



Nitrogen performance indicators on southern Australian grain farms

Rob Norton,
IPNI, Australia and New Zealand

Elaina vanderMark
Southern Farming Systems



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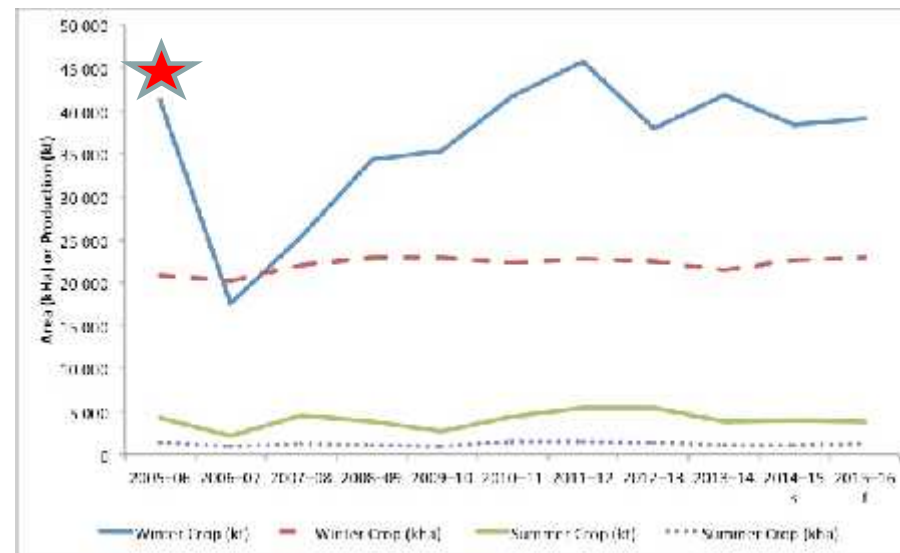
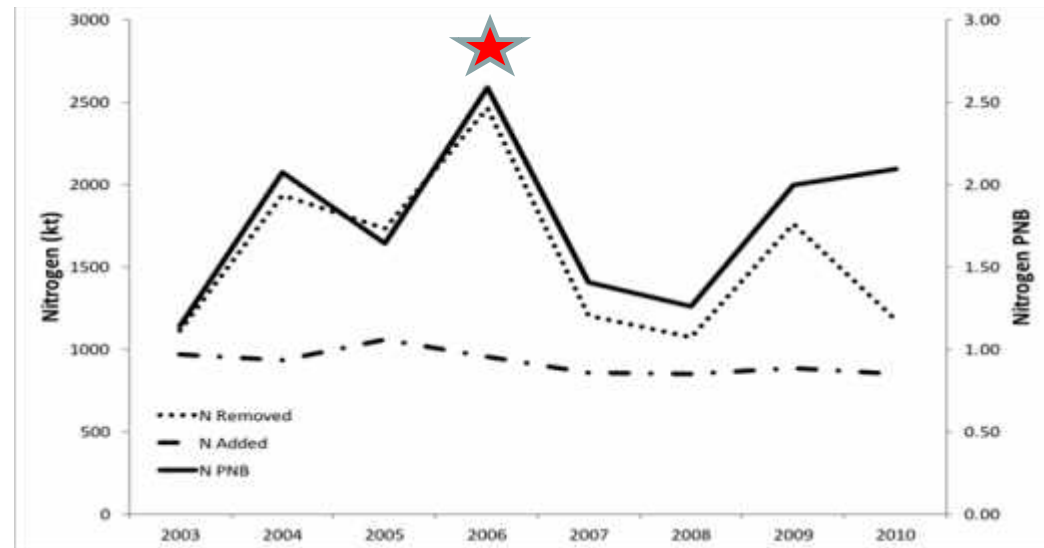
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National N Accounts

- 2002-2010
 - N use from Fertilizer Australia
 - N removal
 - ABARE production stats
 - ANRA nutrient densities

