



MAKING BETTER FERTILISER DECISIONS FOR CROPPING SYSTEMS IN AUSTRALIA

BFDC INTERROGATOR

MINIMUM DATA SET



Department of
Primary Industries



MINIMUM DATA SET

DEFINING THE MINIMUM DATA NEEDED FOR CONDUCTING FIELD TRIALS THAT INVESTIGATE SOIL TEST-CROP RESPONSE RELATIONSHIPS

Fertilisers can contribute more than 20% of variable costs to broadacre grain production. Despite these costs, growers tend to have a low level of confidence in soil testing as a tool to underpin fertiliser decisions on farm.

To help increase confidence in soil testing more than 5000 soil test-crop response relationships from across Australia have been compiled by the *Making Better Fertiliser Decisions for Cropping Systems in Australia* project (BFDC). The BFDC Database includes all available trials for nitrogen (N), phosphorus (P), potassium (K) and sulphur (S) rates applied to cereal, oilseed and pulse crops.

The online *BFDC Interrogator* enables representatives of the grains and fertiliser industries to develop soil test-crop response calibrations and critical soil test values for different crops. Access to the *BFDC Interrogator* is available only after successful completion of the BFDC training workshop.

The database is also being used to identify knowledge gaps and to help answer some important research questions. For example, does phosphorus mineralisation contribute to crop requirements?

Purpose:

Defining the minimum data needed for conducting field trials that investigate soil test-crop response relationships has been prepared as a guide for organisations and individuals conducting future soil test-crop response trials.

Collecting the minimum data described in this fact sheet will enable **suitable trials** to be uploaded to the national database and used for **refining critical soil test values** of soil test-crop response relationships when using the *BFDC Interrogator*.



Back Paddock Company

Essential data:

A report for any nutrition trial must include:

- ☐ A record of the crop species and variety.
- ☐ A description of the treatments applied. This includes the date of application, the rates of application, the placement of the nutrient, and the fertiliser product(s) used (ideally, avoid choosing fertilisers with more than one key nutrient for example, DAP). This description must also include a description of any basal dressings of nutrients not under investigation.
- ☐ A description of a statistically valid trial design best obtained in consultation with a biometrician before conducting the trial. For example, a suitable trial design will include a minimum of three replicates of each treatment randomly distributed across the site. Ideally, ensure there are at least four treatment rates and at least 10 degrees of freedom. This must include a nil treatment (Y_0) and a nutrient rate large enough to achieve maximum yield (Y_{max}).
- ☐ Sowing and harvest dates, and the year(s) the trial was conducted.
- ☐ Resulting crop yields for each of the treatments (t/ha) and reported moisture content. The results must be statistically validated.
- ☐ A description of the calibration curve fitted to crop yield results from a trial (for example, the Mitscherlich curve). Fitting the calibration curve will enable Y_0 and Y_{max} to be estimated using the trial data. Y_0 and Y_{max} are used to derive a percentage of relative yield ($Y/Y_{max} \times 100$) and this is used as part of a soil test-crop response calibration using the *BFDC Interrogator*.
- ☐ Carry out soil testing at the site in the year(s) of the trial. This must include soil fertility test results, soil type (Australian Soil Classification) and topsoil texture, sampling depth or depths and sampling date(s).
- ☐ Use the 'recommended' soil test methods described in (Rayment and Lyons 2010). 'New' tests being developed can also be used and reported in addition to the 'recommended' methods.
- ☐ Eastings and Northings for the location of the trial (or alternatively as a minimum distance to the nearest town).
- ☐ A record of the data owner: the organisation conducting the trial and where data are stored (who has responsibility for the data).
- ☐ Details of any stress effects on the crop reported, such as plant pests and diseases or weather conditions.

Preferred minimum soil testing procedures:

- Carry out soil sampling for nitrogen to a depth of 60 cm or a series of depths that can be aggregated to 60 cm. Determine and report nitrate-N in mg/kg. Obtain a measure of soil bulk density for each depth increment so nitrate-N can be converted to kg/ha.
 - Carry out soil sampling for phosphorus to a depth of at least 0-10 cm and determine Colwell P plus Phosphorus Buffering Index (PBI) as a minimum, although other additional soil phosphorus tests can also be conducted.
 - Carry out soil sampling for potassium for at least the 0-10 cm depth and determine either Colwell K (in mg/kg) or exchangeable potassium as a minimum. Convert exchangeable potassium test results to mg/kg units for comparative purposes. Consider depth sampling to 60 cm.
 - Carry out soil sampling for sulphur for at least the 0-60 cm depth and determine either KCl40 or mono-calcium phosphate extractable sulphur (in mg/kg) as a minimum.
 - Where ever possible use ASPAC certified laboratories for analyses or, before processing samples, cross check internal laboratory method validation with an ASPAC certified laboratory for the analytical methods to be used.
- ☐ Record growing season conditions. Important questions include:
 - Was the crop grown under dryland or irrigated conditions?
 - What was the fallow and growing season rainfall?
 - What irrigation practices were applied and what volumes of water were used?

Source: Rayment, GE and Lyons, DJ 2010, *Soil Chemical Methods — Australasia*, CSIRO Publishing, Collingwood.



OTHER IMPORTANT DATA

In addition to the essential data, there are some metadata which are of benefit to the database:

- **A description of the tillage system used such as:**
 - Multiple tillage (two or more passes pre sowing) or conventional cultivation
 - Reduced tillage (one pass pre sowing)
 - Direct drilling (one pass at sowing)
 - No tillage (knife point or disc at sowing, 5-20% topsoil disturbance)
 - Zero tillage (disc seeding)
 - Raised beds
- **An indication of the row spacing used during sowing.**
- **Grain quality attributes. For example, grain protein, nutrient concentrations or oil concentrations.**
- **A report of paddock history, as this may influence trial results. For example, paddock history information can be used to help better understand the role of residual nitrogen.**
- **A record of any soil variation across the trial site.**
- **Any recorded plant analysis according to the sampling guidelines described in (Reuter and Robinson 1997). Analysis of total plant nutrient(s) under investigation as a minimum but ideally analysis of the full suite of essential plant nutrients.**

Other types of data can also be included in soil test-crop response trial reports (for example, water use efficiency data, maximum and minimum daily temperatures, A class pan evaporation readings). These data can typically be included in the BFDC Database.

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Disclaimer

The information contained in this fact sheet is based on knowledge and understanding at the time of writing — March 2012. The information contained in this publication is provided as general information. Users should obtain any appropriate professional advice relevant to their particular circumstances.

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