

Plant tissue tests: – what do they tell?

Rob Norton, IPNI Regional Director

<http://anz.ipni.net>



@IPNIANZ

Better Crops, Better Environment ... through Science

SFS Tasmania, Results Day, Cressy, August 19, 2015.

Nutrient tests & the Railways

How could you predict the number of people who arrive at Flinders Street station?



Estimate the number of people at the ends of the lines.

What proportion of these folk use public transport?

Soil tests

Count the number of people at each station – close to Flinders St – more accurate.

Dry ash tissue tests

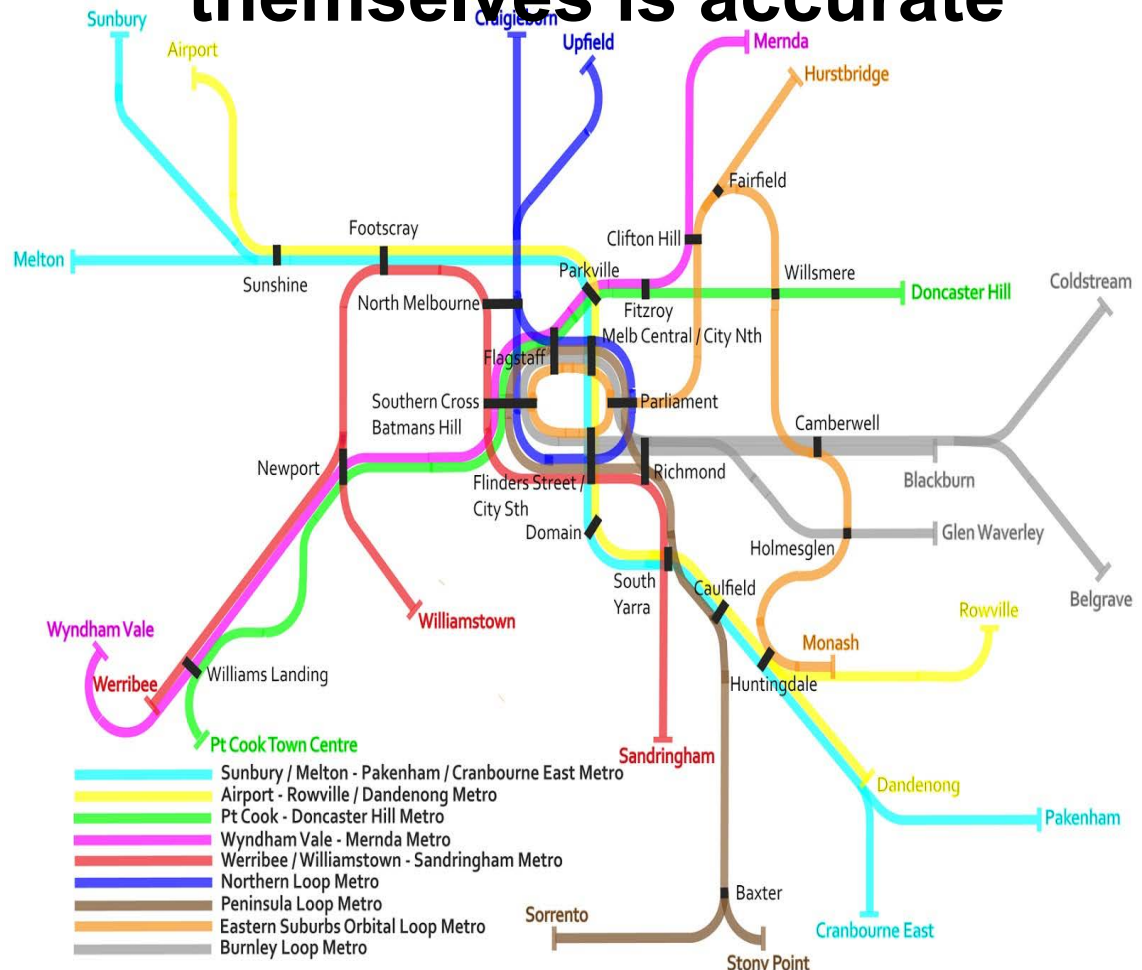
Count the number of people on the trains inbound

Sap tests

Count the number through the turnstiles.

Grain/Product removal
(retrospective prediction?)

