PLANT TISSUE TESTING FACT SHEET

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

SOUTHERN REGION
MAY 2021

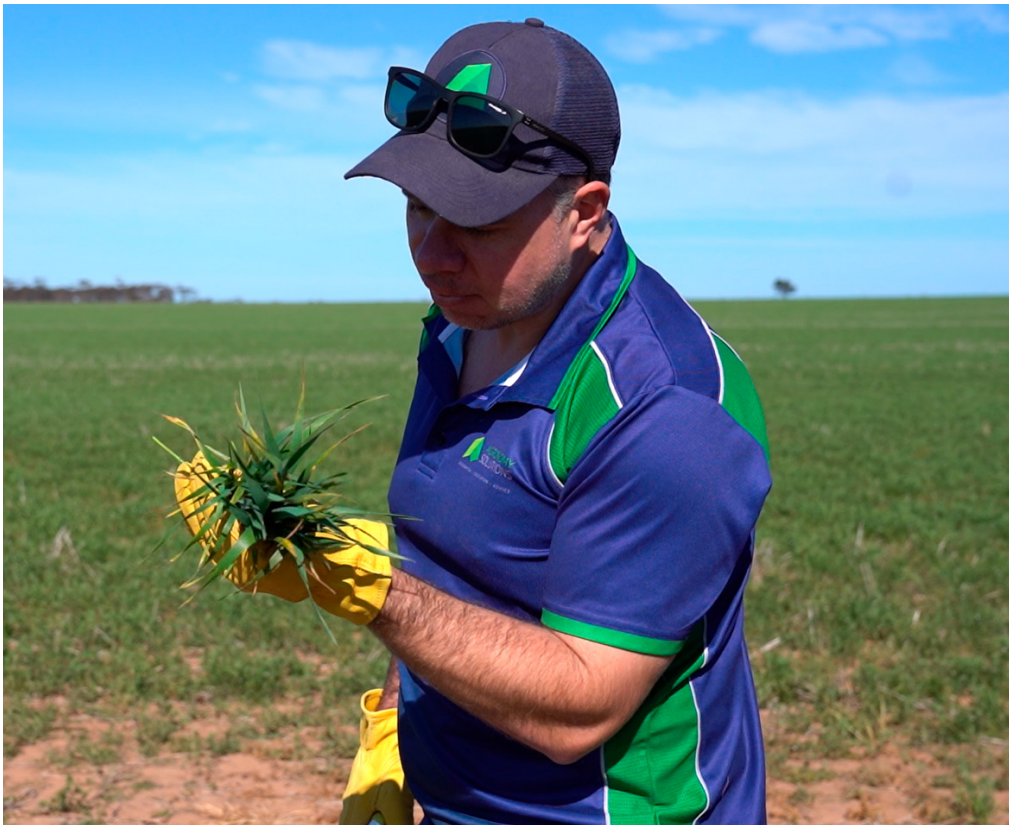
Using plant tissue testing as part of a nutrient management strategy

Plant tissue testing can help growers monitor the uptake of nutrients and possible deficiencies limiting crop growth during the season

KEY POINTS

- Plant tissue testing can diagnose immediate issues in the paddock, monitor the performance of a current fertiliser plan and predict deficiencies in the paddock before it shows visual symptoms.
- Plant tissue testing complements soil testing results and is more accurate for measuring trace element levels.
- Collect samples at growth stage 30 or the end of tillering, prior to in-season fertiliser application.
- To collect a sample, cut the plants in rows on either side of a 30-centimetre ruler in pre-determined zones of the paddock and place sample in a paper bag.
- Be consistent when obtaining a representative sample of the paddock considering production zones and areas of good and poor crop growth.
- Take photos and record growth stage to determine plant nutrient status.
- Do not sample within 36 hours of a frost or heat shock event.

Photo: AgCommunicators



Agronomy Solutions Director Sean Mason assessing a plant tissue sample taken as part of the GRDC project 'Soil and Plant Testing for Profitable Fertiliser Use'.

Used correctly, plant tissue testing is a highly cost effective and strategic monitoring tool for maintaining plant health and optimising crop production.

Plant tissue testing is a much more reliable option for getting a gauge on trace element availability than soil testing.

Why should plant tissue testing be completed?

Plant tissue testing is valuable for monitoring crop nutrient status, predicting nutrient issues during the growing season, understanding interactions between soil and plant nutrient uptake and formulating an in-season fertiliser program to address any deficiencies and imbalances.

It can be used as a diagnostic, monitoring or predictive tool alongside soil testing.

