

Making No-Till Wheat A Winning Nitrogen Tool

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Overview!

- The last 10 years of no-till in Australia
- My visits from farmers, scientist all over
- My own farm experience
- N from C based crops, no legumes
- Practical implications

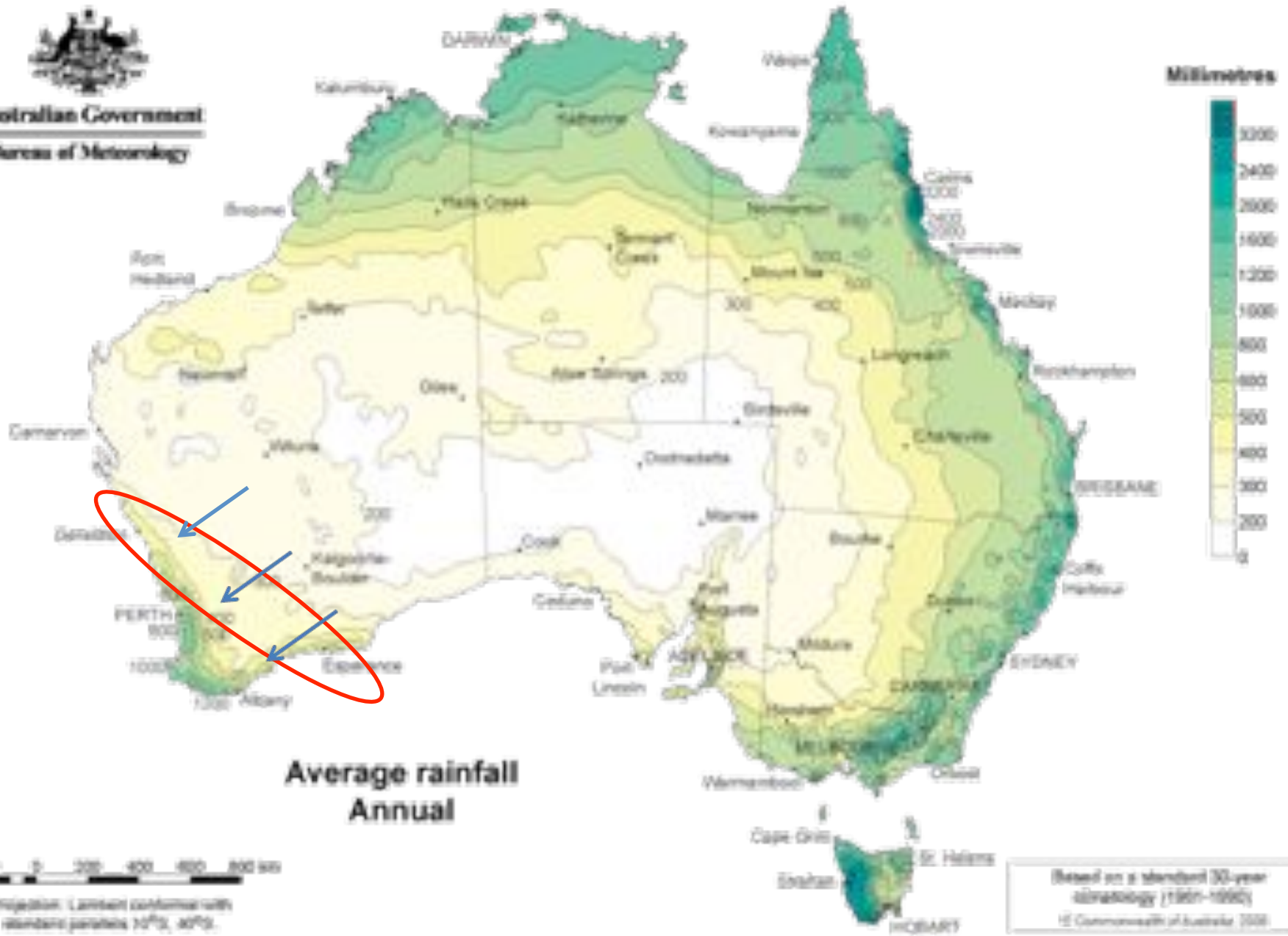


20th Annual National No-Tillage Conference
St. Louis, Missouri * Jan. 11-14, 2012

