CWise – Soil Carbon Solutions

www.cwise.com.au

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- Soil Sampling handout
- Tissue testing handout
- Soil and tissue testing critical values
- Olive grove nutrition
- Soil fertility management.

AUSTRALIAN OLIVE ASSOCIATION

Soil testing Critical Values: What do the numbers mean

- Soil testing company generally gives a guideline of critical values – most likely with values targeted around pastures/inter row nutrition.

- Some soil tests don’t have guidelines or are calibrated to different crop type - work with Fertcare accredited advisor to interpret.

- Best tool baseline monitoring on your own farm. (mine/build/replace)

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APAL
Australian Precision Ag Laboratory

SOIL ANALYSIS

Agent: APAL Agricultural Laboratory
Agent Address: U3, 11 Ridley Street, Hindmarsh, SA, 5007
Client: Demo Company
Test Set or Quotation: SP1
Barcode: 110426985
Batch Number: 11717
Submission ID: 35635

Report Date: 28/08/2019
Sampling Date: NA
Date Received: 20/08/2019
Sample Name: South
Crop: Dryland Pasture
Sample Depth: NA
GPS Start: NA
GPS End: NA

		Unit	Desired Level	Level Found	c.mol/kg
	MIR - Aus Soil Texture			Silty loam	
	ECEC	cmol/kg	5.00-25.0	7.98	
	Organic Carbon (W&B)	%	0.900-1.80	5.33	
	pH 1:5 water	pH units	6.50-7.50	5.40	
	pH CaCl2 (following 4A1)	pH units	5.50-6.50	4.52	
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg	20-50	9.2	
Extractable N-P-K-S	Ammonium - N (2M KCl)	mg/kg	2.0-10	9.2	
Extractable N-P-K-S	Olsen Phosphorus	mg/kg	15-25	6.4	
Extractable N-P-K-S	Colwell Phosphorus	mg/kg	29-34	12	
Extractable N-P-K-S	PBI + Col P		35.0-70.0	85.0	
Extractable N-P-K-S	Colwell Potassium	mg/kg	150-220	320	
Extractable N-P-K-S	KCl Sulfur (S)	mg/kg	8.0-20	14	
Exchangeable cations	Calcium (Ca) - AmmAc	mg/kg	1000-2000	997	4.97
Exchangeable cations	Magnesium (Mg) - AmmAc	mg/kg	150-200	201	1.65
Exchangeable cations	Potassium (K) - AmmAc	mg/kg	150-220	289	0.738
Exchangeable cations	Sodium (Na) - AmmAc	mg/kg	15.0-120	72.1	0.314
Exchangeable cations	Exchangeable aluminium	cmol/kg	0.10-0.35	0.16	
Exchangeable cations	Exchangeable hydrogen	cmol/kg	0.10-0.35	0.14	

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64094
Custom Composts

	Lab No	XJS20022	XJS20023	XJS20024	XJS20025
	Name	Humicarb	Quicken	Control	Synthetic
	Code	26/06/20	26/06/20	26/06/20	26/06/20
	Customer	C-Wise	C-Wise	C-Wise	C-Wise
	Depth	0-10	0-10	0-10	0-10
Colour		DKGR	DKGR	DKGR	DKGR
Gravel	%	0	0	0	0
Texture		1.0	1.0	1.0	1.0
Ammonium Nitrogen	mg/kg	8	7	4	5
Nitrate Nitrogen	mg/kg	11	12	6	7
Phosphorus Colwell	mg/kg	22	33	19	24
Potassium Colwell	mg/kg	140	133	78	112
Sulfur	mg/kg	4.7	3.5	3.8	3.7
Organic Carbon	%	2.36	2.44	2.60	2.49
Conductivity	dS/m	0.058	0.052	0.036	0.046
pH Level (CaCl2)		5.3	5.3	5.1	5.3
pH Level (H2O)		6.5	6.5	6.3	6.6
DTPA Copper	mg/kg	0.77	0.70	0.74	0.64
DTPA Iron	mg/kg	71.80	89.40	68.30	62.70
DTPA Manganese	mg/kg	2.69	2.67	2.61	2.46
DTPA Zinc	mg/kg	3.07	3.08	3.01	3.02
Exc. Aluminium	meq/100g	0.050	0.050	0.070	0.040
Exc. Calcium	meq/100g	4.08	4.26	3.95	4.15
Exc. Magnesium	meq/100g	0.79	0.88	0.80	0.87
Exc. Potassium	meq/100g	0.32	0.24	0.15	0.20

CSBP Lab. Extract Value.