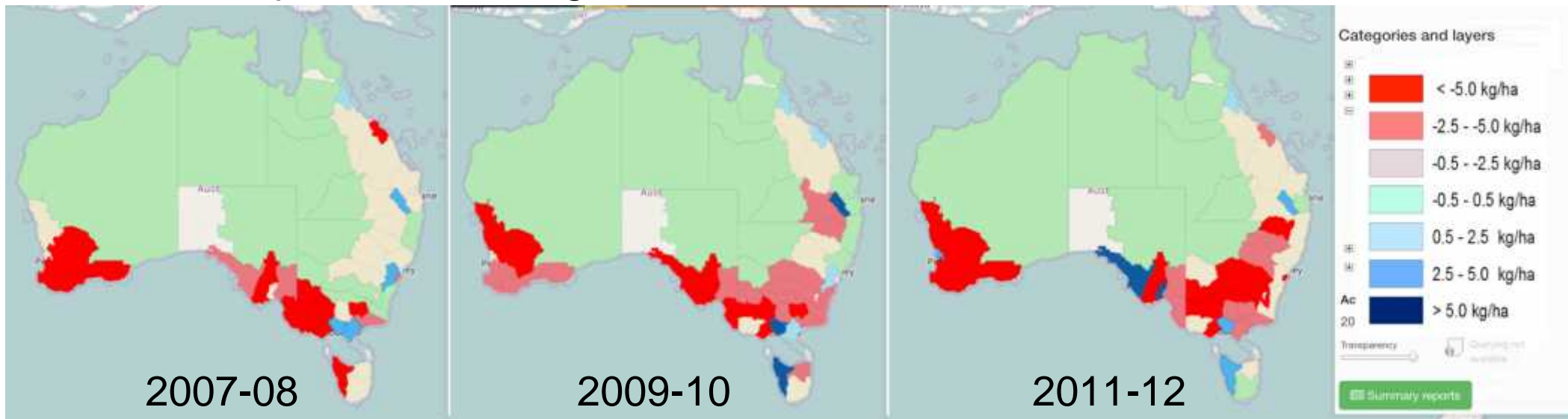
- Variation in PNB due to swings in production with a relatively constant N fertilizer use

- Since 2010
 - N use has increased 50%
 - grain alone increased 30%



National N balances - http://www.ozdsm.com.au/ozdsm_map.php

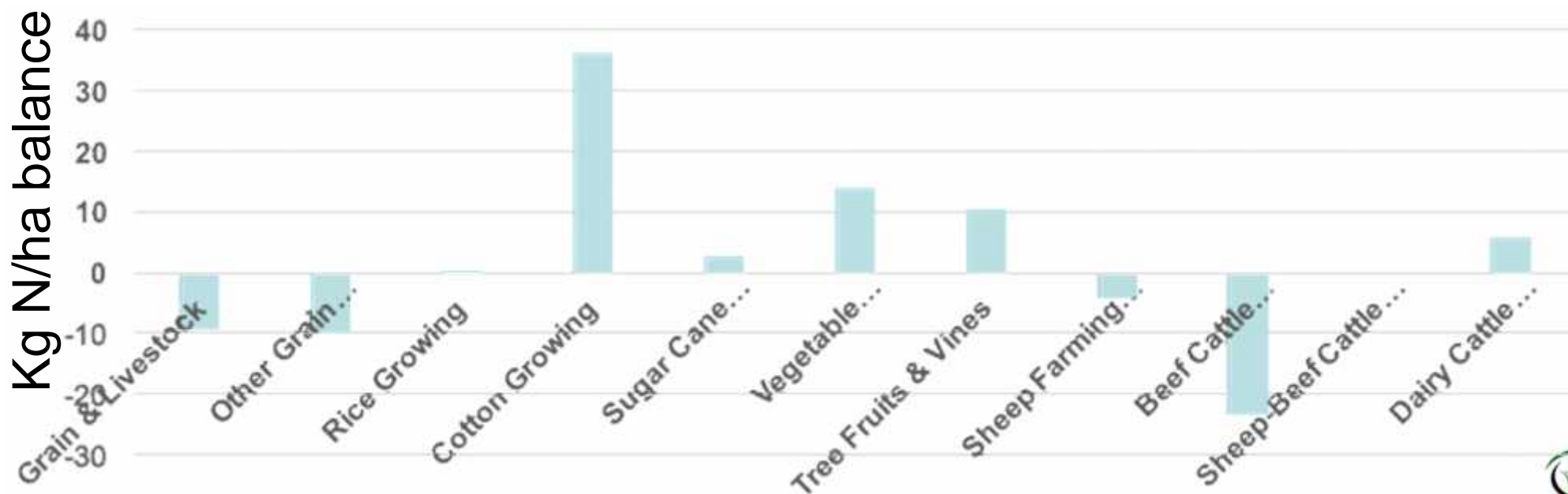
- Removal of N in farm products – ABARE farm statistics/ANRA Nutrient Density
- Addition of N as fertilizer - Fertilizer Australia
 - No consideration of biological N fixation or recycled N (manures, etc).
- Based on areas fertilized – by Natural Resource Management Zones
- Three audit periods – average



(Robert Edis)

