— REPRINTED FROM THE FEBRUARY 2004 ISSUE —

The Paste Extract

a soil management tool

by Joel Simmons

We have many tools to work with in our quest for good soil testing information, starting with the standard chemistry test. This test provides us with the basic "blueprint" of the soil and offers information on nutrients that are held on the soil colloid as well as organic matter, pH, nutrient holding capacities and base saturation. Chemistry test data, if evaluated properly, can usually generate sufficient information to development a satisfactory nutrient management plan for the site tested.

Physical or tissue tests are often used to further qualify any problems or concerns. Physical tests can reveal particle size issues and percentages of sand, silt and clay that can cause infiltration problems. The tissue test can indicate potential nutrient mobility deficiencies, although many factors such as weather and time of day can seriously affect the test results. In addition to physical and tissue tests, the paste extract test is used to identify, of the nutrients held on the soil colloid, how much is actually able to come off the colloid in the presence of soil solution.

"The water soluble paste extract can be used as a valuable tool in determining plant needs," according to Susan Shaner, director of Logan Labs in Russells Point, Ohio. " Many of our consulting clients use this test alongside the standard soil test on all sites they evaluate to help them gain more insight into the plant and soil relationship."

The water soluble paste extract is run in the laboratory using the same soil sample pulled for the standard soil chemistry test.

"The paste extract methodology is very similar to the standard soil test, but instead of using an acid-based extraction solution to draw nutrients off the soil colloid, de-ionized water is used," Shaner explained. "The soil is screened and ground in the same process as when preparing the standard test. The sample is then saturated with de-ionized water and a paste is achieved with a consistency similar to pancake batter. The water is then pulled through the sample using a vacuum system to assure complete extraction. The resulting extract is then evaluated through the Inductively Coupled Plasma Spectrophotometer (ICP, a nutrient evaluation instrument) and a report is generated," she continued.

Many consider the paste extract to be positioned somewhere between a standard soil test and a tissue test in function...

In the golf course and sports turf industries, the water soluble paste extract has taken on increased importance and value. The interpretive information that this test supplies is significant and can answer many difficult questions.

Most superintendents understand the basics of the standard chemistry test, the presence of deficiencies of the major and minor nutrients, and their balance as described through the base saturation. The standard soil test deals with nutrients on the soil colloid that are often held so tightly that little will become available to the plant even though they may be present in large quantities in the soil.

The paste extract takes this soil information and identifies what the plant has the potential to *actually take up* and utilize intra-cellularly. Since this is a soil-based test, the results are usually more relevant than the indications of nutrient mobility generated by a tissue test. MMany consider the paste extract to be positioned somewhere between a standard soil test and a tissue test in function.

The paste extract test result includes many of the same line items as found on the standard soil test, such as basic cations, anions and trace nutrients. Having been extracted with only water, the nutrient levels are listed in ppms instead of the more typical pounds per acre. Understanding how to read this test is critical.

It is not uncommon for standard soil chemistry tests to indicate high or even excessive levels of phosphorous or calcium on the soil colloid. A paste extraction test can determine that virtually no mobility of those nutrients exists in soil solution. The conclusion is to try to mobilize these nutrients using soluble products or liquid formulas.

A golf course soil was recently determined via soil chemistry tests to have over 1200 lbs per acre of easily extractable phosphorous (P_2O5). But when the paste extract was run, the lab

(Please turn to page 8)

Paste Extract... *(Continued from page 7)*
found almost no phosphorous in solution. The superintendent acknowledged that the turf did go purple easily when under stress — a clear indication of phosphorous deficiency. The problem was resolved after the application of soluble phosphorus. Paste extracts have proven valuable in quantifying problems and indicating sustainable solutions where there were no answers before.

of the irrigation water used on the site. High bicarbonates on the soil surface will seal off the soil surface which affects the movement of air and water through the soil."

When a site has been identified with high levels of localized dry spots (LDS) and a paste extract has been run in those areas, the bicarbonate levels are almost always significantly higher than desired. Bicarbonates can be treated with soluble forms of calcium to help knock them off the soil colloid. An aggressive spiking program is often beneficial as well. This problem may have been difficult to identify with conventional soil testing programs.

Perhaps the most significant part of the water soluble paste extract is the soil bicarbonate test, which indicates a true soil bicarbonate load and gives a glimpse into the physical issues of the soil...

Another situation in which the water soluble paste extract is valuable is the identification of excessive sodium. When evaluating most standard soil tests, the pounds per acre and the percentage of potassium are usually higher than those of sodium. When evaluating the paste extract, however, it becomes evident that the sodium is actually more mobile than potassium. This indicates that sodium will likely move into the plant faster and in higher rates than potassium. If this is the case, the plant can actually suffer from sodium-induced wilt, a problem often misdiagnosed by turf managers. This is a common problem on the high sodium soils of western United States, but is rarely an acknowledged concern east of the Mississippi — even though it can be prevalent.

Perhaps the most significant part of the water soluble paste extract is the soil bicarbonate test, which is unfortunately not offered by all labs. This test indicates a true soil bicarbonate load and gives a glimpse into the physical issues of the soil. On the Logan Labs paste extract, Susan Shaner says, "we are concerned when the soil bicarbonate load moves above 50 ppms on most soils. It usually is identified when we run samples

It should be acknowledged that research on the paste extraction test is not widespread, but is ongoing, both commercially and academically. Many agronomists are seeing the benefits of the paste extract test and are using it successfully in fertility programming. This test is becoming widely accepted in determining the nutrient needs of low CEC soils, such as USGA sand-based greens and in calcareous-based sand soils. On these soils the traditional base saturation approach is not very effective and so the paste extract does become a driving factor in fertility determinations.

On calcareous soils, a strong acid extraction such as the Mehlich III or even the ammonium acetate can throw the results off enough to raise questions. The water soluble paste extract shows more of what the plant sees and can help direct the fertility program in the appropriate manner.

The water soluble paste extract should not, however, be used as a stand-alone test to determine the needs of the soil or the plant. Although a good snapshot of what is in soil solution that may become plant available, it is not an effective tool in changing soil colloidal issues. If the soil is chemically imbalanced and physical and biological issues are affected, the tool to use is the standard chemistry test

Susan Shaner suggests, when using the paste extract as part of a complete soil testing protocol, sending the lab enough irrigation water to use for the paste extractions. "The standard in the lab is de-ionized water, which is a good extractant in a wet year. But if irrigation water is being used excessively, it can change the values on the paste extract," she advised. "The irrigation water should also be tested to get a better idea of what it offers. Using the irrigation water for the paste extraction can provide a truer picture of the amount of nutrient going into soil solution."

Susan Shaner can be reached at susan@loganlabsllc.com or 937-842-6100

Saturated Paste Analysis 03/26/03
Sample pH: 7

	ppm	meq/l	%
Soluble Salts	102		
Chloride	14		
Bicarbonate	122		
Phosphorus	0.16		
Calcium	28.92	1.45	65.37
Magnesium	5.01	0.42	18.86
Potassium	0.16	0.00	0.19
Sodium	7.93	0.34	15.58
Sulfur	9.49		
	Total	2.21	
Boron	0.07		
Iron	0.57		
Manganese	0.08		