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N-ST*R Soil Sample Bucket and Soil Sample Collection

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Soil testing is an important part of agricultural production and an essential tool for crop nutrient management. Soil-based tests can provide valuable knowledge concerning the current nutrient status of the soil and provide guidelines for how much fertilizer needs to be applied to optimize crop yields.

A good quality and representative sample must be taken to ensure that nutrient and fertilizer recommendations are accurate. Traditionally, soil samples for routine analysis are only required to a depth of 6 inches for corn, grain sorghum and cotton and 4 inches for all other row crops commonly produced in Arkansas. The recent development of N-ST*R (Nitrogen-Soil Test for Rice) requires that soil samples be taken to a depth of 18 inches on silt loam soils and 12 inches on clay soils. Soil sampling deeper than 4-6 inches can pose problems in many of the rice-producing regions in Arkansas as the plowpan or restrictive layer is often hard to penetrate, especially under dry soil conditions. The N-ST*R sample bucket was developed to facilitate the deep sampling required for N-ST*R in these situations and also to ensure a uniform soil sample is collected.

The N-ST*R Soil Sample Bucket (Figure 1) is an essential component required to take either an 18-inch soil sample for silt loam soils or a 12-inch sample for clay soils. This mechanized approach is a drastic improvement over the slide hammers used to take deep soil samples for nitrate-N in cotton and corn. It is imperative that the entire soil core from 0-18 inches for silt loams or 0-12 inches for clays be collected and packaged for analysis to get an accurate estimate of the potentially available soil N status and a reliable N fertilizer recommendation.

The N-ST*R Soil Sample Bucket has several distinct advantages over the slide hammer, including (1) the use of a cordless drill rather than manpower, (2) the ability to take an entire sample in a single core, (3) the ability to soil sample in a variety of soil moisture conditions and (4) the

FIGURE 1. N-ST*R Soil Sample Bucket developed by the N-ST*R Lab at the University of Arkansas.

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ease with which the soil can be collected and transferred to a 1-quart plastic zip-top sealable bag. Removal of soil from the probe is often difficult when using a slide hammer due to compaction and the risk of soil spillage. In addition, it is often difficult to determine exactly how deep you are sampling when using a slide hammer probe. This is because the soil is often compressed during sampling, and an 18-inch soil depth would require two separate cores to be taken, one from 0-12 inches and another from 12-18 inches.

The parts required to assemble the N-ST*R Soil Sample Bucket can be purchased at most local hardware stores as well as online, except for the steel or aluminum plate and pipe. The N-ST*R Sample Bucket can be made from a variety of items commonly seen around most farm shops. The most critical step is making sure to use a 1-inch inner diameter (ID) pipe to ensure a snug fit between the 1-inch diameter ship auger allowing the soil to be augered up and distributed into the bucket (Figure 2).

Parts Needed for Soil Sample Bucket

1. Ship auger 1-inch diameter, 17-inch length with a 7/16-inch hex shank (Grainger part number 4AAU4).

2. Hole saw extension, 18-inch length with a 7/16-inch hex shank (Grainger part number 2Q507).

3. 5-gallon plastic bucket.

FIGURE 2. Example of soil sample being taken using the N-ST*R Soil Sample Bucket. Please note the tight fit between the ship auger and pipe ensuring that the soil is augered into the bucket.

FIGURE 3. N-ST*R Soil Sample Bucket (bottom view). Please note the footpads on either side for stability during sampling and the 1½-inch nipple on the bottom to ensure that all of the soil is augered into the bucket and does not "leak" out near soil surface.

4. Steel plate (¼-⅜ inch) cut to fit bottom of 5-gallon bucket.

5. Steel pipe 1-inch inner (ID) diameter roughly 5½ inches long.

6. Flathead screws to attach retrofitted steel plate to bucket.

7. 24-volt cordless drill with extra batteries.

Procedure

1. Cut steel plate to fit bottom of bucket. Make sure to include "ears" on either side of bucket to be used as footholds as the torque from the cordless drill and auger can cause the bucket to spin (Figure 3).

