


Just how much are nutrients redistributed unevenly across the paddock when canola and wheat is windrowed?





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8 kg/ha K drilled every year
30 kg/ha K topdressed in 2012
25 kg/ha K topdressed in 2014
25 kg/ha K topdressed in 2016
Occasional windrow burn

Photo: Erin Cahill (agVivo) 2016

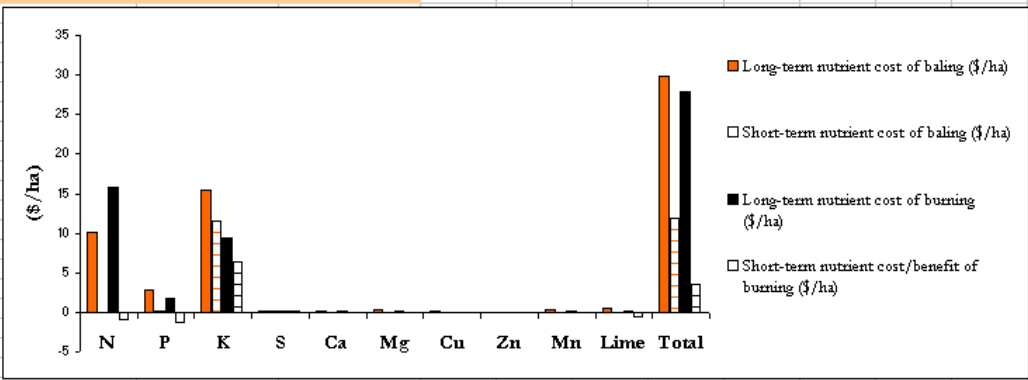
	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Yellow cells = best estimates that are best overwritten by you with better estimates													
2	Orange cells = best estimates that you are unlikely to find better estimates for													
3														
4	Quantity of stubble (t/ha)		4											
5	Percent of stubble baled		60											
6	Ash remaining on paddock after burn (%)		70											
7														
8		Stubble	Plant availability	Lost by	Availability									
9		Concentration	from stubble (%)	burning (%)	from ash (%)									
10	N (%)	0.50	0	90	80									
11	P (%)	0.05	5	10	50									
12	K (%)	0.80	75	10	80									
13	S (%)	0.10	75	25	50									
14	Ca (%)	0.20	0	5	30									
15	Mg (%)	0.10	0	5	30									
16	Cu (mg/kg)	5.0	0	5	30									
17	Zn (mg/kg)	7.0	0	5	30									
18	Mn (mg/kg)	50.0	0	5	30									
19	Lime (%)	2.0	10	0	100									

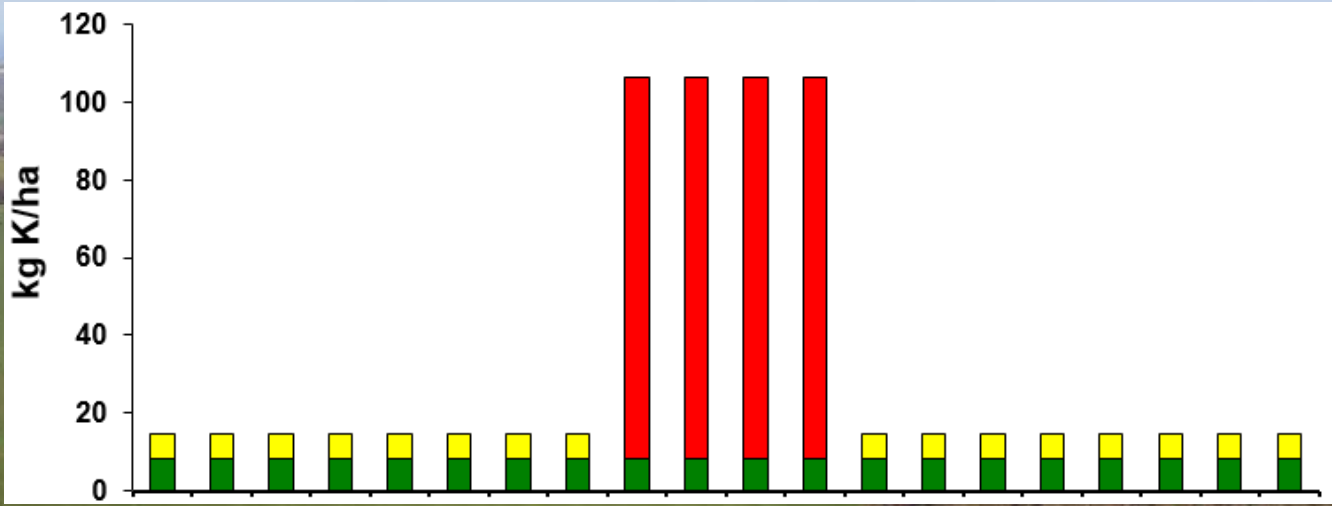
Stubble management: the short and long term implications for crop nutrition and soil fertility

