International Macadamia Symposium 2023

Macadamias South Africa (NPC)
(SAMAC)

Optimising nutrition through updated crop removal values for the macadamia industry

Jeremy Bright (NSW DPI) & Aleysia Kleinert
(Stellenbosch University)

Why was it done?

- Common across a multitude of horticultural crops
- Macadamia work on 3 varieties with results averaged to give current figures.
- Wanted to see if difference between individual varieties
- Identify actual nutrient replacement values and interrogate why we see excess recommendations

Crop replacement values *(Bryen Vimpanny 1996)*

Crop yield (t/ha)	Nitrogen Kg/T	Phosphorus Kg/T	Potassium Kg/T	Calcium Kg/T	Magnesium Kg/T
1	10.5	1.23	9.15	.46	.74
Plus losses	13.5 (30%)	1.23	11 (20%)	.51 (10%)	.9 (25)

Losses through leaching, erosion and soil fixation at the time 1996.

Could not find in literature what:

- *pH*
- *Soil and leaf analysis*
- *Yields for site*
- *Soil type etc.*

Data from 1996 led to further questions:

- Do these values vary with variety?
- Do these values vary with kernel size?
- Do these values vary between regions?
- Do these values vary between management systems?
- Irrigation vs non irrigated?
- Why are recommendations much higher than CRV?

What we did in NSW:

Compared 8 individual varieties:

Hawaiian varieties:

- 816, 741 and 246

Australian varieties:

- A38, A203, A16, A4, and G.

Nutrient replacement values of **husk**, **shell** and **kernel** determined

- converted to nut in shell at 10%mc removed from the field

What we did in SA:

Compared 7 varieties across 2 growing areas:

Hawaiian varieties:

- 695, 788, 814, 816, and 842

Australian varieties:

