SAMPLING OF SOILS FOR SOIL QUALITY—SOUTH AUSTRALIA

Key points

- The approach taken will be defined by the purpose of the investigation, variability in the area sampled, and the analysis and accuracy required.
- For many soil quality parameters sampling is typically done to 10 cm, although 30 cm is required for carbon accounting purposes, stratification below 10 cm is recommended (e.g. 10–20, 20–30 cm).
- The sampling strategy should either integrate or describe the variation within the sampling area.
- Samples should be air dried or kept below 4°C prior to analysis. For biological measurements it is best to analyse as soon as possible.

Background

Before you can decide how you are going to soil sample you need to be clear about the purpose of your sampling. Different sampling approaches may be required depending on what you are sampling for, the soil type, the management unit (e.g. paddock), soil spatial variability (changes in soil type, dunes-swales etc), the accuracy required of the result, and the value given to the information provided (figure 1). So before you start, define very clearly the question you are asking of your soil samples. Consult a professional soil scientist, agronomist or your analytical laboratory to be sure that your soil samples are taken at the right time, from the right depth, the right place, in the appropriate number, and are stored in such way that the analysis required is not compromised. If quantitative soil analyses (kg/ha) are required then soil bulk density must also be measured and this requires considerable care.

Figure 1: *To be meaningful, soil sampling needs to take into account spatial variation in the soil condition. Differences in soil type, nutrient status and other soil properties may be exhibited within a paddock.*

Sampling strategy

Soil properties and fertility often vary considerably, even over short distances, necessitating a sampling strategy which either integrates this variation through creating a composite sample (sampling across) or describes it through including replicate samples (sampling within). Describing the variation requires a defined sampling within each different soil patch and analysing replicate samples separately. Such an approach might be required where there are consistent zones within a field such as under controlled traffic systems, perennial row or tree crops or raised bed systems. More often, the variation within the field is integrated into a single sample through creating a composite. Examples of these are illustrated in figure 2. 'A' is a random sampling that integrates the variation across the field, but samples are strategically located such that the location of samples approximates the relative representation of the different soil types. Sampling type 'B' uses a transect method to integrate the variation across the field, and in 'C' equal numbers of samples are taken from each zone and the area samples kept separate to obtain different soil analyses for each zone.

Sampling equipment

Manual sampling is often used where sampling is only required to 10 cm and bulk density is not required. Small pogo type samplers enable quick sampling for qualitative determinations such as nutrient concentrations or disease presence. Ensure that your sampling equipment is cleaned before you start to avoid contamination. For deeper depths mechanical (hydraulic) samplers are usually required for most soil types. If using these for soil carbon sampling be careful not to contaminate samples with lubricating oil.

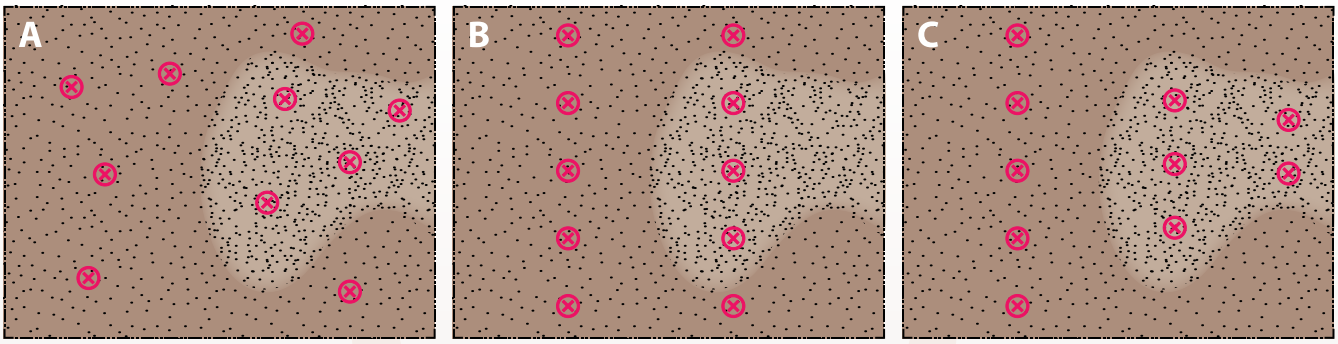

Figure 2: *Sampling strategies used to create a composite sample that integrates variation across different soil types (A & B) and a strategy to describe variation by sampling zones and analysing samples separately (C). A: haphazard samples strategically located to approximate the relative representation of different soil types. B: samples taken along transects intersecting different soil types. C: equal numbers of samples from each zone.*

Sampling depth

Sampling for soil fertility or biological activity assessment is typically done to 10 cm depth as this is where most of the organic matter and nutrient cycling occurs. However, for mobile nutrients like nitrate or potassium, deeper sampling may be required on the more sandy soils. Sampling to the rooting depth of a crop of interest might be useful for these nutrients or when studying water availability, otherwise it is generally too onerous. When assessing soil carbon stocks for accounting or budgeting purposes, a sampling depth of 30 cm is required to conform with standard accounting procedures. When sampling below 10 cm, soil samples are usually stratified by depth increments (e.g. 10, 20, 30 cm), depending on the objectives. When characterising a soil for the first time, sampling corresponding to the different soil layer depths (horizons) is often useful. Plant litter on the soil surface is not usually included in soil samples while plant root material is usually included, although generally sieved out prior to analysis.

Sample handling

Samples can be stored in polythene bags but should generally be dried or kept cool prior to analysis. Air drying (< 40°C) is usually sufficient and storage below 4°C usually arrests most biological activity. Dried samples can be broken up if clods are present, and any stones removed. If the amount of material collected is too great to manage and ship then it can be reduced in size by careful quartering, ensuring that there is no discrimination against particular particle sizes. Samples are typically put through a 2 mm sieve prior to analysis.

Measures of soil stocks

Converting qualitative laboratory data of nutrient concentrations (mg/kg or ppm) to kg/ha amounts requires knowledge of soil bulk density. Small changes in soil bulk density values can have a large impact on the calculated amounts of nutrient stocks. Bulk density sampling should thus be conducted carefully and rigorously to avoid substantial inaccuracies (see 'Bulk Density—Measuring and 'Bulk Density—On Farm Use' fact sheets). In order to correct stock calculations for stone and gravel content, the weight of stones/gravel > 2 mm will also be required.

Further reading

Dagliesh N, Foale M (2000) 'Soil matters: monitoring soil water and nutrients in dryland farming', APSRU, CSIRO, Brisbane. (online)

Rayment G, Lyons D (2011) 'Soil chemical methods—Australasia', CSIRO Publishing, Collingwood.

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