



Agricultural Laboratory

Soil Sampling Instructions



Correct Sampling is imperative to ensure accurate analysis and interpretation. Precise Nutrient Management can only occur with a quality representative sample.

The following document will guide you to obtain a representative sample and avoid contamination.

Why Soil Test?

Predictive

What soil chemical properties are limiting my production?

Trouble Shooting

Are soil chemical properties causing under performance or affecting yield? (Imbalances which can include a deficiency and/or excess)

Monitoring

Monitor changes in soil chemical properties over time.

- Asses the capacity of the soil to support plant growth
- Establish soil current nutritional status
- Diagnose plant nutrient deficiencies/toxicities
- Make informed decisions in soil management and fertiliser applications to maximise yields and profits
- Indicate the ameliorants required to correct physical or chemical soil imbalances
- Monitor soil fertility; ensure we are not mining soil, building soil health and fertility
- Fine tune nutritional inputs
- Ensure fertiliser applications are not having environmental effects
- Apply precision agricultural technology

To give the most economic fertiliser program soil testing should be best used in-conjunction with;

- Fertiliser history
- Crop or pasture type information (including rotations)
- Soil type information
- Plant analysis
- Economics

Obtaining a Representative sample

Soils are inherently variable across farms and single paddocks. Therefore soil depth and the numbers of cores taken are critical. For the chemical analysis of soil we are aiming to obtain a representative sample of a single soil type. Guides to soil sampling depths are provided based on the depths in which methods have being calibrated, however it is also important to consider the plants rooting depth and soil horizons when determining the ideal sampling depth.

If comparing a single site, ensure the GPS coordinates are accurately marked and you are using a suitable device to return to the same position for future testing.

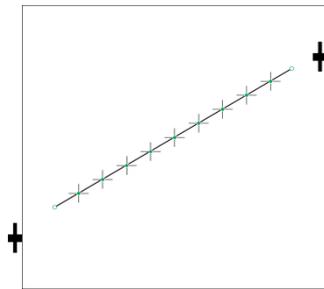
The key factors to consider when determining a soil sampling plan and a representative sample will take into consideration:

- Sample different soil types separately.
- Avoid unusual areas, stock camps, fertiliser dump sites, dam sites, gates, troughs, trees.
- Avoid fence lines (old and new), sheds and roadways
- Sample varying topography (Hills and flats) separately.
- Avoid poorly drained areas and wet conditions

- Avoid headlands
- Ensure different fertiliser and rotation histories are sampled separately.
- Avoid dung and urine patches in pastures
- Sample High and low yielding areas separately.
- Don't sample paddocks that have had ameliorants (lime) or fertiliser applied in the past 2-3 months

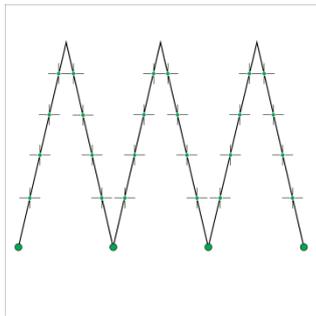
When trouble shooting it may be beneficial to take plant samples at the same time to establish soil-plant interactions. If irrigation is involved a water sample will also be beneficial.

Recommended sampling strategies:



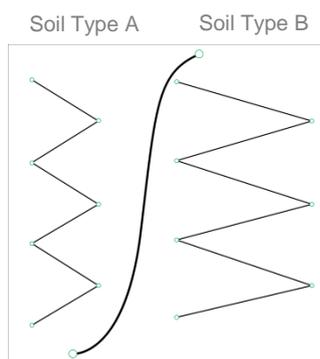
Transect (Random with bias)

Transect is the simplest of sampling strategies. APAL recommends transect testing in most cases. Identify 2 markers (which ideally are identified by GPS coordinates, can use trees or posts etc) and sample between these markers. Transect testing allows for the sample line to be used precisely in consequent years to monitor fertility trends.



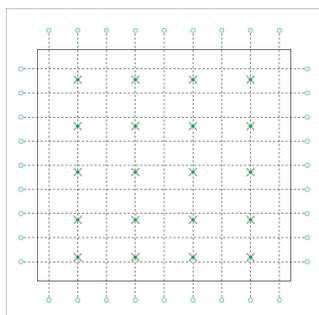
Zigzag (Random with bias)

The zigzag sampling method is determined to obtain the best coverage on smaller areas if care is taken. The degree and type of bias will vary with experience of the operator. This is often the best design for diagnostic work.



Differentiate between soil type and topography (Random with bias)

It is important to sample differing soil types or topography separately. Clearly identify (soil type A & soil type B) and sample via transect sampling or Zigzag sampling (as discussed above).



Grid (non-random)

The grid approach allows for a systematic sampling design. The Grid sampling procedure generally only applies for precision agriculture technologies or when undertaking intensive horticultural development. It can overcome landscape or yield variation. Allows for repeat sampling with high precision. The most costly technique due to the increased number of tested samples.