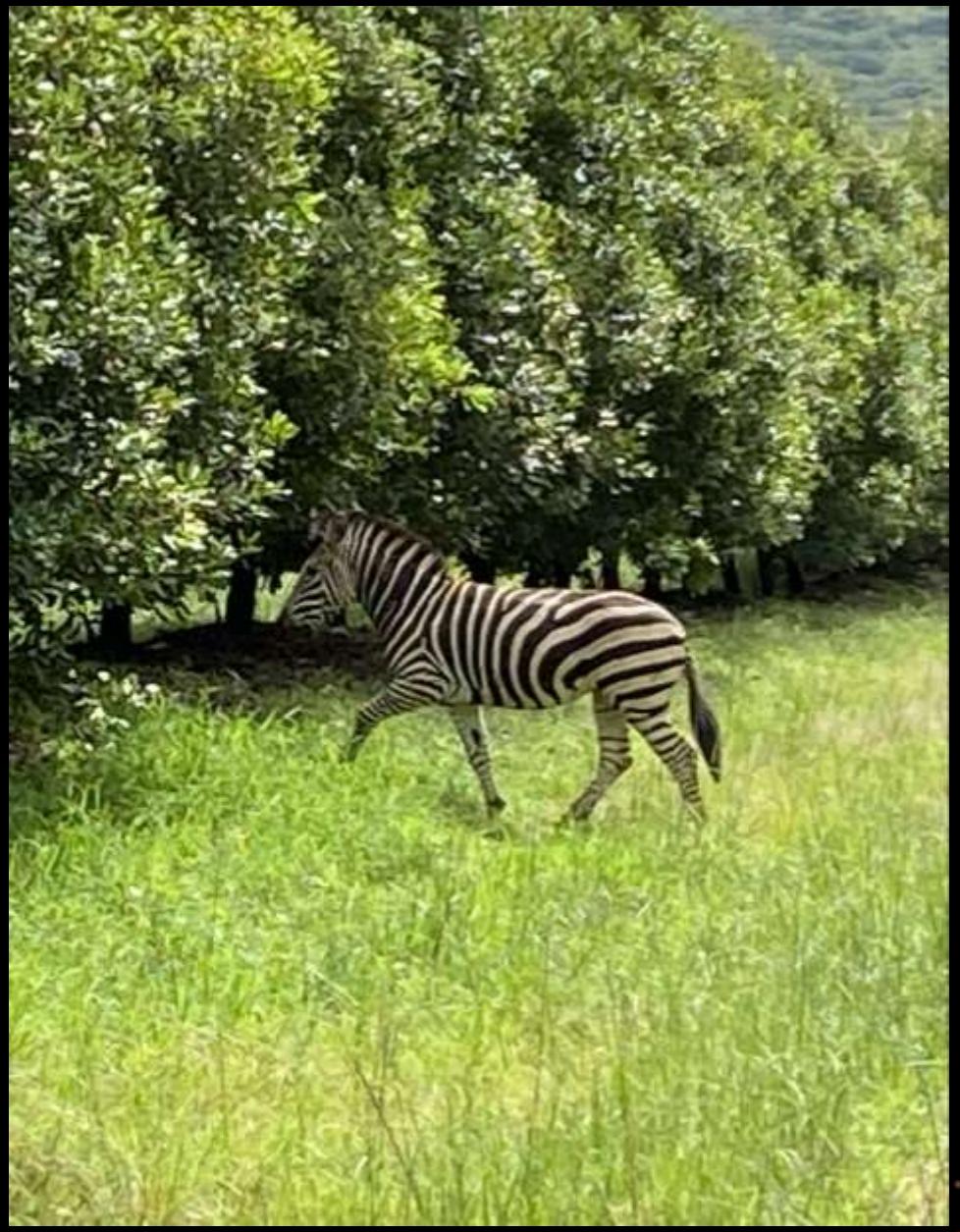
- A4, A16,

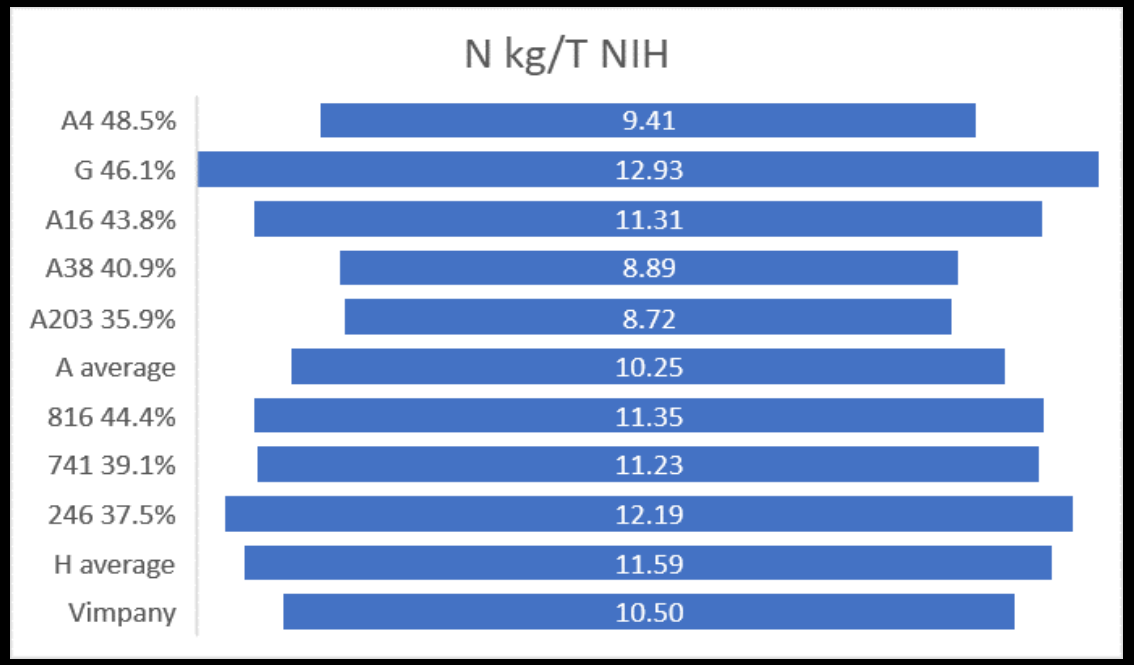
Also Nelmak2