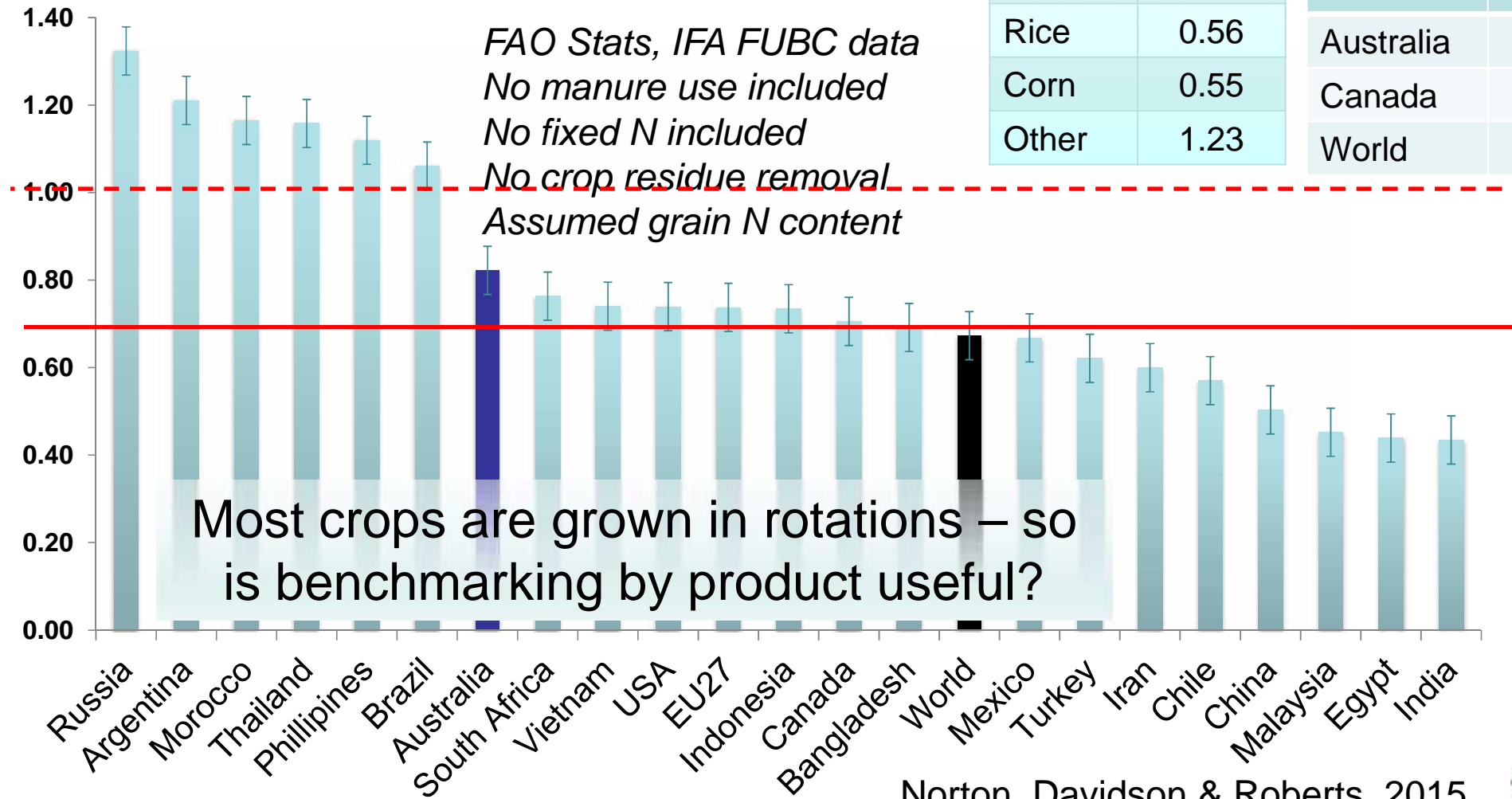
Comparison of agricultural crops and NUE

- Production and fertilizer use data from ABS Farm Survey 2012
- Nutrient densities from ANRA Nutrient Density
- No estimate of fixed N or manure or recycled residues.
- Estimate a nutrient balance intensity - kg N/ha surplus or deficit.



Cereal N PNB - kg N grain/kg N fertilizer

Crop	PNB	Region	PFP - N
Wheat	0.74		
Rice	0.56	Australia	52
Corn	0.55	Canada	45
Other	1.23	World	43



Norton, Davidson & Roberts, 2015



Deriving performance metrics (eg PNB, PFP, NBI)

- What is the purpose of deriving the metrics
- None of these *per se* provide environmental or economic insights
 - Statements of accountability for regions/industries?
 - Market access and/or production system certification?
 - Provide information to farmers so they can improve their nutrient management?
- Can they be derived?
 - Numerator Y/F or $(Y-Y_0)$ – Denominator F or $(F+S)$



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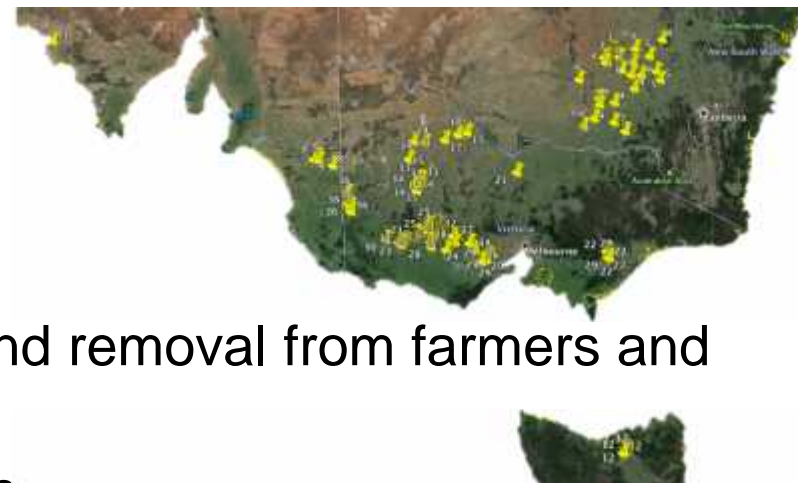
Deriving performance metrics (eg PNB, PFP, NBI)

