Organic matter accumulation in sand-based rootzones

I STUDIED SOIL ORGANIC MATTER (OM) ACCUMULATION for my Master's research project at Michigan State, and now I'm putting to use some tools based on what I learned to manage the sand-based athletic fields at Iowa State.

OM accumulation in a sand-based rootzone can lead to some serious issues when it comes to playability and water movement within the rootzone. As soil organic matter accumulates within macropores of the soil, a stratified profile is produced (small pores over larger pores) and the upper portion of the surface holds much water. Little oxygen exists in these water-filled pores and plant roots are not able to survive. This can produce relatively shallow root systems that create many problems. OM can increase nutrient and water-holding capacities, but pore stratification generally leads to shallow root systems that hinder playability. Unmanaged OM in sand-based rootzones will lead to a decrease in both drainage and playability.

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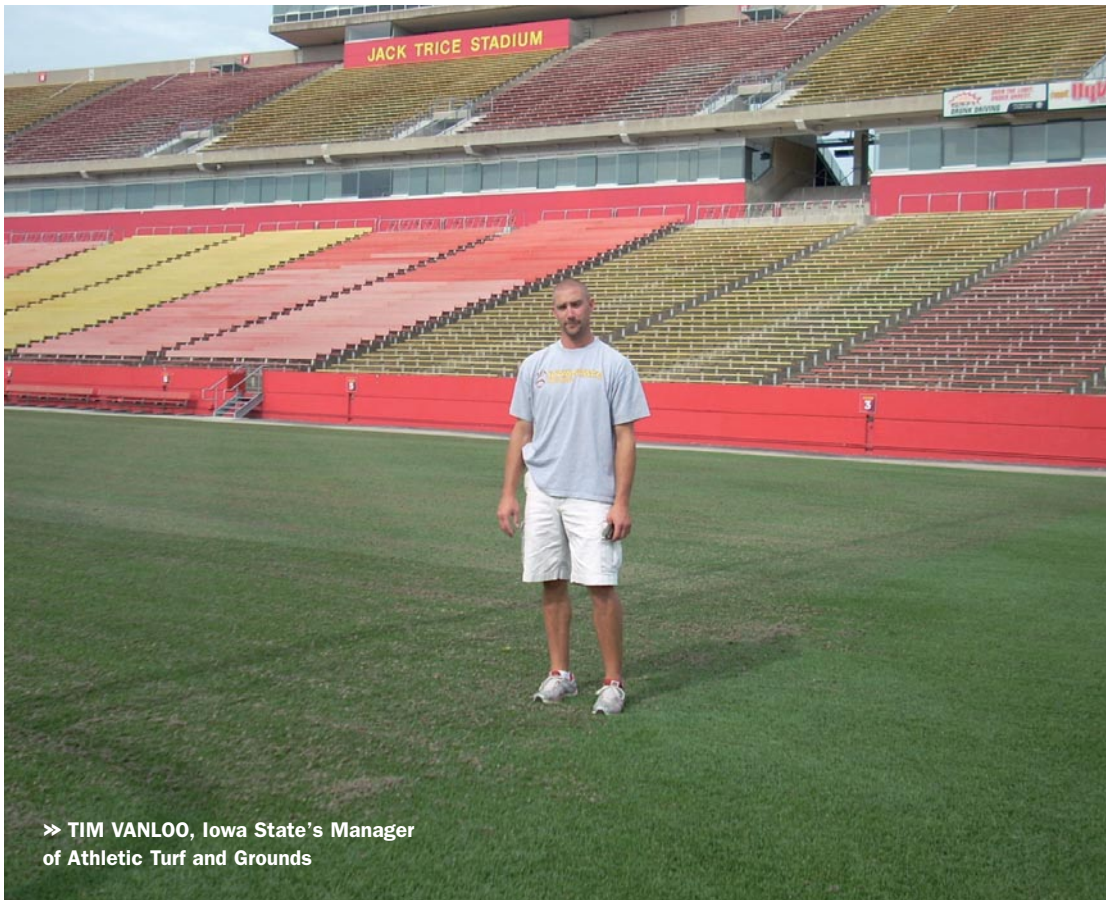

