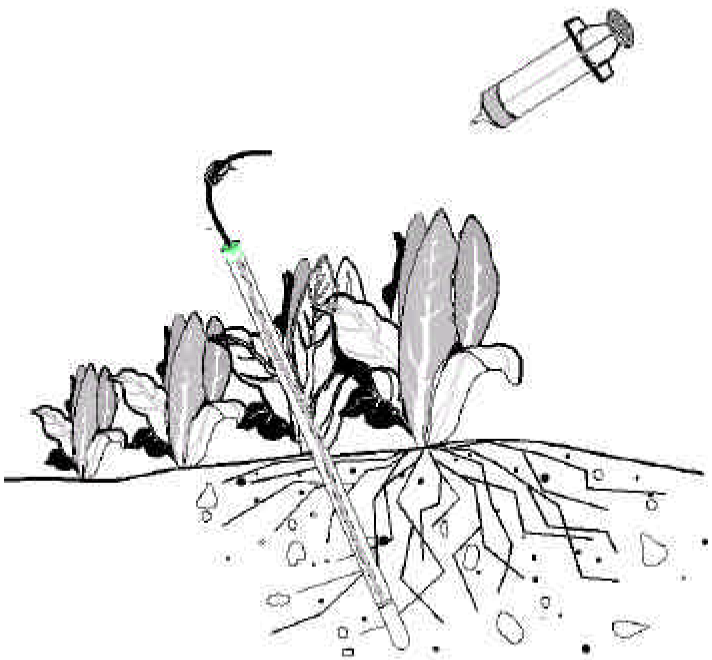
If nothing else, once you establish this relationship, and look at a given soil water sample "reading," you will be able to verify that you do not need to add more nitrogen, for example. Further, by analyzing soil solution samples below the root system, you can verify deep percolation loss of nitrogen due to over-irrigation.

Summary

Soil solution sampling by a farmer is a convenient, inexpensive and valuable practice. It allows for a much better informed management decision, which directly relates to crop production. In most cases, it can result in significant cost savings on the fertilizer bill. And finally, it can help the farmer mitigate the deep percolation of nitrates into the ground water supply that results from over-fertilization and over-irrigation.



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IRROMETER SOIL SOLUTION ACCESS TUBES (SSAT)

INSTALLATION & OPERATION INSTRUCTIONS

SOIL WATER SAMPLING – SUCTION LYSIMETRY

Background

This technology is a simple, inexpensive and non-destructive method of extracting a soil water sample for chemical analysis. The early work in this field was principally done in the area of salinity monitoring. Today, most of the application of this technology is in the area of nutrient management because of fertigation, the practice of introducing nutrients, principally nitrogen, in soluble form through a low volume (micro/drip/trickle) irrigation system. Many commercial agriculture producers involved in drip irrigated vegetable crops have adopted the use of this technology to monitor and control their nitrogen injection systems.

Practical Field Use

In the area of nutrient management, where drip/trickle systems are used by a farmer to "spoon feed" nitrogen to a growing crop, the technique of soil water sampling has proven to be a useful tool in manipulating the rate at which soluble nutrients are introduced through the irrigation water. Tissue analysis is still the baseline practice, but this can be time consuming and costly. And with the "spoon feeding" of nitrogen, sometimes done with every irrigation cycle, tissue analysis results are always lagging the actual event. Further, the technique of soil water sampling can help to monitor any excessive leaching of mobile nutrients beyond the root system, which would be caused by over-irrigation.

Certain cautions should be recognized when using this technique, particularly the fact that adequate sampling sites should be used to mitigate variations that may be encountered.

WHEN to Sample

The best advice is to extract your solution sample when the soil is at field capacity. This condition usually occurs anywhere from a few hours after, to the day following, an irrigation. Soil moisture sensors (IRROMETERS OR WATERMARKS) placed in the active root system of the crop (and in the area wetted by the emitter) are the most convenient way to verify this condition of field capacity (15-25 centibars of soil water suction). At this time you are also sampling the soil solution, which contains the nitrogen introduced with the irrigation. And, with readily available soil water, the time required to draw the solution sample into the SSAT (Soil Solution Access Tube) is lessened. Attempting to draw a solution sample from soil that has dried beyond 35 centibars of suction can be frustrating, because in this condition the soil water environment contains a much greater volume of air.

