Essential Foundations for Designing Plant Nutrition Programs
Petiole Analysis, a practical example.

By James Dick

T/A CropWalker

Points of discussion

1. Water Quality Management
2. Balanced Nutritional Program
3. EC and Irrigation Management
4. Nitrogen Management – Ammonium vs Nitrate Nutrition
5. Petiole Analysis
6. Conclusion

Water Quality Management

- Neutralize hardness –
  - reduce blockages,
  - improve nutrient availability.
  - Free CaNO3
  - NB – add into storage tank (reverse reaction – by prod = CO2)

CROPWALKER FERTIGATION PLAN

				meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
CLIENT:		SHADOWLANDS		NO3-N	HCO3	CO3	Na	K	Ca	Mg	SO4	Cl	Fe	Mn	Zn	Cu	B	Mo
REPORT NO:				0.00	4.90	0.05	2.20	0.06	2.26	0.92	0.27	0.31	0.00	0.00	0.00	0.00	0.00	0.00
DATE:		28/10/2014		0.09	298.90	3.00	50.52	2.23	45.14	11.05	13.15	10.85	10.00	74.21	17.57	4.31	1.00	0.00
pH:		6.8	mg/l:															
E.C. mS/cm:		0.06																
	mmol acid :	3																

Total Cations (me/L)	5.43153456	
Total Anions (me/L)	5.53395833	0.10242377

Litres PER 1000 l		ACID SOURCE		TOT-N	g NH4-N	g NO3-N	g P
0.253		NITRIC ACID 58 %		33.7047466		33.7047466	
0.283		PHOSPHORIC ACID 80 %					84.9000594

Balanced Nutritional Program

- Find a fertilizer program/product that fits (water quality)
- Cations (+) = Anions (-), otherwise complexes will form in the stock solution, not available to the plant.

Total nutrient concentration	198.7207	15.772	182.95	32.915	284.89	126.75	25.7	81.194	3.584	0	2.1	0.5	0.25	0.0375	0.625	0.0625
Total nutrients in Solution	**199**	**16**	**183**	**33**	**287**	**172**	**37**	**86**	**14**	**51**	**12**	**75**	**18**	**4**	**2**	**0**
Total me/L		1.126	13.061	1.0739	7.343598	8.5778	3.0241	5.3348	0.4071	2.1975						
Cations me/L		20.1		Anion me/L		19.877										
Calculated Nutrient Solution E.C. (mS/cm)		1.9974														

EC and Irrigation Management

- EC in 1.6 mS/cm (emitter), EC out 1.6 mS/cm (caught under tray/pot)
- Sum must equal = 3.2
  - e.g. If EC-out 2, then 3.2 – 2 = 1.2, EC-in = 1.2
  - If EC-out climbs too high, lower the EC-in. If no affect, then leach.

- Measure runoff – catch runoff with a trough that fits snugly under a tray/pot.
  - Run-off = 10 - 15%
  - If run-off >> 15% then reduce irrigation period.
  - If no run-off, increase irrigation period.
  - If seedlings wilt (midday), increase irrigation frequency

Nitrogen Management – Ammonium vs Nitrate Nutrition

- As a rule, highest growth rates obtained by a combination of NH_4 & NO_3 (80% of total nutrients is nitrogen).
- The form of nitrogen has great impact on:
  - Uptake of other elements (Ca, K etc)
  - Cellular pH regulation (Fe)
  - Rhizosphere pH
    - NH_4 pH down
    - NO_3 pH up
- 8 – 15% NH_4

Growth Response to Zn Drench & Practical Explanation using Petiole Analysis

Reasons for Trial

- Not enough Zn reserves
  - Zn – Major role in bud development and flowering
- Blind Bud
  - Buds stay dormant in the top of the tree until later in season
- Zn status in W Cape soils
  - Zn deficiencies are common on high or low pH, sandy soils

Observations of Trial

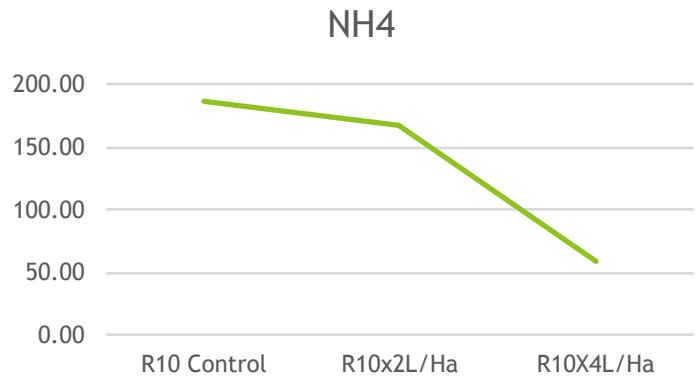
- Treatment blocks initiated earlier than control
  - Greater bud break and extra growth
  - Zn level restored in tree as soils warm up.
  - Yield and fruit quality improved significantly in both blocks