Sampling Information (Depth, timing, required no of cores)

Avoid sampling within 3 months of liming and 2 months of fertiliser application.

Depths should reflect the depths used when the method was calibrated.

Surface Soil samples

Crop	Surface soil samples (cm)	When to Sample?	No Cores
Crops (Cereals/oilseeds/legumes)	0-10 (Tasmania 0-15)	Summer/Early Autumn Or after the opening rains.	25-30
Pastures	0-10 (Tas) 0-7.5	Autumn or spring. One month prior to fertiliser applications, allowing sufficient time for recommendations and product.	25-30
Orchard/Vineyard	0-15	Pre-plant, establishment year and every 2-3 years after. Post-harvest. Late winter/early spring. Soils can be taken at the same time as plant tissue sampling	25-30
Cotton	0-30 (irr) 0-10 (rain)	One month prior planting for fertiliser requirements. If amendments are required sample 2-3 months prior	25-30
Sugarcane	0-20	One month prior planting for fertiliser requirements. If amendments are required sample soon after harvest or start of fallow	25-30
Horticulture	0-15	1 month before planting to determine fertiliser requirements. If lime or gypsum is required sampling is required 2-3 months prior to planting to provide enough time for effective soil amelioration.	25-30
Annual Greenhouse Crops grown in soil	0-15 or depth rotary hoe	1 month before planting to determine fertiliser requirements. Where salinity is detected and leaching undertaken test again after leaching.	25-30
Tree Crops	0-15	Pre-plant, establishment year and every 2-3 years after. Post-harvest. Late winter/early spring. Soils can be taken at the same time as plant tissue sampling	25-30

If you are in the Great Barrier Reef catchment areas, prior to initiating any soil testing or nutrient recommendation for sugarcane, refer to the details outlined at the website:
www.reefwise farming.qld.gov.au

Note: avoid sampling during excessively wet periods and some test results can vary depending on the time of year (eg pHw)

It should be noted that for crops under **no- minimum till** with a row spacing of <25cm sample as per above guidelines, utilising a transect or zig zag approach to obtain a representative sample.

In soils with residual fertiliser bands, it is recommended to double the amount of cores taken. If the location of the fertiliser band is known:

- 30 inch spacing: sample once in the band for every 20 in between (1:20)
- 12 inch spacing: sample once in the band for every eight between (1:8)

When sampling soils for **row crops or permanent beds** this can give misleading results. Where the location of the fertiliser band is known, a representative sample consists of cores taken from within the fertiliser band and between the fertiliser band.

The number of cores, *S*, taken between the rows for every soil core taken within the row is determined by the following equation.

$$S = \text{row spacing (cm)} \times 0.262$$

For **tree crops** soil samples should be taken from the zone of maximum root growth and fertilisation, which will generally extend from around 30 cm from the base of the tree to just outside or 30 cm beyond the drip zone of the tree.

For **vineyards or drip irrigated crops** it is recommended to sample a constant distance from the drippers depending on the soil type (eg 50 cms away).

Subsurface Soil samples

Fewer numbers of cores are required in subsoil samples as they generally display less variability.

Deep soil testing will be deemed necessary when:

- Where N responsive crops are grown, deep soil N testing is required pre-crop to determine soil N levels, allowing for a nitrogen strategy to be developed.
- To investigate mobile elements like N and S.
- Check subsoil constraints. In particular in the new establishment of orchard, vines or tree crops. Or deep rooted pasture species.
- Monitor and diagnose subsoil constraints (toxicities such as Boron and salinity, soil structure issues such as sodicity, and pH issues such as acidity or alkalinity).
- Subsoil fertility is an emerging area with some crops.

When taking deep soil tests you can consider a horizon approach rather than strict depths which can often cross over different horizons.

Subsoil samples depths are a guide.

Always consider:

- Rooting Depth
- Soil horizons

Crop	Sub-Surface soil samples (cm)	No Cores
Crops (Cereals/oilseeds/legumes)	10-30 30-60 60-90 90-120 Deep Soil Nitrogen depths may change pending rooting depth and soil horizons.	8-15
Pastures	10-30	8-15
Orchard/Vineyard	15-90	8-15
Cotton	30-60	8-15
Sugarcane	20-60	8-15
Horticulture	15-30	8-15
Tree Crops	15-90	8-15

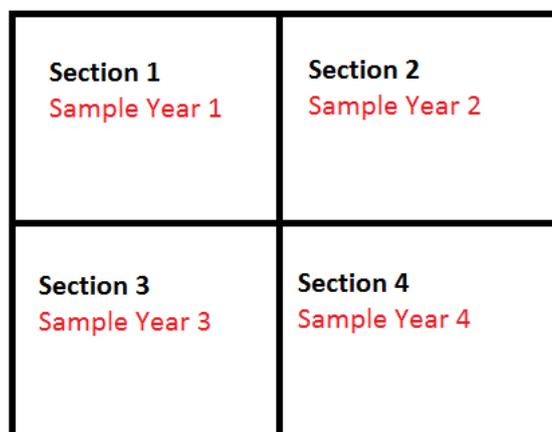
For diagnosing subsoil acidity in broad acre crops and pastures 10-20cm and 20-30 cm sample depths are recommended. Note: If you are using interpretative software or simulations (i.e. Yield prophet) please refer to their desired soil depths for sampling.