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BOYUP BROOK 6244

Order No:
K Thompson 24-01-1

GRAPHIC REPORT OF SOIL ANALYSIS

Sample Name:	**Old House Dam**	**Lab Number:**	**1079844**	**Core Length (cm):**	10.0
Crop Type:	Oats	**Stock Type:**	Not Allocated	**Soil Type:**	Gravel
GPS Coordinates:		**Yield Potential:**	4.00		

Analysis		Result	Optimum	Low	Optimum	High
pH [H2O]	.	5.8	6.0-7.1			
pH [CaCl]	.	4.9	5.5-6.5			
Phosphorus [Colwell]	ppm	83	20-25			
Potassium [Colwell]	ppm	>500	50-200			
Sulphur	ppm	7				
Exch. Aluminium	ppm	1.5	<5			

Analysis		Result	Norm	Low	Norm	High
P Buffer Index (PBI-Col)	.	79	20-123			
Total Nitrogen	ppm	2,500	1500-2500			
Total Carbon	% w/w	3.52	1.0-2.0			
Organic Matter	% w/w	6.1	1.7-3.4			
CEC	me/100g	6.3	3-10			
DTPA Copper	ppm	0.46	0.2-1.2			
DTPA Iron	ppm	70.7				
DTPA Mn	ppm	28.6	5-10			
DTPA Zinc	ppm	1.22	0.2-2.0			
Electrical conductivity	dS/m	0.12	0.00-0.53			
Ammoniacal Nitrogen	ppm	9.7				
Nitrate- Nitrogen	ppm	17.3				
Exch. Calcium	ppm	791				
Exch. Magnesium	ppm	144				
Exch. Potassium	ppm	316				
Exch. Sodium	ppm	87				
Carbon/ Nitrogen Ratio	.	14	10-16			
Calcium Base Sat.	%	62.0	65-80			
Magnesium Base Sat.	%	18.8	10-20			
Potassium Base Sat.	%	12.9	3-8			
Sodium Base Sat.	%	6.0	0-4			
Aluminium Base Sat.	%	0.3	0.5-2			
Potential Yield Reduction (Electrical Conductivity)	%	Nil				

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ROUTINE AGRICULTURAL SOIL ANALYSIS REPORT

Job No:	XXXX
No of Samples:	3
Date Supplied:	dd, month, yyyy
Supplied by:	Valued Client

					Sample 1	**Sample 2**	**Sample 3**	***Heavy Soil***	***Medium Soil***	***Light Soil***	***Sandy Soil***
				Sample ID:	28°49'02.9"S 153°17'57.1"E	#1 Soil	Good #1				
				Crop:	Environmental	Analysis	Laboratory				
				Client:	--	--	--	*e.g Clay*	*e.g Clay Loam*	*e.g Loam*	*e.g Loamy Sand*
Method		*Nutrient*		*Units*	*XXXX/1*	*XXXX/2*	*XXXX/3*	***Indicative guidelines only- refer Note 6***			
	Morgan 1	Calcium	Ca	mg/kg	718	517	512	*1150*	*750*	*375*	*175*
		Magnesium	Mg		263	198	107	*160*	*105*	*60*	*25*
		Potassium	K		4.6	15	220	*113*	*75*	*60*	*50*
		Phosphorus	P		1.1	1.1	1.8	*15*	*12*	*10*	*5.0*
	Bray1	Phosphorus	P	mg/kg	4.7	11	10	*45 note 8*	*30 note 8*	*24 note 8*	*20 note 8*
	Colwell				20	47	17	*80*	*50*	*45*	*35*
	Bray2				10	23	22	*90 note 8*	*60 note 8*	*48 note 8*	*40 note 8*
	KCl	Nitrate Nitrogen	N	mg/kg	17	3.3	1.6	*15*	*13*	*10*	*10*
		Ammonium Nitrogen			1.5	1.8	4.0	*20*	*18*	*15*	*12*
		Sulfur	S		24	10	1.6	*10.0*	*8.0*	*8.0*	*7.0*
	1:5 Water	pH		units	7.08	6.46	6.95	*6.5*	*6.5*	*6.3*	*6.3*
		Conductivity		dS/m	0.126	0.050	0.038	*0.200*	*0.150*	*0.120*	*0.100*
	Calculation	Estimated Organic Matter		% OM	1.6	1.8	2.1	*>5.5*	*>4.5*	*>3.5*	*>2.5*
		Calcium	Ca	cmol+/Kg	6.51	4.57	4.33	*15.6*	*10.8*	*5.0*	*1.9*
				kg/ha	2924	2051	1944	*6250*	*4300*	*2000*	*750*
				mg/kg	1305	916	868	*3125*	*2150*	*1000*	*375*
		Magnesium	Mg	cmol+/Kg	3.45	2.50	1.37	*2.4*	*1.7*	*1.2*	*0.60*
				kg/ha	938	682	374	*590*	*400*	*290*	*150*

