Development of an Australian soil test calibration database

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

Better Crops, Better Environment ... through Science
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Better Crops, Better Environment

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
• 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 $Y_0$ & $Y_{\text{max}}$ 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

<table>
<thead>
<tr>
<th></th>
<th>Cereals</th>
<th>Oilseeds</th>
<th>Pulses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen</td>
<td>1890</td>
<td>235</td>
<td></td>
</tr>
<tr>
<td>Phosphorus</td>
<td>1976</td>
<td>607</td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>277</td>
<td>149</td>
<td>36</td>
</tr>
<tr>
<td>Sulphur</td>
<td>154</td>
<td>153</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5542</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.
  - $RY\% = 100 \times Y_0 / Y_{max}$
- Recognized soil test & recorded sample depth!!!!

Project background

- **What** — to provide independent, consistent soil test calibrations
- **Why** — ensure consistent understandings of critical levels and their modifying factors reducing confusion, increasing trust and ensuring well-informed fertiliser investments.
- **How** — combine well-defined, interrelated soil sampling, laboratory analysis methods and critical ranges to provide the rigour that ensures reliability and repeatability.

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
**Method**

<table>
<thead>
<tr>
<th>Soil/solution ratio</th>
<th>Extraction period</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olsen P0.5 M NaHCO₃, pH 8.5</td>
<td>1:20 30 min</td>
<td>Olsen SR, Cole CV, Watanabe FS, Dean LA (1954)</td>
</tr>
<tr>
<td>Colwell P (modified Olsen)</td>
<td>0.5M NaHCO₃, pH 8.5</td>
<td>Colwell JD (1963)</td>
</tr>
</tbody>
</table>

**Estimation of available phosphorus in soils by extraction with sodium bicarbonate.**

US Department of Agriculture, Circular No. 939.

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