Wayne Pluske and Bill Bowden

Crop Updates 2005

22	Cost of nutrients in fertilizer equivalents	
23	N	0.85
24	P	2.30
25	K	0.80
26	S	0.10
27	Ca	0.04
28	Mg	0.12
29	Cu	7.00
30	Zn	2.20
31	Mn	2.20
32	Lime	0.010





For a 2 t/ha wheat crop

Photo: Erin Cahill (agVivo) 2016



Controlled traffic

8 -10 kg/ha K drilled every year for 10 years

No burning since 2010

Colwell-K consistently > 100 mg/kg

Photo: Erin Cahill (agVivo) 2016



Our direct measurement approach:

- Calingiri harvest, November 2017
- Canola and wheat
- Measured:
 - Stems/leaves/pods to be harvested
 - Grain yield
 - Soil-attached residue remaining after harvest
 - Straw/chaff out the back of header
 - Nutrient concentrations
- Estimated how much nutrient was flushed from straw/chaff after a “rain”
- **To gauge the cost of nutrient redistribution, in fertiliser equivalents, of windrowing**



Quantities and concentrations

	Dry matter (t/ha)	N (%)	P (%)	K (%)
Canola				
Soil-attached residue	2.6	0.49	0.02	1.33
Harvestable biomass:				
Stems/leaves/pods – direct-headed	2.9	0.49	0.03	1.48
Stems/leaves/pods – swathed	2.8	0.58	0.04	1.22
Seed	1.3	3.27	0.59	0.72
Straw/chaff out the back of header	3.1	0.59	0.03	0.95
Wheat				
Soil-attached residue	2.5	0.63	0.01	1.03
Harvestable biomass:				
Stems/leaves/pods – direct-headed	2.3	1.27	0.13	0.67
Seed	4.5	1.80	0.24	0.44
Straw/chaff out the back of header	2.4	0.40	0.02	1.72

Nutrient quantities

	N (kg/ha)	P (kg/ha)	K (kg/ha)
Canola			
Soil-attached residue	13	1	35
Harvestable biomass:			
Stems/leaves/pods – direct-headed	14	1	42
Stems/leaves/pods – swathed	16	1	34
Seed	42	8	9
Straw/chaff out the back of header	18	1	29
Wheat			
Soil-attached residue	16	0	26
Harvestable biomass:			
Stems/leaves/pods – direct-headed	29	3	15
Seed	81	11	20
Straw/chaff out the back of header	9	0	40