- Have good quality data on which to estimate the metrics.
 - Regional and industry specific values – system (not crop).
 - Production data is usually of good quality
 - Regional & crop specific fertilizer application rates – difficult to find.
 - Regional & crop specific product nutrient concentrations.
 - e.g – Canola in South Australia - UEP 36 kg N/t *cf* MNSA 49 kg N/t
 - Include non-fertilizer nutrient inputs & removals
 - Manures, fixed N, cover crops, crop residue management, water/air.

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What did we do?



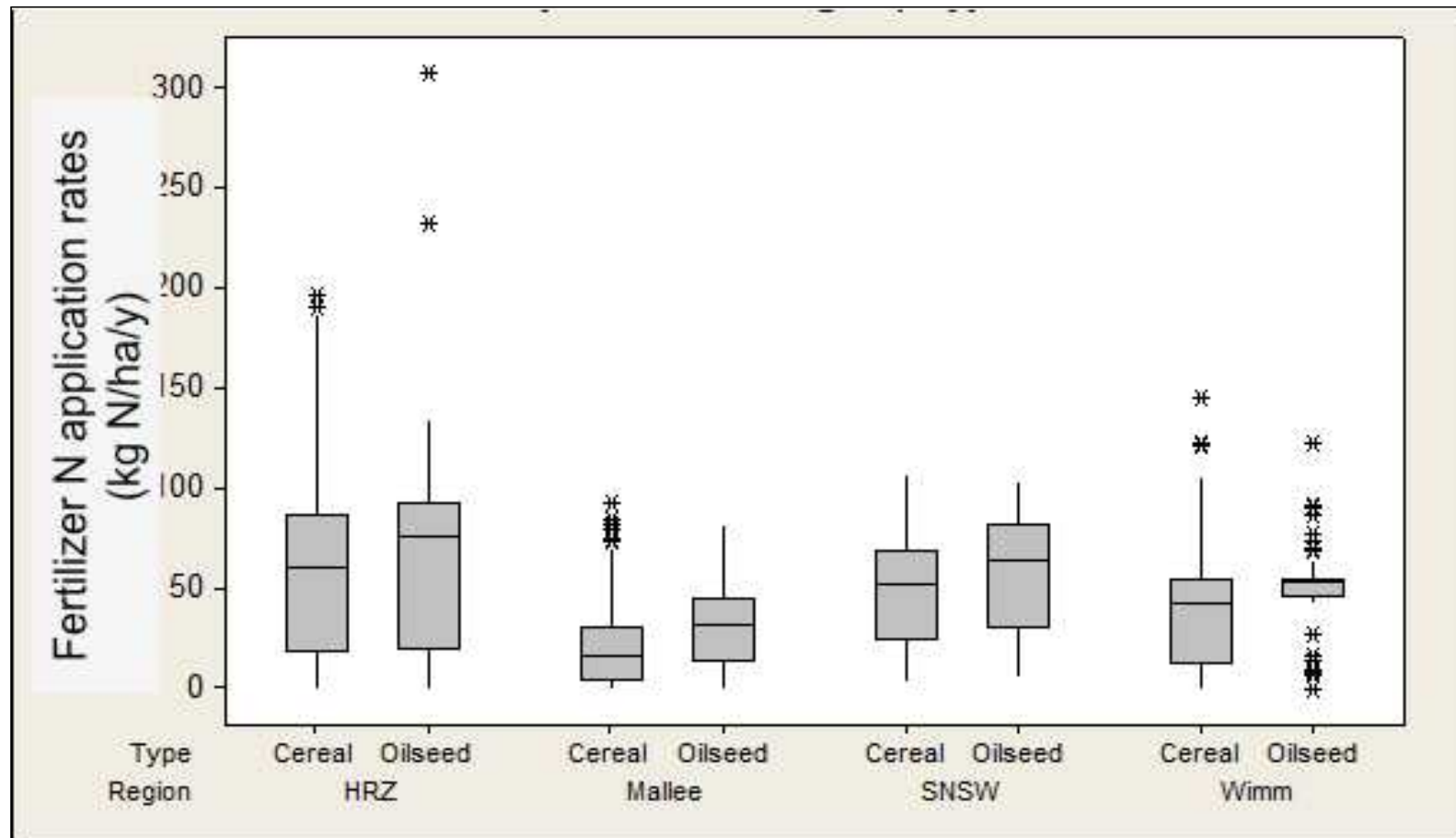
- Collected farm/paddock level nutrient input and removal from farmers and consultants
 - 3-5 years of paddock records, 2555 paddock/years
 - Crops, yields, protein, hay, stubble management

Region	Growers	Paddocks	Area (ha)
HRZ	45	145	7,600
Mallee	23	184	17,800
SNSW	33	63	5,300
Wimmera	17	82	4,200
Tasmania	4	15	320
UEP	6	18	2,100

Crop	%Pdk
Wheat	37%
Barley	21%
Canola	20%
Pulse	11%
Pasture	6%
Fallow	2%

- Some earlier data surveying actual wheat and canola regional nutrient densities. Large regional and annual variability.

