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Canola seed nutrient concentrations for Southern Australia

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Better Crops, Better Environment … through Science

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Why would you want to know grain nutrient concentrations?

- Nutrient budgeting – removal versus replacement
  - Critical issue is the nutrient contents of produce removed
  - Reuter values often quoted (ANRA Audit)

	N%	P mg/kg	K mg/kg	S mg/kg	Ca mg/kg	Mg mg/kg
Wheat (11%)	* (2.2)	2600	3600	1400	380	1200
Wheat (0%)	*	2900	4000	1600	430	1400
Canola (0%)	3.4	5600	8100	5500	1500	3800

- Diagnostic for some soil/plant nutrient status
- Seed/Grain quality (eg N:S ratio, heavy metals, P & Zn)
- *N removal to use ratio will be a reportable metric in the next round of the Sustainable Development Goals.*

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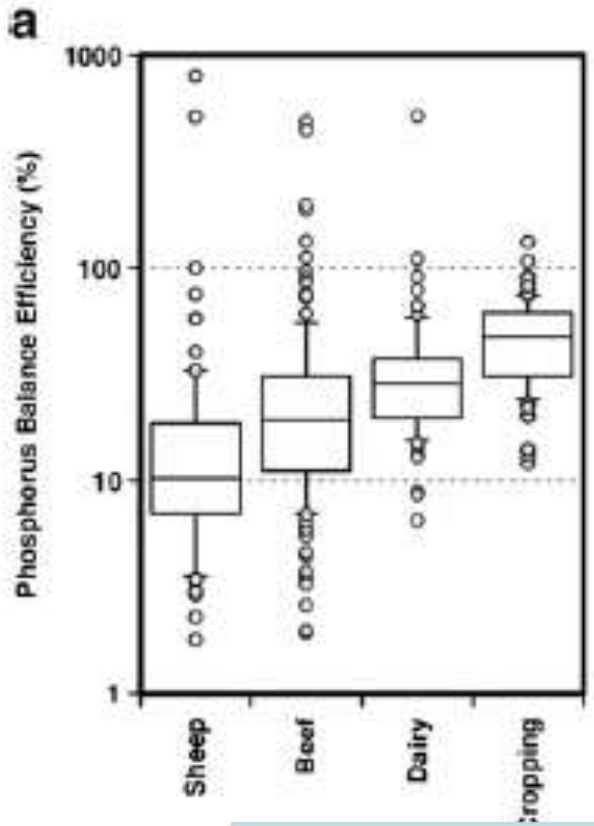
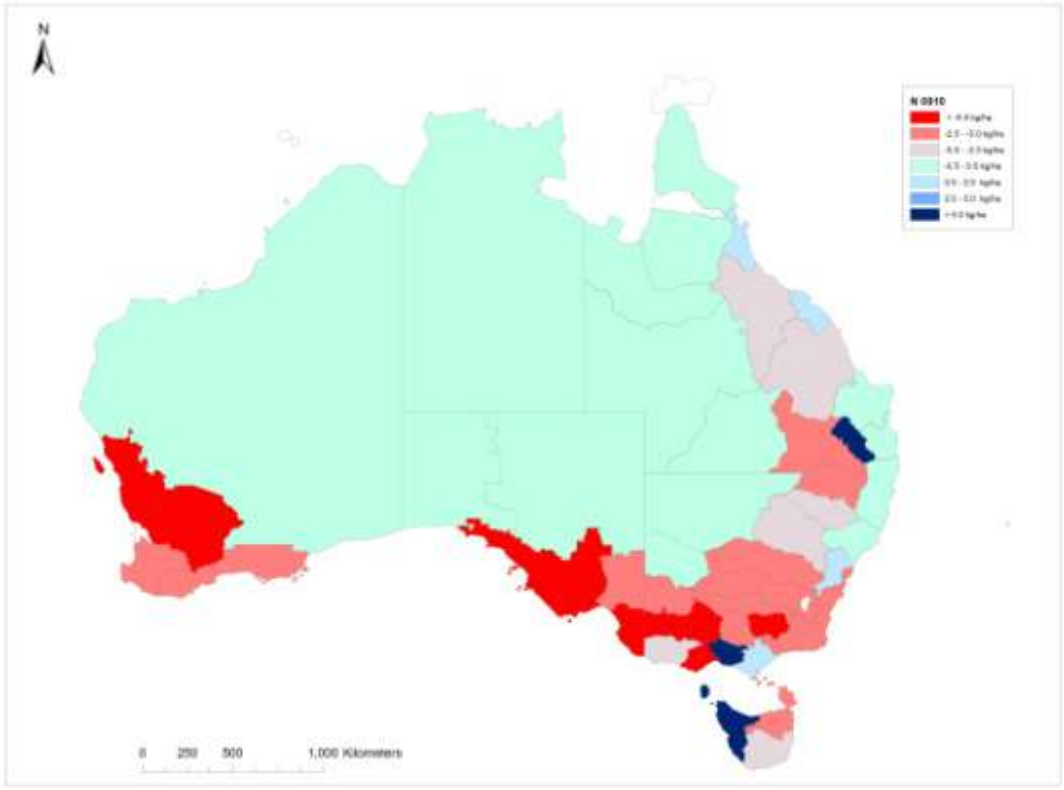
Relevant targets & indicators