Depths of Sampling

In drip irrigation, the crop root system tends to be massed more towards the soil surface. This is the area where the crop extracts water and nutrients and thus the top 18″ – 24″ (45-60 cm) is the most critical for tree and vine crops. With shallower rooted crops such as vegetables, the top 12″ (30 cm) is most significant. Mobile nutrients, such as nitrogen, are quickly transported beyond the root system if irrigation is excessive. And this fact emphasizes the need to monitor irrigation scheduling very carefully to prevent excessive leaching. Sampling of the soil water below the root system can be useful to spot heavy concentrations of nitrogen being lost to deep percolation. But the basic rule, for nutrition management, is to sample the active root system.

Installation

To install the SSAT (Soil Solution Access Tube) in the soil or container, make a 7/8 inch (22mm) diameter access hole to the desired depth with a soil coring tool, Irrometer Installation tool, a piece of ½″ galvanized pipe, or 7/8″ (22 mm) diameter solid rod. This provides for a snug fit (close contact with the soil). Compact the soil at the surface around the top of the tube to avoid water channeling down the tube to the ceramic tip. Also, avoid installing in depressions, or low areas, which could retain standing water around the tube. Longer tubes can be used to sample from shorter depths to provide more vacuum capacity. They can be installed at an angle to avoid having too much of the tube exposed above ground to avoid possible accidental damage.

Sample Collection

The SSAT should have the vacuum applied when the soil is at or near field capacity (10-25 centibars of soil water suction). Vacuum is applied with the hand vacuum pump (#1002-SSAT) connected to the tubing with the finger clamp in the open position. Pump until the vacuum is between 70 and 80 centibars on the pump gauge. Then close the finger clamp tightly on the tubing. Then the pump can be removed.

The vacuum will draw soil water into the SSAT through the ceramic tip. How long it takes to collect a sufficient sample size depends on how wet the soil is near the tip and how much vacuum is applied to the tube. On a very short SSAT (6″ to 12″, 15 to 30 cm) the handheld plastic syringe (#DS-50CC) can be used to place a partial vacuum, which can be sufficient in very moist soils.

After sufficient time has passed to collect a significant volume of soil water (4 to 8 hours), the vacuum is released by opening the finger clamp. Twist the rubber stopper loose to make the sample easier to extract. Then connect the plastic extraction syringe (DS-50CC) to the tubing by twisting it onto the end fitting and draw up on the syringe plunger to extract the soil solution for analysis. Between samples, it is important to rinse the syringe with distilled water to prevent carry-over contamination from sample to sample.

Field Analysis

Many nutrients as well as salinity (EC) can easily be measured with test kits (colorimeter), handheld meters or laboratory analysis. Some sources for such testing equipment are listed here:

Hach Company, P. O. Box 389, Loveland, Colorado 80539,
(970) 669-3050, www.hach.com

Spectrum Technologies, 12360 S. Industrial Dr. East, Plainfield,
Illinois 60544, 815-436-4440, www.specmeters.com

Myron L Company. 2450 Impala Dr., Carlsbad, CA 92010,
760-438-2021, www.myronl.com

Measuring pH with suction extraction can be done successfully, however the pH of the solution changes because some CO_2 is lost due to the vacuum process. The loss can be calculated and thus compensated for during interpretation. Additional information is available upon request.

In any event, analysis of the field sample cannot be done in a "vacuum". The sample analysis needs to be compared to some base. The best "standard" to use would be the tissue (petiole) analysis done by a lab and in conjunction with known agronomic facts concerning the particular crop and its nutrient uptake rate in relation to the amount of that nutrient in the soil water. This is not totally precise, but once you establish a correlation, or ratio, you have a guideline for future adjustments in the soil water/nutrient balance.