



MAKING BETTER FERTILISER DECISIONS FOR CROPPING SYSTEMS IN AUSTRALIA

CASE STUDY: *Phosphorus in field peas in South Australia*

Fertilisers can contribute more than 20% of variable costs to broadacre grain production. Despite these costs, there tends to be a low level of confidence in soil testing to underpin fertiliser decisions on farms.

CASE STUDY SITUATION

- A consultant in South Australia wishes to estimate the critical Colwell P in the 0-10 cm depth for field peas in that State.



To help increase confidence in soil testing, more than 5000 soil test-crop response results from across Australia have been compiled by the *Making Better Fertiliser Decisions for Cropping Systems in Australia* project (BFDC).

The *BFDC National Database* includes all available trials for nitrogen (N), phosphorus (P), potassium (K) and sulphur (S) use in cereal, oilseed and pulse crops.

The online *BFDC Interrogator* has been built to enable members of the grains and fertiliser industries to develop soil test-crop response calibrations and critical soil test values for different crops.

Registered access to the *BFDC Interrogator* is available after successful completion of a BFDC training workshop.



Department of
Primary Industries



IDENTIFYING SOIL TEST-CROP RESPONSE TRIALS

The *BFDC Interrogator* enables users to select from all of the national trials (locations shown as grey dots on the map in Figure 1).

For this case study, the user first selects 'phosphorus', 'grain legume field pea', 'SA' and 'All' soils and years.

This means that the list of possible trials is not narrowed at the start of the interrogation.

On the **Soil test-crop response trials** page (see Figure 1), the following options were selected: Nutrient — 'P', Farming System — 'dryland', From Year — 'All', To Year — 'All', State — 'SA', Season — 'winter', Crop — 'grain legume field pea' and Australian Soil Class — 'All'. The user then clicks on the 'Select trials that satisfy the selection criteria above' option.

Figure 1. Soil test-crop response trials

Soil test-crop response trials

The database holds 5420 trial treatment series undertaken at 2593 sites. These consist of 1709 N, 2281 P, 356 K and 270 S trials.

Searching the database

Trial sites are plotted on the map as grey dots. Make a selection of trials based on the search criteria below and/or by drawing a polygon on the map around your region of interest. Always begin with a broad selection, then narrow the criteria to search the selection in more detail.

Nutrient: **P** Farming System: **dryland**

From Year: **All** To Year: **All**

State: **SA** Season: **winter**

Crop: **grain legume field pea**

Australian Soil Class: **All**

Select trials that satisfy the selection criteria above

Map tools: **Draw Polygon**

Optional Layers | Legend

☐ Road ☐ Vegetation ☐ Rainfall



SOIL TEST-CROP RESPONSE CALIBRATIONS

The screen changes to the **Soil test-crop response calibrations** page (see Figure 2), where the selection of trials is refined and soil test-crop response criteria are derived. The map now displays SA and the 51 sites with field peas where soil phosphorus testing has been reported (coloured dots).

Note: The points highlighted on the map in Figure 2 are soils where phosphorus soil test data exist for trials on field peas.

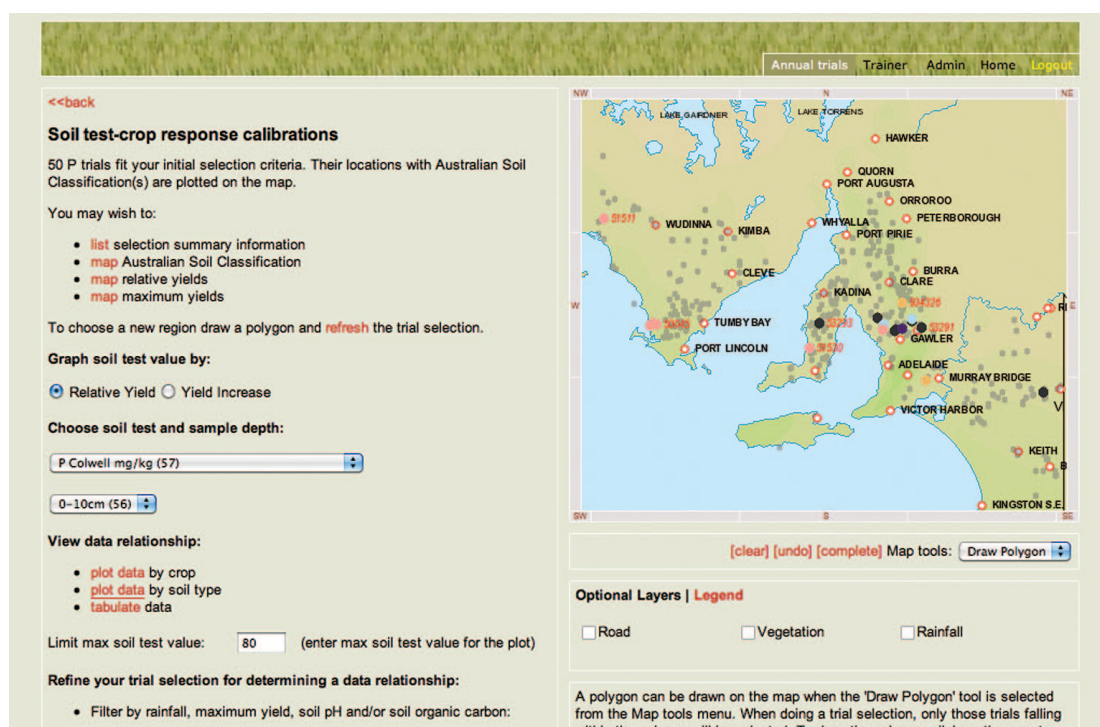
On the **Soil test-crop response calibrations** page (see Figure 2), the following options were selected: 'Choose soil test and sample depth' — select 'P Colwell (mg/kg)' and '0-10 cm'. 'Relative Yield' was the default selection under

'Graph soil test values by'. Limit the x axis in the plot by entering '80' mg/kg (this eliminates a single very high soil test value). The user then clicks on the 'plot data by soil type' option.