Soil testing estimates how much nutrient is likely to be available and plant testing estimates how much nutrient was actually taken up by the plant. In some respects, plant analysis is more accurate than soil testing as factors such as dry conditions and poor root growth impact the results.

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Diagnose

- Testing can diagnose an immediate issue which requires immediate action.
- Plant tissue analysis can be used to determine the limiting nutrient or other reasons for poor growth using reference samples (from strip trials – see the GRDC Soil and Plant Testing Project fertiliser strategy factsheet).

Monitor

- Optimise yield and production by assessing plant nutrition levels and adjusting fertiliser or management strategies to suit.
- Collect plant testing data to build a data set for future reference.

Predict

- Visually assessing plants can be useful in identifying if a deficiency is present. However, the symptoms may be similar to other disorders such as plant disease or other nutrient deficiencies.
- Often plants will only show visual signs of nutrient deficiency when they are seriously deficient. The 'hidden hunger zone' is the period before a crop visually shows it is being constrained when nutrient levels are low. Plant tissue testing can help determine this period before the growth is seriously reduced.
- Waiting until a crop shows visual signs of deficiency can be a costly strategy, causing yield penalties greater than 20 per cent. When a crop shows clear signs of nutrient deficiency, the impact on growth might be severe and it will never be able to recover.

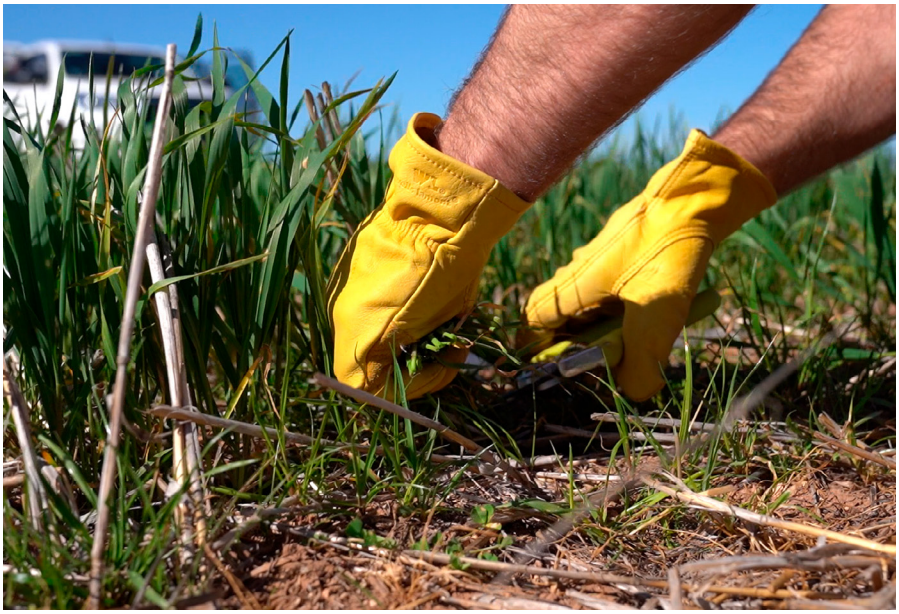
When conducting plant tissue testing, it is advised to collect samples at growth stage 30 (GS30), or the end of tillering before plant demand for nitrogen increases rapidly.

How to collect a plant sample

When collecting plant samples, whole shoots (or whole tops) should be cut at the base, where the plant changes from white to green above the soil, for simplicity and to ensure accuracy.

For phosphorus trials, take tissue samples in each testing zone (see the GRDC Soil and Plant Testing Project zoning factsheet for more information on zoning) at GS30 for each treatment.

Photo: AgCommunicators



Clean secateurs and gloves must be used to take appropriate plant tissue samples for testing.

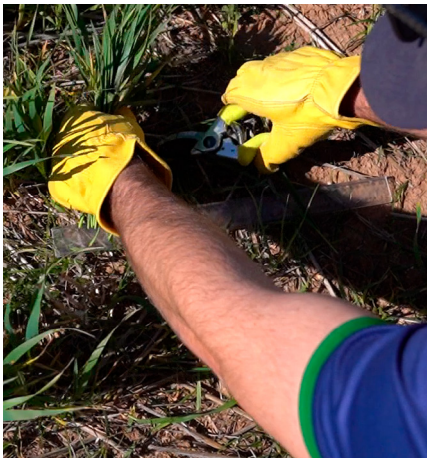
For nitrogen trials, take samples at least two to three weeks after nitrogen application to see how that application has affected levels.

It is important to collect samples from areas of both good and poor growth to understand base line levels and the variability within the paddock.