None of the tests by themselves is accurate



Other factors can impact such as weather.

Why are you doing this?

- Monitoring crop progress
 - Is something missing?
- Diagnostic
 - What do you suspect?



Why are you doing this?

- Monitoring crop progress
 - Is something missing?
- Diagnostic
 - Why are some parts good and others poor?
 - Trouble shooting

**Is there
time to do
something
about it?**

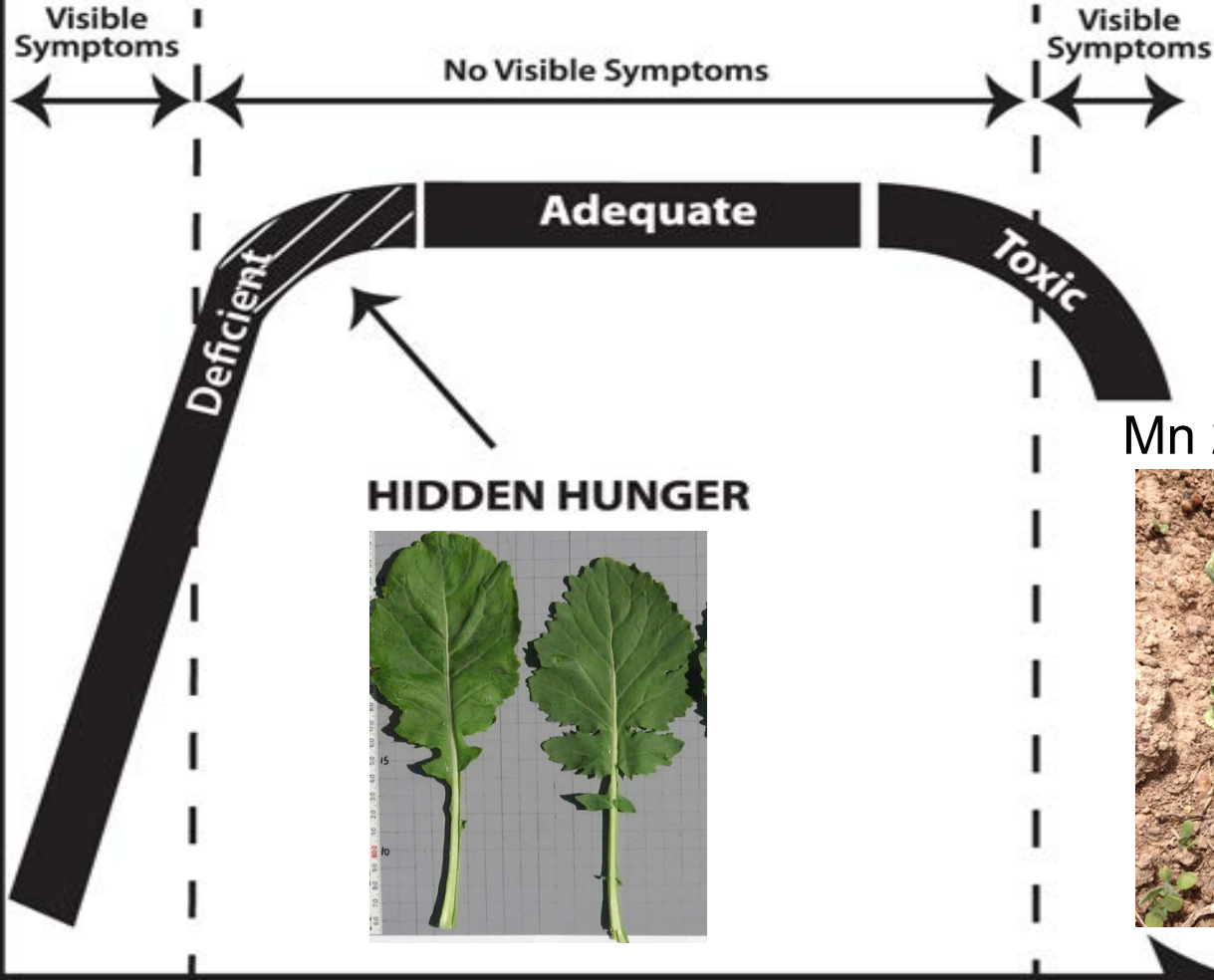
4.1% K

0.6% K



Deficiency to Adequacy to Surplus to Toxicity

Yield or performance



Visible Symptoms

No Visible Symptoms

Visible Symptoms

Deficient