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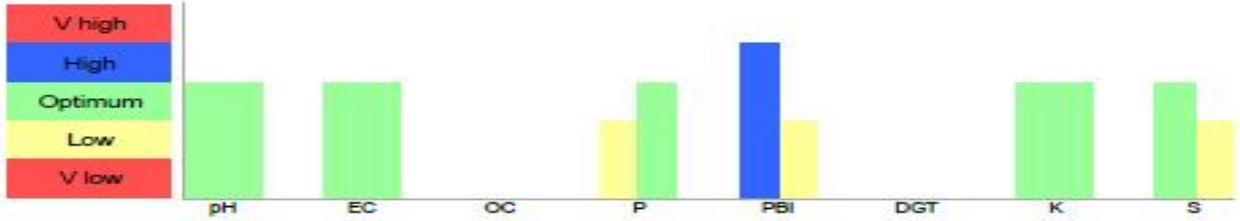
LANDMARK

Soil Sample Report

NutriScription

Grower: Andina
Property: all
Advisor: Chris Wieman
Crop: Oats
Interpretation Date: 11 Mar 2019
Report Year: 2019

Paddock : Site	Depth cm	pH CaCl2 4B1	EC dS/m 3A1	Organic C % 6G1	NO3 N mg/kg (KCl) 7C1c	NH4 N mg/kg (KCl) 7C1a	P mg/kg (Colwell) 9B2	PBI 9G2a	DGT µg/L	K mg/kg (Colwell) 18A1	S mg/kg (KCl40) 10D1
1-Dookanng : A	0-10cm	5.7	0.120	2.84	15	6	35	85		146	15
2-Dookanng : B	0-10cm	5.9	0.060	1.32	3	3	28	32		65	6
Average					9	5	31	58		106	10



Analysis	Unit	BA005297.001 000349269 Soil - Big (349269)	BA005297.002 000349270 Soil - Soak (349270)	BA005297.003 000349271 Soil - Shed (349271)	BA005297.004 000349272 Soil - Front (00349272)
ACIDITY					
pH - Water	pH units	5.50	5.58	5.68	5.27
pH - CaCl2	pH units	4.75	4.88	5.10	4.69
MAJOR ELEMENTS					
Potassium	mg/kg	55	103	77	88
Phosphorus - Colwell extr	mg/kg	21	20	30	37
Ammonium Nitrogen	mg/kg	7.0	4.5	3.5	4.0
Nitrate Nitrogen	mg/kg	7	8	16	13
Nitrogen	mg/kg	909	1290	3360	5950
SECONDARY ELEMENTS					
Calcium	mg/kg	465	520	1030	836
Magnesium	mg/kg	75	69	132	76
Aluminium	mg/kg	14	5	2	30
Potassium - Colwell ext	mg/kg	76	161	109	169
Sulphur - KCl	mg/kg	6.4	5.1	5.6	7.3
Aluminium	mg/kg	14	5	2	30
TRACE ELEMENTS					
Copper	mg/kg	0.2	0.3	0.4	0.4
Zinc	mg/kg	0.4	0.8	0.6	0.8
Manganese	mg/kg	17	23	20	11
Iron	mg/kg	180	200	150	87
ORGANIC MATTER					
Organic Carbon	%	3.4	>4.0	3.5	3.9
SALINITY					
Sodium	mg/kg	86	76	52	29
Electrical Conductivity	dS/m	0.09	0.11	0.09	0.08
EXCHANGEABLE CATIONS					
Cation Exchange	meq/100g	3.62	3.77	6.66	5.51
Exchangeable Sodium	meq/100g	0.37	0.33	0.23	0.13
Exchangeable Sodium Percent	%	10.3	8.8	3.4	2.3
Exchangeable Potassium	meq/100g	0.14	0.26	0.20	0.23
Exchangeable Potassium Percent	%	3.9	7.0	3.0	4.1
Exchangeable Calcium	meq/100g	2.32	2.60	5.13	4.18