Nutrient use by region & crop



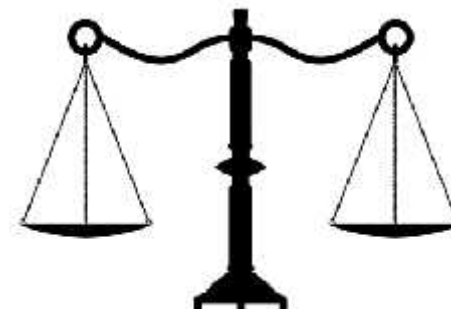
Developing nutrient balances

- Removal of nutrients

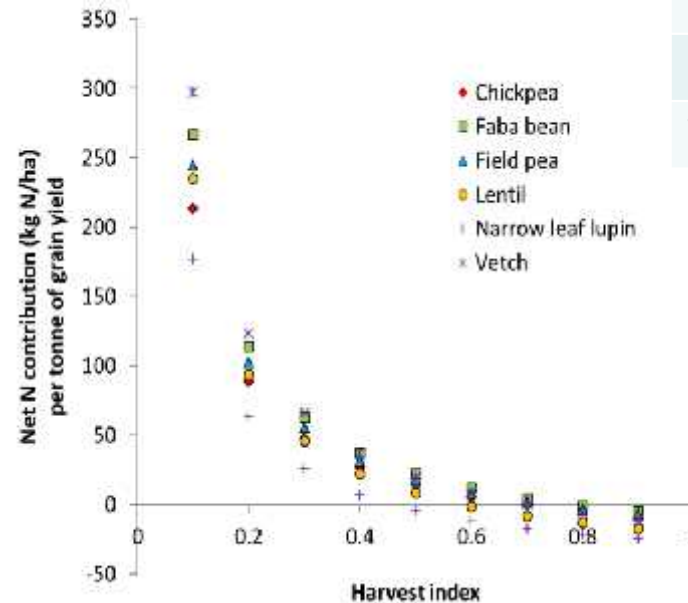
- Grain
- Burned stubbles (Y/HI* loss – N (80%), P (44%), K (40%), S (80%))
- Grazing N (50%), P, K, S (0)

- Inputs of nutrients

- Fertilizers
- Fixed N – derived from grain yield
 - Shoot N%, %Ndfa, Shoot N:Root N and HI
 - Used a gross value
 - Deduct removal in grain/hay
 - Net range 7-65 kg N/t grain
 - Pastures – cereal*2*40