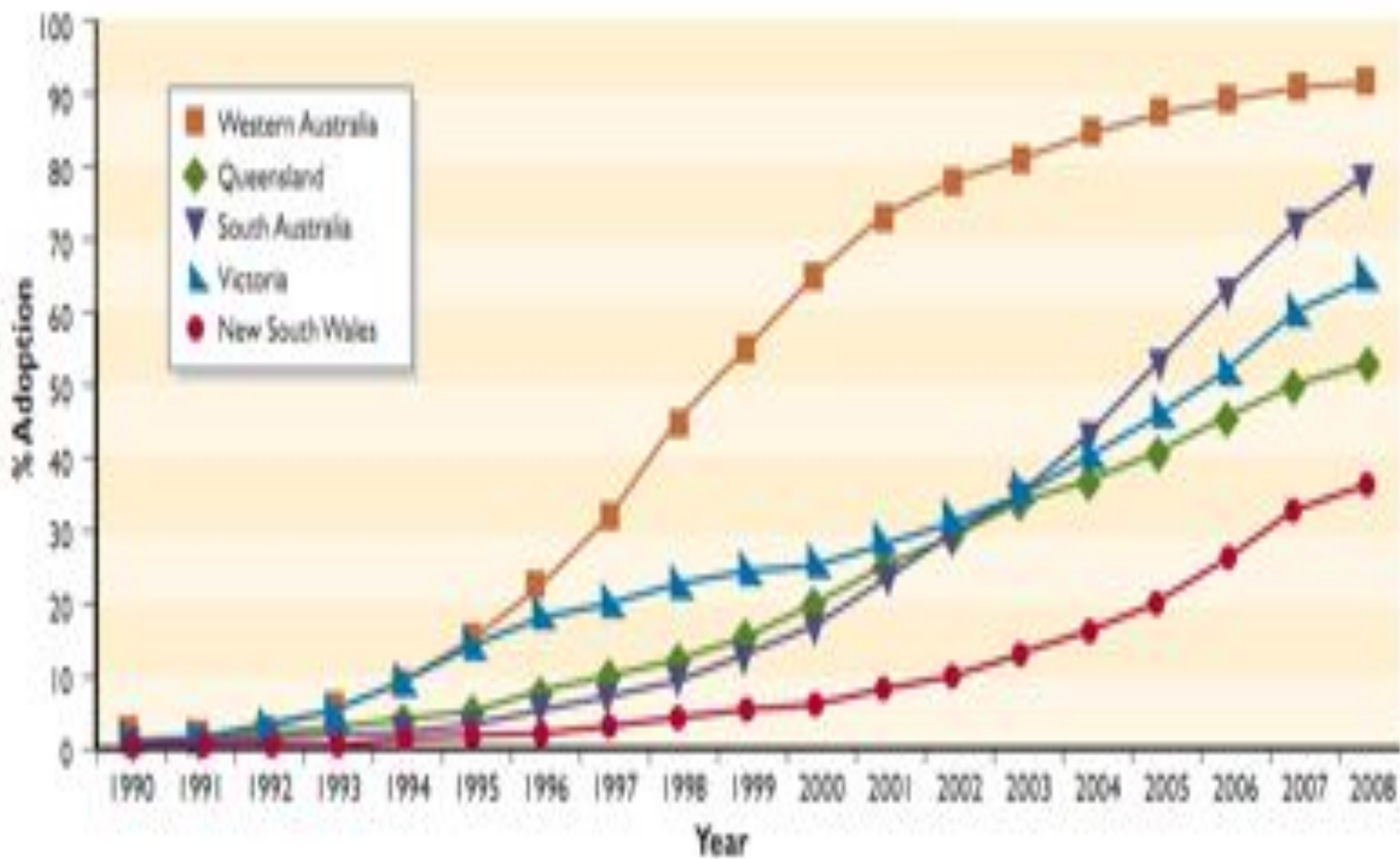




Australian Government
Bureau of Meteorology



Estimated rate of adoption of no-tillage for Australia states (Crabtree).



