Quality topsoil delivers best results

Quality soil makes the balance of site work easy in the short and long term.

by Paul D. Sachs

■ The soil in a new landscape application is like the foundation of a new building: if quality is overlooked at this stage, many problems will undoubtedly lay ahead.

Unfortunately, soil at a site is rarely specified to be improved in most contracts. The more common practice is to call for imported topsoil and lay it down four to six inches deep. This superficial fix can cause a malady called layering which disables the capillary movement of air and water through the soil.

Many years ago a scientist named W.H. Gardner found that the movement of water was abruptly inhibited by inconsistent layers of soil. His experiments (see Fig. 1) showed that a layer of topsoil applied to a subsoil with a significantly different consistency became an insufficient reservoir of moisture for whatever crop was planted. As the topsoil settles and/or compresses over the years, that reservoir shrinks. The topsoil may never integrate enough with the subsoil to permit proper capillary movement of water and atmosphere.

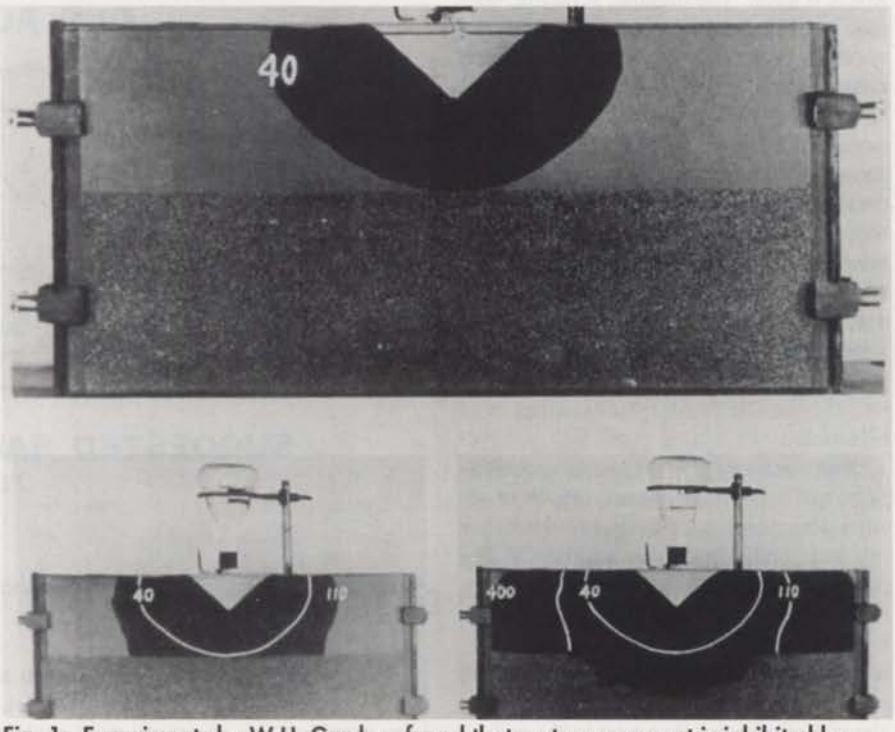

Fig. 1: Experiments by W.H. Gardner found that water movement is inhibited by inconsistent layers of topsoil. Numbers indicate minutes to reach saturation points.

During heavy rains the topsoil layer will become saturated with water before any drainage into the layer below occurs. This condition starves the roots of oxygen and stresses the plants. It can also cause denitrification which results in a loss of available soil nitrogen. When drought periods occur the field capacity of four to six inches of topsoil is often not enough to sustain the moisture needs of plants. Starting a site with this problem can be a warrantee of many more problems to come.

When replacing soil from an excavated site, the subsoil is oftentimes compacted by the repeated passes of heavy equipment. This also disrupts the flow of water and atmosphere through soil layers. However, controlling compaction during construction is often difficult. The remedy is to attempt a replication of the natural changes from subsoil to topsoil.

