ABOVE: Soil testing is critical (Photo: Bits and Splits)

A guide to soil sampling for small landholders in the Shire of Esperance

This factsheet introduces small landholders/ growers to soil management. It provides detail on how to conduct a soil test, what the results mean and what to do about it.

Introduction

Soils are dynamic ecosystems containing vast numbers of living organisms, mineral particles and organic matter which provide water, nutrients and air for plant growth.

Healthy soils are important as they enable plants to be productive and soil issues (i.e. erosion) to be minimised. A key method of determining soil health is soil testing.

A soil test commonly refers to the analysis of a soil sample to determine nutrient content, composition, and other characteristics such as the acidity of pH level.

A soil test can also determine fertility and assist landholders to maximise the health of the soils and make decisions about management to maximise production.

Identifying potential soil limitations through soil testing, enables landholders to develop plans to reduce the potential of the problem areas.

Focus area

The focus area of this factsheet are landholders and growers within a 30-50km radius of the Esperance town site, primarily within the catchments of Lake Gore and Lake Warden.

Shire of Esperance land zoning of the focus area are classed as either 'Agriculture General' (broad scale enterprises) or 'Rural Small Holdings' (land size up to 8 hectares).

The focus area is commonly referred to as having 'lifestyle blocks' with production off the land varying from vegetable growers, forestry, aquaculture and grazing to name a few.

Key Messages

1. A representative soil sample is key to meaningful results
2. Interpret your results (with help if needed)
3. Develop a management plan for your soil for productive land use

Concerns for focus area

Soil management concerns identified by Department of Agriculture and Food WA (DAFWA), Esperance Regional Forum (ERF) and landholders for the study area include:

- Wind erosion – This occurs when groundcover is insufficient and soils are exposed to wind.
- Soil acidity – Acid soils are when the soil pH levels are less than 7.0 (strongly acid soil are less than 5.0).
- Waterlogging - Waterlogging refers to the saturation of soil with water.
- Water erosion – This occurs when soil is 'worn away' by the action of water
- Water repellence – Where water may not readily soak into the soil but tends to 'sit' on the top.

Soil sampling guide

Soil test results are only as accurate as the samples taken. If the samples do not represent the soils in the area, then the test results are likely to provide an inaccurate picture of soil health.

Collecting a representative soil sample

What tools/ resources do I need?

- Stainless steel sampling tube or probe. Note: sampling tubes are available from ERF offices.
- Collection bags (large sealed plastic lunch bags). Note: Make sure these are clean.
- Map of property/ paddock.
- Permanent marker.

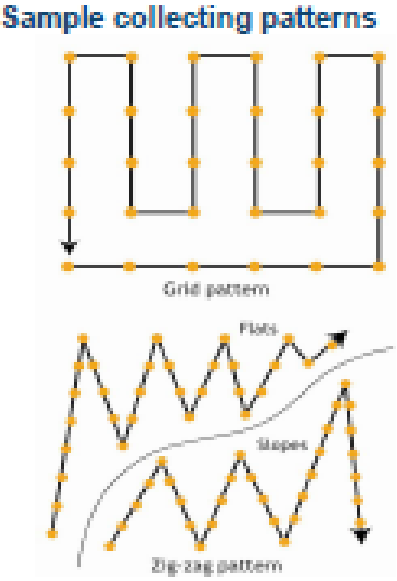
NOTE: Soil test kits can be obtained from your local agri-business.

When is the best time to take a sample?

- Changes in soil moisture, plant growth state and organic matter, all affect soil nutrient levels.
- Typically mid-summer (Jan-Mar) is the best time to take soil samples, or when the soil is dry and when the nutrient levels are the most stable.
- Check with your local agronomist/ agri-business as to the best time to sample soils in your area.

What are the best locations to take a soil sample?

- Take samples from across a paddock using a pre-determined sample pattern. Typical sample patterns are grid or zig-zag pattern.
- Sampling should be taken within all the different land management units within the paddock. NOTE: Refer to Property Planning factsheet.
- To increase soil test accuracy, avoid sampling near fences, trees, headlands, stock watering points and tracks, clumps of manure/ fertiliser dumps, burnt areas, and areas of abnormally good/ poor growth.
- Avoid sampling of paddocks where soil fertiliser or amelioration (i.e. liming/ gypsum) has occurred within the preceding three months.