10 tough yrs = diversity retreat!

- 2000-2010, most of Australia has had 7 droughts of less than half average
- Good farmers have tightened the belt
- 2001 we were trying cover crops, WSC
- Our main legume yields less
- Lupins are 50% wheat in dry and <\$/t



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NO-TILL FARMER



Let's talk N budgets & no-till

- So more wheat and some canola – soil spec
- With no legume and no-till plus crop residue
- We are holding OC levels through time
- We are exporting more N than we apply
- Where is the N coming from?
- Is it from N that is mineralised from OC?
- No! If this was so then OC would decrease
- Therefore the answer is not mineralised N

N Budget: Avon, SA 1979-96

Continuous wheat rotation

- Total grain harvested = 19.7 t / ha
- N removed = 394 kg / ha
- Total N 1979 = 0.140%
- Total N 1996 = 0.135%
- N from soil pool = 60 kg/ha
- Fertiliser N added = 0 kg/ha

Unexplained N

334 kg/ha (394-60)
= 19.7 kg N/ha/year

The bacteria responsible are those that thrive in the absence of available soil N and the absence of legumes. Rotations without legumes, and where stubble is retained for several years, often produce crops that exceed the N budget expected and are proof of this phenomenon of nitrogen-fixing bacteria. Further proof that this occurs is that soil organic matter levels rise, and crops perform better than expected, given the amount of N applied. Some agronomists have suggested the N must be coming from lightning but this could only account for about 7 kgN/ha, not the 30-40 kgN/ha that is often calculated to be happening.

Referred to nature! A group of South African farmers are interested in the N response. Compare the plots of 0 versus 30kgN/ha in foreground and background respectively (green this is the 10th non-legume crop in a row).

