

Sampling instructions for soil testing with ATC

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Concise instructions (for a quick overview, or as a refresher for repeat customers): Collect samples to a 10 cm depth (4 inches). Leave grass and thatch on the sample. Each soil sample should be at least 60 cm³ or $\frac{1}{4}$ cup in volume. Air dry the samples after pulling them from the soil to stop ion exchange and soil microbial activity. For an 18 hole golf course, I recommend testing five greens, three fairways, and three tees. One of those greens should have the sample divided into two depths, testing from that green 0–5 cm and a 5–10 cm (0–2 and 2–4 inch) segments for an analysis of nutrient gradients by depth. If you will fertilize rough or lawns, I recommend testing those areas also.¹ Fill out the soil sample metadata sheet and send to me. Get the sample submission forms and soil import permits (if necessary) from me. Confirm that the proper test codes have been requested for each of your samples. Send the dried samples, in spill-proof bags, along with soil worksheets identifying the samples and the requested tests, to Brookside Labs in Ohio. It is important to get these forms correct, so the lab staff know exactly what to do with each sample. Please send samples to the lab only after confirming that the forms have been filled correctly.

THIS COMPREHENSIVE GUIDE will go step by step through soil sample collection² in the way I recommend, which will ensure the results can be analyzed and interpreted in the most modern way possible. Sample collection methodology is important. I will be interpreting the results, and making recommendations, and you will be making decisions about nutrient application and soil pH adjustment, based on two aspects of the results. We will be looking at the most recent test results. That's one. And we will also be looking at the change over time—how the test result has changed since the last sampling. Both of these analyses depend on careful sampling methodology.

When and how often to collect soil samples

FOR MANY TEMPERATE CLIMATE locations, I recommend soil testing once per year, in autumn. Nutrient levels tend to be lowest at this time of year, and we have the winter months to consider the results and to plan for the next season.

If you are in a Mediterranean climate, where it basically doesn't rain in the summer, salts accumulate from addition through irrigation water, and then winter precipitation leaches the salts. In those climates, nutrient levels will be lower in spring than in autumn. My recommendation for this type of climate is to do the primary sampling in the spring, and to do a secondary sampling³ in the autumn to check how much the soil has changed through the summer.

In tropical climates I recommend sampling twice per year. Where

This is version 0.2 of the instructions, generated on October 6, 2024. ATC is currently charging USD \$75 per sample, so the twelve annual soil nutrient tests I recommend for most golf facilities comes to USD \$900 for the soil nutrient tests. The minimum order is \$500. If you submit a lot of samples that go on the same report, you may get a volume discount. If you are looking for the total organic material by depth sampling instructions, check the [OM246 sampling instructions](#)

¹ Please contact me for sampling advice for areas other than golf courses, or for courses with more or fewer than 18 holes.

² This guide is for soil nutrient analyses done for the primary purpose of making fertilizer recommendations, with a little bit of preventing problems in the soil. If you are trying to diagnose turf problems by soil testing, please tell me. We will approach sampling in a different way.

³ The secondary sampling is about half the number of samples as a primary sampling.

there are pronounced wet and dry seasons, I recommend doing the primary sampling at the end of the rainy season, and doing a secondary sampling at the end of the dry season.

If you have any questions about the optimum sampling schedule for your climate, please ask me. Sampling only when you have problems with the grass or soil is not the way I'd do it. By the time you can see problems, it's way too late. And sampling at irregular intervals is not recommended either.

When should I submit irrigation water samples?

I RECOMMEND sending an irrigation water sample at the start of the peak irrigation season at your location. If you are at a location with salinity issues⁴ in the irrigation water, then at a minimum you would want to check the water at the time it has the lowest salinity and at the time of year when salinity is highest. To find the salinity change through the year, you can submit samples monthly for a year (or for one irrigation season) to identify how the salinity changes.

⁴ If you have salinity issues, I recommend you get a salinity meter and check the irrigation water weekly, yourself, in addition to any samples you send for lab analysis.

Tools and Materials

MAKE A SAMPLING PLAN so you know which areas will be sampled and how many bags you'll need. Prepare the following tools and materials before collecting your samples.

- Soil sampler or profiler
- Cutting board or clipboard
- Knife
- Ruler or measuring tape⁵
- Ziploc⁶ or paper bags
- Permanent marker, use to label the bags before collecting samples
- Bucket with sand or turf plugs (for filling sample holes)

⁵ We want to be exact with sampling depth so that results from year to year can be compared knowing the sample depth was the same.

⁶ I highly recommend Ziploc-style plastic bags. Most of you will be sending dried samples in what needs to be spill proof packaging. That means samples in small Ziploc bags, with 10 or 20 sealed small bags inside a large Ziploc bag.