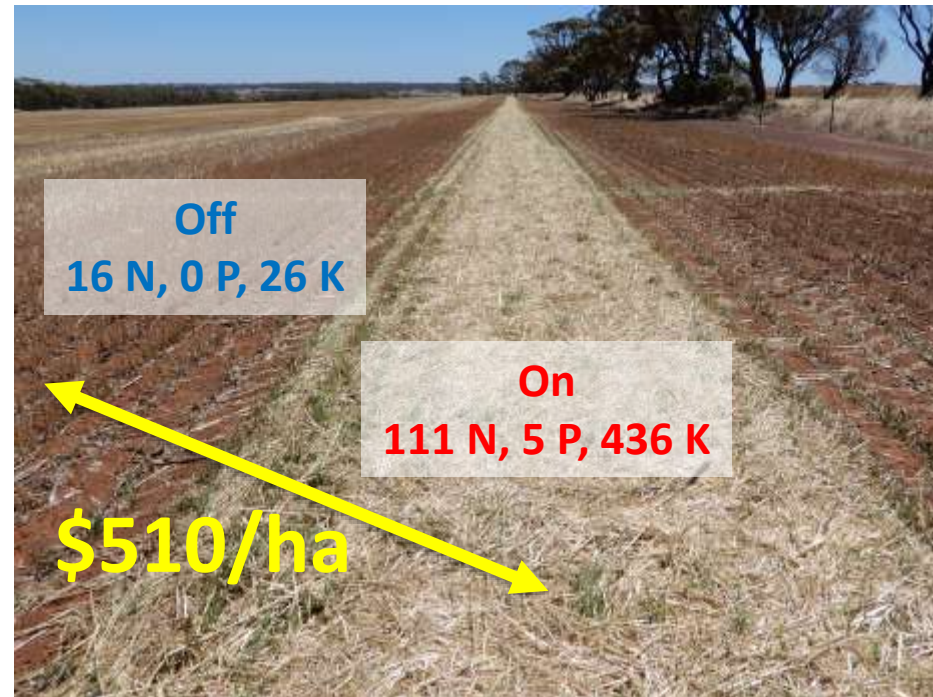
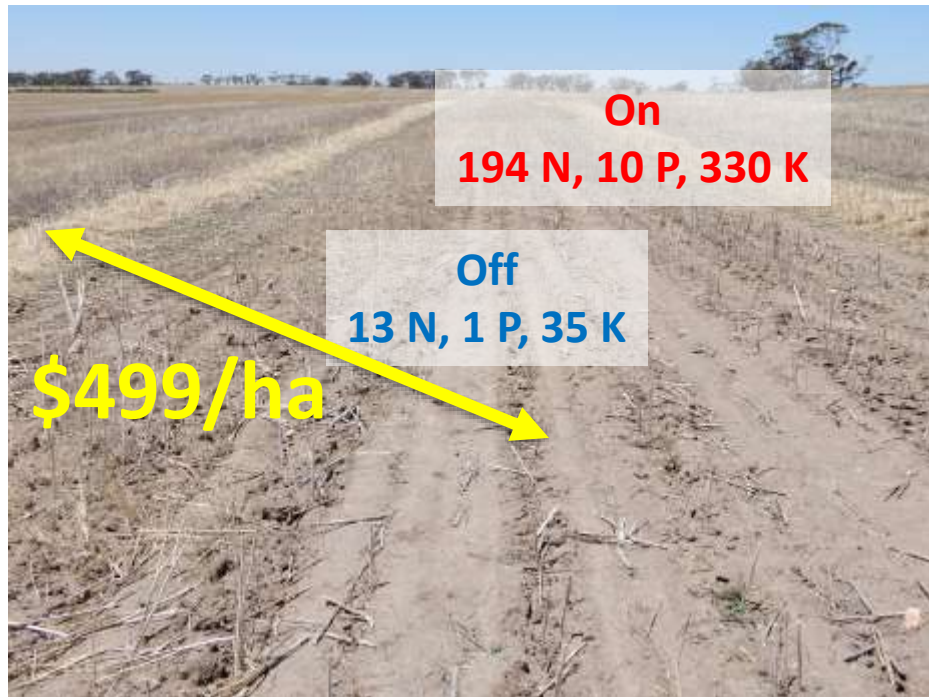
kg/ha of total NPK on and off windrows (includes soil attached residue)