How many samples do I take?

- It is better to over-sample than under-sample. The more samples the better picture of soil health.
- Take at least five (preferably more) samples per hectare, covering the whole area. Keep in mind that a hectare is 100m by 100m and to take five samples diagonally will involve taking samples about 30m apart in a zig-zag pattern.

What is the recommended sampling technique?

- Determine the soil sampling location.
- Using the predetermined sample collecting pattern, traverse over paddock to the soil sampling location.
- Remove debris from the soil surface without disturbing the soil.
- Push in the sample tube until the 10cm soil depth is reached. Note: Soil nutrients are concentrated in the top 10cm of soil, so samples are to be taken consistently to this depth. Most soil probes have a 10cm marker (and if not mark off within a ruler).
- Half turn the sample tube and remove it from the ground, taking care not to lose any soil from the end of the tube.
- Place a sample bag over the end of the bag and empty core into the bag. Tap the tube to loosen then sample if required.
- Take care not to touch the soil sample with your bare hands as this may contaminate the sample and affect the results.
- Label the bag clearly with the labelling system on the bag matching the labelling system on your property/ paddock map.
- Air dry samples by leaving the top of the bag open

if there is a delay between sampling and posting.

- When completed, close/ tape bags and organise transport/ posting to laboratory.

Where do I send my samples to be analysed?

- A number of laboratories are available to test and analyse your soil samples.
- There are a number of soil analysis that can be performed but a basic soil analysis is sufficient.
- Some services also offer soil test interpretation.
- It is important to send samples to the same laboratory over successive years as results between laboratories are not easily comparable.
- Contact your local agronomist/ agri-business or ERF for further information.

How often shall I perform soil sampling?

- Many factors influence soil test results, therefore soil analysis over one season is not conclusive.
- Testing the soils at the same time every few years, improves the comparison of results and builds a great picture of soil health over time.

Interpretation of soil tests

Laboratory tests of soil samples will diagnose and monitor the nutrient status of soils and indicate the level of soil acidity (pH).

Soil test results will indicate the soil nutrient status and level of soil acidity on the samples taken on your property. Tests may also include recommendations where deficiencies are identified.

For further information on the interpretation of your soil results contact your local agronomist/ agri-business.

What is soil acidity?

Soils are often characterised as being acidic or alkaline. This is determined using pH (a measure of hydrogen ions). The pH scale (Figure 1) covers a range from zero to 14.0 with 7.0 being neutral.

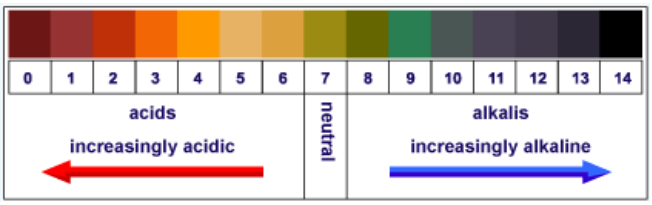


FIGURE 1: Soil pH scale

If soils are measured at less than pH 7.0 (in water) they are considered to be acidic. If they are less than pH 5.5 they are considered to be strongly acidic.

Acidic soils can be detrimental to plant health because they restrict the availability of plant nutrients, thereby limiting plant growth which can often lead to a lack of ground cover, increased weed growth and erosion.

Plant growth and most soil processes are favoured by a soil pH range of 5.5 to 8.0.

What is soil fertility?

Plants require a range of nutrients to grow successfully and if levels of these are not adequate in soil, production will decline and animal health may be affected.

Important nutrients to monitor include:

- Main soil nutrients - Phosphorus (P), Nitrogen (N), Potassium (K), Sulphur (S), Magnesium (Mg), and Calcium (Ca)
- Trace elements - Copper (Cu), Zinc (Zn), Manganese (Mn), Molybdenum (Mo), Iron (Fe), and Boron (B).