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As the level of backfilling approaches twelve to sixteen inches below grade, topsoil could be added and mixed with the replacement subsoil so that abrupt changes in the soil's horizons do not occur. This can be accomplished with a rotortiller, harrow, plow, or by premixing the subsoil with topsoil. As backfilling gets closer to grade (within eight to ten inches) a greater percentage of topsoil can be mixed with the subsoil. The last four to six inches of backfilling can be accomplished with straight topsoil.

This construction design provides more gradual changes in the soil's physical structure allowing better movement of air and water. Root systems of plants will have better drought resistance and easier access to soil atmosphere. This program may be more expensive in the short term, but can be much less expensive in the long term if some of the problems associated with layering do not occur.

In areas where backfilling is not part of the operation, some topsoil should be worked into the existing soil before the final 4-6 inch layer is applied. This transitional layer will mitigate the abrupt changes from poor soil to quality loam. The practice can also loosen the compacted rough grade layer.

The quality of the topsoil being imported is another area that should require more scrutiny. Topsoil is often ordered from suppliers, dumped, and spread without any question of where it came from or how rich it is in nutrients and organic matter. Some physical attributes may be noted by the contractor but it is usually related to the ease or the difficulty of handling the material.

Knowing the quality of topsoil might be analogous to knowing the quality of the concrete being poured for the footings of a tall building. The consequences of poor quality in either case could result in complete reconstruction at some point down the road. Without a soil test, the long

term success of a landscape is at risk.

Imported topsoil is often changed in the transition of where it comes from to where it goes. The digging, scraping, dozing, loading, transporting, dumping, and spreading of topsoil causes significant changes to its structure, chemistry, and biology. If topsoil is left sitting in a pile for any extended period of time, more of these changes will occur. Unfortunately none of these changes improve the quality of the topsoil. Organic matter is diminished, beneficial organisms such as earthworms and mycorrhizae fungi are all but wiped out, and the aggregation of soil particles is significantly lessened. If the topsoil was of poor quality where it was excavated, then it will be even less acceptable when it is delivered.

Soil testing. Too often site specifications call for lime, fertilizer, and/or other amendments without analyzing the existing soil conditions. This practice is like hunting in the dark, by discharging every round of ammunition in ones possession in the hope that some game will be hit. It is not a practical approach in terms of cost efficiency or in addressing any real deficiencies or excesses that exist in the soil.

Additionally, excess or unneeded applications of fertilizer can cause pollution which may have liability ramifications for the owner, the designer who wrote the specifications, and the contractor who applies it.

> Knowing how much organic matter is in the soil is like knowing how much fuel is in the tank of your automobile.

Conducting a soil test is a simple and inexpensive way to insure that the proper amount of soil conditioners are applied. However, if the soil samples gathered do not represent the overall soil conditions, the information from the analysis report will be less helpful than no information at all.

How to take samples. In any given area, it would be rare if two soil samples could be found, even if they were drawn a foot away from each other, that produced the exact same test results. So it is extremely important to get a good representation of the entire area being evaluated. The test results will only be as useful as the sample is accurate. Fig. 2 shows an example of a sampling pattern usually recommended to insure results that are relative to the overall condition of the area. The number of samples taken should depend on the size of the area. The more samples taken, the better the representation.

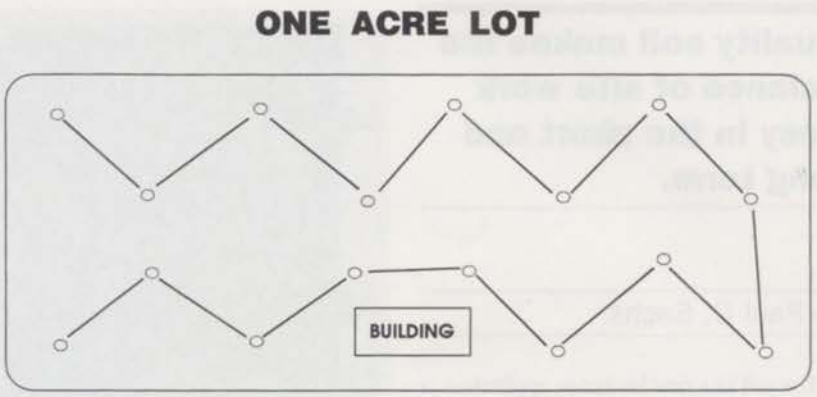

Figure 2

A sampling pattern similar to the one shown above improves your chances of obtaining an accurate soil analysis.