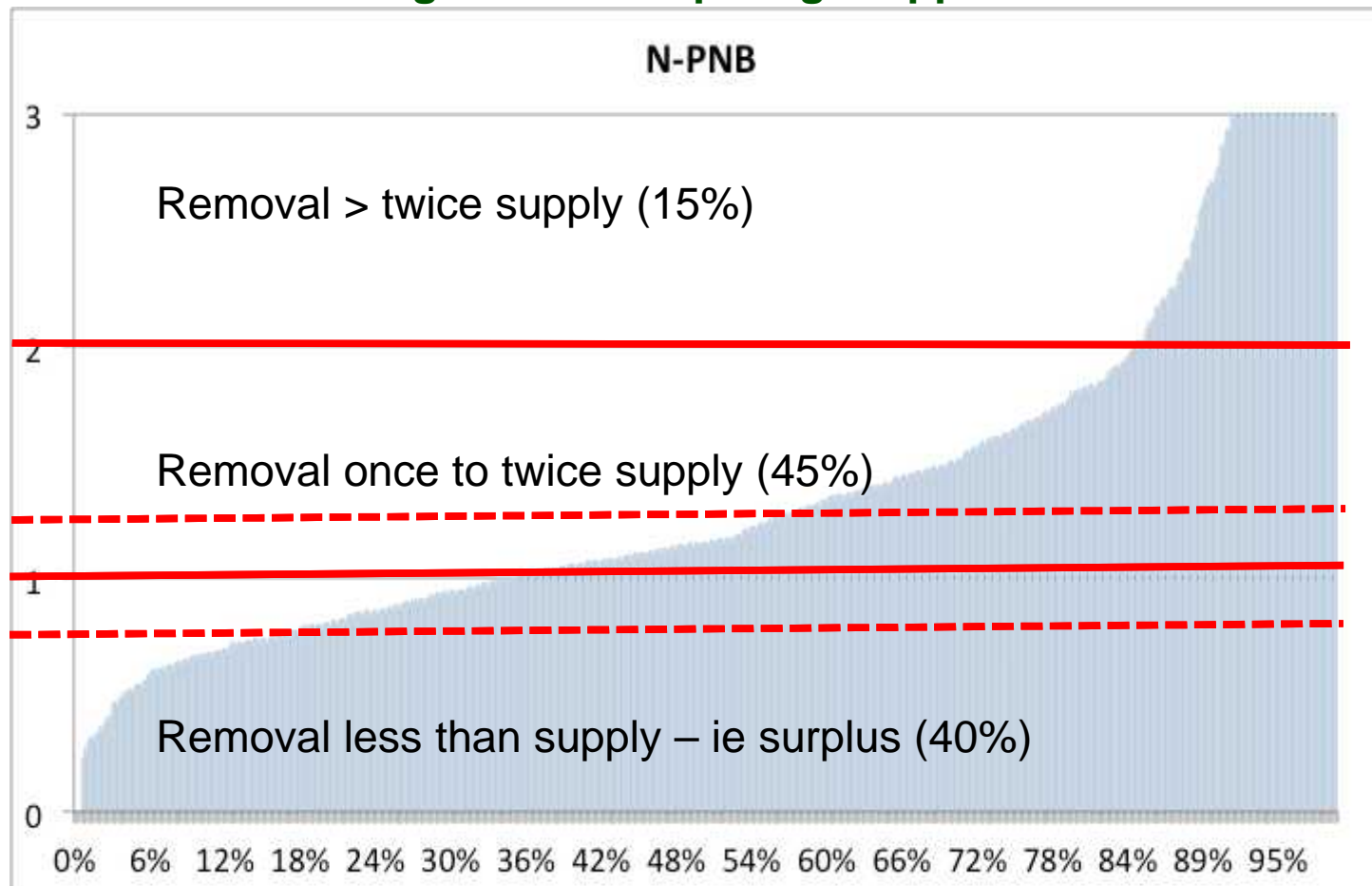
Region	% BNF
HRZ	16
Mallee	29
SNSW	
Wimmera	50