Goal & Target	Issue	#	Potential Indicator	Potential Lead
2b Countries report on their contribution to **planetary boundaries**	Nitrogen and phosphorus fluxes	10	Excessive loss of reactive N and P to the environment (kg/ha) – indicator to be developed	UNEP or other agency
6a Sustainable food production	Staple crop yields	50	Crop yield gap (actual as % attainable)	FAO with IFA
	Sustainability of agriculture	51	Crop nitrogen use efficiency	FAO with IFA
	Water productivity	52	Crop water productivity	FAO
8b Reduce non-energy related GHG emission	GHG emissions from landuse change	78	Net GHG emissions in agriculture, forest & other land use sectors	UNFCCC

http://unsdsn.org/resources/goals-and-targets/

For example - N balances – National values – all agriculture = 1.76; cereals = 0.82





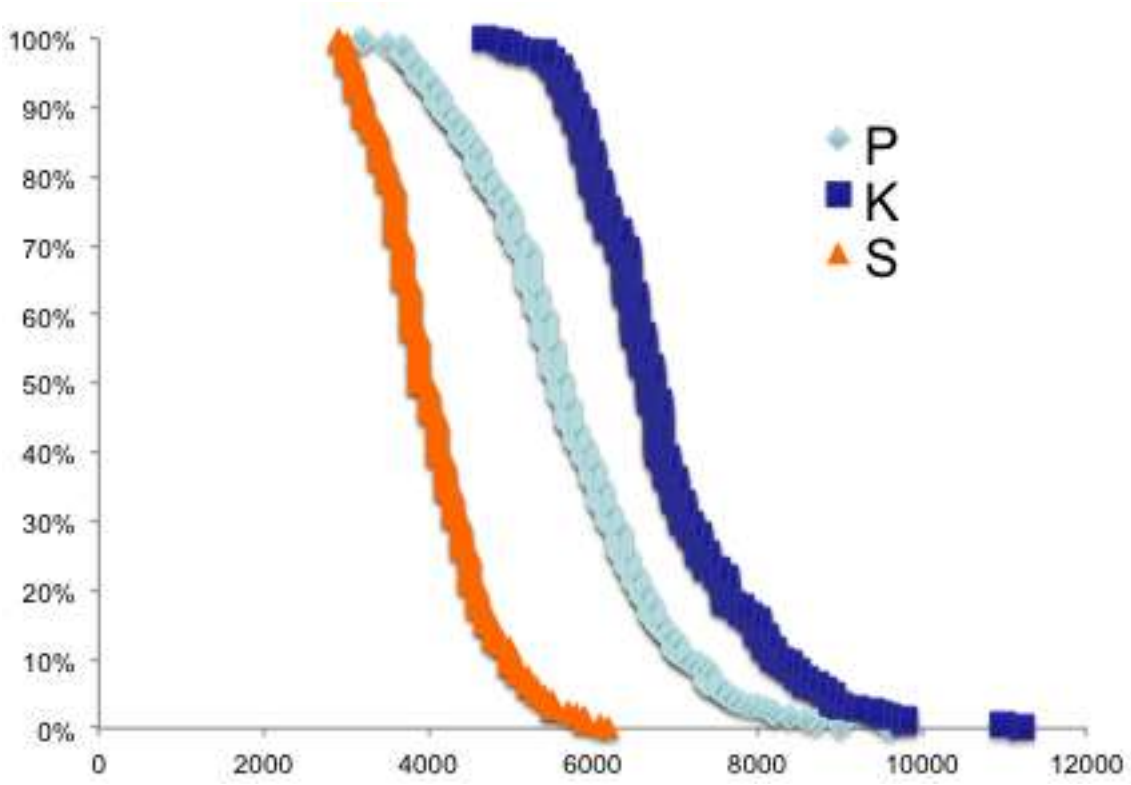
New South Wales	Victoria	Queensland	Western Australia	South Australia	Tasmania	NT	Australia
2.05	**2.49**	**1.08**	**1.48**	**2.28**	**1.25**	**4.20**	**1.76**