Adequate

Toxic

HIDDEN HUNGER



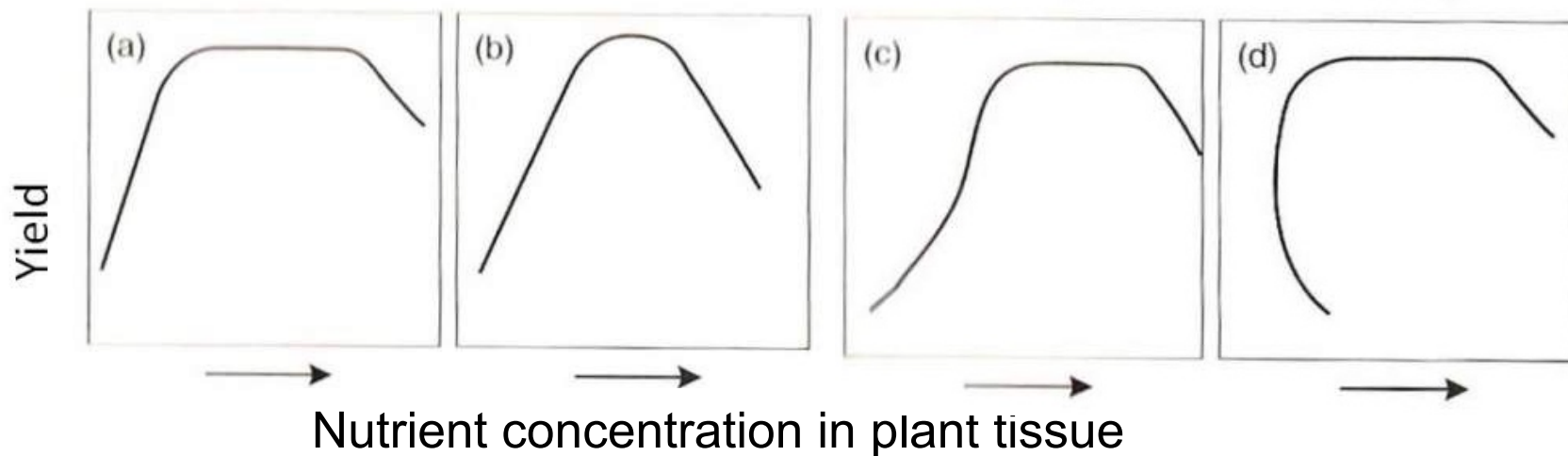
Mn 2,400 mg/kg



Mn < 30 mg/kg

410 mg/kg

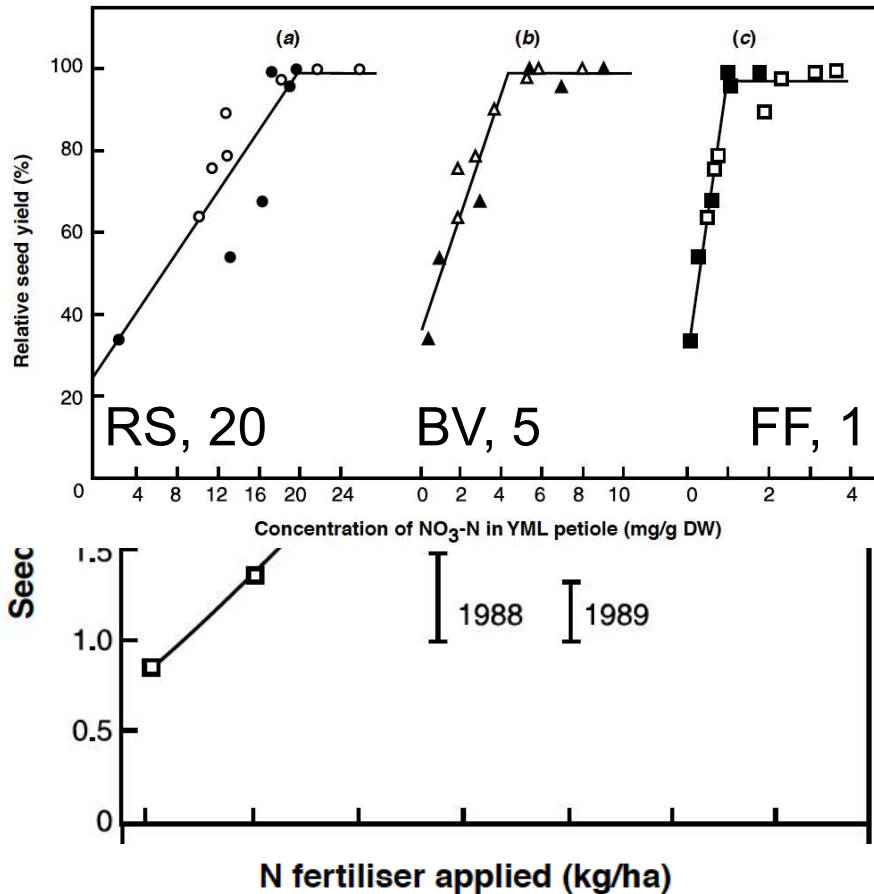
Tissue tests and dilution patterns



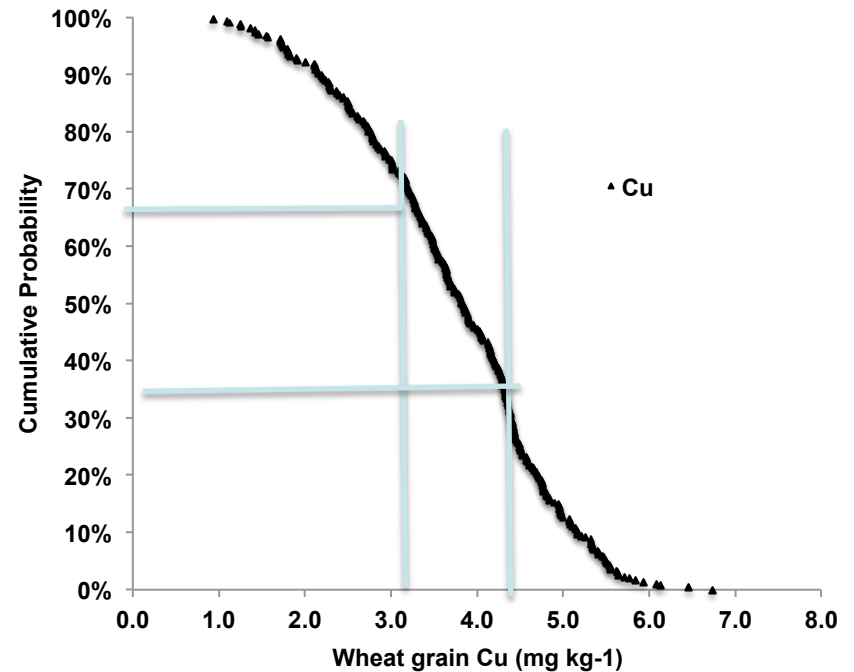
Nutrient	Deficient	Sufficient	Excess/Toxic
Iron	<50	100-500	>500
Zinc	10-20	20-100	100-400
Manganese	15-25	20-300	300-500
Copper	2-5	5-30	20-100
Boron	5-30	10-200	50-200
Molybdenum	0.03-0.15	0.1-2.0	>100

How are critical values developed:

- Experiments



- Surveys



Both have their role

Critical aspects of tissue testing

- Soil conditions can affect tissue values (eg with micronutrients)

	Cu	Fe	Mn	Zn	B	Mo
pH > 7.0	---	---	--	---	**	++
pH < 5.5	++	+++	+++	+	--	--
water-logged soil	+	--	+	+		
drought	---	---	---	-	---	--
high humus content	---	++	++	++	++	-
high P-content	-	---	-	---	-	+++
sand	---	---	--	---	--	-
compaction	+	++	+	+	+	+

Critical aspects of tissue testing

- Soil conditions can affect tissue values
- **Right Timing – to plant growth stage**
 - Whole shoot K contents for wheat

Stage	Deficient	Marginal	Adequate
Start Tillering	<3.5%	3-5-4.5%	>4.5%
Early Tillering	<3.0%	3.0-3.5%	>3.5%
2 nd Node	<1.8%	1-8-2.3%	>2.3%
Booting	<1.3%	1.3-1.6%	>1.6%