Frequency

Complete farm sampling

Complete farm sampling allows for complete test coverage of the farm over a 3-4 year period. For example the farm is split into quarters (as per below diagram). When splitting the farm it is important to take into account the following characteristics;

1. Soil type
2. Paddock history
3. Management practice



Sample paddocks from quarter one in year one, quarter two in year two. Once you have sampled the entire farm begin back at quarter one.

Regular tests build better profile

Because many factors influence soil test results, soil analysis for one season is not conclusive. Subtle differences in soil type can impact significantly on the availability and exchange of nutrients between the soil and plants so it is important to test soil regularly.

Testing the soil at the same time each year improves the comparison of results between years and builds a clear profile of soil health over time.

Sampling equipment

Adequate sampling tools should:

- Take a small enough equal volume of soil from each core site so that the composite sample will be of an appropriate size to process for analysis
- Be easy to clean
- Be adequate for dry sandy soil and moist sticky soil
- Be rust resistant
- Provide uniform cores of equal volume in all spots within the representative sampling area.

Your sampling tool should be constructed from stainless steel to avoid contamination. Other metals can cause contamination, which is of concern if you are undertaking a complete analysis including trace elements.

You will require:

1. A core sampler (available from www.apal.com.au)
2. For deep soil analysis, a hand auger or hydraulic sampler. If using lubricants for soil probes ensure they don't contain organic carbon which can contaminate the sample (silicon spray can be used). When using hydraulic samplers ensure the full core is extracted so your sampling depths are correct.
3. A clean plastic bucket to pool samples
4. A screwdriver and brush to clean probe between samples

Quarantine

APAL is accredited and audited by PIRSA Plant Health and has a permit to accept soil and plant samples from interstate for laboratory analysis. APAL Quarantine room procedures follow PIRSA Biosecurity Plant Health requirements as documented in PIRSA "Procedures for Importation of State Quarantine Risk Material by an Accredited Laboratory" March 2010.

APAL Agricultural Laboratory– (Registration number : S1286)

Sending soil and leaf petiole samples to APAL for analysis is possible for growers in Phylloxera PIZ & PRZ restricted zones if they are forwarded in APAL's secure Bio-packs.

APAL has a Bio-Security SA accredited Quarantine Facility (Level 2) and can now accept your samples without pre-treatment. We can also provide a covering permit from DEPI Victoria that will allow movement of the soil and leaf petiole samples from your vineyard. Please refer to www.apal.com.au to order your Bio-pack.

Taking the sample

1. Review your required tests from APALs price list/service guide. If guidance is required consult APAL or your local agronomist/advisor.
2. Determine an appropriate sampling plan
 - Ensuring a representative sample is obtained
 - Avoid unusual areas discussed above
3. Ensure all your equipment is clean
4. Remove debris and plant material from the soil surface
5. Take the required number of cores utilising a transect or zigzag sampling plan
6. Pool your cores in a clean plastic bucket, breaking the soil into small crumbs
7. Mix the sample thoroughly in the bucket
8. Place your representative sample into APALs soil test bags and fill to the required line. Place no more than 500 g if using your own bags
9. Ensure your equipment and bucket is clean before moving onto your next sample.
10. If using a shovel ensure the sample is consistent down to the required depth (eg take a slice down the side not a V sample)
11. If excess sample is collected ensure the sample is well mixed before sub-sampling- try to reduce the sample to around 300-400 gms to avoid excessive postage charges.

Sending the Sample to the lab

1. Ensure APALs sample bags are filled to the desired line. If using other bags please ensure there is 500 g of soil.
2. Ensure you have the correct submission form and the details are filled out correctly with test code, sample name, Crop and sampling depth. If any extra tests are required but not pre-populated please mark with a cross or note the code in other tests.

Soil Analysis Submission Form

Test code	Office Use/Barcode	Sample Name	Crop	Sampling Depth	Extras	
					<input type="checkbox"/>	DGT
					<input checked="" type="checkbox"/>	Soluble Nutrients
					<input type="checkbox"/>	Other tests:
					<input type="checkbox"/>	

3. Place soils and paperwork in an APAL returned paid envelope if prior agreements have being made. Please note that these are not express post. Express post is recommended for urgent samples.
Place in freight satchel.
Deliver to:

APAL Agricultural Laboratory
PO Box 327 Magill
Adelaide, South Australia 5072

For any further information please contact APAL on 08 8332 0199 or info@apal.com.au