Nutrient values – Mine/Build/Replace

Predicted critical Colwell P soil test values for standard PBI categories, derived from the national data set.

PBI category		Critical value for mid point of PBI category (range)[1]
<15	Extremely low	23 (20 – 24)
15-35	Very very low	26 (24 – 27)
36-70	Very low	29 (27 – 31)
71-140	Low	34 (31 – 36)
141-280	Moderate	40 (36 – 44)
281-840	High	55 (44 – 64)
>840	Very high	n/a[2]

[1] Critical Colwell P value (mg/kg) at the mid-point of PBI category. Values in parenthesis are critical Colwell P values at the lowest and highest PBI values within the category.

[2] Insufficient data to derive a response relationship.

https://www.asris.csiro.au/downloads/BFD/Making%20Better%20Fertiliser%20Decisions%20for%20Grazed%20Pastures%20in%20Australia.pdf

Nutrient values – Mine/Build or Replace :

Table 6 - Available Potassium (mg/kg). – Source: Target 10, 2005

Nutrient status	Sands	Sandy Loams	Clay Loams	Clays	Peats*
Low	Below 50	Below 80	Below 110	Below 120	Below 250
Marginal	50 – 140	80 – 150	110 – 160	120 - 180	250 – 300
Adequate	141 – 170	151 -200	161 -250	181 - 300	350 – 600
High	Above 170	Above 200	Above 250	Above 300	Above 600

Potassium	Moderate Stocking Rates (7-12 DSE/ha)	High Stocking Rates (13-20 DSE/ha)
Sands	80-100	100-120
All other Soils	120-150	150-180

https://www.ccmaknowledgebase.vic.gov.au/brown_book/10_Nutrient.htm

Nutrient values – Mine/Build/Replace:

Table 9 - Sulphur (KCL 40) – Source: Target 10, 2005

Nutrient Level	Sulphur Level mg/kg (KCL40 test)	Recommended Capital S application
Low	<4	30kg S/ha
Marginal	4-8	15kg S/ha
Adequate	9-12	7.5kg S/ha
High	13-20	0
Very High	>20	0

Table 10 - Recommended nutrient levels for sulphur at moderate and high stocking rates. – Source: Nie & Saul, 2006

	Moderate Stocking Rates (7-12 DSE/ha)	High Stocking Rates (13-20 DSE/ha)
Sulphur KCl-40	6.5	8.5

pH:

	Soil pH (water)		Soil pH ($CaCl_2$)	
Plant species	Minimum	Maximum	Minimum	Maximum
White clover	5.3	6.5	4.5	6.5
Sub clover	5.3	7.0	4.5	6.5
Perennial ryegrass	5.0	6.5	4.3	6.5
Annual ryegrass	5.0	6.5	4.3	6.5
Phalaris	6.0	8.0	5.0	6.5
Cocksfoot	5.0	7.5	4.2	6.5
Lucerne	6.0	7.5	5.3	7.0

