they can best be used. Until the results of such studies are in, it is suggested that they be used with caution and only on a trial basis.

In conclusion, I think many of us feel that if mixtures could be composted before use, for a long enough period to produce a homogeneous soil, many of the difficulties resulting from fresh artificial mixtures would be materially reduced. This would permit the initial changes, which so often cause trouble, to take place in the compost pile or bed, rather than on a green. It would give us a much better opportunity to judge what we are going to end up with and help us to arrive at a formula that will do a good job. I fully realize that this may not be practicable on some courses, but commend it for your consideration wherever facilities are available.

from "TURF CLIPPINGS"

Michigan and Border Cities
Golf Course Superintendents Assoc.
RICHARD A. NAVARRE, *Editor*
1465 Square Lake Rd.
BLOOMFIELD HILLS, MICHIGAN

BULK RATE
U. S. POSTAGE
PAID
Permit #753
Pontiac, Mich.

Dr. Kenyon Payne
Farm Crops Dept.M.S.U
East Lansing, Mich.