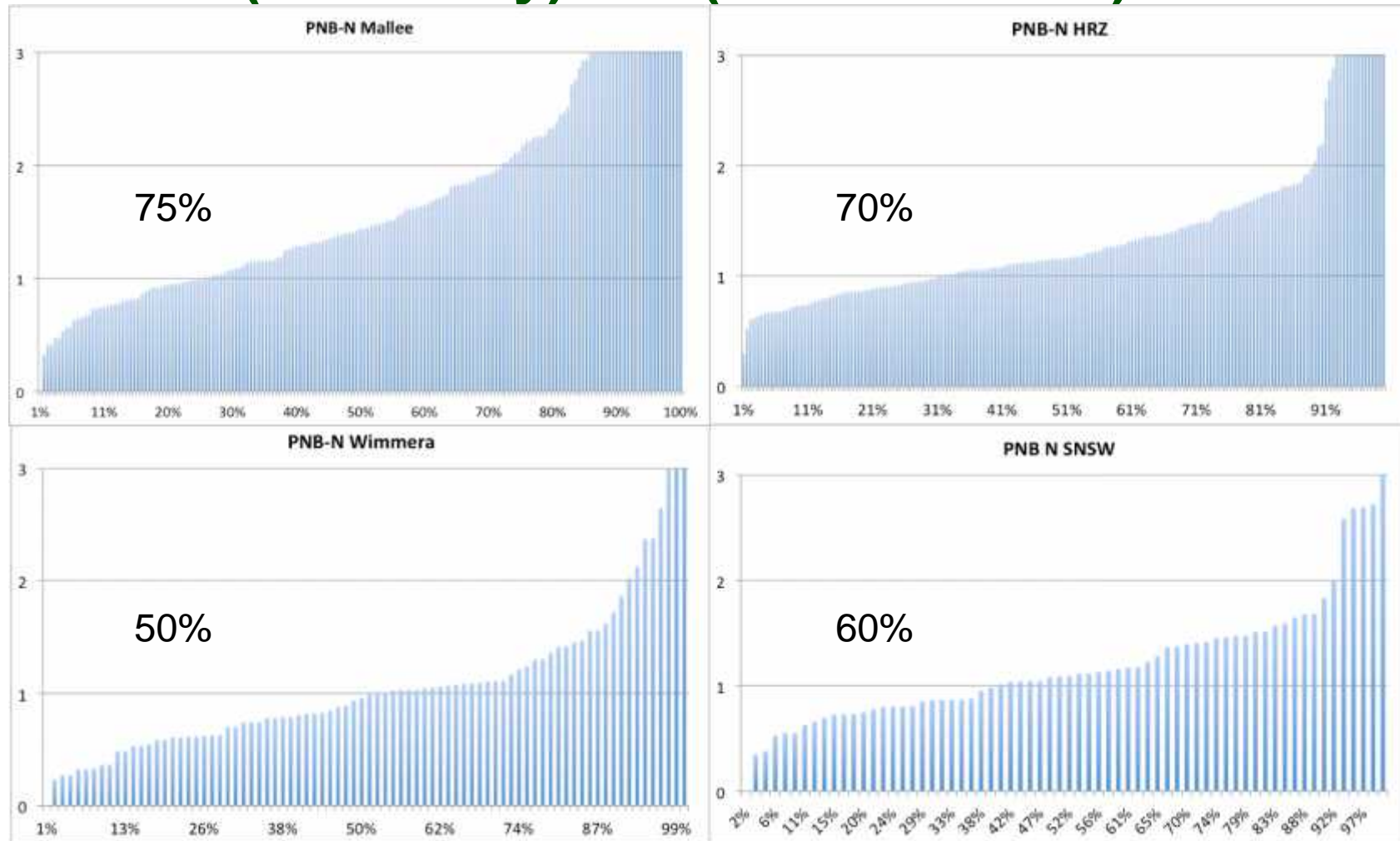
Shu-Kee Lam

PNB (efficiency) – N – all data

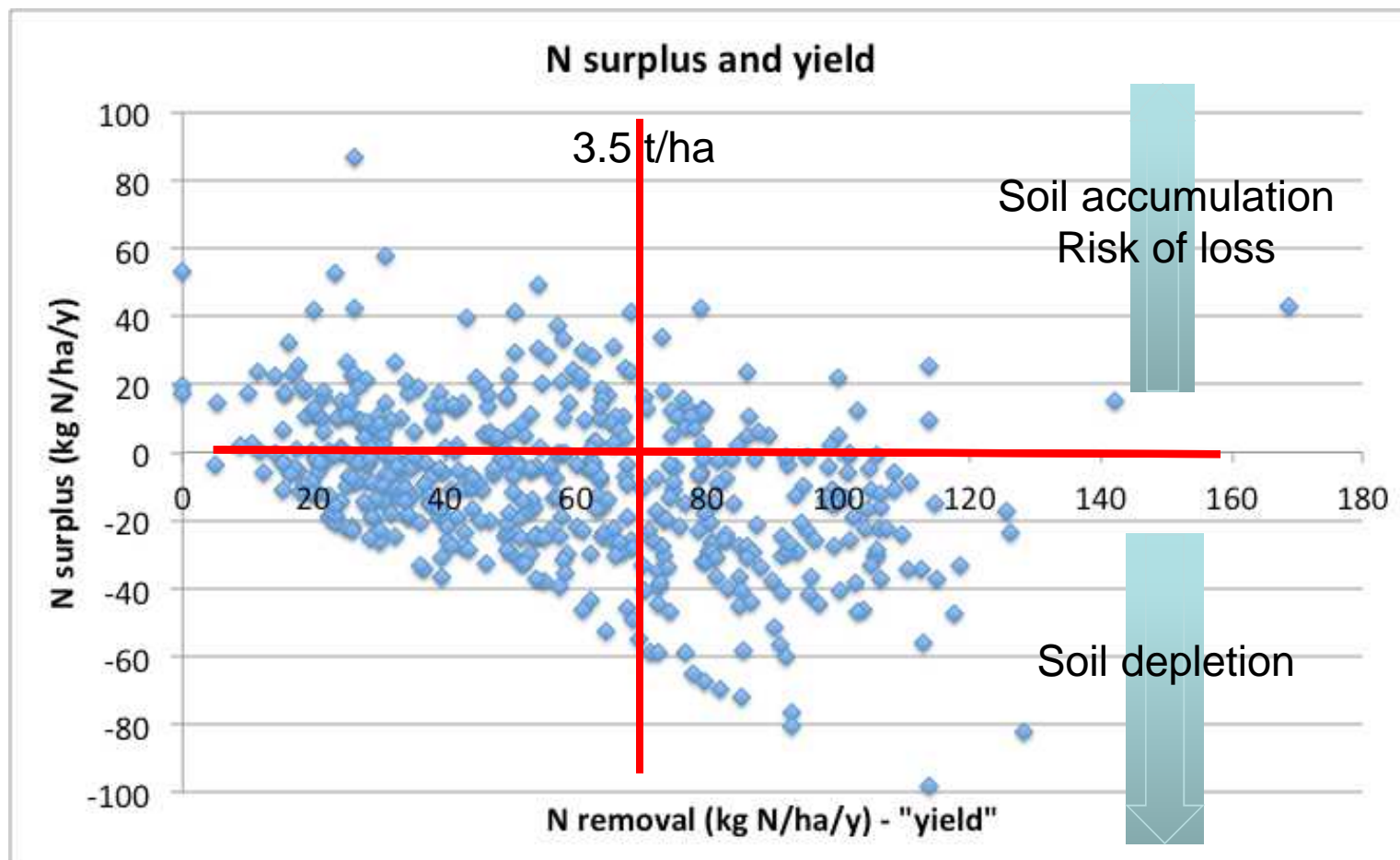
mean 1.14 kg N removed per kg N applied



PNB (efficiency) – N (% in N deficit)