https://mbfp.mla.com.au/pasture-growth/tool-28-soil-nutrient-critical-limits/

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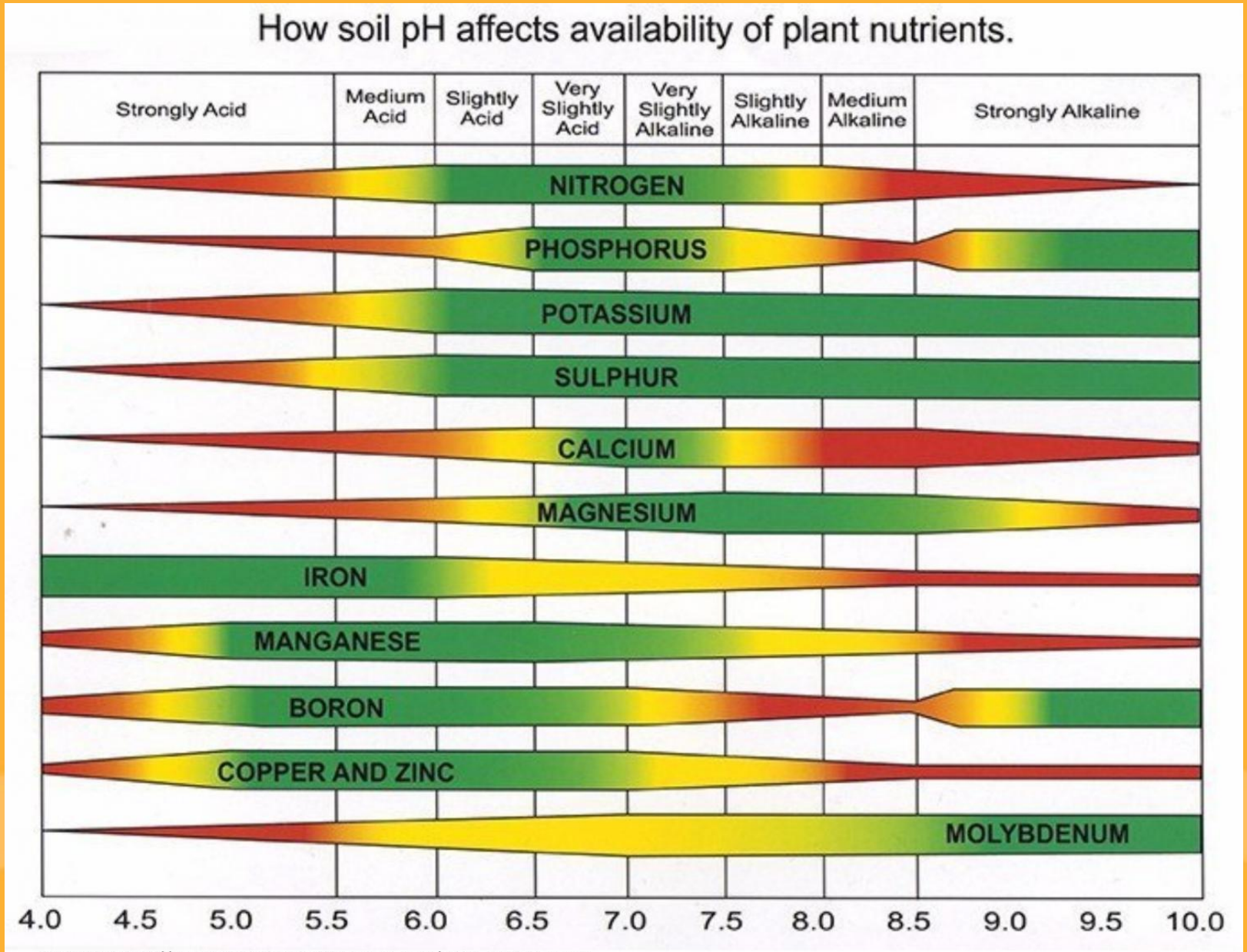