There are also a number of filter options, which allow users to further refine a calibration relationship (these are not demonstrated in this case study).

The percentage relative yield (% RY) is the yield at no fertiliser (Y_0) expressed as a percentage of the maximum yield (Y_{max}) obtained for a trial with fertiliser application ($Y_0 / Y_{max} \times 100$).

Figure 2. Soil test-crop response calibrations



CALIBRATION RELATIONSHIPS

A graph is plotted for the data selected, with soil test axis (x axis) and the relative yield axis (y axis), with each Australian Soil Class (ASC) shown as a different colour (see Figure 3).

The *BFDC Interrogator* fits a calibration curve to the trial data selected. It also calculates the soil test concentrations at the 80, 90 and 95% RY with their 95% confidence limits for the fitted curve.

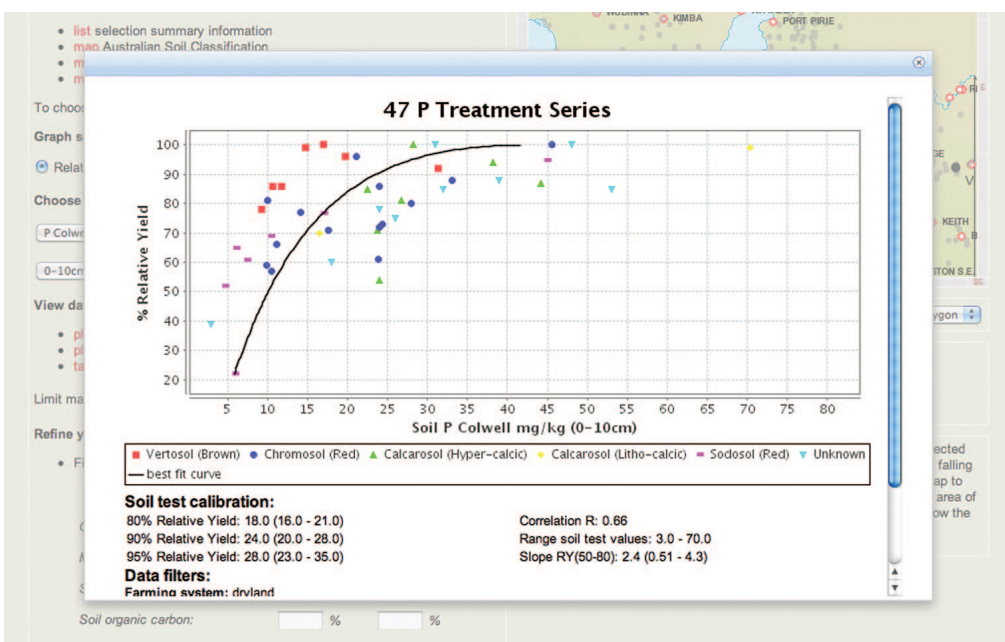
In this case study, the RY calibration plot shows that 47 treatment series met the final selection criteria.

A treatment series is a response calibration data point. A trial may have one or more treatment series. For example, some trials may use different phosphorus fertilisers (for example, fluid vs granular), different tillage systems (for example, no-till vs multiple tillage), or different placements of phosphorus at a range of rates. This could give a number of crop responses to phosphorus (treatment series) for a single trial.

The calibration curve shows that a critical soil test concentration of 24 mg/kg Colwell P was associated with 90% RY. The Colwell P value was within the critical range of 20-28 mg/kg (95% confidence limits). The fit to the data was good as the 'R' correlation coefficient was 0.66. A minimum 'R' value of 0.15 is required for a data set to be accepted.

(Continued page 5) ►

Figure 3. Calibration relationships





► (Continued from page 4)

The brown vertosols (red squares) have few data points (7), but they appeared to fit a much lower critical value relationship. The hyper calcic calcarosols (upright green triangles; also seven data points) appeared to be mainly below the line of best fit. This hints that a possible difference in critical soil test value is due to soil type. However, there are insufficient data available to explore this possibility; the *BFDC Interrogator* will only fit a relationship to a minimum of eight data points, and then only if the 'R' is >0.15.

Registered users of the *BFDC Interrogator* can only exclude specific trials from a calibration by using the filter options or by limiting the extent of the soil test axis to exclude excessively high (outlier) values of the soil test. More information on the use of filters is given in case study: **Potassium in wheat.**

CONCLUSION

The critical value of Colwell P concentration in the 0–10 cm depth for field peas in SA was 24 mg/kg with a critical range of 20–28 mg/kg.

The relationship was good ($R = 0.66$), despite several clear outliers, possibly due to soil type differences.

Acknowledgements

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Disclaimer

This case study is an example of the use of the *BFDC Interrogator* obtained from trial data entered into the database before December 2011. The *BFDC Interrogator* does not provide a fertiliser recommendation and this example does not seek to interpret the calibration relationship. The case study demonstrates the scope of the database and how the data can be used. Contact your FERTCARE® Accredited Advisor if you would like more information.

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