Cox 1981

Critical aspects of tissue testing

- Soil conditions can affect tissue values
- **Right Timing – to plant growth stage**
 - Marginal values for Zinc concentrations on canola

Crop	Stage	Tissue	Critical
Canola	3-5 leaf	YML	<12 mg/kg
		YOL	<27 mg/kg
	Stem elongation	YML	<8 mg/kg
		YOL	<16 mg/kg

Reuter & Robinson 1997

Critical aspects of tissue testing

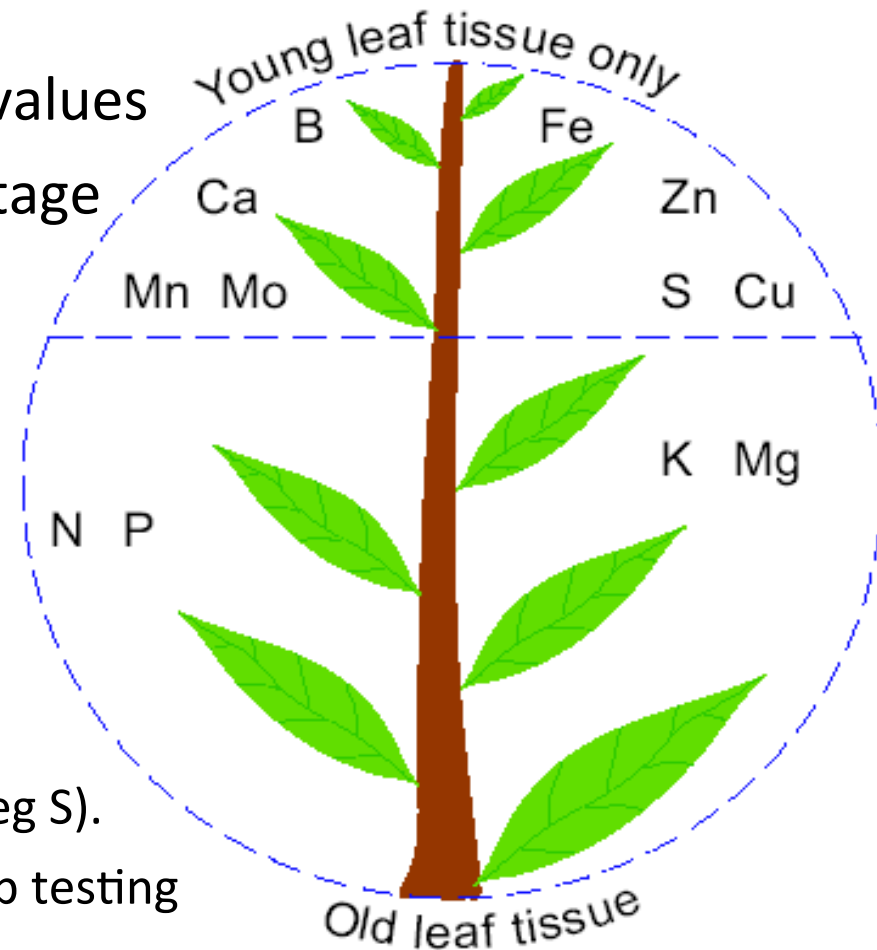
- Soil conditions can affect tissue values
- Right Timing – to plant growth stage
- **Take the Right tissue**
 - Marginal values for Zinc concentrations

Crop	Stage	Tissue	Critical
Wheat	Mid-tillering	YML	<14 mg/kg
		YEB	<16 mg/kg
		WS	<9 mg/kg

- Right amount of tissue (100 good leaves)

Critical aspects of tissue testing

- Soil conditions can affect tissue values
- Right Timing – to plant growth stage
- **Take the Right tissue**
 - Nutrient mobility
 - Determines if seen in older or younger leaves
 - Symptoms in older leaves occur with mobile nutrients (eg N)
 - Symptoms in younger leaves occur with less mobile nutrients (eg S).
 - Nutrient mobility important for sap testing