SOURCE: https://www.emporiumhydroponics.com/what-is-ph-1-to-14

MINE BUILD or REPLACE – Nutrient removal values

Product	N	P	K	S	Ca	Mg	Cu	Zn	Mn
	kg per tonne						grams per tonne		
Wheat	23	3	4	1.4	0.33	0.93	5	29	40
Barley	20	2.9	4.4	1.1	0.3	1.08	3	15	11
Oats	16	3	4	1.5	0.5	1.0	3	17	40
Canola	40	6.5	9.2	9.8	4.1	4.0	4	40	40
Lupins	51	3.8	8.8	3.1	1.7	1.7	5	30	60
Chickpeas	34	3.8	8.9	1.8	1.1	1.2	7	38	34
Faba Beans	39	3.8	9.8	1.4	1.1	1.0	10	28	30
Field Peas	37	4.0	8.2	2.0	0.7	1.2	5	35	14
Hay	20	2.0	25	2.0	0.5	1.1	5	20	40
Milk	5.7	0.95	1.4	0.3	1.2	0.12			
Greasy Wool	170	0.26	15.8	28.5	1.2	0.3			
Sheep - Live	34	7.0	2.3	4.0	14.4	0.4			

Olives 3-4 g/kg 0.7 g/kg 4.5 g/kg (250trees ha @ 10kg/ha yield = 40N, 7P, 45K)

Tissue testing – what are the critical values

Element	Deficient	Sufficient	Toxic	Pasture legumes	Oats 4-6 leaf	Kikuyu
Nitrogen %	1.40	1.50-2.00		5.5	6	3.0 - 4.5
Phosphorus %		0.10-0.30		0.5	0.6	0.24 - 0.35
Potassium %	0.40	>0.80		4	6	2.3 - 3.8
Sulphur				0.4	0.45	>0.12
Calcium %		>1.0		2	0.6	0.4 – 0.7
Magnesium %		>0.10		0.5	0.5	0.3 – 0.58
Manganese (ppm)		>20		<50	100	
Zinc (ppm)				30	40	
Copper (ppm)		>4		10	10	
Boron (ppm)	14	19-150	>185	25 - 100	10	10
Sodium %			>0.20	0.7	0.5	
Chlorine %			>0.50			

Source: https://www.agric.wa.gov.au/high-rainfall-pastures/tissue-sampling-and-testing-high-rainfall-pastures-western-australia
:Australian olive growers association
Phosyn critical levels

Olive Grove Nutrition

- Olive trees are native and are not heavy feeders
- Very fertile conditions are counterproductive, causing excessive vegetative growth, and lighter bloom and fruit set.
- Olive trees tend to produce most consistently with nutrition that is minimal but adequate, and not deficient in any critical element.
- Chemical fertilisers can be utilised efficiently in an olive orchard but they must be carefully monitored to avoid excessive applications. http://www.oliveaustralia.com.au/Olifax_Topics/Fertilising/fertilising.html

- Nitrogen is the one nutrient an olive tree may be deficient in. It is needed for formation of flowers, fruit and leaves. During spring growing season
- The optimum N application for each orchard depends on the size of the tree, there production, the soil type, season and adjusted based on leaf tests. (Olive Growing Edition 5)

- It is unlikely that olive trees would be deficient in either phosphorus or potassium. When using organic fertilizers, the olive tree usually gets all the potassium it needs. Unless soils are very poor, olives usually have satisfactory levels of secondary and trace elements like copper, zinc, manganese, magnesium and calcium (https://homeguides.sfgate.com/fertilizer-olive-trees-45627.html)

Olive Grove Nutrition

- Foliar nutrient uptake is impacted directly by environmental conditions and very particularly by moisture and temperature. Uptake takes place when the leaf is kept moist and it ceases when the leaf dries out.

