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Development of an Australian soil test calibration database

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Better Crops, Better Environment … through Science

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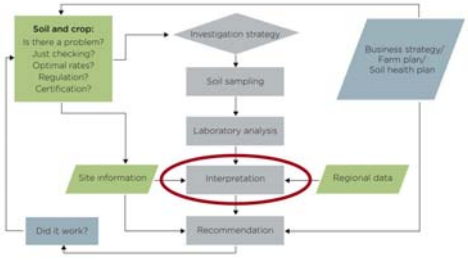
NSW Department of Primary Industries GRDC Grains Research & Development Corporation

Introduction

- Since the 1950's many thousands of fertiliser trials have been conducted in Australia using N, P, K &/or S in cereal, pulse & oilseed crops
- Combination of research projects, industry programs, & individual trials
- Undertaken by state & federal agencies, fertiliser companies, universities, & grower groups
- Variable amounts of data reported for different trials:
  - Consistent sampling protocols
  - Analytical methods

BFDC Interrogator:

Soil testing and nutrient management



Better Fertilizer Decisions for Cropping

- Developed a consistent online database of all available & future fertiliser response trials for cereal, pulse & oilseed crops
- Developed an online interrogation tool & national training resources enabling the Australian grains & fertiliser industries to review critical soil test criteria
- Critical soil test criteria published in Crop & Pasture Science (CSIRO Publishing).
- Findings underpin Decision Support Systems under Fertcare® – the Australian Fertiliser Industry's stewardship program

Searchable data respository

- Two requirements for a repository:
  - Consistent and manageable data entry process
  - Easily accessible to next usersTo develop a consistent data repository:
  - A minimum compulsory dataset was defined. Key data were:
    - A fitted estimate of Y_0 & Y_{max} obtained from fully replicated & statistically valid trial results
    - Soil test values, soil test depths, analytical methods
  - A standard Microsoft Access© data entry template was developed and used by more than 20 persons
  - Data were checked for consistency and imported into a central MySQL® Australian Crop Nutrition Database

Australian Nutrition Crop Database

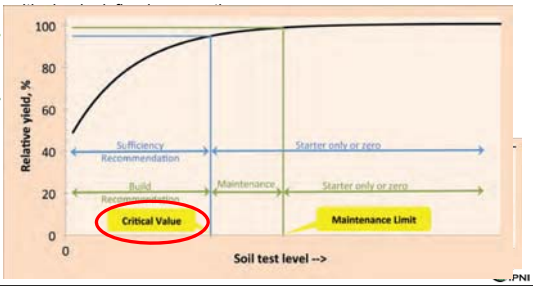
	Cereals	Oilseeds	Pulses
Nitrogen	1890	235	
Phosphorus	1976	93	607
Potassium	277	149	38
Sulphur	114	158	5
			5542

Minimum data requirements

- Location & soil type (ASC)
- Crop species, variety,
- sowing dates, harvest dates.
- Treatments described (4Rs)
- Statistically valid
- Yields recorded
- Able to fit Y_0 and Y_{max} to generate relative yield
  - Mitscherlich, quadraticm parabolic, square root.
  - $RY\% = 100*Y_0/Y_{max}$
- Recognized soil test & recorded sample depth!!!!!

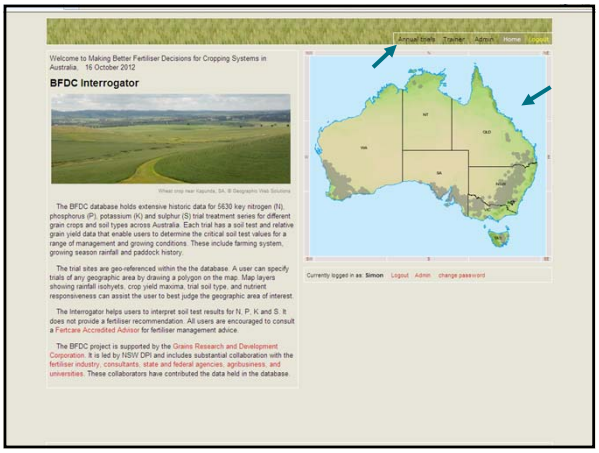
Project background

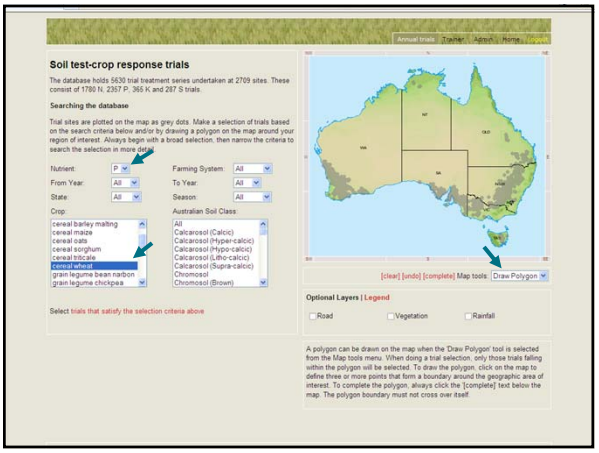
- What — to provide independent, consistent soil test calibrations