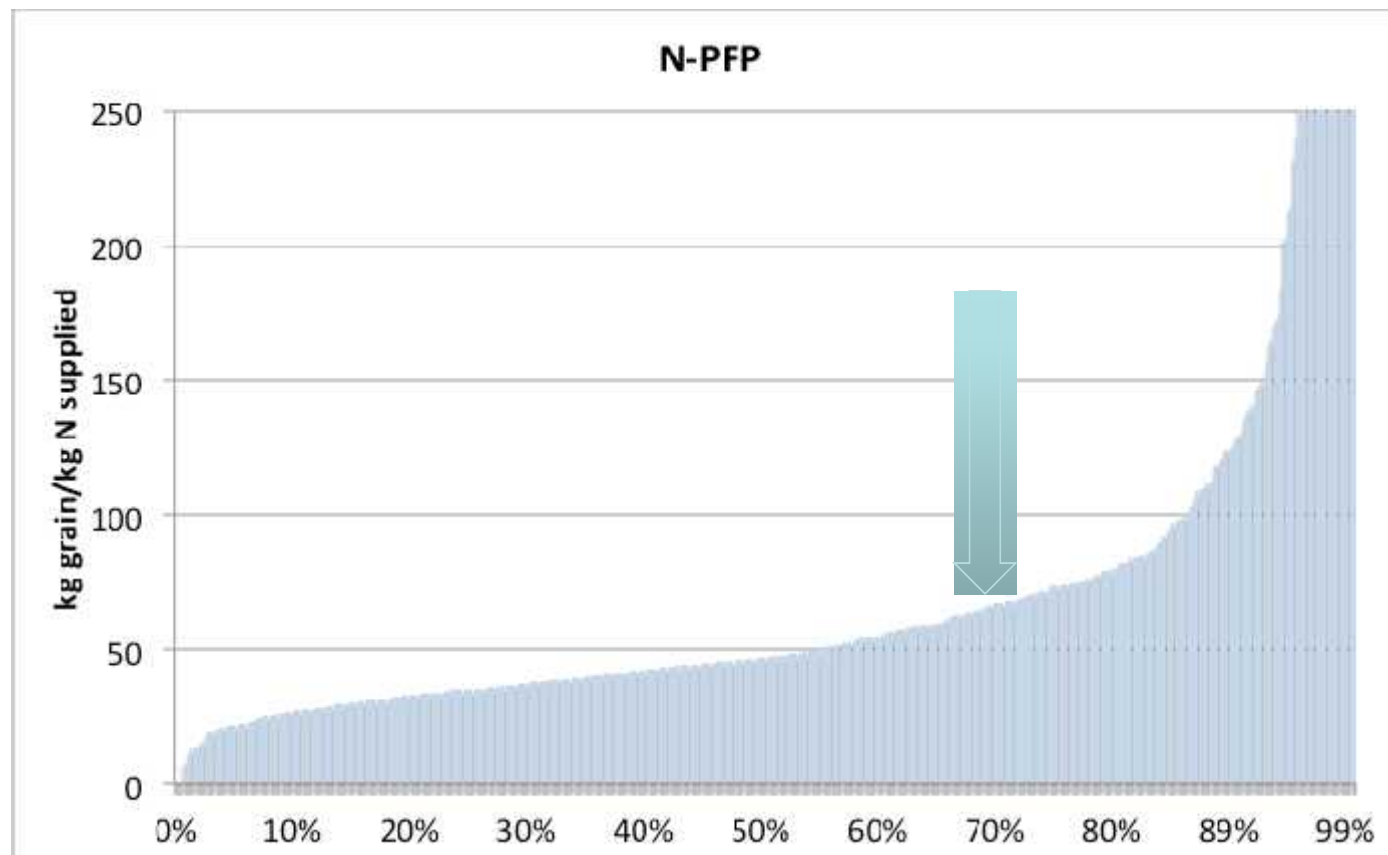


PNB “Correcting” for yield –



PFP (effectiveness) – N – all regions

mean 77 kg grain per kg N



Value of grain : Cost of urea

So what to make of this?

- Many grain producers are in N deficit
- Few growers are in N surplus
- Can develop nutrient efficiency and effectiveness regional values (need to refine both) – **with ranges**
- The farming system *not the product* is the unit, so farmers need to be engaged.
- *Link to soil “health”, environmental indicators.*
- *Link to economic indicators.*
- Communicate and explain what these numbers mean to growers & advisors.
- Multiple indicators are needed



Regions	Average of PNB-N	Average of PFP-N
HRZ	1.55	71
Mallee	2.09	105
SNSW	1.20	50
Wimmera	1.24	47
South East	1.66	77



Affiliate Members



Thanks for your attention...



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