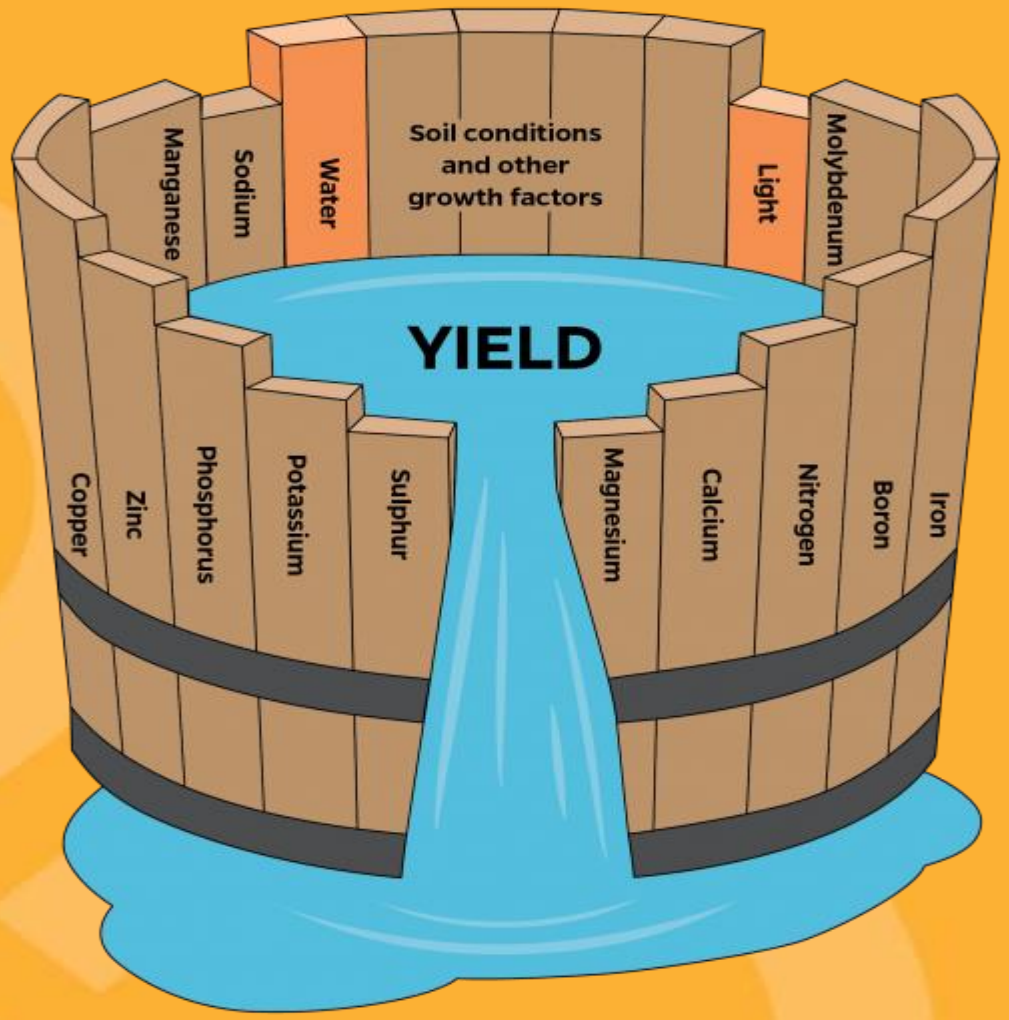
- Nutrient application improves when carried out at night when relative humidity is higher