2. Cut hole in center of steel plate that is equal to the outside diameter (OD) of the 1-inch ID pipe.

3. Weld 1-inch inner diameter pipe into center of the plate with 1½ inches extended below the bottom surface of the steel plate (Figure 3). This should leave roughly 4 inches of pipe sticking up in the

middle of the plate, which when attached to the bucket will allow the soil to fall down into bottom of bucket (Figure 2). Beveling the inside of the pipe at the bottom will allow it to be pushed into the soil much easier, but is not necessary.

4. Cut hole in center of bucket to allow insertion of the pipe and attachment of steel plate to bottom of bucket. This can be easily done with a hole saw that matches the outside diameter of the steel pipe.

5. Drill holes through the steel plate and bucket to allow flathead screws to be inserted and tightened to hold bucket firmly to the steel plate. The flathead of the screw should be placed in the inside of the bucket to allow easy removal of the soil from the bucket. Rivets have been used in some cases, but screws are much sturdier and allow easy transfer of the plate to another bucket if damaged.

Producers are encouraged to make modifications to the bucket as needed to make it more ergonomic or user friendly, but keep in mind that the ability of N-ST*R to make accurate N fertilizer recommendations relies heavily on proper sampling depth and uniformity of the soil sample. N-ST*R sample buckets are available for purchase from the N-ST*R Soil Test Lab and include a fabricated bucket, ship auger and extension as well as a bushing stop with a set screw that can be used to ensure that the proper soil sampling depth is being reached.

When taking samples using the N-ST*R sample bucket, remember to keep one foot on the footpad as the torque generated can cause the bucket to spin (Figure 4). Generally, you can take 10-20 samples per fully charged battery (lithium ion) depending on soil moisture conditions and experience. Under most soil moisture conditions, a single N-ST*R soil sample can be taken in <1 minute. Although this sampling bucket allows you to take soil samples under a wide range of conditions, it is not advisable to take soil samples in areas where the soil is wet enough to stick to the bottom of your shoes. Sampling in areas which are extremely wet can increase the amount of time it takes to sample, make it more difficult to take a good sample and make it much harder to remove soil into

FIGURE 4. Demonstration of how to take an 18-inch soil sample using the N-ST*R Soil Sample Bucket.

Prior to taking samples make sure and mark the auger extension to ensure that the proper soil depth is being sampled. Place the bucket flat on the ground and allow the nipple on the bottom to push into the soil. Place at least one foot on a footpad to stabilize the bucket during sampling. Slowly auger out soil in small increments to ensure that the auger does not jam. Continue collecting soil until the proper sampling depth has been achieved.

a plastic zip-top bag and clean the bucket between individual samples. In soils that are wet or have increased clay content, a wire brush can be used to help remove soil from the auger in a timely fashion with no impact on the soil sample. While holding the auger over the sample bucket, simply hold the wire brush next to the auger and move up and down the length of the auger as the drill is turned. This will easily remove soil from the auger and allow it to collect in the bucket with the remaining soil.

Packaging Soils for Shipment

After collecting soil samples in the field, the second and equally important part of submitting a quality soil sample is proper packaging prior to shipment. Current recommendations require 10 samples

FIGURE 5. Individual soil samples should be placed in a single 1-quart plastic zip-top bag. Soil samples taken from the same field should be packaged together to help reduce shifting during shipment and allow easier identification if label is removed.

FIGURE 6. Properly packaged N-ST*R soil samples ready for shipment. Note that additional space has been filled with newspaper or packing material to prevent shifting and sliding during transport, which can result in spilled samples that will not be analyzed.

per field, which should be collected and placed in 10 individual 1-quart sealable bags and then grouped in either a larger sealable bag or grocery sack (Figure 5). Grouping soil samples from fields together can eliminate some shifting during shipment and also allows identification of samples if the writing on bags is smeared or removed. When preparing samples for shipment, do not place more than 40 samples in a single box as the weight can cause damage to the box and soil samples. Please remember to package samples tightly and fill in any extra space with newspaper or packing material (Figure 6). If samples are not secure during shipment, shifting and sliding can cause bags to split. Please do not use soil sample boxes to aid in packing and shipping as they often result in soil spillage. Spilled samples will not be analyzed because they could lead to an erroneous soil test and incorrect fertilizer recommendation.

For more information concerning purchasing or manufacturing an N-ST*R Sample Bucket, please contact the N-ST*R Lab at 479-575-7569 or *NSTARLAB@uark.edu*.

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