Single core or composite sampling

I RECOMMEND single core sampling. By that I mean taking a single soil core from the area being testing, and submitting that core as *the sample* for that area.⁷ The conventional way of soil sampling turfgrass areas is to collect **multiple subsamples** from an area, to mix all those subsamples together, and to either submit that composite as the sample, or to take a portion of the material out of

⁷ Yes, that means on soil core from one putting green is a single sample. And on another green, another single core is a single sample. You don't have to do it this way. You do need to be mindful of minimum sample size, and this single core method is most efficient if you have the size of sampler that allows you to get enough material with one core.

the composited subsamples, and submit that as the sample. I make this recommendation because:

1. Composite samples hide the variability across a site.⁸ With single core sampling, we are more likely to capture extreme high and low values, which will give a better representation of the conditions in which the grass is growing.
2. I and many ATC soil testing clients have compared single core and composite sampling from the same areas. The results and recommendations for single core samples are equivalent or superior to those from the composite samples.
3. Single core sampling is *much* faster⁹ than composite sampling.

If you prefer to collect composite samples, that's fine. You can indicate whether the samples were single core or composite on the metadata sheet.

One more explanation

YOU CAN CHOOSE between two primary sampling techniques:

Single core sampling Taking one core sample from each location. I prefer this method because it captures some of the variability in soil chemical properties.

Composite sampling Taking multiple smaller core samples from a specific area, mixing them, and taking a subsample for analysis. While this method can provide an average nutrient level for the area, it may not capture the full range of variability. Although this is the standard method, I prefer single core.

Random sampling

WHETHER YOU CHOOSE single core or composite sampling, I recommend collecting the samples *almost* at random. Here are the exceptions:

- On greens, I generally avoid obvious bunker splash areas.
- On fairways, I want to compare year to year, over time, and to ensure I collect from the same area, I systematically choose to collect a sample 150 yards from the green. When I come back to take a sample again the next year, I will be collected from the same area, about 150 yards from the green.
- On tees, I also want to compare year to year, so I pick one set of tees, for example the "white" tees, or the "6600 yard tees", and take tee samples from those tee decks.

⁸ You can read more about this in my document on [Composite soil testing for turfgrass](#).

⁹ This is an fortuitous benefit. I prefer single core sampling because it can capture a wider range of soil conditions under the grass. But it's nice to be able to sample a course in 30 minutes too!

- You know your property better than I do. If you want to get some low areas, and some high areas, and some sun areas, and some shade areas, and some clay areas, and so on, I understand. If you can design the sampling plan in a way that those areas happen to be at the 150 yard mark on different holes, that's one way to plan it. Or take notes. The idea is to come back and sample approximately the same area next time too.

Sampling depth and volume

SAMPLES SHOULD BE COLLECTED to a depth¹⁰ of 10 cm (4 inches). Grass, thatch, and mat at the top of the rootzone should be left on the sample. The zero point on the sample is the bottom of the grass and top of the soil or thatch; the top of the grass is *not* the top of the sample. Cut the soil 10 cm below the zero point. In the grinding room at the lab, the sample is broken into small pieces and passed through a 2 mm sieve. Rather than removing the grass and thatch yourself, I prefer the consistency of machine removal at the laboratory.

The minimum sample volume for one sample is 60 cm³, or $\frac{1}{4}$ cup of material.

I have found it convenient to use custom samplers made from stainless steel pipes, ground to be sharpened at one end.

A 3 cm diameter sampler pulls a 70 cm³ single core sample to a 10 cm depth.

A 4 cm diameter sampler (Figure 1) pulls a 62 cm³ single core sample to a 5 cm depth.

With samplers of that size, single core sampling is easy. If you are using a smaller sampler, such as 1.8 or 2 cm diameter, you will need to take multiple samples to get enough material. If you take those samples at roughly the same spot, I'd call that single core. And if you move around to get those samples, that's composite.

Here's an **important note** about sampling tools. In a sand rootzone, the types of custom samplers made from stainless steel pipe work great. The sampler goes into the soil and the soil can be pressed out. In loam or silt or clay loam soils, a straight pipe sampler is not effective. Straight pipes don't go into such soil as well, and removing the sample from the pipe can be extremely difficult. In soils, I prefer to use a conventional sampler with a tapered tip.

Checking nutrient gradients on greens

FOR ONE OUT OF EVERY FIVE greens tested, please submit the sample divided into two bags. One bag will have the 0–5 cm depth (0–2 inches) of the sample, and the second bag will contain the 5–10 cm depth (2–4 inches) of the sample. These samples divided by depth are especially useful to check:



Figure 1: This is a 4 cm diameter sampler made from stainless steel pipe.

¹⁰ If you have a good reason to collect the sample to a different depth, let's discuss that, and make sure we agree on it, and that the samples get labeled correctly to note the special depth.

- Nutrient gradients by depth in the soil, for example P being higher or lower near the surface
- Soil pH gradients by depth
- Effect of liming or acidifying treatments
- Salinity gradients in the soil

Labeling Samples

BEFORE COLLECTING SAMPLES, label the bags. Each sample will be uniquely identified by three IDs.

- ID 1 is the name of the course or property or stadium
- ID 2 is the zone (G for green, T for tee, F for fairway, R for rough, etc.)
- ID 3 is the hole number, along with any depth notation if necessary

Here is an example. A soil sample from the green on hole 6 at Example Hills Golf Club would be labeled as follows:

Example Hills G 6

A sample from the 11th tee at Example Hills would be labeled as:

Example Hills T 11

The two samples from the 18th green split into the 0–5 and 5–10 cm depths would be labeled as

Example Hills G 18 0–5 cm

and as

Example Hills G 18 5–10 cm

Or use 0–2 in and 2–4 in if you prefer inches.