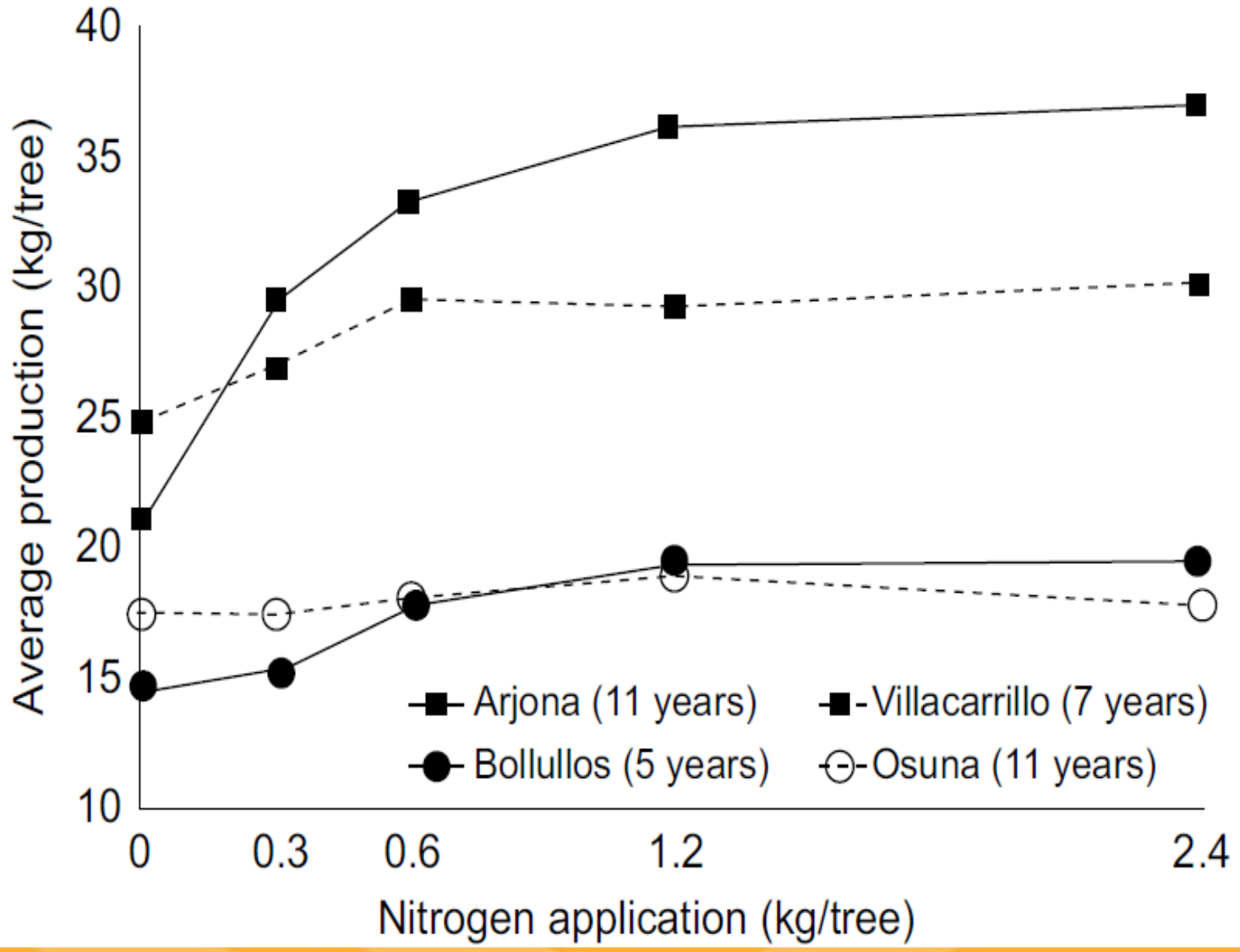
- Older leaves are less efficient than younger ones at absorbing nutrients. Reasons for lower uptake include an increase in cuticle thickness and reduction of metabolic activity. As a result, foliar applications need to be performed when young leaves are available.

- In potassium deficient olive groves it is advised to apply 1–3 kg of potassium per tree to correct the deficiency. In dryland groves, foliar application of potassium nitrate at 1–3%, or of soluble potassium sulphate in concentrations of up to 4%,have been effective but have needed to be repeated 2 to 4 times depending on the deficiency level. (Olive Growing Edition 5)

Soil and tissue testing and soil fertility management.

- Consistent sampling methods, laboratory, timing, equipment.
- Select sites based on needs (diagnostic, monitoring, growth stage)
- Soil and tissue test results can be conflicting – truth test/ground test results.
- Review the data year on year to monitor trends. (mine/build/replace)
- Where is your farm tracking over a period of ten years
- Basic soil tests vs comprehensive soil tests
- Production is bigger than one nutrient it is the combination of nutrients and biology.
- Soil tests can miss the interaction of Carbon, Water, Fertility and Biology
- Role of organic matter/soil organic carbon and carbon in production.





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Excessive nitrogen fertilisation is the norm in most olive groves, but it has negative impacts on the trees which may become more sensitive to frosts and more susceptible to pests and diseases. Furthermore, it was recently proven that excessive nitrogen fertilisation seems to increase nitrogen content in the fruit, causing a significant drop

years of experimenting did not elicit any response to nitrogen application in groves whose N leaf concentration was above the deficiency level (Table 9.3). All the experimental evidence points to the fact that annual maintenance nitrogen application makes no sense in olive groves and that N fertilisation should only be applied when foliar concentrations indicate there is a deficiency. This is why leaf analysis is such a useful tool in planning annual fertilisation programmes for olive groves.

Garcio Nevelo 2002 - …after 7 years