Data sources

- 2012 NVT canola sites – 2 cultivars per site
  - represent the difference HT groups and as common as possible.
  - NSW – 69 samples/12 sites
  - SA – 66 samples/12 sites
  - Vic – 66 samples/10 sites
  - WA – 89 samples/12 sites
- ICP-OES - B, Cu, K, Mn, P, S, and Zn
- ICP-MS – Cd (Mo, Co, Se)
- NIR – N (protein)
- Data collected as part of a micronutrient risk assessment scoping study.

National variation in macronutrients

- N: 4.28 ± 0.62 %
  - (3.4)
- P: 5672 ±1125 mg/kg
  - (5600)
- K: 6863 ±1015 mg/kg
  - (8100)
- S: 4063 ±670 mg/kg
  - (5500)



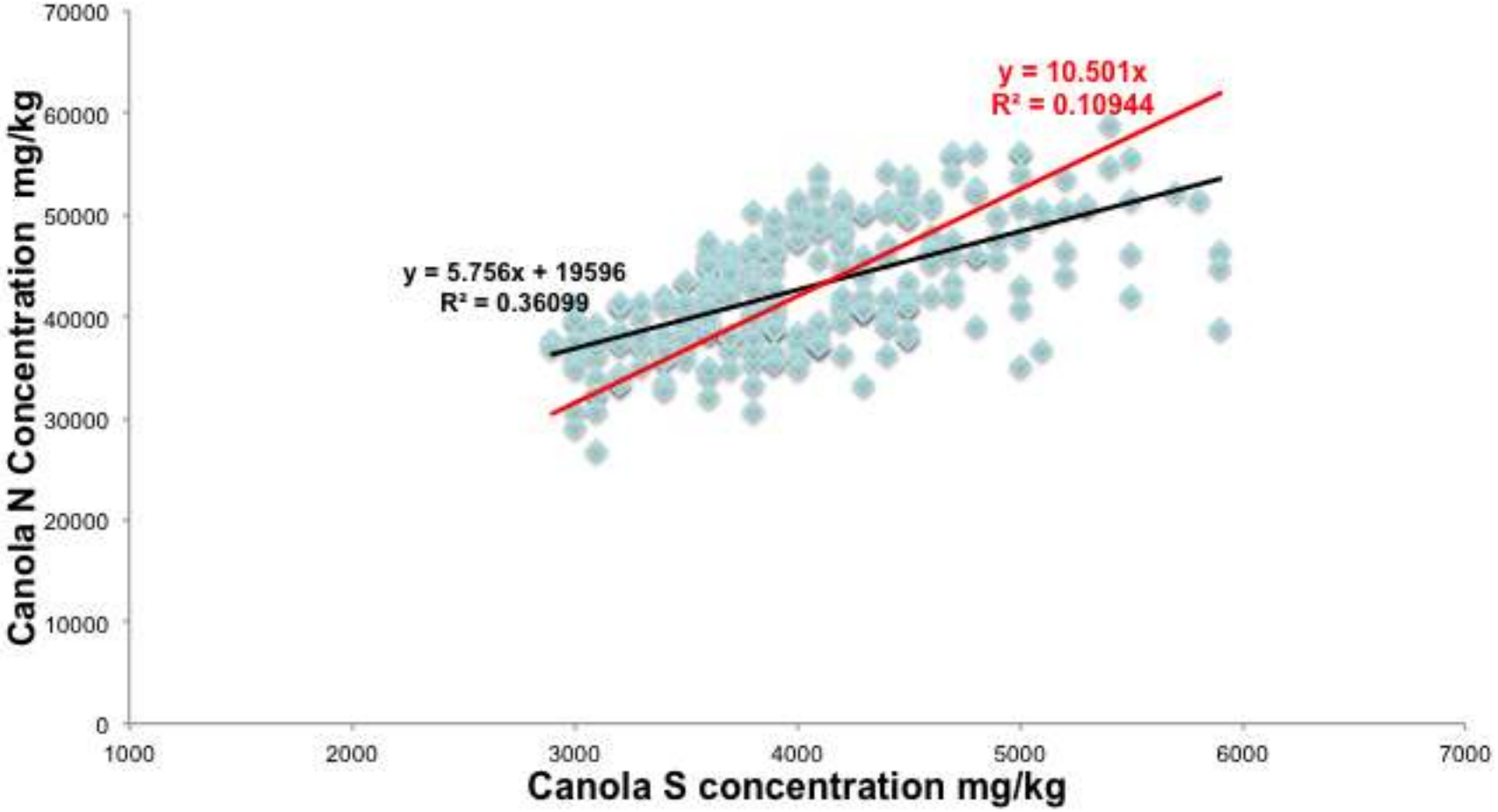
Factor AnoVar P	N	P	K	S
Region	0.000	0.000	0.000	0.000
State	0.000	0.094	0.000	0.000