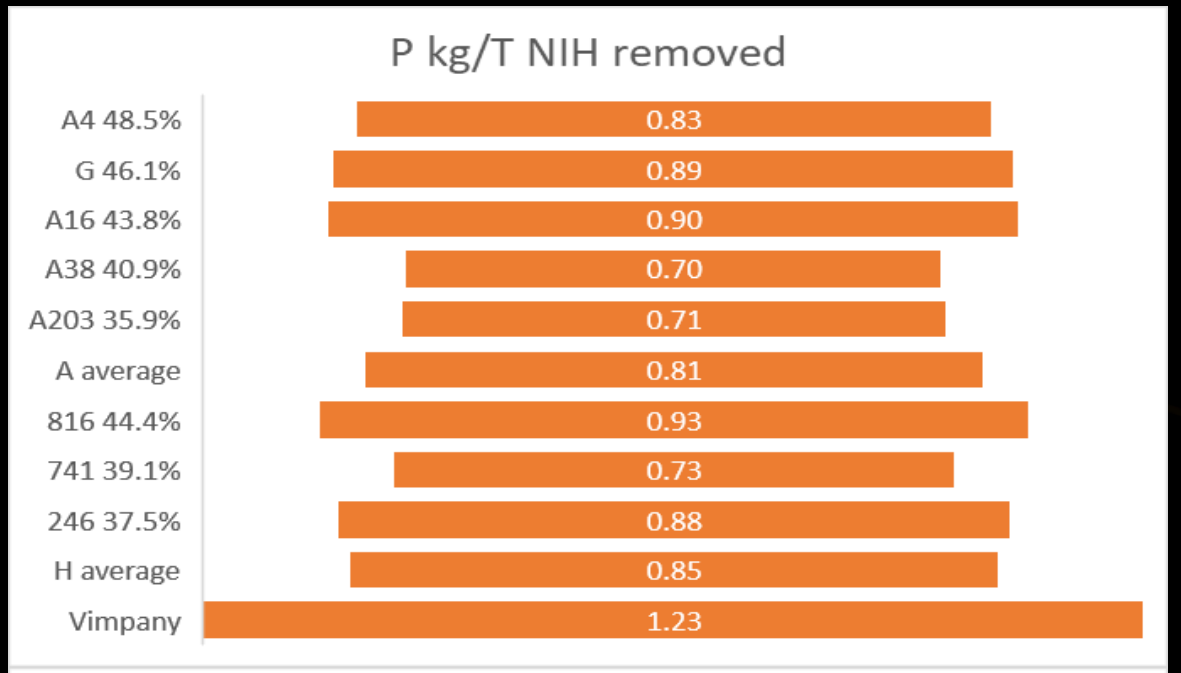
Nutrient replacement values of **husk**, **shell** and **kernel** determined