There are two recommended methods for plant testing:

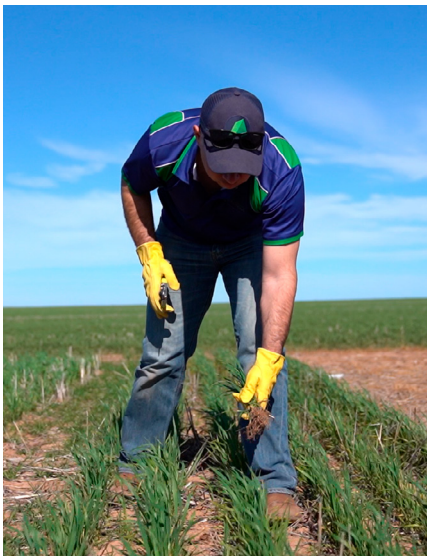
- **Method 1:** In between crop rows in the pre-determined sampling zone, place a 30-centimetre ruler on the soil and cut the plant material on either side of the ruler at ground level (where the plant stem changes from white to green). Repeat this process three times in each of the pre-determined monitoring zones. Bulk the samples and send to the laboratory for analysis.

Photo: AgCommunicators



Method 1 for plant sample collection.

Photo: AgCommunicators



Method 2 for plant sample collection.

- **Method 2:** Pull 20 to 30 whole plants from the soil at random in a pre-determined sampling zone. Cut off the roots at the green and white margin. Record the number of plants collected. Bulk the samples and send to the laboratory for analysis.

Tips for plant sampling:

- Sample early in the day from 10am to 1pm
- Use clean scissors or secateurs
- Include all above ground shoot material in the sample
- Record GPS location (this will already be recorded if completing soil testing at the same time)

Be consistent when obtaining a representative sample within the sample area by selecting plants of similar vigour, variety, size and age.

If a soil sample is taken to aid the interpretation of plant tissue results, ensure the sample is taken from the same area as the plant tissue sample.

Take photos of the crop and samples and record the growth stage of the crop, time between emergence and sampling, the row spacing and seeding rates so biomass production and plant nutrient status can be calculated. Recording growth stage and yield estimate is essential to have a reference point of growth.

Also record any symptoms of disease, weather conditions, crop rotation, fertiliser history and any recent fertiliser or pesticide applications.

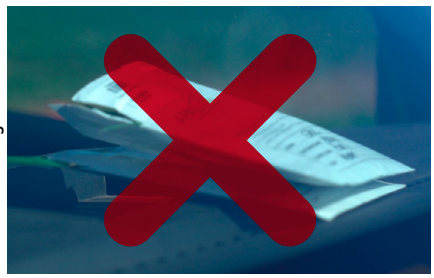
Once collected, the sample needs to be kept cool until sent for analysis.

Things to avoid

Photo: AgCommunicators

Make sure you bring fresh paper bags, a ruler, clean secateurs or scissors and clean gloves to the plant sampling site and label the sample for the lab appropriately.

Photo: AgCommunicators



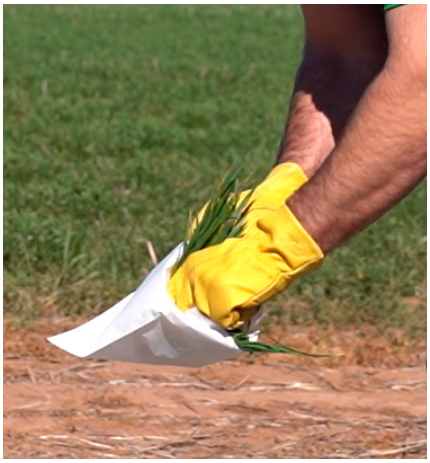
Do not put samples in direct sunlight. This will cause the sample to sweat and hasten its decomposition.

Plant sampling should not be conducted within 36 hours of a frost, heat shock event or and within a week of a herbicide application.

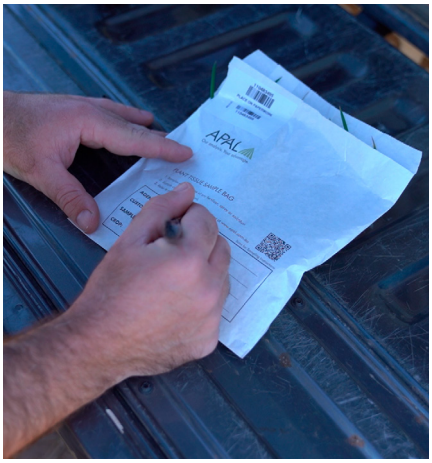
Do not sample plants under moisture stress.