Even spread: 31 N, 2 P, 64 K

25 N, 1 P, 66 K

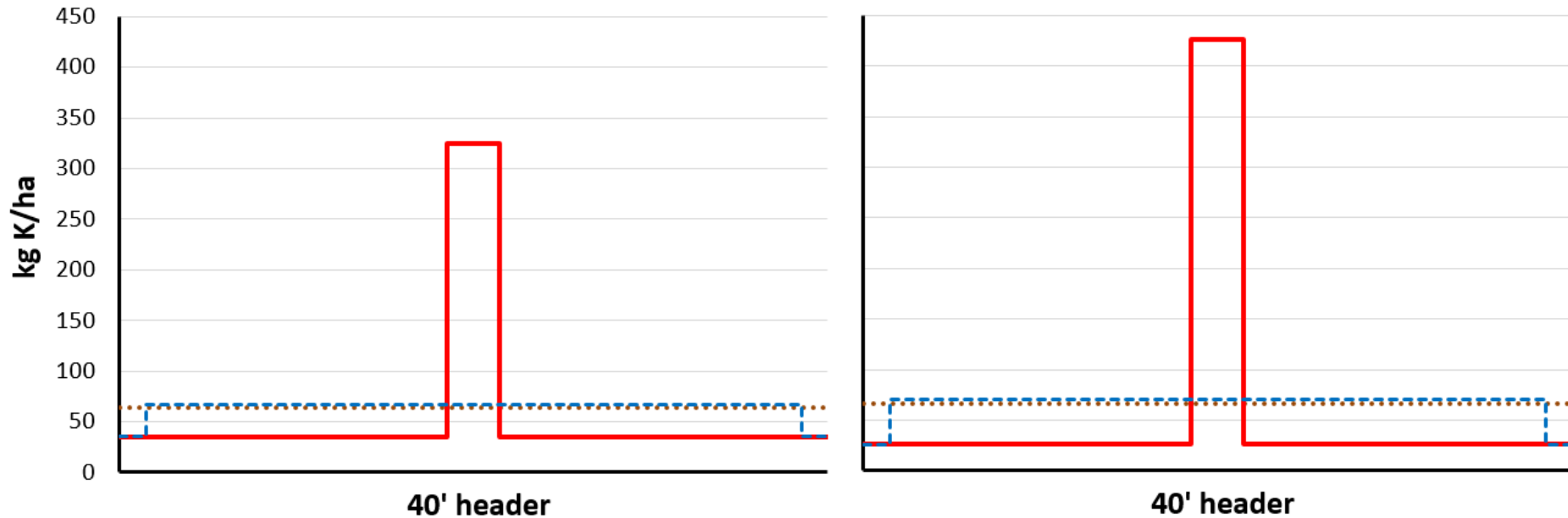
kg/ha of total NPK on and off windrows (includes soil attached residue)