>> TIM VANLOO, Iowa State's Manager of Athletic Turf and Grounds

From spring 2004 through fall 2006 I studied the OM accumulation in two rootzones with Kentucky bluegrass growing on them. The first rootzone was USGA specification sand; the second was a blend of 75% USGA sand and 25% native soil producing a rootzone with 90% sand and 10% silt+clay.

To determine where the OM would accumulate in the soil profile of the two different rootzones, we took soil samples from the depths of 0-1 in., 1-2 in., and 2-4 in. in fall 2004, fall 2005, fall 2006, and spring 2006. To measure the OM in the soil three procedures were used: Loss on Ignition, Walkley-Black Method, and Carbon/Nitrogen analyzer. Loss on Ignition and Walkley-Black are commonly used procedures in Soil Testing laboratories and the Carbon/Nitrogen analyzer was used to represent relatively new instrumentation becoming more available. The different testing methods were used to compare the results by each procedure and see if one method made more sense for sand-based rootzones.

Figure 1 shows the relationship between soil depth and percent OM with an average of all three testing methods and both types of rootzones. Please notice the organic matter contents are relatively low since these are newly blended materials. We consider the baseline OM content to be somewhere between 0.2 and 0.3 percent as represented as the OM contents

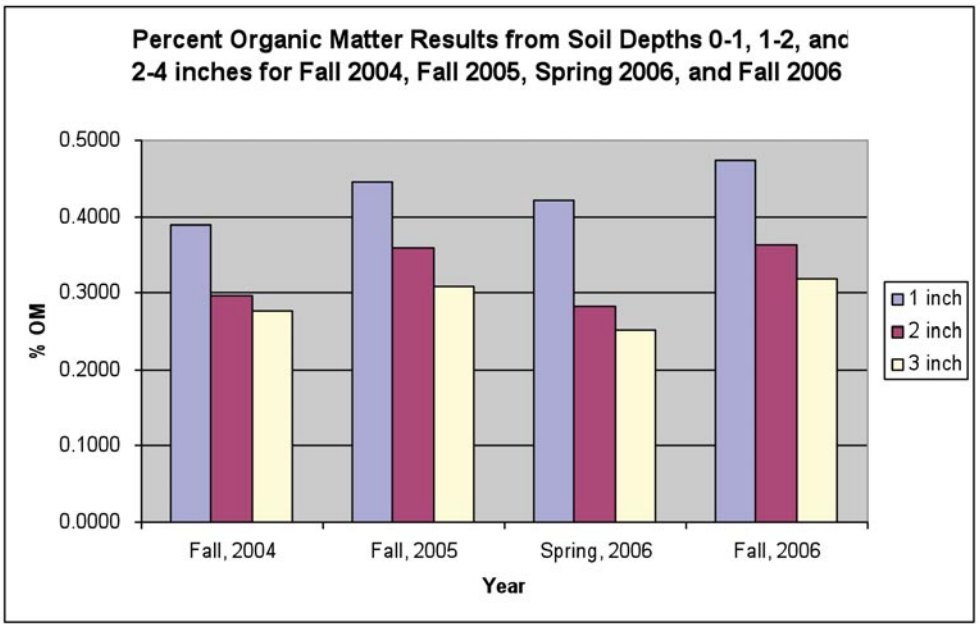

Figure 1

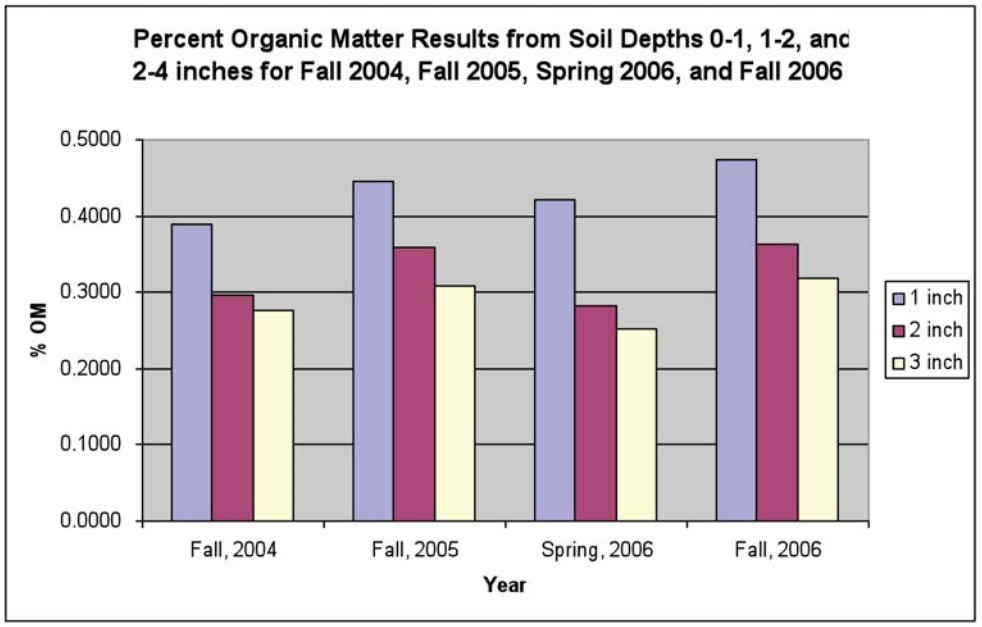

Figure 2

in the 2-4 in. depths. Values above that in the 0-1 in. and 1-2 in. depths we believe indicate OM accumulation.

Organic matter was higher near the soil surface. This makes sense because most of the plant roots are in the top part of the soil profile along with any grass clippings or dead leaf tissue. This is important information when dealing with OM in the soil profile and trying to manage it. If OM management is your cultivation purpose, than deep tine or solid tine aerification may not be the tool of choice. Core aerification followed by core harvesting will mechanically remove OM from the soil.