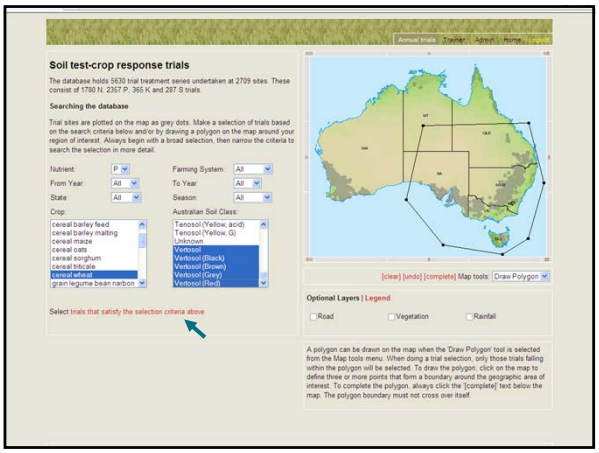


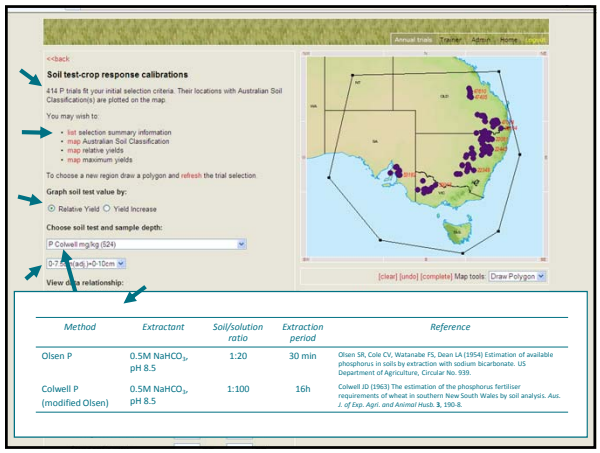
Calibration Curves developed

- Graph % RY by soil test value for data selected.
- Linear regression in the domains of
  - y = ln (soil test),
  - x = arcsin (sqrt RY),
  - computing the critical levels and ranges
  - then back transformed.
- OUTPUTS
  - Graphic representation of data used
  - Critical values calculated






Soil test-crop response trials
The database holds 5630 trial treatment series undertaken at 2709 sites. These consist of 1780 N, 2357 P, 365 K and 287 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:
Farming System:
From Year:
To Year:
State:
Season:
Crop:
Australian Soil Class:
Select trials that satisfy the selection criteria above
Optional Layers | Legend
Road
Vegetation
Rainfall
A polygon can be drawn on the map when the 'Draw Polygon' tool is selected from the Map tools menu. When doing a trial selection, only those trials falling within the polygon will be selected. To draw the polygon, click on the map to define three or more points that form a boundary around the geographic area of interest. To complete the polygon, always click the '[complete]' text below the map. The polygon boundary must not cross over itself.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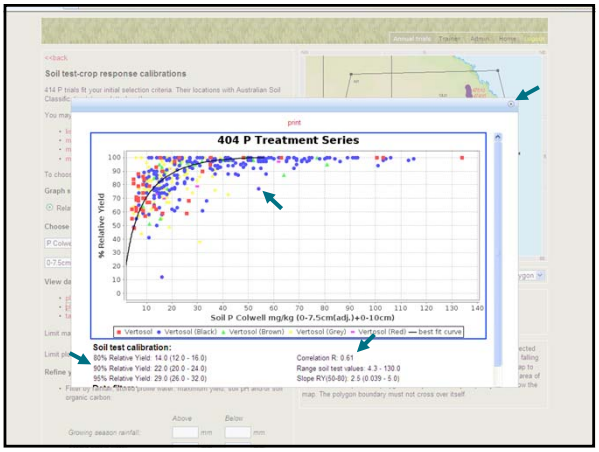
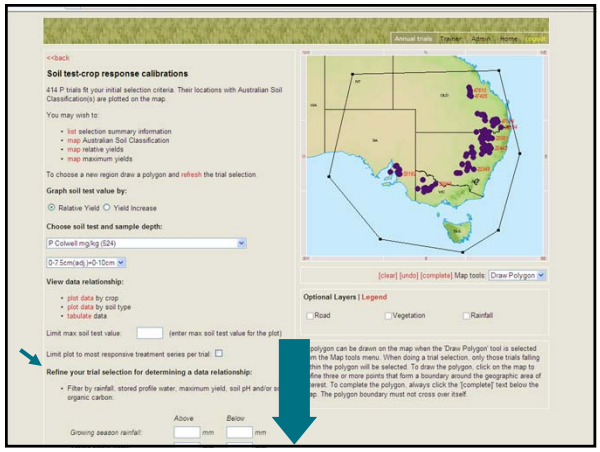
Soil test-crop response calibrations
414 P trials fit your initial selection criteria. Their locations with Australian Soil Classification(s) are plotted on the map.
You may wish to:
list selection summary information
map Australian Soil Classification
map relative yields
map maximum yields
To choose a new region draw a polygon and refresh the trial selection.
Graph soil test value by:
Relative Yield
Yield Increase
Choose soil test and sample depth:
P Colwell mg/kg (524)
0-7.5cm(adj.)+0-10cm
View data relationship:
Method
Extractant
Soil/solution ratio
Extraction period
Reference
Olsen P
0.5M NaHCO3, pH 8.5
1:20
30 min
Olsen SR, Cole CV, Watanabe FS, Dean LA (1954) Estimation of available phosphorus in soils by extraction with sodium bicarbonate. US Department of Agriculture, Circular No. 939.
Colwell P (modified Olsen)
0.5M NaHCO3, pH 8.5
1:100
16h
Colwell JD (1963) The estimation of the phosphorus fertiliser requirements of wheat in southern New South Wales by soil analysis. Aus. J. of Exp. Agri. and Animal Husb. 3, 190-8.