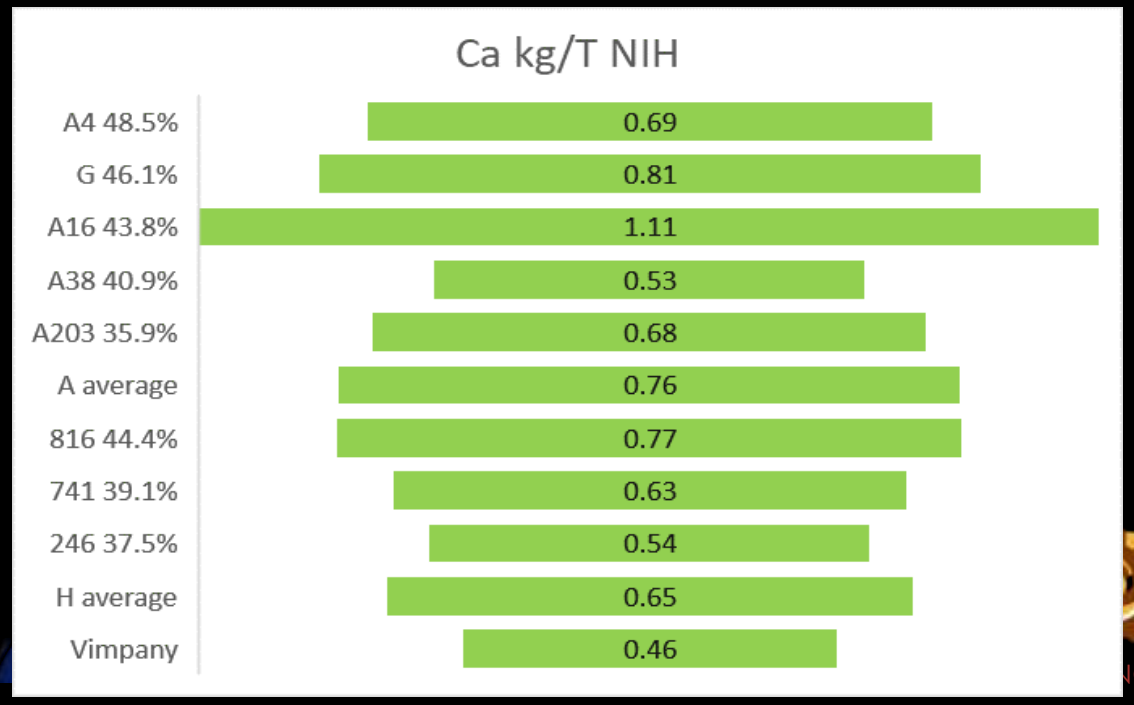
Nutrition Crop replacement values

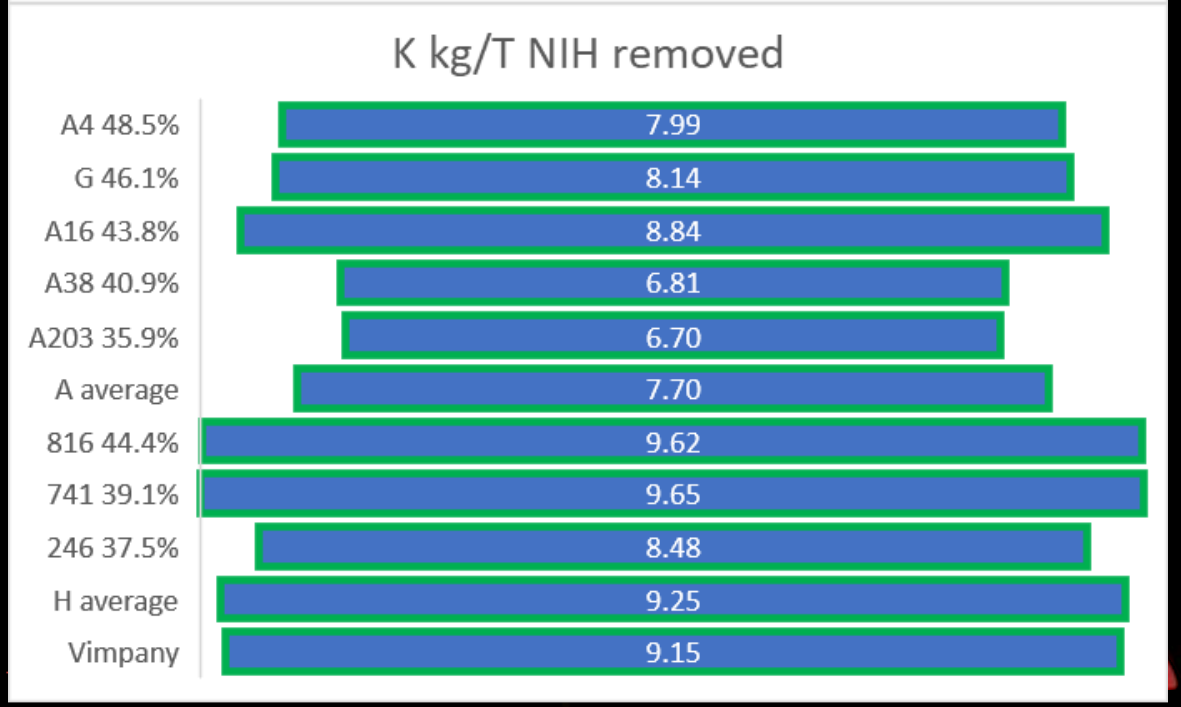
- Sampling in May, June, July (NSW) and March – June (SA).
- Selection of nut in husk (2kg) ensuring husk was sound ie fresh green and not split where possible
- NIH was then weighed, dehusked, nut in shell then weighed giving us a value of percent husk
- Nut in shell (NIS) was then cured in oven at 45ºC for 2 days so that kernel would easily separate from the shell



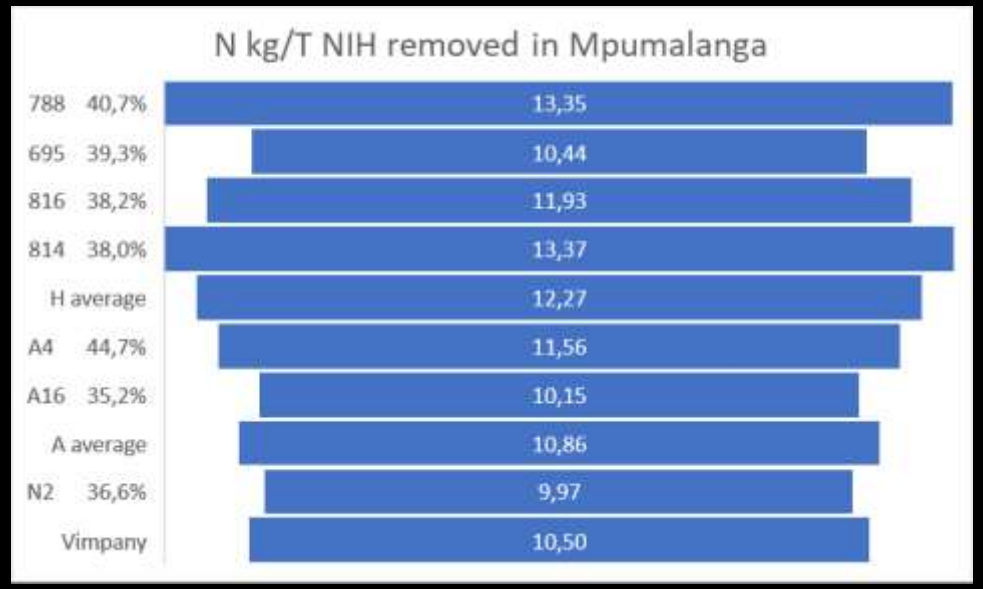

N kg/T NIH
A4 48.5%
9.41
G 46.1%
12.93
A16 43.8%
11.31
A38 40.9%
8.89
A203 35.9%
8.72
A average
10.25
816 44.4%
11.35
741 39.1%
11.23
246 37.5%
12.19
H average
11.59
Vimpany
10.50