As I manage the sand based fields at Iowa State, I think about these results. Most of our cultural practices are geared toward managing the soil organic matter and consistency throughout the soil profile. We do this by aerating often in the top 3-4 inches. We always harvest the cores and topdress after. We do this to ensure that OM does not build up near the soil surface. By harvesting the cores we can gather some of the OM that has formed in the top layers of the soil. Sand topdressing afterwards will fill some of the aeration holes with new sand. Doing this often enough will maintain the initial root-zone properties. If you're able to this for the life of the field it should not fail due to OM build up.

Figure 1 also shows that over time OM is accumulating. Compare the fall test dates and you can see a small increase every year. The spring testing date does not follow that trend. It actually decreased from the previous fall. Without other testing dates of a similar time period it is hard to tell if this would be a consistent trend.

We can however come up with one piece of advice from that information. If you are to test for OM accumulation from year to year do so by testing during the same time every year to help produce a consistent data set.

Figure 2 shows the percent OM for the four testing dates with all three testing procedures. The methods were consistent throughout the duration of the study when compared over time. Loss on Ignition consistently tested higher on all sample dates. That doesn't necessarily mean it's not as good as the others, it just means you should stick to one testing method every year. Make sure you ask how your OM was tested and maintain that testing method over time.

I have had soil samples done at Iowa State and also when I was at Northwestern University. When each sample came back the first thing I looked at was OM percent. The very next thing I did was made a call to see how it was tested (neither had that information on the test). I have experienced Walkley Black and Loss on Ignition so far in my career. Understand that testing methods can give different results. Make sure you know what method your lab uses and make sure to stay consistent. ■

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