The correct level of nutrients in your soil depends on a number of factors including soil pH profile, soil type, farming system and rainfall.

For further information on the best soil fertility regime for your soil and productive land use, seek advice from your local agronomist/ agri-business.

Soil management

Healthy and fertile soils are critical for optimum plant growth and production from the land.

Included below are soil management recommendations for soil acidity and other soil issues (i.e. structure and fertility). There are many soil management methods, so therefore correctly understanding the current status of your soil is important to determine how to best manage it. Soil testing is critical to good land management.

Managing soil acidity

Soil acidification is a natural process which is accelerated by agriculture. The main cause is the inefficient use of nitrogen fertilisers (if a nutrient is not taken up by plant roots, it can leach from the root zone leaving the soil acidic). Removal of produce (i.e. hay) also contributes to soil acidification and some products are more acidifying than others.

Soil acidity can be managed through the application of lime, acid tolerant farming systems or a combination of these management strategies.

Liming

Applying agricultural lime is the most economical method of ameliorating soil acidity. Lime neutralises the acid and raises the pH of the soil.

The application rates of lime will depend on the existing soil pH profile, soil type, farming system, rainfall and lime quality.

Lime with a higher proportion of small particle size is best as it will react quicker to neutralise acid in the soil. In addition, the neutralising value is also important, as the higher the neutralising value, the less lime is needed.

Qualified liming experts are able to develop liming recommendations to suit individual requirements.

In WA agriculture, target pH levels above 5.5 in the topsoil and 4.8 in the sub-soil is recommended.

As a general guide, the following liming applications (Table 1) are recommended.

TABLE 1: Recommended liming amounts (DAFWA, 2014)

Soil Depth	Soil pH	Lime amount (over 5 years)
0-10cm	Under 5	2 tonne/hectare
0-10cm	Under 5.5	1 tonne/hectare
10-20cm	Under 4.5	2 tonne/hectare
10-20cm	Under 4.8	1 tonne/hectare
20-30cm	Under 4.5	1 tonne/hectare
20-30cm	Under 4.8	Measure pH in 3 years

It is important to note that the rate of soil acidification due to agriculture can be reduced but not eliminated. Liming will always be needed to prevent the soil from becoming too acidic.

Acid tolerant farming systems

The impact of soil acidity can be reduced by choosing crop and pasture species or varieties that are tolerant of low soil pH (Figure 2).

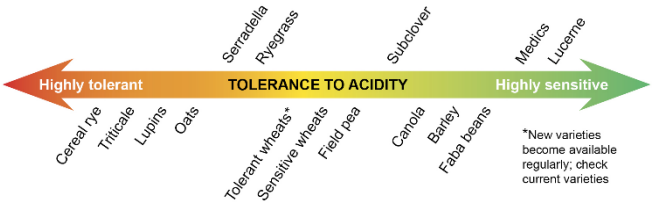


FIGURE 2: Soil pH scale (DAFWA, 2016)

Acid tolerant plant species should be used in conjunction with a liming program to recover soil pH to target pH levels.

Improving soil nutrient profile

Healthy soils and correct soil nutrient balance is critical for optimum plant growth. The first step to working out a soil fertiliser regime is determining what you want to produce, as plants have different growing habits and nutrient needs.

Application of fertilisers are important, however the correct fertiliser application is vital as application in excess of the plant requirements can be a source of pollution, not to mention being ineffective and costly!

Generally speaking, major soil nutrients (N, P, S) need to be applied frequently during the plant growing season, whereas minor nutrients and trace elements can be applied less frequently.

Choosing fertilisers can be confusing, so in order to determine how much of a particular product to add, the nutrient status of your soil needs to be properly understood, and the 'nutrient analysis' of fertiliser known.

There are different types of fertilisers available on the market including organic and inorganic fertilisers, macro and micro-nutrient fertilisers and general agricultural fertilisers i.e. urea.

Fertilisers are different in how they release nutrients. Some are quick release (releasing nutrients over short time) or others are controlled release (release nutrients to plants over a long period).