Were there differences among regions?

- For example – South Australia
  - For P 50% mean difference
  - For S 30% mean difference
- Maybe some yield effects
  - no correlation with yield
- Maybe some soil effects
  - no correlation of P with Colwell P soil test
- Regional values better than means – maybe even extend to farm values for nutrient budgets for P especially

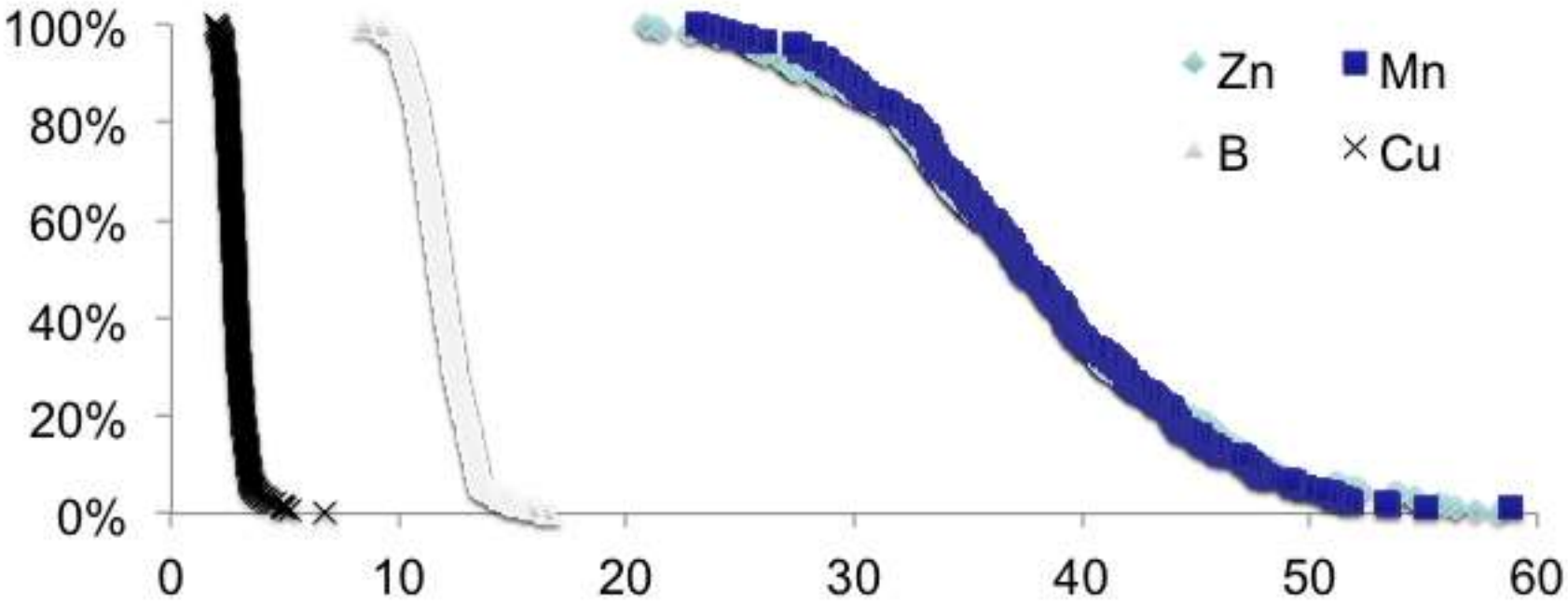