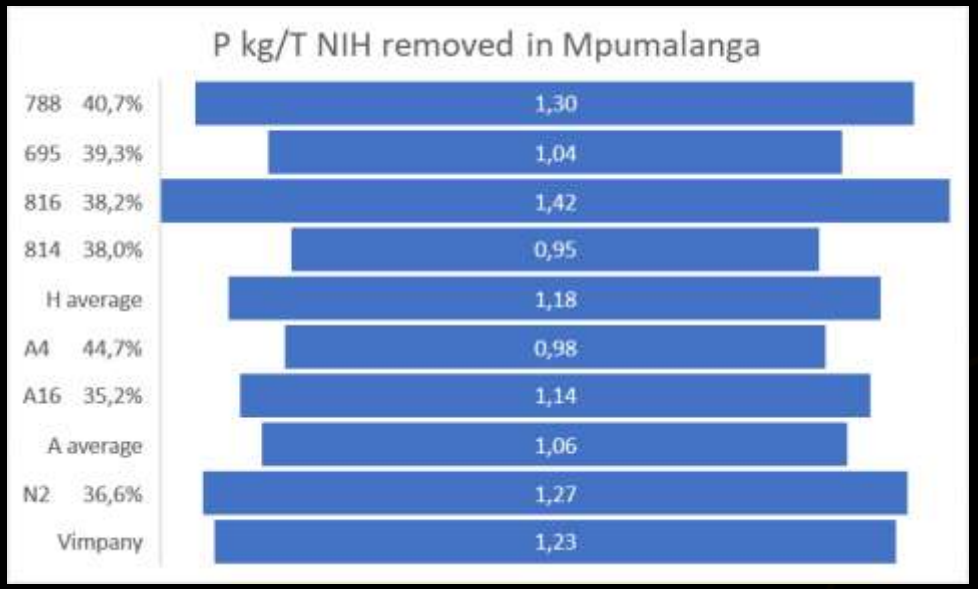

P kg/T NIH removed
A4 48.5%
0.83
G 46.1%
0.89
A16 43.8%
0.90
A38 40.9%
0.70
A203 35.9%
0.71
A average
0.81
816 44.4%
0.93
741 39.1%
0.73
246 37.5%
0.88
H average
0.85
Vimpany
1.23

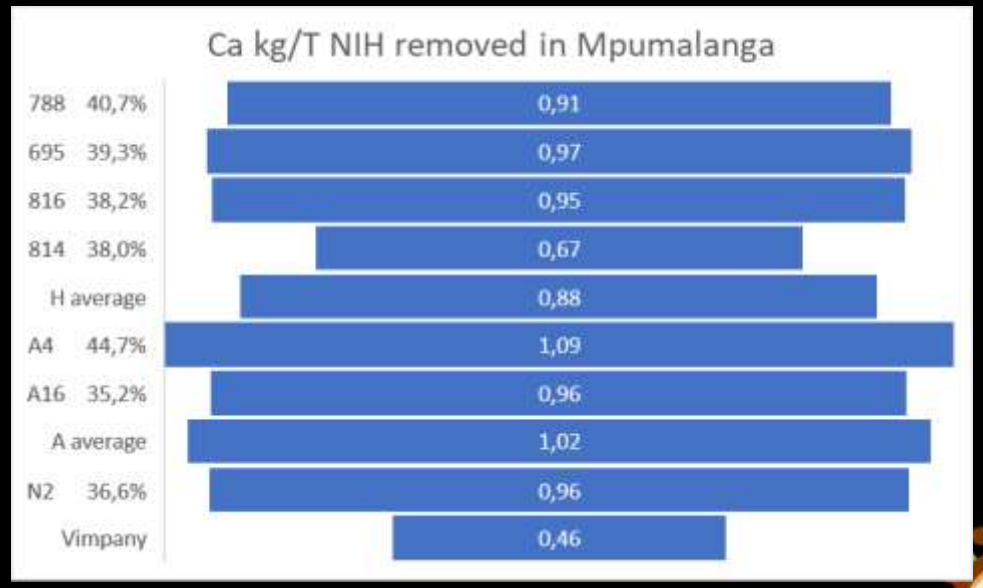

Ca kg/T NIH
A4 48.5%
0.69
G 46.1%
0.81
A16 43.8%
1.11
A38 40.9%
0.53
A203 35.9%
0.68
A average
0.76
816 44.4%
0.77
741 39.1%
0.63
246 37.5%
0.54
H average
0.65
Vimpany
0.46

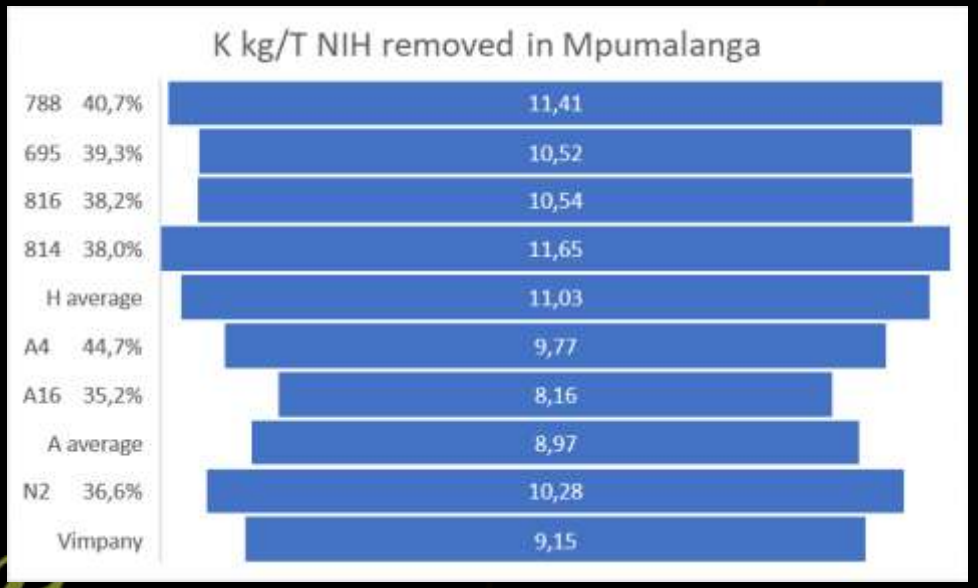

K kg/T NIH removed
A4 48.5%
7.99
G 46.1%
8.14
A16 43.8%
8.84
A38 40.9%
6.81
A203 35.9%
6.70
A average
7.70
816 44.4%
9.62
741 39.1%
9.65
246 37.5%
8.48
H average
9.25
Vimpany
9.15