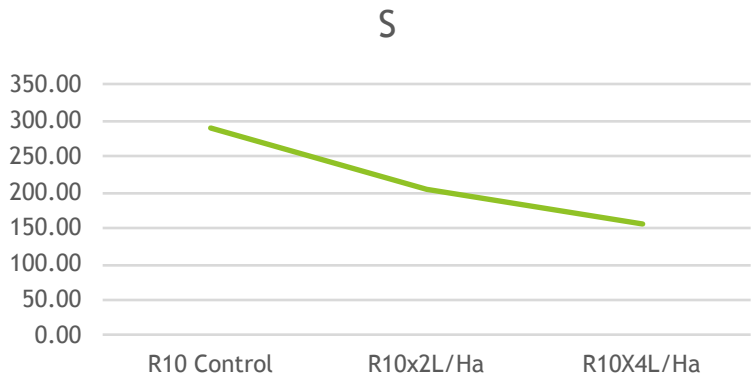
Results - Stone Fruit

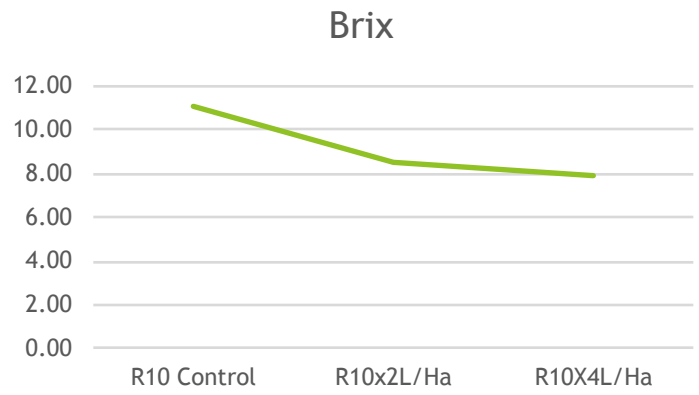
Results - Pome Fruit

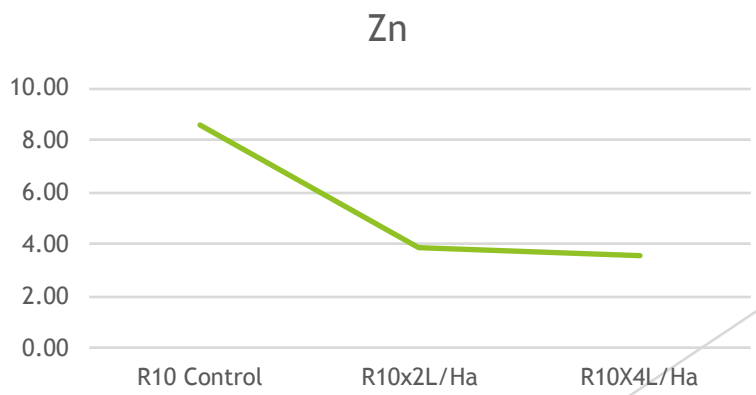
Stone Fruit Petiole Analysis Results sampled 08/08/2015

Ref No	Gewas	mg/l																mg/l
	Crop	NH4	NO3	P	K	Ca	Mg	Zn	B	S	Cu	Fe	Mn	Na	Mo	Al	Brix	Cl
R10 Control	Nectarine	185.76	37.21	561.21	3904.23	332.94	270.05	8.56	3.94	288.44	1.03	3.36	2.62	84.88	0.05	5.35	11.00	473.97
R10x2L/Ha	Nectarine	166.41	4.43	609.60	3755.28	264.30	200.37	3.92	3.12	205.39	0.69	1.36	1.92	43.72	0.05	1.60	8.50	270.48
R10X4L/Ha	Nectarine	59.21	3.99	603.70	3330.82	201.95	171.10	3.60	3.67	155.98	0.70	1.10	2.08	36.69	0.06	1.18	7.90	193.56



