



IPNI
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Development of an Australian soil test calibration database

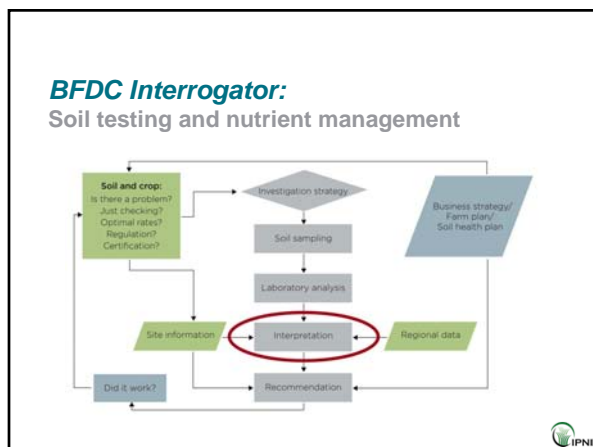
Simon Speirs, Graeme Watmuff, Douglas Reuter, Ken Peverill & Robert Norton

Better Crops, Better Environment ... through Science
XXIV Congreso Argentino de la Ciencia del Suelo
Bahia Blanca, May, 2014.

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



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 repository



- Two requirements for a repository:
 - Consistent and manageable data entry process
 - Easily accessible to next users
- To 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

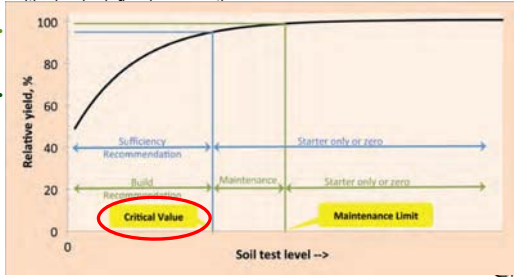

Minimum data requirements

- 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, quadratic 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
 - $y = \ln(\text{soil test})$,
 - $x = \arcsin(\sqrt{RY})$,
 - computing the critical levels and ranges
 - then back transformed.
- **OUTPUTS**
 - Graphic representation of data used
 - Critical values calculated



"I think you should be more explicit here in step two."




MAKING BETTER FERTILISER DECISIONS FOR CROPPING SYSTEMS IN AUSTRALIA

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- BFDC Interrogator**
- Included data
- Calibrations
- Publications
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- Acknowledgments
- Disclaimer

MAKING BETTER FERTILISER DECISIONS FOR CROPPING SYSTEMS IN AUSTRALIA




New South Wales Department of Primary Industries



Welcome to Making Better Fertiliser Decisions for Cropping Systems in Australia, 18 October 2012

BFDC Interrogator




The BFDC database holds extensive historic data for 5630 key nitrogen (N), phosphorus (P), potassium (K) and sulphur (S) trial treatment series for different grain crops and soil types across Australia. Each trial has a soil test and relative grain yield data that enable users to determine the critical soil test value for a range of management and growing conditions. These include farming system, growing season rainfall and paddock history.

The trial sites are geo-referenced within the database. A user can specify trials of any geographic area by drawing a polygon on the map. Map layers showing rainfall isohyets, crop yield maxima, trial soil type, and nutrient responsiveness can assist the user to best judge the geographic area of interest.

The Interrogator helps users to interpret soil test results for N, P, K and S. It does not provide a fertiliser recommendation. All users are encouraged to consult a Fertiliser Accredited Advisor for fertiliser management advice.

The BFDC project is supported by the Grains Research and Development Corporation. It is led by NSW DPI and includes substantial collaboration with the fertiliser industry, consultants, state and federal agencies, agronomists, and universities. These collaborators have contributed the data held in the database.



Soil test-crop response trials


The database holds 5630 trial treatment series undertaken at 2709 sites. These consist of 1700 N, 2307 P, 365 K and 207 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.



Soil test-crop response trials

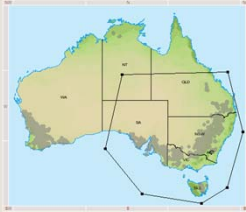
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Nutrient: P To Year: All From Year: All To Year: All State: All Season: All Farming System: All Australian Soil Class: Vertisol (Black) Vertisol (Brown) Vertisol (Gray) Vertisol (Red) Tenosol (Yellow, acid) Tenosol (Yellow, G) Ustosol Vertisol (Black) Vertisol (Brown) Vertisol (Gray) Vertisol (Red)

Select trials that satisfy the selection criteria above



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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 NaHCO ₃ , 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 NaHCO ₃ , pH 8.5	1:100	16h	Colwell JD (1963) The estimation of the phosphorus fertilizer requirements of wheat in southern New South Wales by soil analysis. Aust. J. of Exp. Agril. and Animal Husb. 3, 190-8.



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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:

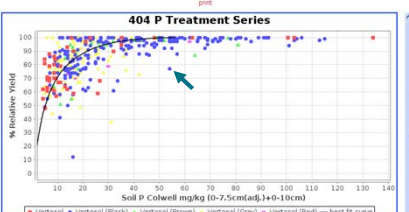
Refine your trial selection for determining a data relationship:

- Filter by rainfall, stored profile water, maximum yield, soil pH and/or soil organic carbon.

Growing season rainfall: Above Below mm mm

Stored profile water: mm mm

Maximum yield: t/ha t/ha



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(SD): 2.5 (0.039 - 5.0)

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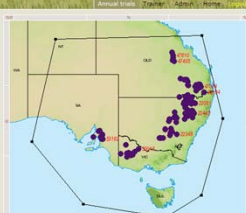
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- Filter by rainfall, stored profile water, maximum yield, soil pH and/or soil organic carbon.

Growing season rainfall: Above Below mm mm



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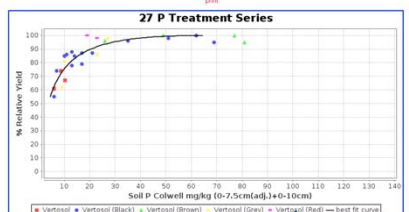
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Maximum yield: t/ha t/ha



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 (22.0 - 37.0)

Correlation R: 0.84
 Range soil test values: 6.8 - 81.0
 Slope RY(SD): 3.0 (0.48 - 7.3)

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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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