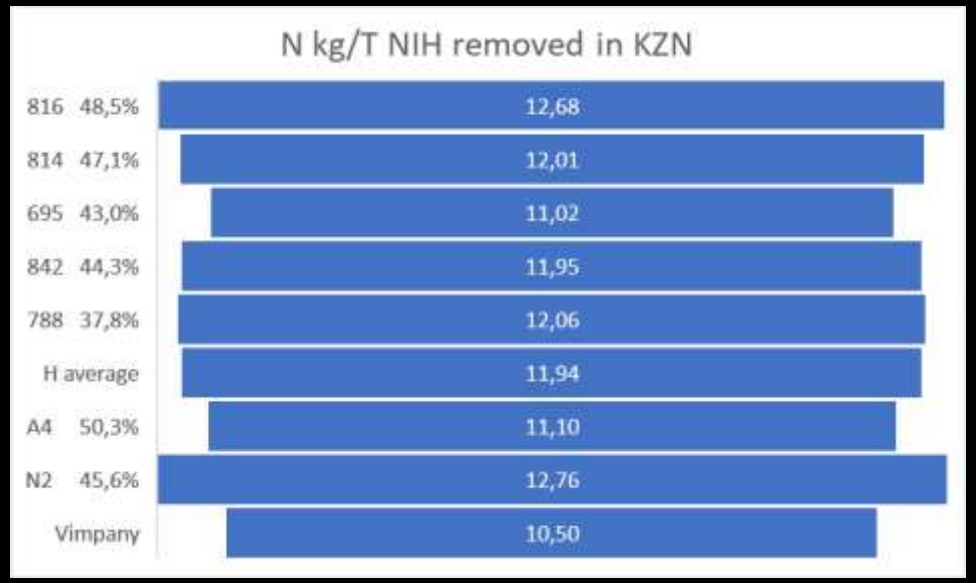
NG FORWARD

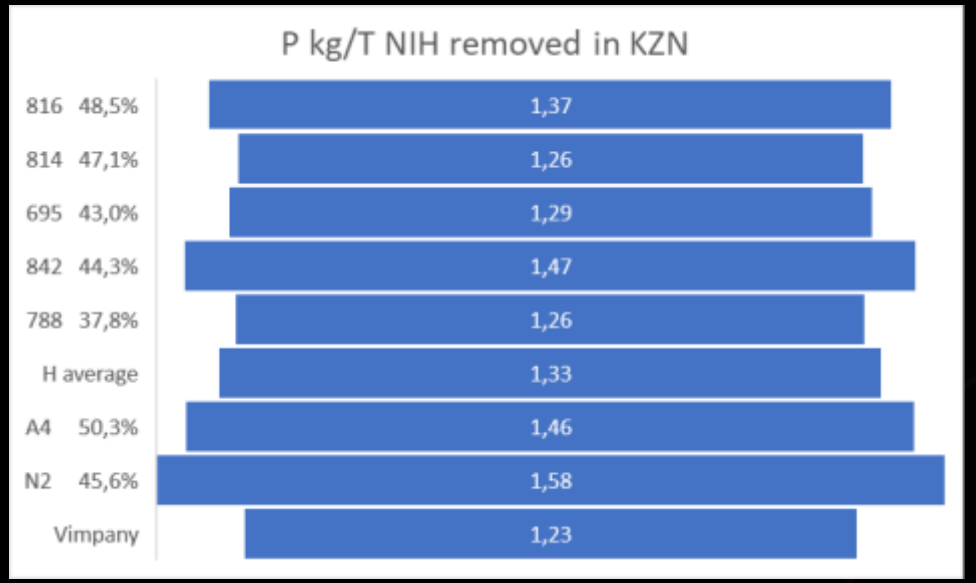

N kg/T NIH removed in Mpumalanga
788 40,7% 13,35
695 39,3% 10,44
816 38,2% 11,93
814 38,0% 13,37
H average 12,27
A4 44,7% 11,56
A16 35,2% 10,15
A average 10,86
N2 36,6% 9,97
Vimpany 10,50