Critical aspects of tissue testing

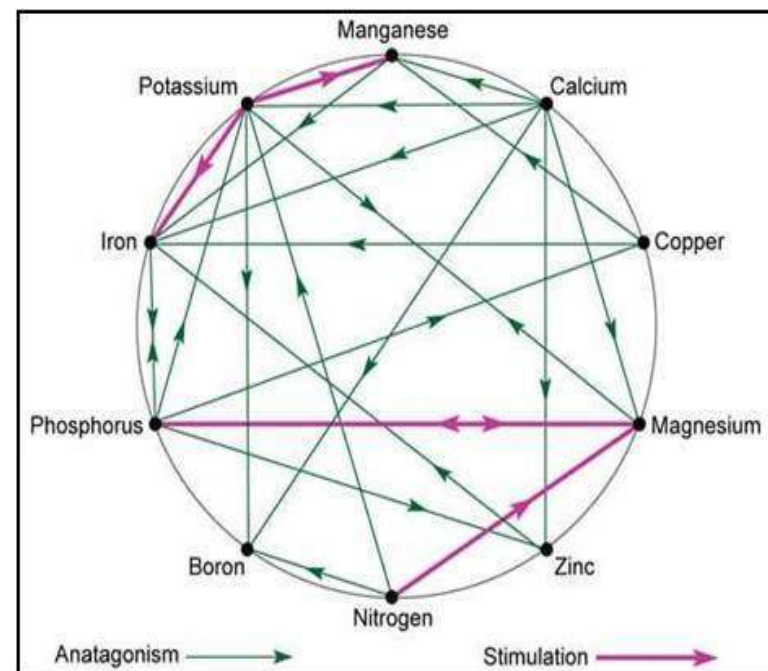
- Soil conditions can affect tissue values
- Right Timing – to plant growth stage
- Take the Right tissue
- **Take samples under the Right conditions**
 - Plants need to be active
 - Avoid overcast & cold days
 - Sample between 9 and 3
 - Roots to be developed – access nutrients.
 - Especially important for saps (temp/light/water)