Redistribution of total K out the back of the header

Canola

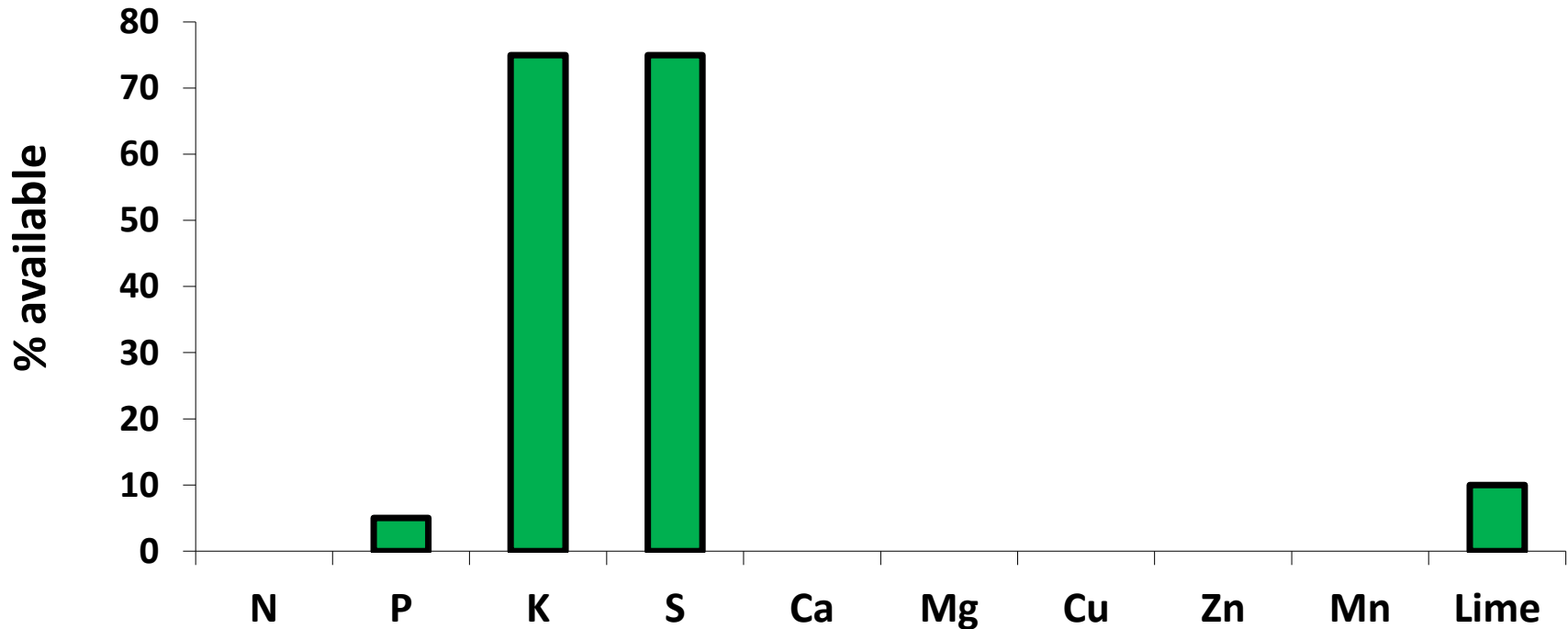
Wheat



..... Even spread — 4' windrow - - - 36' throw

How plant-available are nutrients?

Historical/conventional thinking



Pluske and Bowden

How plant-available are nutrients?

- We mimicked a single reasonable rainfall event
 - Canola straw/chaff
 - Ground samples (20g) shaken with Milli-Q water (100ml) on an end-over-end shaker for 24 hours
 - Soluble extract decanted and centrifuged at 4000 rpm for five minutes
 - Solution analysed
- **To gauge the cost of nutrient redistribution, in fertiliser equivalents, of windrowing**

Nutrient extracted in a mimicked single rainfall event

Canola (lab)

8% N

32% P

55% K

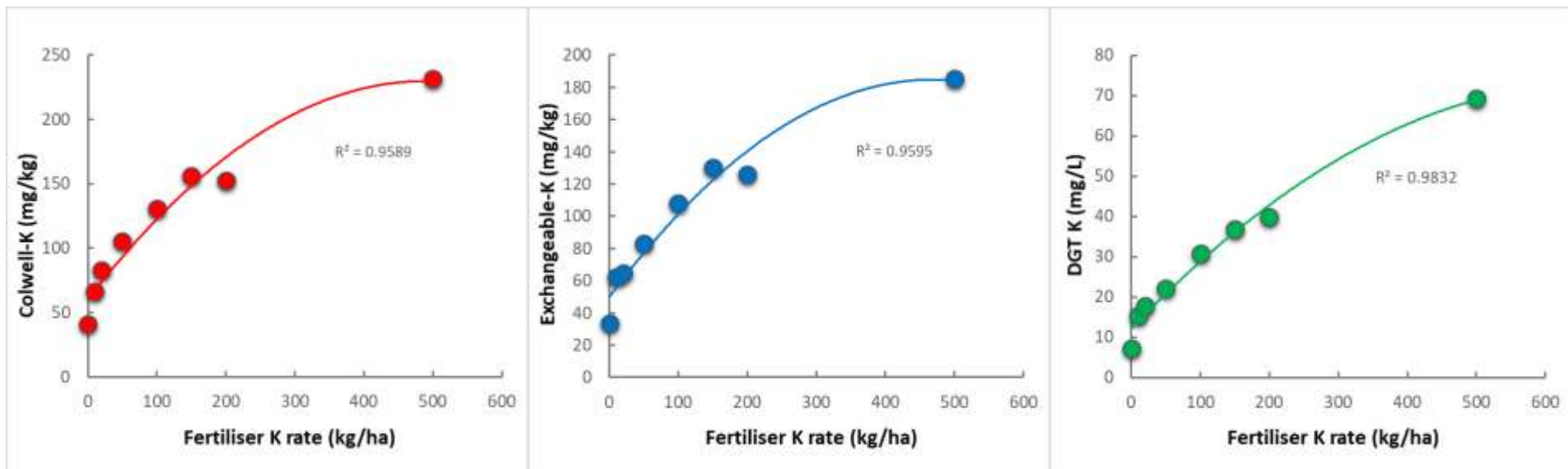
Canola (paddock)	N (%)	P (%)	K (%)
Straw/chaff out the back of header	0.59	0.03	0.95
After 65mm rain (15/1/18)	0.48	0.03	0.41
% loss	19%	0%	57%

Approx. value in fertiliser equivalents of K redistributed



Implications?