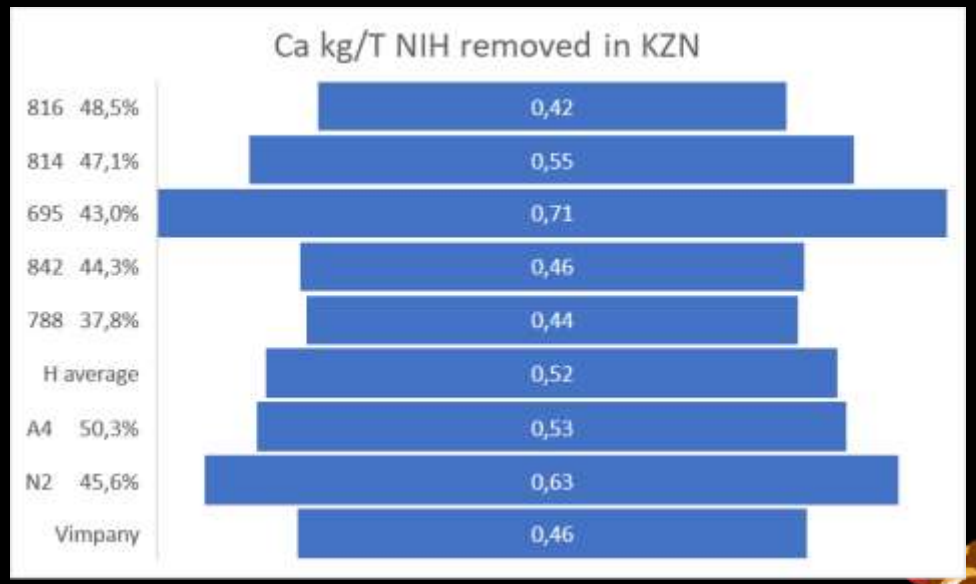

P kg/T NIH removed in Mpumalanga
788 40,7% 1,30
695 39,3% 1,04
816 38,2% 1,42
814 38,0% 0,95
H average 1,18
A4 44,7% 0,98
A16 35,2% 1,14
A average 1,06
N2 36,6% 1,27
Vimpany 1,23

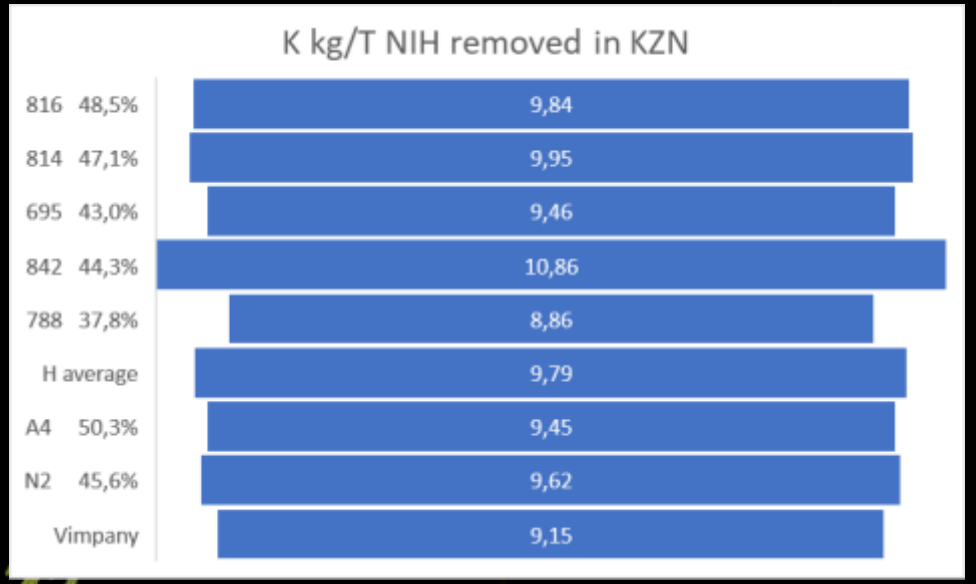

Ca kg/T NIH removed in Mpumalanga
788 40,7% 0,91
695 39,3% 0,97
816 38,2% 0,95
814 38,0% 0,67
H average 0,88
A4 44,7% 1,09
A16 35,2% 0,96
A average 1,02
N2 36,6% 0,96
Vimpany 0,46


K kg/T NIH removed in Mpumalanga
788 40,7% 11,41
695 39,3% 10,52
816 38,2% 10,54
814 38,0% 11,65
H average 11,03
A4 44,7% 9,77
A16 35,2% 8,16
A average 8,97
N2 36,6% 10,28
Vimpany 9,15


N kg/T NIH removed in KZN
816 48,5%
12,68
814 47,1%
12,01
695 43,0%
11,02
842 44,3%
11,95
788 37,8%
12,06
H average
11,94
A4 50,3%
11,10
N2 45,6%
12,76
Vimpany
10,50


P kg/T NIH removed in KZN
816 48,5%
1,37
814 47,1%
1,26
695 43,0%
1,29
842 44,3%
1,47
788 37,8%
1,26
H average
1,33
A4 50,3%
1,46
N2 45,6%
1,58
Vimpany
1,23


Ca kg/T NIH removed in KZN
816 48,5%
0,42
814 47,1%
0,55
695 43,0%
0,71
842 44,3%
0,46
788 37,8%
0,44
H average
0,52
A4 50,3%
0,53
N2 45,6%
0,63
Vimpany
0,46


K kg/T NIH removed in KZN
816 48,5%
9,84
814 47,1%
9,95
695 43,0%
9,46
842 44,3%
10,86
788 37,8%
8,86
H average
9,79
A4 50,3%
9,45
N2 45,6%
9,62
Vimpany
9,15