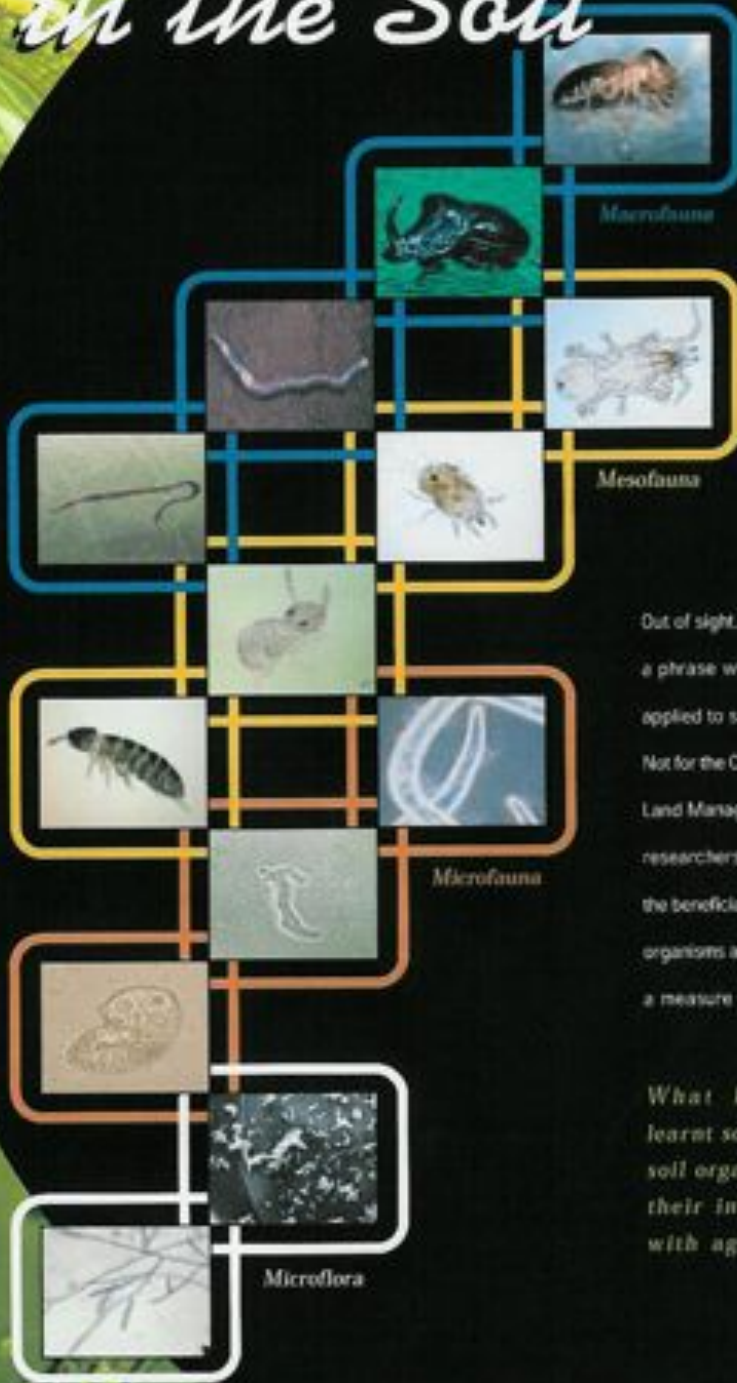


Supporting N story from no-tillers

- Gary and Darryl Hine, at Wellstead
- Geoffrey Marshall at Hyden
- John Young at Calingiri
- Owen Brownley (dec) at Lake King
- Steve King, Lake Grace
- Scott Day, Manitoba
- John A., from Washington State
- Jack Human, South Africa
- North Dakota State
- Farmer Bill Crabtree (4 years)