The main points to consider here are:

- Know your soil fertility (and deficiencies) i.e. soil test,
- Know what you want to produce off the land, and
- Apply fertiliser regime to match your needs.
- Seek help from your local agronomist/ agri-business!

Improving soil structure

Healthy soils are soils that have good soil structure, soil nutrient status and soil pH. Soil structure is generally inherent in the soil, however, land management practices can improve or decrease structure and condition to some extent.

Improving water and nutrient retention

Many soils in the study area are typically free draining, hold little water, are inherently infertile and contain (and retain) few of the essential nutrients. Improving the water and nutrient holding capacity of your soil provides significant benefits to plants, decreasing water requirements and reduces leaching of nutrient into the environment.

Water and nutrient retention can be improved by adding:

- Organic material (i.e. compost, peat, animal manure)
- Finer mineral particles i.e. clay, loam (aim is to lift clay content to about 5-10%)
- Other additives (i.e. vermiculite, perlite)

Water-repelling soils

Some soils are water-repellent, caused by organic matter breaking down leaving behind a waxy coating on the soil.

The simplest way to improve water take-up by these soils is to use a soil wetting agent.

A soil wetting agent acts similarly to detergents and allows water to penetrate into the pore spaces between the soils particles. Adding fine mineral particles (i.e. loam or clay) is an effective long term management technique.

Soil erosion

Soil erosion can be significant. For example a loss of 1mm of top soil represents 10 to 12 tonnes per hectare of soil loss. Large areas of land can be lost to wind and water erosion, which not only results in scouring of land and windblown areas but can also result in siltation and damage to aquatic habitats.

Key management techniques to control erosion include:

- Maintain adequate surface cover of native vegetation, pasture or stubble.
- Minimise the amount of land to be cultivated.
- Fence off sand dunes and permanently stabilise by planting perennial vegetation.
- Establish wind-breaks to reduce surface velocity and combat the erosive forces of the wind.
- Construct contour banks to reduce water runoff.

Soil compaction

In some circumstances, excess cultivation and animal or vehicle traffic can result in soil compaction and loss of soil structure. Most soils will benefit from the addition of organic matter, as well as the addition of gypsum.

Waterlogging

Waterlogging (excess water in the root zone) and inundation (surface ponding) can often reduce plant yields and in some areas result restrict plant growth.

Drainage or raised beds are possible ways to overcome waterlogging and inundation in most areas. Changes to crop species, varieties and management may also be necessary for these areas.

Need help?

Esperance Regional Forum:
admin@esperanceregional forum.org.au
http://esperanceregionalforum.org.au

Department of Agriculture and Food WA
Melijinup Road Esperance
Phone: (08) 9083 1111
www.agric.wa.gov.au

References

Overheu, T D, Muller, P G, Gee, S T, and Moore, G A. (1993), Esperance land resource survey. Report 8. DAFWA.

Department of Agriculture and Food WA (2014). Small landholder series noteworthy 9. Soil sampling and testing on a small property. DAFWA.

Department of Agriculture and Food WA (2014). Small landholder series noteworthy 16. Soil acidity on your small property. DAFWA.

Government of South Australia (n.d) Managing soils for sustainable production. Government of SA.

Various soil collection and management citations, retrieved from http://www.agric.wa.gov.au

Author:

Nadene Baldwin, Principal at HSE Consulting

PHONE: 0428 855 056

EMAIL: nadene@hseconsulting.com.au

WEB: www.hseconsulting.com.au

Other resources in this series:

The Esperance Growers' Markets; more than just fresh, local produce.

A guide to property planning for small landholders in the Shire of Esperance.

A guide to soil sampling for small landholders in the Shire of Esperance.

www.esperanceregionalforum.org.au
admin@esperanceregionalforum.org.au
PO Box 1153 Esperance WA 6450
PH: 0409 750 878

NURTURING A SUSTAINABLE ESPERANCE

Australian Government | National Landcare Programme | Shire of Esperance We make it happen!

SOUTHCOAST NATURAL RESOURCE MANAGEMENT INC.

Regional Landcare Facilitator

HSE CONSULTING HEALTH SAFETY ENVIRONMENT