Region & State	N %	P mg/kg	K mg/kg	S mg/kg
LEP	4.09	6317	7140	3252
MNSA	4.96	5767	7191	4101
SESA	4.52	5076	7048	3923
UEP	3.69	7809	7407	3127
YP	4.57	6170	7496	3734
SA	*4.46*	*5868*	*7204*	*3725*
Mean	**4.28 ±0.62**	**5672 ±1125**	**6863 ±1015**	**4063 ±670**
LSD * (p<0.05)	**0.24**	**637**	**561**	**372**

N:S ratios – given as 7 – maybe more than that?



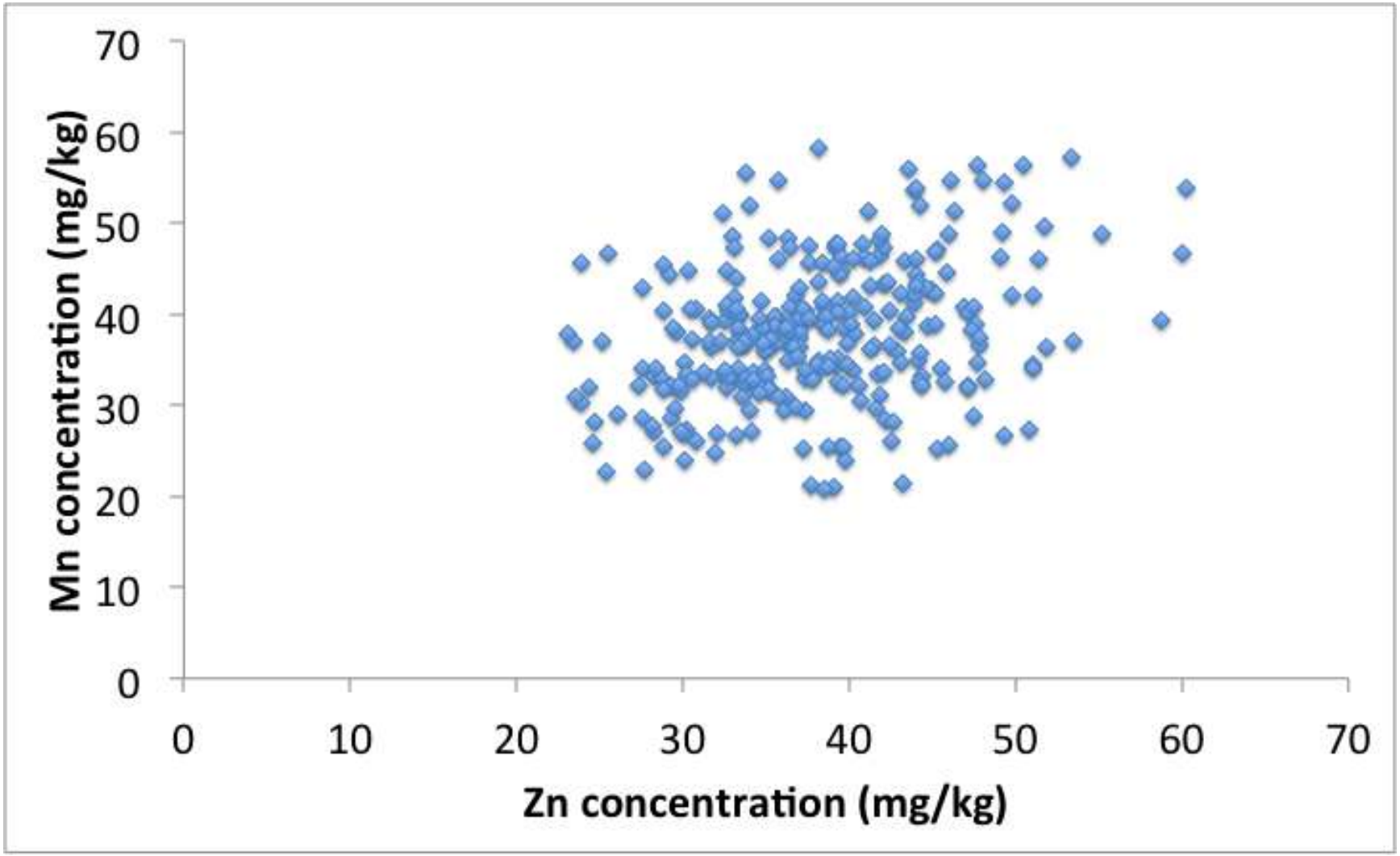
Question S requirements & balancing S with N