print
404 P Treatment Series
% Relative Yield
Soil P Colwell mg/kg (0-7.5cm(adj.)+0-10cm)
Vertosol
Vertosol (Black)
Vertosol (Brown)
Vertosol (Grey)
Vertosol (Red)
best fit curve
Soil test calibration:
80% Relative Yield: 14.0 (12.0 - 16.0)
90% Relative Yield: 22.0 (20.0 - 24.0)
95% Relative Yield: 29.0 (26.0 - 32.0)
Correlation R: 0.61
Range soil test values: 4.3 - 130.0
Slope RY(50-80): 2.5 (0.039 - 5.0)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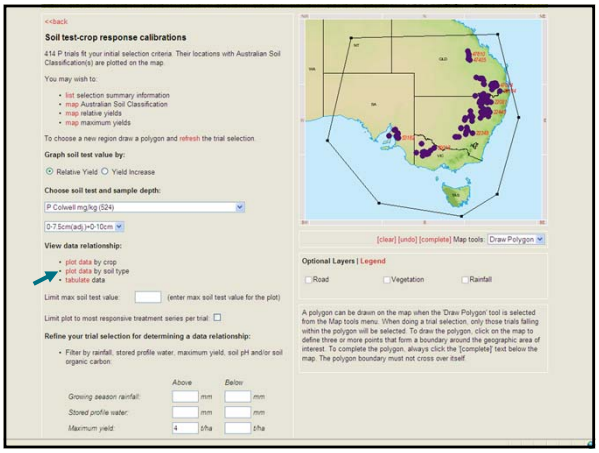
Yield Increase
Choose soil test and sample depth:
P Colwell mg/kg (524)
0-7.5cm(adj.)+0-10cm
View data relationship:
plot data by crop
plot data by soil type
tabulate data
Limit max soil test value:
(enter max soil test value for the plot)
Limit plot to most responsive treatment series per trial:
Refine your trial selection for determining a data relationship:
Filter by rainfall, stored profile water, maximum yield, soil pH and/or soil organic carbon:
Above
Below
Growing season rainfall:
mm
Optional Layers | Legend
Road
Vegetation
Rainfall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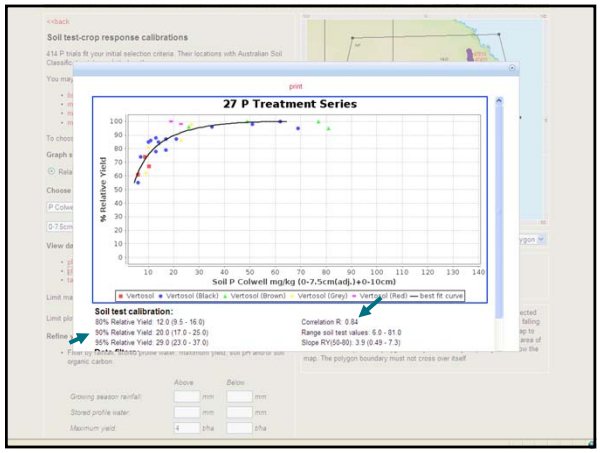
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27 P Treatment Series
% Relative Yield
Soil P Colwell mg/kg (0-7.5cm(adj.)+0-10cm)
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Vertosol (Black)
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best fit curve
Soil test calibration:
80% Relative Yield: 12.0 (9.5 - 16.0)
90% Relative Yield: 20.0 (17.0 - 25.0)
95% Relative Yield: 29.0 (23.0 - 37.0)
Correlation R: 0.84
Range soil test values: 6.0 - 81.0
Slope RY(50-80): 3.9 (0.49 - 7.3)

Accessing the data

- Accredited users of the database
  - Trained in using the tool
- Promotion of the outcomes
  - Conference talks, etc.
  - Special Edition of Crop & Pasture Science
- Accreditation through FertCare
- Legacy data
- On-going input of data, with described minimum datasets and key nutrient/crop/soil combinations

http://www.bfdc.com.au/interrogator/frontpage.vm

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