Evidence based agriculture

If you believe – it will be so?

Rob Norton
Regional Director, ANZ
International Plant Nutrition Institute.

Agronomy Community Meetings, July/August 2013
Kingaroy, Dubbo.
Why discuss this issue?

• As a scientist I get asked whether or not some new product “works”.

• The quality of information from some companies that is paraded as “proof” or as “science”.

• Other ag. inputs are required to prove efficacy as well as safety.
  – Agricultural Pesticides and Veterinary Medicines.
  – National Variety Testing schemes.

• Need for evidence based agriculture

• Ignorance more frequently begets confidence than does knowledge.
  – Charles Darwin
Trying out “New” Products

• Lawes had patented this acidulation process.
• Lawes and Bennet 1843 set out to assess the efficacy of the product.
• Established Broadbalk at Rothamstead (UK) in 1843, farmed continuously since then.
• Established to see if chemical sources of nutrients were as good as farmyard manure.
Evidence – what do we mean?

- Self promotion
- Endorsements (*IT & AMI*)
- Testimonials
  - “Well I love it”

Legal reference: ACCC v Advanced Medical Institute Pty Ltd (No 3) (2007)
ATPR (Digest) 46-269
Caveat Emptor – let the buyer beware?

• The Australian Competition & Consumer Commission does not agree
  – “Truth in advertising” (country music, military intelligence)

• Australian Consumer Law (Jan 2011 Federally enacted)
  – Australian Consumer Law (ACL) – through the ACCC or ASIC
  – the law guarantees the product must be safe, durable, free from defects, fit for purpose, acceptable in appearance, match its description and match any sample or demonstration model.

• Courts have found false and misleading representations:
  – business made a series of untrue representations about the therapeutic benefits of negative ion mats it sold.

Legal reference: ACCC v Giraffe World Australia Pty Ltd (1999) 95 FCR 302; 166ALR

• http://www.accc.gov.au
Evidence – what do we mean - *Controls*

- In science, we start with a premise that something does *not* work and then design tests to test that premise.

- The testing has to be against some other treatments
  - Test material
  - Nothing
  - Normal practice
  - At equal nutrient levels
  - Soil test

  “Appropriate controls”
Evidence – what do we mean - *Replicated*

- Differences occur across fields – so the treatments should be repeated. Remove/average the trends.

- Number of replicates depends on how small the difference is that is to be detected
  - 5-10% normal variation
  - 10% difference
  - 10% chance of capturing
  - 3-4 replications min.

“Replicate”
Evidence – what do we mean - *Randomized*

- Positional effect within a field as well as between adjacent treatments.

- The treatments need to be mixed up
  - Completely randomised
  - Blocked
  - Randomised complete block
  - “Border plots”
  - Other designs

“Randomised”
Evidence – what do we mean - *Repeatable*

- Anyone can win the lottery.

- The testing has to be across soils types, over years and maybe with different crops or pasture species.

- Does it work for your situation?
  - Local research
  - Field based
  - Well designed

- For publication – 2-4 years of data across multiple sites
Evidence – what do we mean - *Reasonable*

- Does the product claim it is “special”?

- If it raises yields – nutrients have to come from somewhere.

- There is a mechanism and predictability about the actions
  - Cause & Effect

- Occum’s Razor *lex parsimoniae*
  
  *when faced with competing hypotheses that are equal in other respects, select the one that makes the fewest new assumptions*

"I think you should be more explicit here in step two."
Building a body of evidence

• Field trials & Glasshouse studies
• Publications – available and describe what was done
  – Conference publications
  – Peer Reviewed Journal publications (Crop & Pasture Science, Soil Science, Field Crops Research, Plant & Soil, etc).
  – Hierarchy within these journals as well (based on citation)
  – Reviewed as a body of work

• Evidence based agriculture
  – Evaluation of the evidence based on experiments.
  – Reasons for the observations.
  – Predictions about where else the effects could occur.
Presenting results

<table>
<thead>
<tr>
<th>Product</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>3.5</td>
</tr>
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<td>3.9</td>
</tr>
<tr>
<td>RN 308</td>
<td>4.1</td>
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</tbody>
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- Scales on graphs
- Indication of error
  - What is really different
Presenting results

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<th>Yield (t/ha)</th>
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</tr>
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• Scales on graphs

• Indication of error
  – What is really different
  – **Least significant difference**
  – Probability
  – LSD or SE notations
  – Science has been done
Stretching the friendship

• Comparing results that are not statistically different
  – 3.9 t/ha – cost $40 - return $780 /ha
  – 4.1 t/ha – cost $45 – return $820/ha
    • Extra $40 per hectare for an extra $5

• Comparing unequal application rates as equal
  – 10 t/ha @ 5 l/ha product X
  – 10 t/ha @ 4 l/ha product Y
    • So product Y is 25% more effective than product X

• Comparing something without soil tests
  – 400 bushel apples/ha using 50 ml/ha of product X
  – 400 bushels apples/ha using normal fertilizer application
    • So product X replaces the whole of normal fertilizer application
New/Old Products

• Evidence from Trials
  – Appropriate controls
  – Replicated
  – Randomised
  – Repeatable
  – Reasonable
    • Mass balances?
    • Magic or special?
    • Laws of physics/chemistry

• Test it yourself, be sceptical – its your $ and your reputation.

• Ask “How do you know that?”

“Frankly, I don’t know what to believe. They say if it sounds too good to be true, it usually is.”
“The illiterate of the future are NOT those who can’t read or write, but those who cannot learn, unlearn and re-learn”

Alvin Toffler
How definite is evidence?

- Interpretation is often the key – but keep an open mind.
- John Maynard Keynes - When the facts change, I change my mind. What do you do, sir?
Our Industry should aim to -

• Pride itself on good science.
• Be objective about information.
• Not have to resort to litigation to resolve issues of efficacy.
• Not need to have small print.