For soil testing



Eradu 2017

At Calingiri (on windrows with 150+ kg of fertiliser-K/ha) before and after 65mm rain (15/1/18):

- Colwell-K: 269 => 398 mg/kg
- Exchangeable-K: 303 => 417 mg/kg



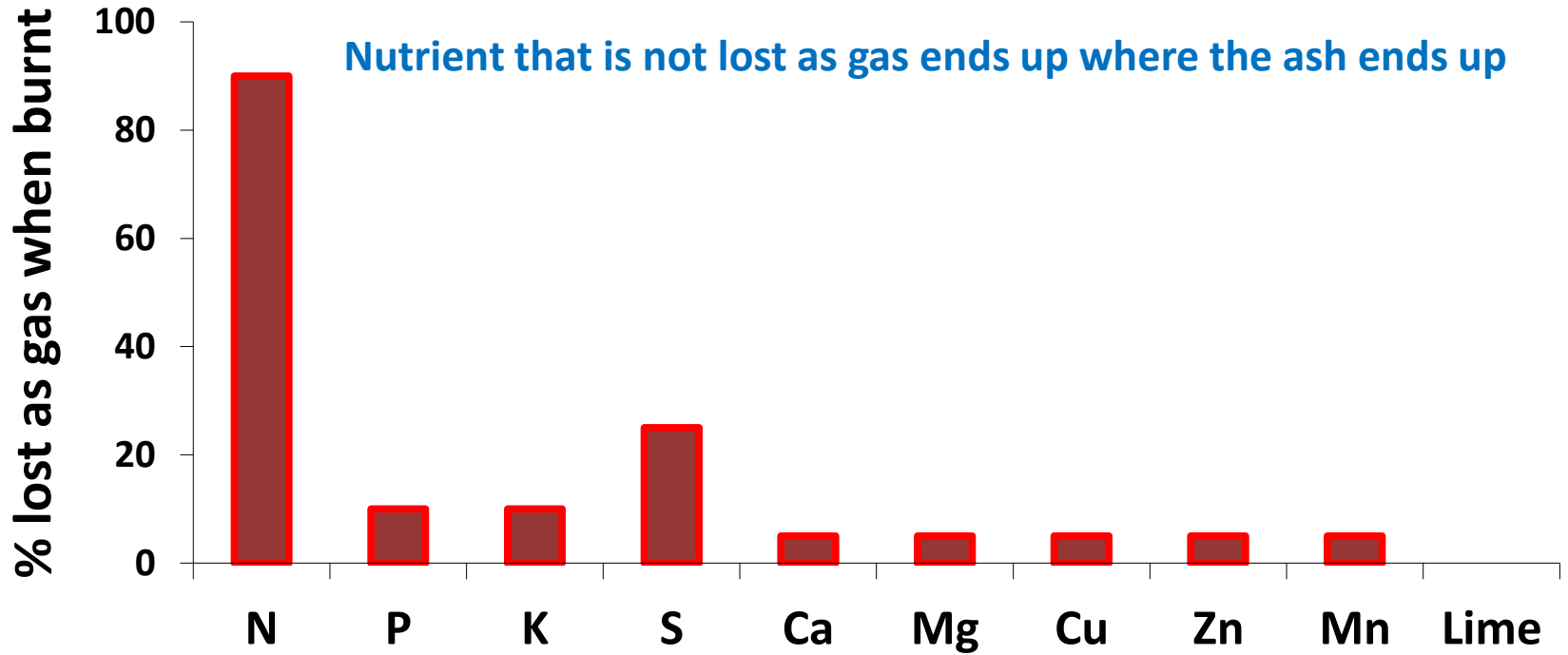
Colwell-K (mg/kg)

DGT-K ($\mu\text{g/L}$)

197	28	70
2540	200	380

Implications?