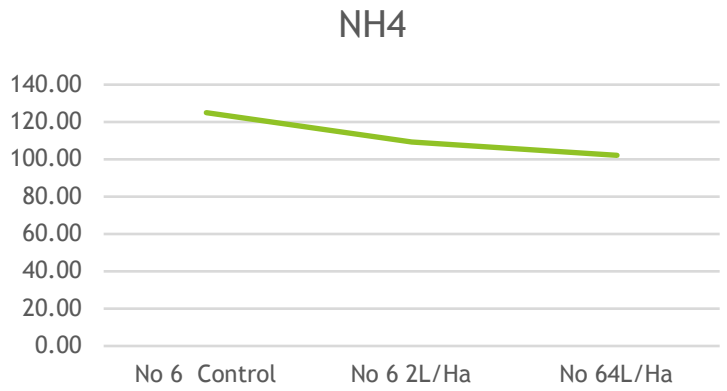


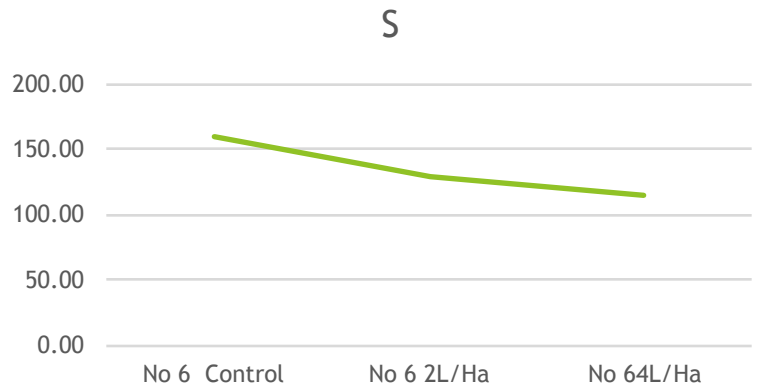


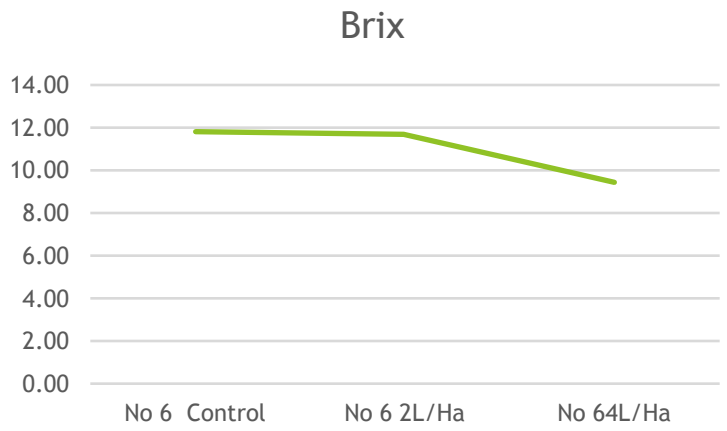


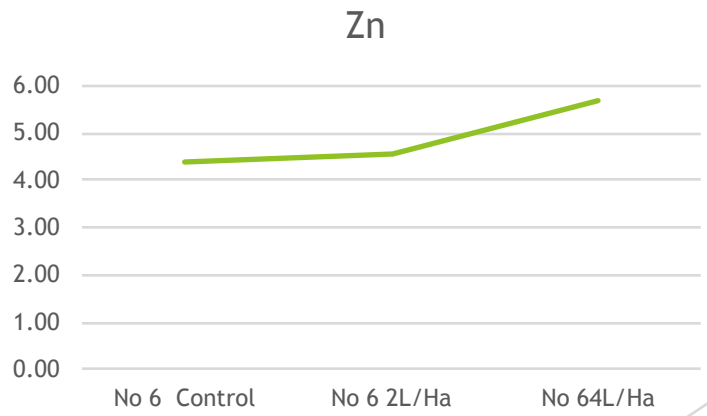
Pome Fruit Petiole Analysis Results sampled 28/08/2015

Ref No	Gewas	mg/l														
	Crop	NH4	NO3	P	K	Ca	Mg	Zn	B	S	Cu	Fe	Mn	Na	Mo	Brix
No 6 Control	abate fetel	124.16	1.33	876.82	4243.00	369.54	594.00	4.36	5.35	159.08	1.78	1.80	15.29	25.69	0.03	11.80
No 6 2L/Ha	abate fetel	109.65	1.33	770.91	3932.54	367.95	551.83	4.58	4.82	129.87	1.65	1.85	15.44	21.78	0.01	11.70
No 64L/Ha	abate fetel	102.56	9.75	599.56	3576.84	350.60	473.88	5.69	4.58	115.96	1.90	2.24	19.18	29.43	0.03	9.50