National variation in micronutrients



- Large variation in Zn **37.9 ±7.7 (**critical value <25)
  - lowest values in SA (YP & UEP)
- Some variation in B **12.0 ±1.2** (critical value <10)
  - Lowest values in NEV & SWV
- Little variation in Cu **2.9 ±0.5** (critical value <3)
  - <3 on Chromosols, Tenosols, Vertosols
- Large variation in Mn (no critical value)

Critical values taken from Reuter & Robinson


Mn concentration (mg/kg)
70
60
50
40
30
20
10
0
0
10
20
30
40
50
60
70
Zn concentration (mg/kg)

The manganese story

Images – DAFWA – MyCrop/CroPro

	B mg/kg	Cu mg/kg	Mn mg/kg	Zn mg/kg
Con	11.2	2.7	36.2	33.6
IT	11.4	3.1	40.8	39.6
RR	12.1	2.9	36.4	36.7
TT	12.5	2.8	37.0	39.0
LSD ($p<0.05$)	0.4	0.1	1.7	1.8

No evidence of lower Mn levels in RR type canola.

The cadmium story

All Pb concentrations were <0.3 mg/kg and all Ni concentrations <1 mg/kg, Se values 0.2 mg/kg; Co 0.083, Cd 0.025

EU & FSANZ revising its standards for heavy metals

No standard for canola but wheat standard proposed at 0.1 mg/kg

1 sample exceeded the wheat standard for whole seed.

0.1 mg/kg in defatted meal, could equate to 0.06 mg/kg whole dry seed

5% of samples (saline, acid, high P soils)

Summary

- N, P and S grain concentrations show regional variations that should be used in farm gate budgets rather than national values.
- Micronutrient grain concentrations show little evidence of compromised B, Mn or Zn supply, although Cu values are low but the critical values are not fully reliable diagnostically.
- There is no evidence of comprised Mn nutrition in glyphosate tolerant canola from these data.
- There are situations where high grain/meal Cd concentrations have been seen.

Acknowledgements

- Alan Bedggood and the NVT teams for providing the seed & background soil test data.
- Waite Analytical Services for ICP analyses
- GRDC for supporting this work

- Full micronutrient scoping study is available at:
  - http://research.ipni.net/project/IPNI-2012-AUS-15