Sample preparation

NOW THAT THE SAMPLES are out of the ground, here's what to do.

Drying

PLEASE DRY the samples.¹¹ There are many reasons for this. The main one is to stop soil microbial activity and ion exchange. This ensures the test results will be close to the soil condition when it was pulled from the soil.¹² Drying also reduces shipping weight (and cost).



Figure 2: Single core, composite, and OM246 total organic material samples drying in a golf course maintenance office.

¹¹ If you are in Ohio or in a US state adjacent to Ohio, and the samples will get to the lab the next day, go ahead and ship the samples in the field wet condition. Otherwise, please take the time to dry to samples.

¹² My post [A reminder to dry soil samples](#) shows how much soil N can change when samples are not dried.

- After collecting the samples, **air-dry** them in the office or another dry area.
- This is important to stop microbial activity and prevent changes in nutrient levels.
- Spread the samples on sheets of A4 paper or on clean plates or in shallow pans and allow them to dry completely (Figure 2).
- Don't leave the samples in the bags. That stops air movement and slows drying.
- Take samples out of the bag, put the bag under the paper or drying tray, and when the sample is dry, place it back in the same bag.
- I use a fan to move some air over the samples. I find samples dry in two or three days, usually, and I then send them to the lab.

Paperwork and shipping

PLEASE COMPLETE AND RETURN the soil sample metadata sheet to me. These data include turf condition, the exact date each sample was collected, the grass species, and the N, P, and K fertilizer rates. These data are used to tailor your report and recommendations to your site conditions.

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Brookside LABS
200 White Mountain Drive New Bremen, OH 45869

Page ____ of ____

Office Use
Form#: _____ Due Date: _____
Samples Rec'd: _____
Date Rec'd: _____
Rec'd By: _____

Date Submitted: _____ Client #: _____ # Samples Submitted: _____
Client Name: Example Hills CC Consultant: 635
Address: Your club City/State (and/or country) Sampled By: Your name

Check box if data is to be: Fax# email: _____
Choose your preference: Report unit (pick one): lb/ae lbs/1000 sq ft kg/ha Sample Depth: _____ inches OR _____ cm

Sample Location	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2	ID Space #1	ID Space #2
Example Hills	G	1	G	3	G	7	G	11	G	15
Example Hills	G	18	F	1	F	10	F	17	T	3
Example Hills	T	7	T	15						

Short course name: _____
Course zone (use G, F, T, R, for greens, fairways, tees, and rough, and for lawns use L): _____
Hole number or identifier: _____

Please check soil package: S001 S001P S001A S001B S001C S110 S001N S001AN S001BN S001CN
 S001PN S003 S004 S005 S006 S006W=client water S007 S009 S015 S015N S019 S019A S010
 S17 S176 S180 S251 Manure, Fert., Lime: Z001 Z002 Z003 Z004 X001 X002 X003 L001 L002
 Other _____

Figure 3: You can use the example worksheets I provide as a guide, or ask for assistance to ensure the samples are labeled properly and that the appropriate tests are requested.

¹³ It's important to request the proper tests to avoid delays or mistakes at the lab. If you haven't done this before, or if you have any questions, please check with me to confirm the forms are correct *before* shipping the samples.

Complete the soil worksheets that identify the samples and tell the lab which tests to run on each sample. If you need assistance with this, please ask me and I will be happy to help. There are all kinds of test options that we may want to choose to get the most useful results for your samples.¹³

Seal the dried samples in Ziploc bags (Figure 4). If you are sending from outside the USA, the small sealed bags should be enclosed in large sealed bags. The purpose of this is to prevent any soil spillage during shipping.

All samples from outside the continental USA, and samples from many states in the USA (especially those with fire ants) need to have a permit enclosed inside the package and a special identifying label placed on the outside of the package. I will provide that label and permit to you.

When you have the metadata information sent to me, the soil worksheets completed to identify all the samples and test requests for the lab staff; when samples are sealed in leak proof bags and boxed up with the proper permit and label, you can then ship the samples to Brookside Labs.

The mailing address is:

Brookside Labs
200 White Mountain Drive
New Bremen, OH
45869
USA

phone: 1-937-538-6749

If you are sending soils from outside the USA, I strongly recommend using a shipping service that provides a tracking number for the package.

Test results and reports

THE TIME TO get results from the lab depends on the time of year and on the specific tests requested. For most tests I will get the results two to four business days after the samples arrive to the lab. I will then prepare a full report and send to you as soon as I can.

Miscellaneous notes

I KNOW THIS SEEMS like a lot. And it is. But if we are going to do this, I want to do it in the most accurate way possible. And once you've done this sampling once, or twice, the steps become familiar and it isn't nearly as daunting as it was the first time.

I'd like to encourage you to take your time with this, make sure the samples are treated with care, and let me know whenever you have any questions.



Figure 4: A composite sample (top) and a single core sample (bottom) in adjacent sealed bags prior to shipping.