Life in the Soil

The relationship between agriculture and soil organisms

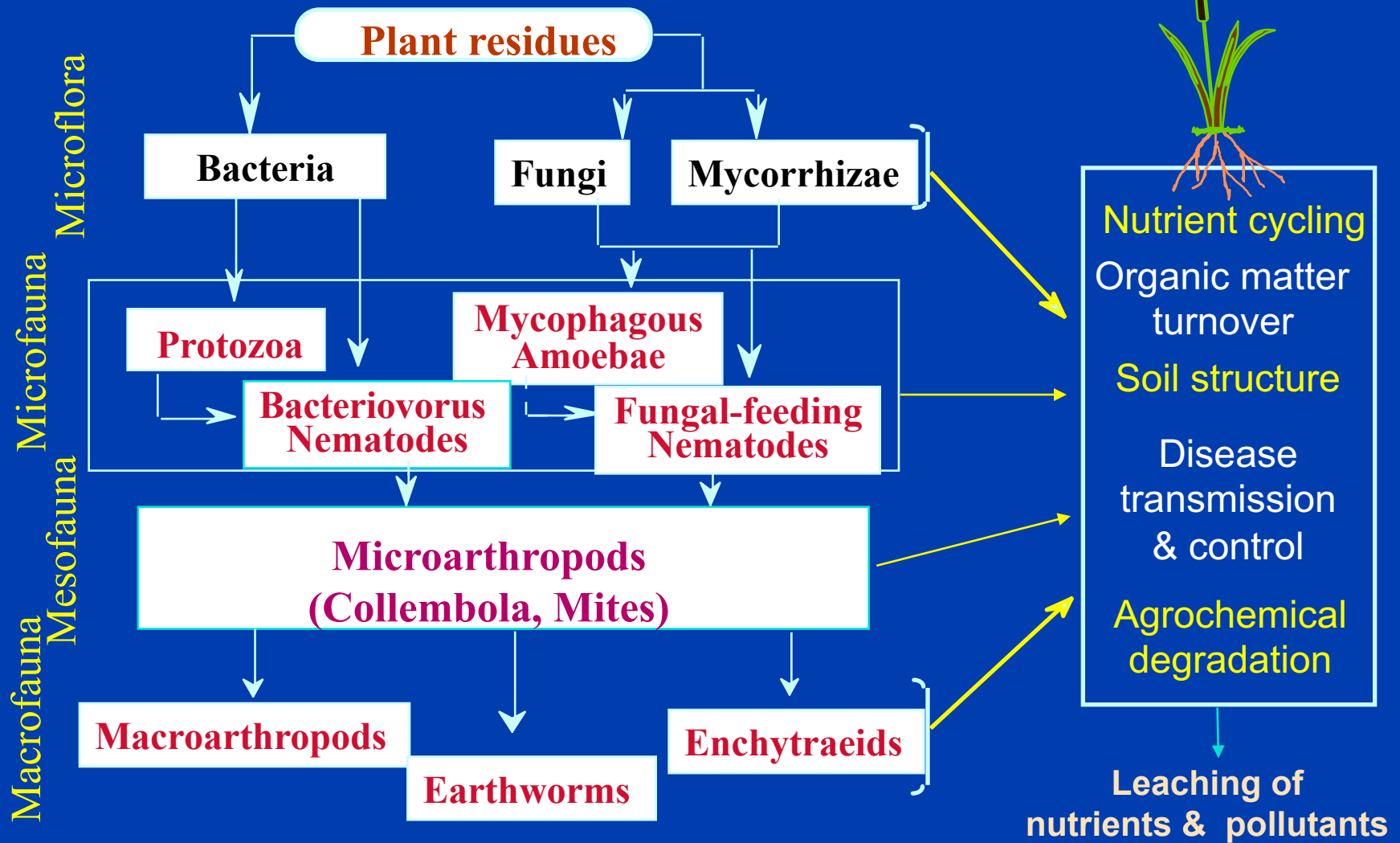


Out of sight, out of mind is a phrase which could be applied to soil organisms. Not for the CRC for Soil and Land Management whose researchers are exploring the beneficial effects of soil organisms and their use as a measure of soil health.

What has been learnt so far about soil organisms and their interactions with agriculture?



Detritus Food-Web



Gupta et al. (1997)

Biological food web – complex, interactive



Collembola spp
(springtails)
Litter transformers



Fungi



Bacteria



Protozoa



Amoeba (eating fungi)



STUBBLE

Lignin 14%

Cellulose 43%

Hemicellulose 36%

Soluble carbohydrate 6%

Protein 1%

Decomposition of stubble by fungi
and cellulolytic bacteria

Release of energy rich sugars

Nitrogen fixation by free-living bacteria



What could be happening?

- How can N be generated from C
- Life requires amino acids
- Amino acids consist of CHONPS
- First 3 are plentiful (CO_2 , H_2O)
- N, P and S are often applied as fertiliser
- N can be extracted from air, which is 78% N
- In the form of N_2 , or $\text{N}\equiv\text{N}$
- Such N is inert – it needs to become a chemical (NO_3^- or NH_4^+) first
- Provide C-energy and something will eat it
- Restrict N and – they will come