If imported topsoil is being used on a job it is a good idea to test a sample of it. Like anything else, there are good quality materials as well as poor quality materials. The same sampling procedure should be used on a pile of topsoil to get a good representation of the entire shipment.

Most labs offer recommendations either automatically or as an option that costs a little extra and are based on the data derived from the sample. Therefore, the lab recommendations are only as good as the samples taken. Recommendations are based on nutrient uptake of specific plants under average conditions. Normally, a lab will ask for more information such as type of crop, crop use, topography and previous treatments if they are to provide recommendations.

Organic matter. Organic matter is a barometer of soil health. The population of organisms that is supported by soil organic matter is of immeasurable benefit to plants. More organic matter means more decomposers that recycle nutrient from plant and animal residues faster; more nitrogen fixing and mineralizing bacteria; more beneficial organisms that help dissolve mineral, transport water from soil depths and help control pathogenic fungi; and more humus that increases the water and nutrient holding capacity of the soil. Humus acts like a sponge in the soil which expands and contracts as its moisture level changes. This activity within the soil creates porosity which improves the movement of air and water.

The test for organic matter, especially in a sample of imported topsoil, is important. Topsoil with an organic matter content of less than two percent in temperate regions should be considered an inferior quality material. Topsoils with four percent or more organic matter are superior and should be preferred in site specifications. Muck soils with twenty percent or more organic matter can be too much of a good thing. They can be soggy and difficult to work with and not an ideal growing medium for many cultivated plants.

As we move closer to the equator, high levels of organic matter in soils are more difficult to find and maintain because the warmer annual temperatures increase the biological activity that decomposes soil organic matter. However, this is not a reason to accept poor quality topsoil. Many suppliers are now mixing composted organic wastes into topsoil, increasing the percentage of organic matter. Beginning a job with higher quality topsoil, even in the warmer regions of the country, gives plants a better chance for long term survival.

Peat moss is also used as a means to increase the organic matter content of topsoil, and although it does lower the bulk density of the soil and provide porosity, it does not break down into humus very quickly and will take longer to provide many of the benefits of a stable soil organic matter.

An alternative to applying imported topsoil is the incorporation of high quality compost into the native soil. This practice enables one to improve the existing soil environment as opposed to creating a new one.

Adding compost will stimulate beneficial soil functions but it is important to understand that compost is not stable soil humus. Less than one percent of a compost application may actually become stable soil humus (depending on soil conditions, climate, and the way in which the soil is managed). If the top six to seven inches of soil weighs two million pounds per acre and the compost being used is 50 percent organic matter, then it would take 20 tons per acre to temporarily raise the soil organic matter by one percent. Heavy applications of compost (greater than 30 tons per acre) are not recommended unless it is incorporated into the soil because, like layers of topsoil, it can disrupt the flow of water and atmosphere through the soil horizons. Tilling or dicing in ample amounts of compost can change the quality of a backfilled subsoil into a medium that promotes vigorous plant growth without the occurrence of layering. Another advantage of compost over topsoil is that it usually contains little or no weed seed, negating the need for a herbicide application.

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Construction of the soil requires the same care of design and quality materials as any structure that is built to last. The proper structure and fertility of any soil is important if the quality of a landscape is designed for the long term.

Paul Sachs is founder and president of North Country Organics, a Vermont-based manufacturer and supplier of natural fertilizers, soil amendments and environmentally compatible pest controls since 1983. His book, Edaphos: Dynamics of a Natural Soil System, *examines ways in which Sachs believes human beings are linked to the ecosystem, and how that link determines the future of civilization. To order* Edaphos, *call (802) 222-4277.*