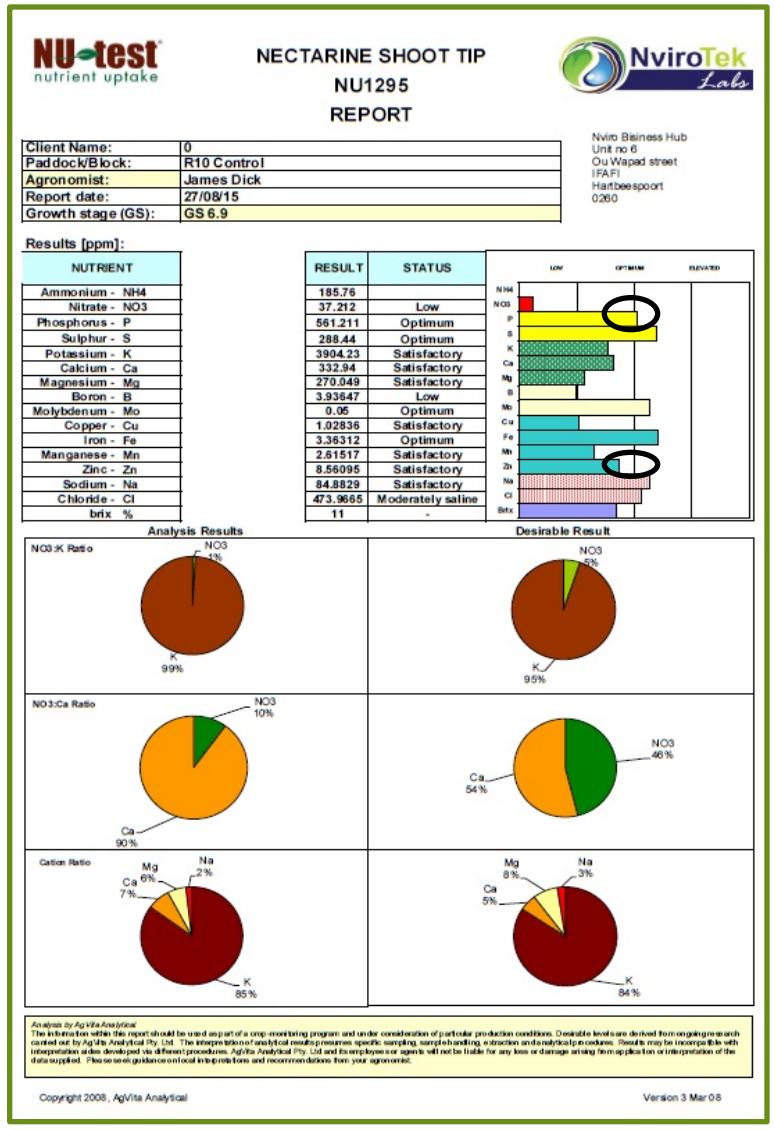






A decrease in Zn content in the shoots and an induction of Zn deficiency symptoms by high P supply is often the result of enhanced shoot growth and , thus, ‘dilution’ of zinc in the plants. (Mineral Nutrition of Higher plants – Horst Marschner)

- Zinc deficiency enhances uptake of P by the roots and translocation to the shoots. Specific to Zn and not other micro-nutrients



NU-test nutrient uptake

NECTARINE SHOOT TIP
NU1295
REPORT

NviroTek Labs

Nviro Bisiness Hub
Unit no 6
Ou Wapad street
IFAFI
Hartbeespoort
0260

Client Name:	0
Paddock/Block:	R10 Control
Agronomist:	James Dick
Report date:	27/08/15
Growth stage (GS):	GS 6.9

Results [ppm]:

NUTRIENT	RESULT	STATUS
Ammonium - NH4	185.76	
Nitrate - NO3	37.212	Low
Phosphorus - P	561.211	Optimum
Sulphur - S	288.44	Optimum
Potassium - K	3904.23	Satisfactory
Calcium - Ca	332.94	Satisfactory
Magnesium - Mg	270.049	Satisfactory
Boron - B	3.93647	Low
Molybdenum - Mo	0.05	Optimum
Copper - Cu	1.02836	Satisfactory
Iron - Fe	3.36312	Optimum
Manganese - Mn	2.61517	Satisfactory
Zinc - Zn	8.56095	Satisfactory
Sodium - Na	84.8829	Satisfactory
Chloride - Cl	473.9665	Moderately saline
brix %	11	-