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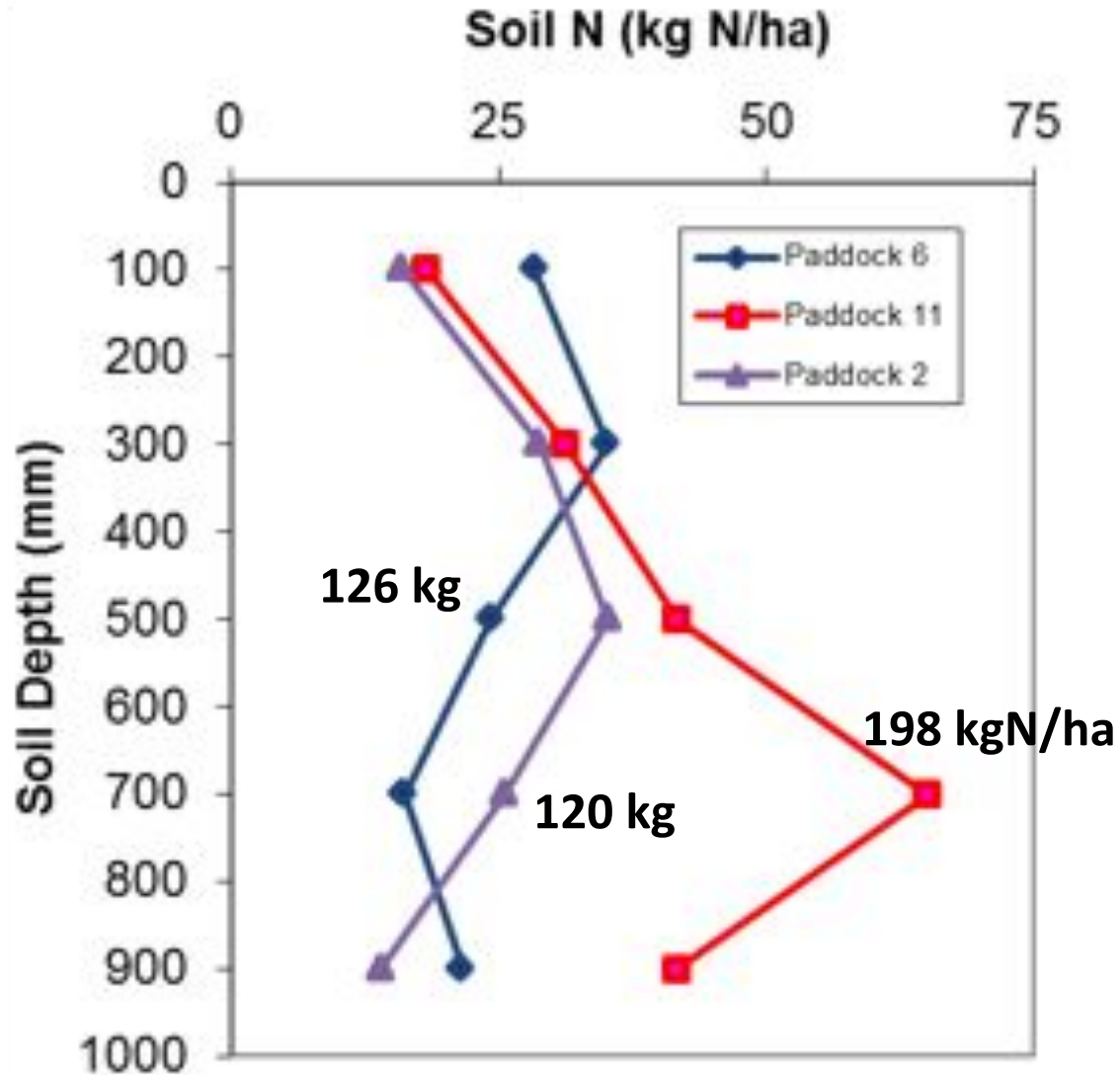