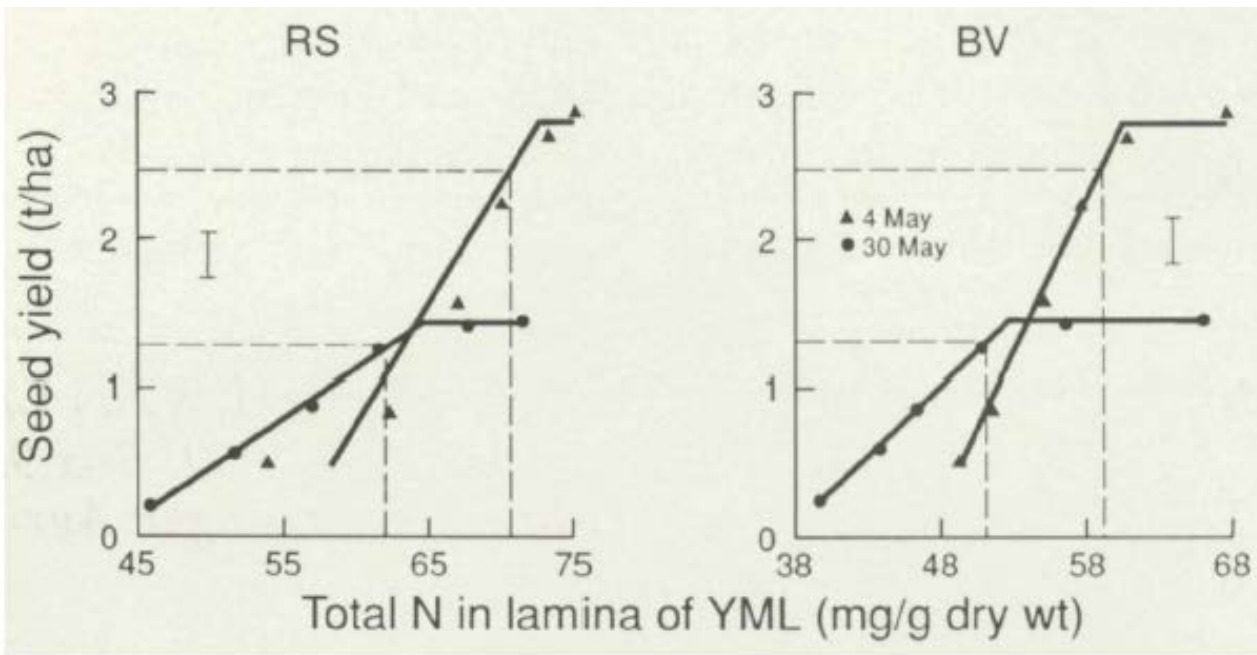


Critical aspects of tissue testing

- Soil conditions can affect tissue values
- Right Timing – to plant growth stage
- Take the Right tissue
- Take samples under the Right conditions
- **Care with interactions among nutrients**
 - High sulfur
 - Low selenium (animal issue)
 - Reduces zinc accumulation
 - Reduced Mo accumulation
 - High K
 - Reduces Mg uptake
 - High P
 - Reduces Zn uptake

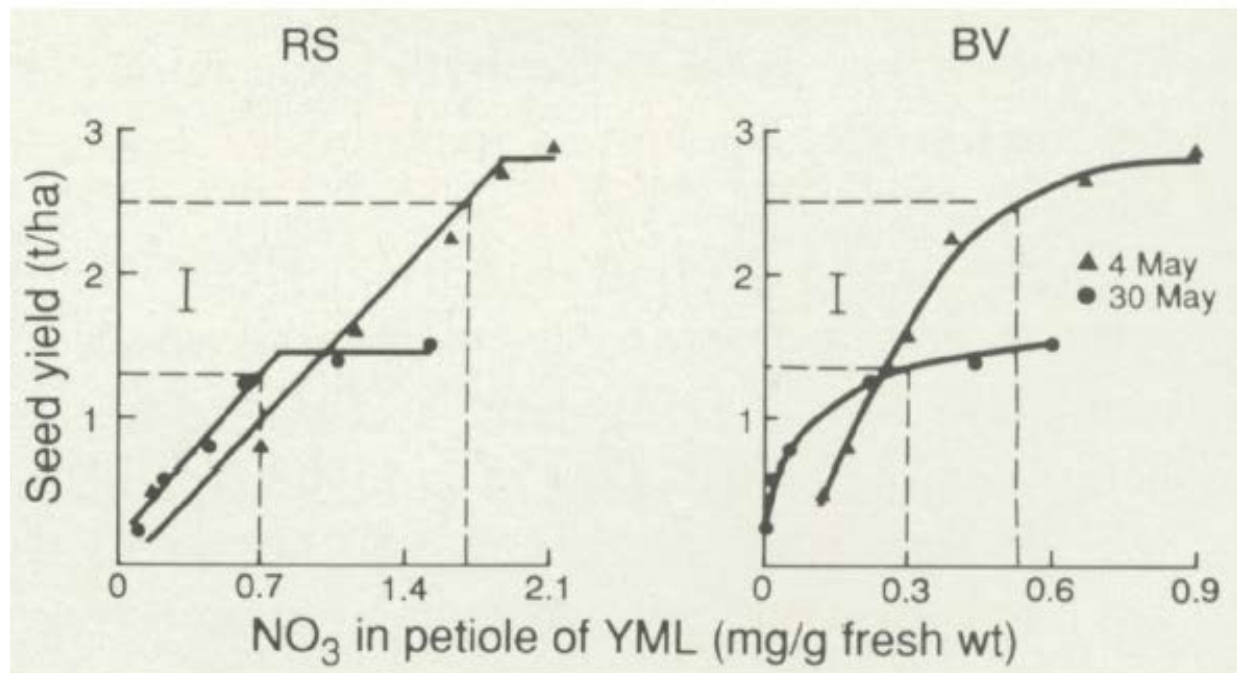
P Applied kg/ha/y	Colwell P (mg/kg)	Wheat Zn (mg/kg)
0	17	31
9	40	21
18	72	20
36	125	16





N in canola Dry ash N *versus* Sap nitrate

(Hocking 1997)



Using tissue tests to make fertilizer decisions

- Sampling is critical (garbage in = garbage out)
 - Right timing, Right tissue, Right conditions.
- Dry ash tests – part of ASPAC proficiency standards.
 - Experimental values published.
- Sap tests not currently evaluated through ASPAC.
 - Experience of the advisors interpreting the values.
- Analytical issues for low concentrations.
 - All methods have analytical uncertainty (10%?).
- **Tissue/Sap testing are useful tools – provide useful information on the nutrient status at a point in time.**
 - *Operation successful – but the patient died.*