Nutrient replacement rates

Husk left infield

	Nitrogen	Phosphorus	Potassium	S
	Kilograms pe (NIS @ 10% moist			
1 t/ha actual*	7.1	0.9	1.7	0
1 t/ha adjusted**	9.2	1.7	2.1	0
2 t/ha adjusted	18.5	3.5	4.2	1
4 t/ha adjusted	36.8	7.0	8.3	2
6 t/ha adjusted	55.3	10.4	12.5	4

Husk removed from field

	Nitrogen	Phosphorus	Potassium	Su
	Kilograms per ton (NIS @ 10% moisture c			
1 t/ha actual*	11.1	1.1	8.5	1.4
1 t/ha adjusted**	14.4	1.2	10.3	1.4
2 t/ha adjusted	28.8	2.4	20.5	2.7
4 t/ha adjusted	57.7	4.7	41.0	5.5
6 t/ha adjusted	86.5	7.1	61.5	8.2

Nutrition Crop replacement values

	N	P	K	Ca	S	Mg	B	Cu	Zn
Total (Vimpany)	10,50	1,23	9,15	0,46	1,38	0,74	0,01	0,01	0,01
Total (Ave 2021 - NSW)	11,17	1,23	8,72	0,65	1,40	0,81	0,01	0,01	0,01
Total (Ave 2021 - Mpumalanga)	11,54	1,16	10,33	0,93	0,52	0,68	0,01	0,01	0,01
Total (Ave 2021 - KZN)	11,94	1,38	9,72	0,53	1,02	0,69	0,01	0,00	0,01

Nutrition Crop replacement values

	N	P	K	Ca
Total (Vimpany)	10,50	1,23	9,15	0,46
A16 43,8% (NSW)	11,31	0,90	8,84	1,11
A16 35,2% (Mpumalanga)	10,15	1,14	8,16	0,96
A4 48,5% (NSW)	9,41	0,83	7,99	0,69
A4 44,7% (Mpumalanga)	11,56	0,98	9,77	1,09
A4 50,3% (KZN)	11,10	1,46	9,45	0,53
816 44,4% (NSW)	11,35	0,93	9,62	0,77
816 38,2 (Mpumalanga)	11,93	1,42	10,54	0,95
816 48,5% (KZN)	12,68	1,37	9,84	0,42

CRV summary

- No relationship between nutrient levels and kernel recovery
- Values vary somewhat between varieties
- Values vary somewhat between regions
- There are differences specifically in Ca (more) and S (less) between Mpumalanga and the other 2 regions
- But……

Why are application rates significantly higher than CRV?

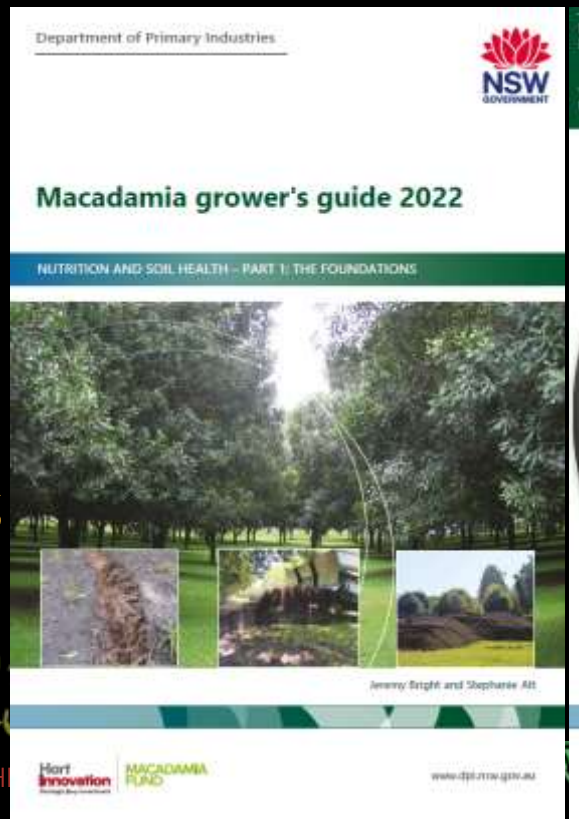
- Removal for 4T/ha is 44kg/ha of N
- Typical application rate is 100kg/ha of N
- Where does the **56**kg/ha go?
- Increased leaf/plant levels?
- Stored in the soil?
- (Excess) vegetative growth ?
- Environment ? (deep drainage / wash-out, volatilization)

To reduce application rates successfully, the first step is to implement Integrated Orchard Management (IOM)

Put in place the soil health and nutrition **foundations** –

- soil structure,
- pH,
- organic matter,
- monitoring,
- correcting deficiencies / toxicities

To be continued.....



QUESTIONS ?

The CCC Research project is funded through the NSW Government's Marine Estate Management Strategy to improve water quality for our ocean, estuaries, and coastal wetlands.

IMS 23
MOVING FORWARD TOGETHER