When windrows are burnt

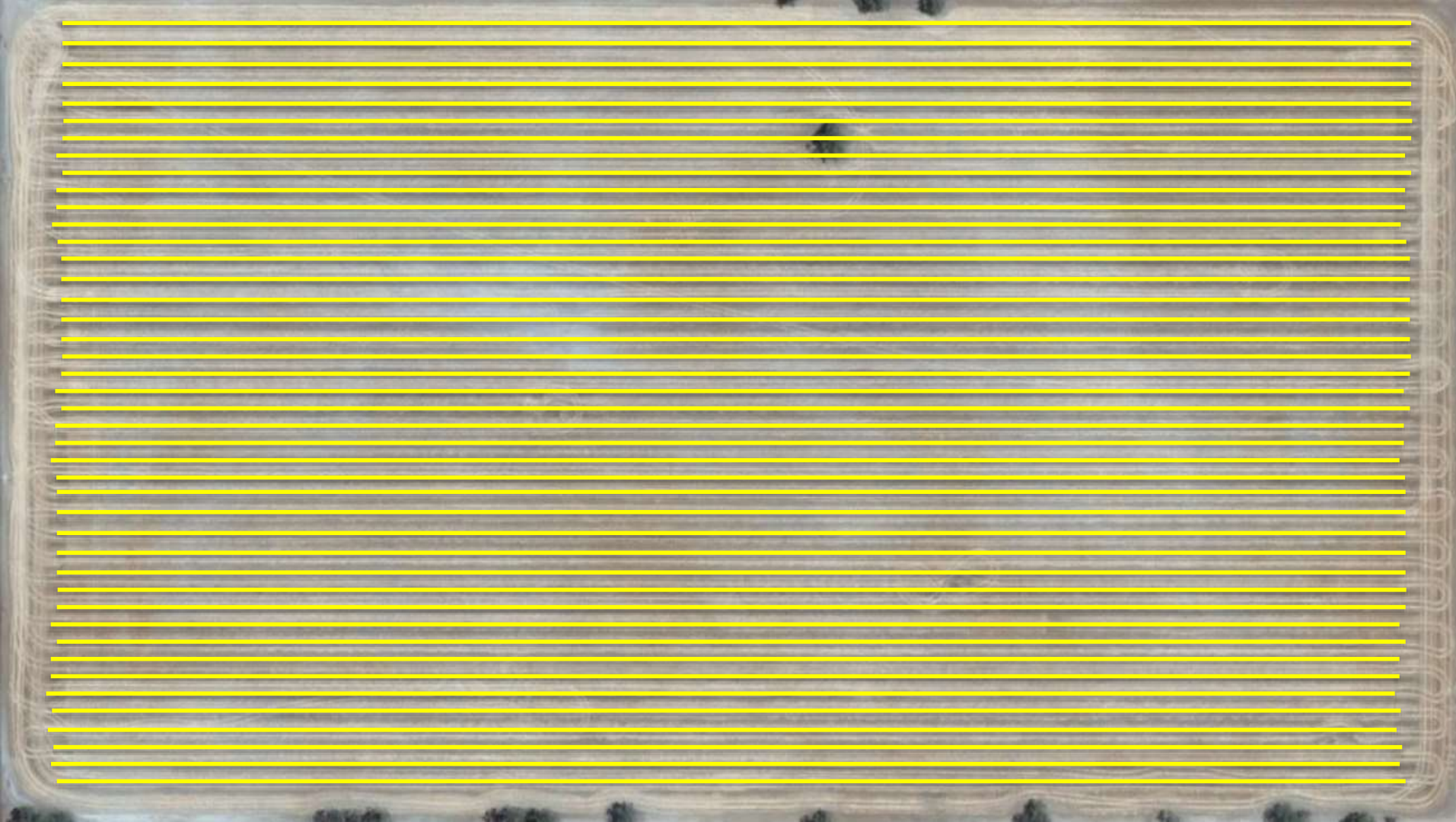


Take home messages

- The economic consequences of nutrient redistribution can be high

300 - 500 kg/ha MoP?





Take home messages

- The economic consequences of nutrient redistribution can be high
- There is still much to learn about the quantities and plant-availabilities of nutrients redistributed at harvest in windrows, CTF, chaff lines, chaff dumps,
- There'd want to be big benefits from shifting plant material around paddocks because there's sizable nutrient costs

Backers of this research



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