Analysis Results

Desirable Result

NO3:K Ratio

NO3:Ca Ratio

Cation Ratio

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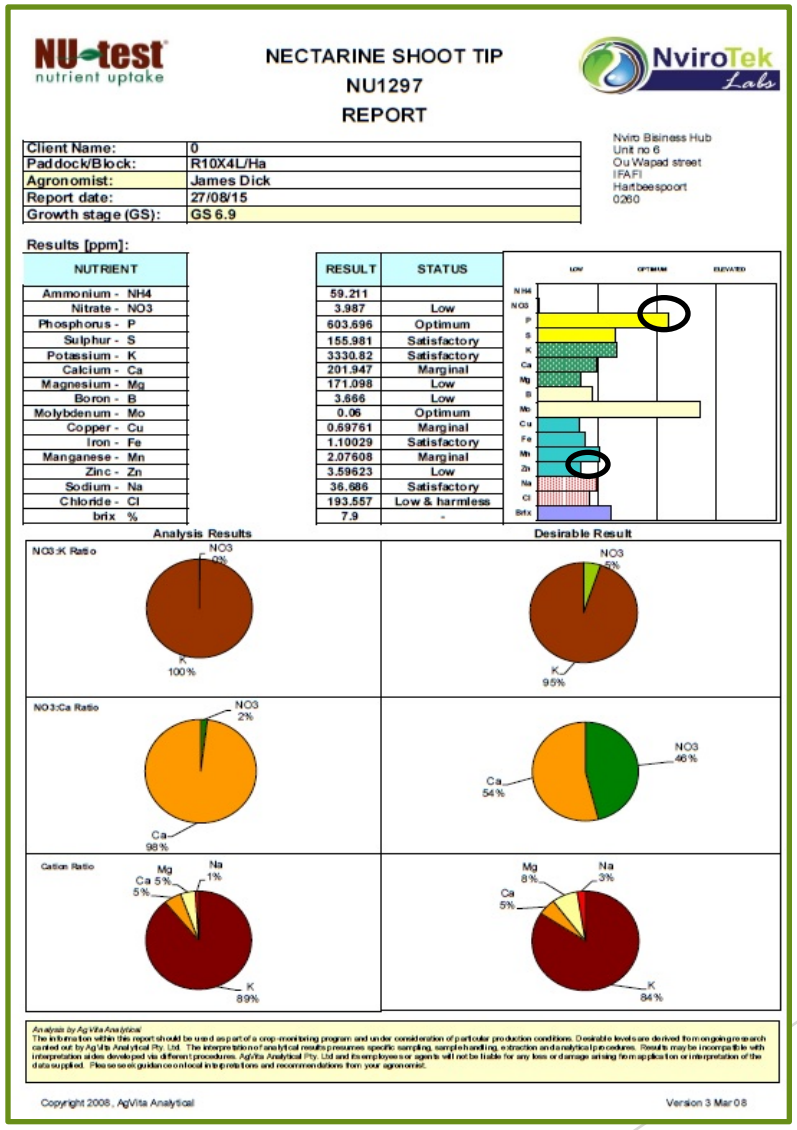

NU-test nutrient uptake

NECTARINE SHOOT TIP
NU1297
REPORT

NviroTek Labs

Nviro Bisiness Hub
Unit no 6
Ou Wapad street
IFAFI
Hartbeespoort
0260

Client Name:	0
Paddock/Block:	R10X4L/Ha
Agronomist:	James Dick
Report date:	27/08/15
Growth stage (GS):	GS 6.9

Results [ppm]:

NUTRIENT	RESULT	STATUS
Ammonium - NH4	59.211	
Nitrate - NO3	3.987	Low
Phosphorus - P	603.696	Optimum
Sulphur - S	155.981	Satisfactory
Potassium - K	3330.82	Satisfactory
Calcium - Ca	201.947	Marginal
Magnesium - Mg	171.098	Low
Boron - B	3.666	Low
Molybdenum - Mo	0.06	Optimum
Copper - Cu	0.69761	Marginal
Iron - Fe	1.10029	Satisfactory
Manganese - Mn	2.07608	Marginal
Zinc - Zn	3.59623	Low
Sodium - Na	36.686	Satisfactory
Chloride - Cl	193.557	Low & harmless
brix %	7.9	-

Analysis Results

Desirable Result

NO3:K Ratio

NO3:Ca Ratio

Cation Ratio

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Conclusion

- Hard Water Acidification
  - Reduced blockages
  - Improved nutrient availability
  - Free $CaNO_3$
- Balanced Nutritional Program
  - Enhanced nutrient availability
- EC and Irrigation Management
  - Manage aeration of growing medium
- Nitrogen Management
  - Combination NH_4 & NO_3 = highest growth Rates
- Petiole Analysis -
  1. Current nutrient status
  2. Results reflect growing conditions
  3. Reflects nutrient synergisms & antagonisms e.g. Zn & P, SO_4 & Mo etc

THANKS

Presented by James Dick, CropWalker 0729571846