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.

CASE STUDY: Potassium in wheat

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 researcher wishes to establish the critical K Colwell (0–10 cm depth) for wheat in Australia.
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 ‘K’, ‘cereal wheat’ and ‘All’ soils to give a large data set. This means that the list of possible trials is not narrowed at the start of interrogation.

On the Soil test-crop response trials page (see Figure 1) the following options were selected: Nutrient — ‘K’, Farming System — ‘dryland’, From Year — ‘All’, To Year — ‘All’, State — ‘All’, Season — ‘winter’, Crop — ‘cereal wheat’ 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 CALIBRATIONS

The screen changes to the Soil test-crop response calibrations page (see Figure 2, page 4), where the selection of trials is refined and soil test-crop response criteria are derived. The map of Australia now shows the location of all 208 currently selected trial sites (shown as coloured dots).

**Note:** The points highlighted on the map in Figure 2 are soils where potassium soil test data exist for experiments on wheat and cover a full range of soil pH. Users can then select a filter to identify trials with specific soil pH.

On the Soil test-crop response calibrations page (see Figure 2, page 4) the following options were selected: ‘Choose soil test and sample depth’ — select ‘K 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 ‘1100’ mg/kg (this eliminates a single very high soil test value). Scroll down and select ‘Soil pH\text{CaCl}_2$ below 5.5’. This filter will restrict trials to those on more acidic soils. The user then clicks on the ‘plot data by soil type’ option.

In this case study the ‘soil pH’ filter option has been used.

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

(Continued page 4)
Figure 2. Soil test-crop response calibrations
A graph is plotted for the data selected, with soil test axis (x axis) and the relative yield axis (y axis), with each soil 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 192 treatment series met the revised selection criteria. However the range of the critical value for \( K_{\text{Colwell}} \) is compressed by the much higher values of \( K_{\text{Colwell}} \) in some soils, even though the length of the x axis has already been limited to 1100 mg/kg. These high \( K_{\text{Colwell}} \) values leverage the line of best fit and give a false high critical value (52 mg/kg; range 47–57 mg/kg).

**Figure 3. Calibration relationships**
Close this page and return to the Soil test-crop response trials page. Select 'Limit max soil test value' and change from '1100' to '200'. Select 'plot data by soil type' again (see Figure 4).

Figure 4. Alternative calibration relationships
(Continued from page 6)

This change deleted the sites with highest leverage (174 treatment series now rather than 192). The line of best fit shows that a critical K Colwell concentration of 41 mg/kg was associated with 90% of maximum grain yield (range 39–44 mg/kg). This was a lower critical value than with the 192 treatment series (52 mg/kg: range 47–57 mg/kg). The fit to the data was good as the ‘R’ correlation coefficient was 0.60.

Scrolling down the page shows details on the data and filters selected in this case study.

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.

CONCLUSION

The critical value for K Colwell concentration in the 0–10 cm depth for wheat on more acidic soils was estimated at 41 mg/kg with range of 39–44 mg/kg.

The relationship was good (R = 0.60). Some data were eliminated by limiting the x axis and restricting critical K Colwell values to a maximum of 200 mg/kg.

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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.