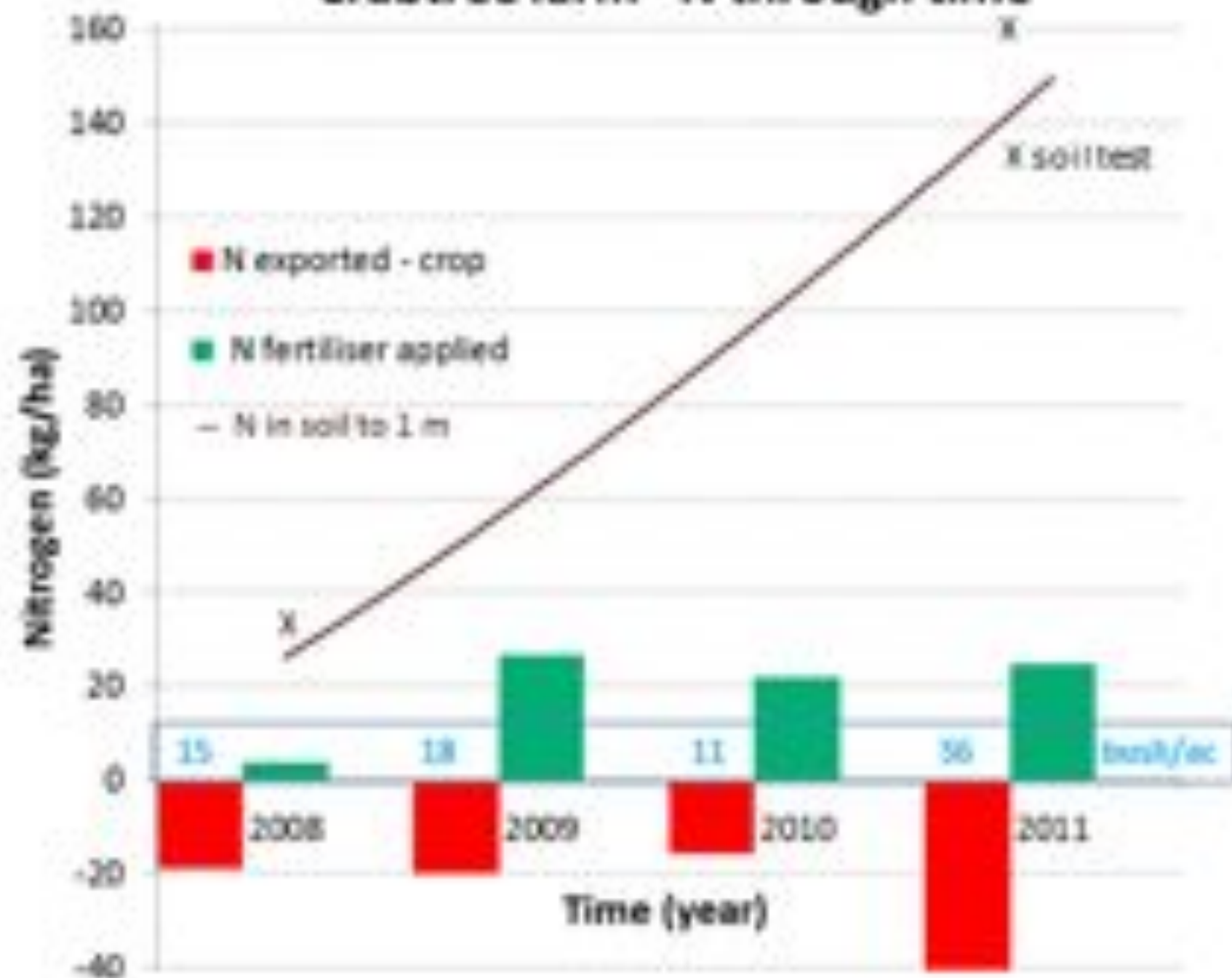


After 3 years continuous wheat [08/09/10]





Crabtree farm - N through time



Let's do the numbers?

- Over 4 years I have applied 77 kgN/ha
- Have exported 96 kgN/ha in crop N
- Wheat crop yields have averaged 20 b/ac/yr
- Protein averaged 11.2%.
- The extra N gained has been $120 + 96 - 77$
- = 139 kgN/ha/4 years
- Which is **35 kgN/ha/yr**
- Worth \$42/ha/year or \$114,260 annually
- I am just a beginner no-tiller – in practice



What about practical implications?

- Will likely not work with soya
- Consider non-legumes if it makes sense 4 U
- Measure it yourself to be sure
- Band fertiliser N
- Get the N away from residue
- Feed crop, starve weeds and force N fixation
- Listen to and observe the crop
- Do deep soil N, do tissue tests
- Observe

Thank you