Avoid spoiled, diseased, insect damaged and dead plant tissue, areas of the paddock which are poorly drained, headlands or sheep camps and plants growing in dung or urine patches.

Photos: AgCommunicators



Place plant samples in a paper bag to ensure sample does not sweat.



Record growth stage of the crop and fertiliser history for the lab.

Do not place the sample in a plastic bag. This will cause the sample to sweat and hasten its decomposition. Use a paper bag instead.

Avoid contamination from dust, fertilisers and chemical sprays.

What nutrients can be tested from plant tissue?

The availability of all essential nutrients can be determined using one sample.

For nitrogen, GS30 is just before a crop's peak nitrogen demand so if a laboratory can offer a suitable turnaround time, growers can decide whether they need to apply more nitrogen just before the crop really needs it.

Plant analysis is particularly useful for monitoring uptake of nitrogen, phosphorus, potassium, sulphur and trace elements (e.g. zinc, copper and manganese)

Using the results from plant tissue testing

For phosphorus, plant tissue testing is a gauge of whether the fertiliser application at sowing delivered enough nutrient and whether the plant has been able to access the fertiliser and soil reserves.

Unfortunately, phosphorus and potassium deficiencies cannot be fixed in-season, but tissue testing will provide useful information for application decisions in later seasons.

Plant testing results for nitrogen can be used to help determine in-season

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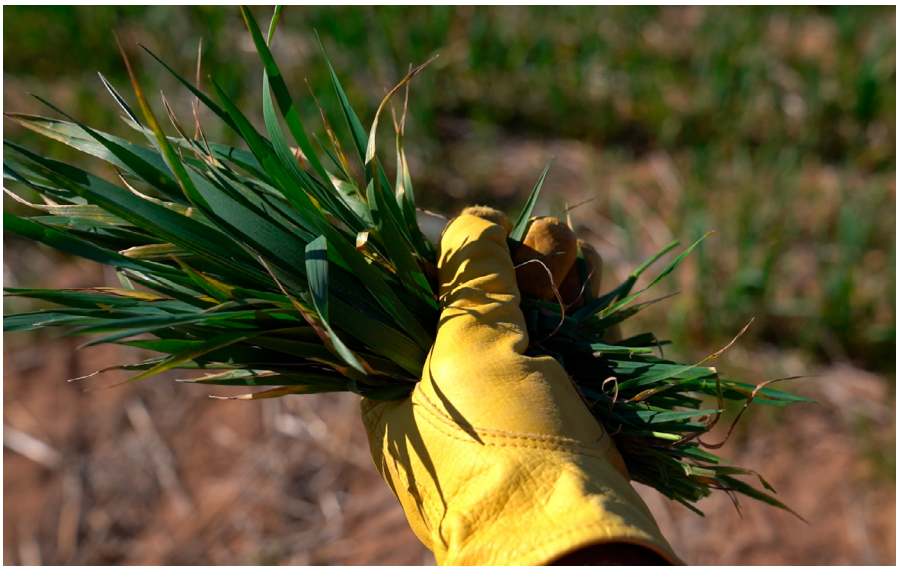

Select samples which are representative if the sample area and are not frost damages or drought affected.

nitrogen application in conjunction with deep nitrogen soil test results. Similarly, sulphur deficiency can also be corrected in season.

Trace element deficiencies identified early in the season can be rectified with foliar sprays. Zinc deficiency usually shows up early in the season and needs to be addressed promptly. Hence, plant analysis during early tillering (growth stages 21 to 26) is recommended if zinc deficiency is possible.

If plant tissue testing shows low levels of a particular nutrient, test strips can be completed in areas of high risk to confirm the plant responsiveness to that nutrient. A test strip may be a foliar spray or fertiliser application which will provide residual levels.

It is important to identify the extent of the deficiency and develop nutrient management strategies and seasonal tactics for the future such as changing spray rate or planting less susceptible crop species.

Use this factsheet in conjunction with the GRDC 'Nitrogen soil testing for in-season fertiliser application' fact sheet.

USEFUL RESOURCES & REFERENCES

GRDC update paper: Plant tissue testing for micronutrients and likelihood of responses www.grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2017/02/plant-tissue-testing-for-micro-nutrients-and-likelihood-of-responses

GRDC podcast: Plant Tissue Testing – uncovering hidden hunger www.grdc.com.au/news-and-media/podcasts-old/driving-agronomy-podcasts/2010/06/plant-tissue-testing-uncovering-hidden-hunger

GRDC Crop Nutrition fact sheet – Micronutrients https://grdc.com.au/__data/assets/pdf_file/0029/126497/grdc_fs_micronutrients_low-res-pdf.pdf.pdf

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