

INTELLIGENCE



Emerging Technologies

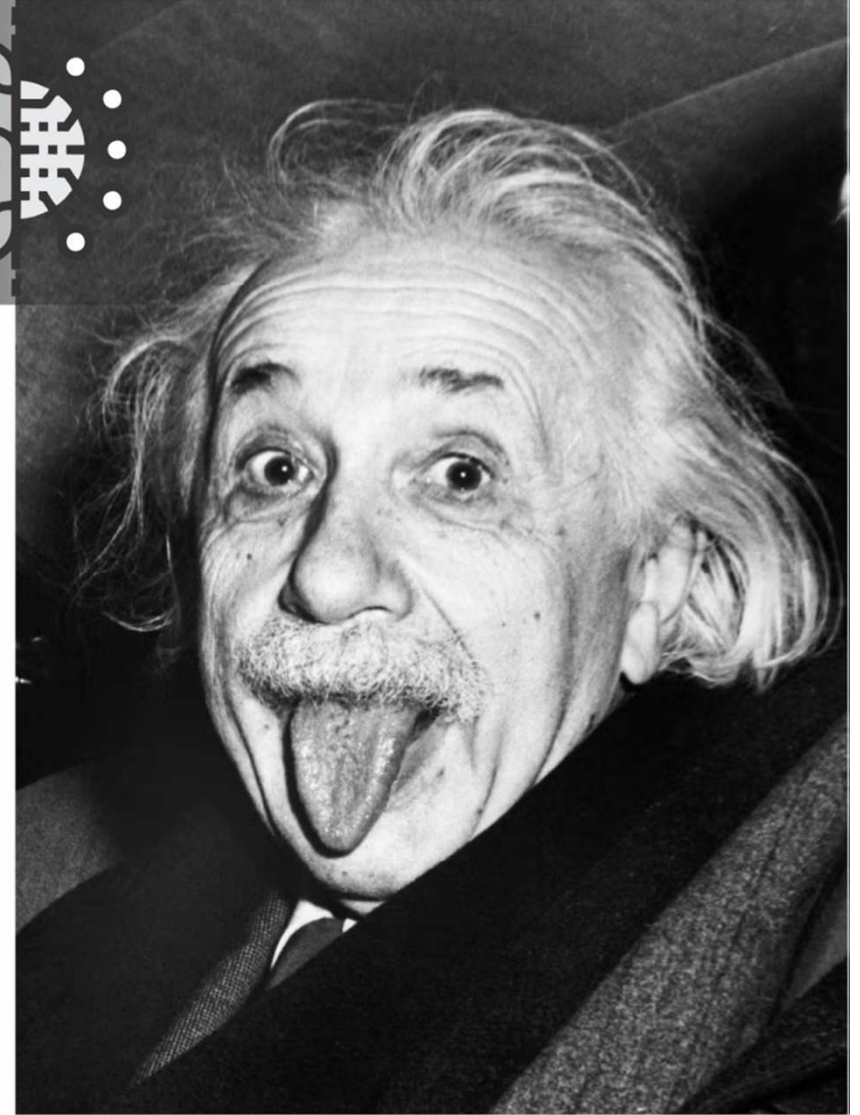


Data Trends



**Applied Research
in Agriculture**

FROM LABORATORY DATA TO FARM DECISIONS
Labserve's Latest Research • By Larne Auerswald



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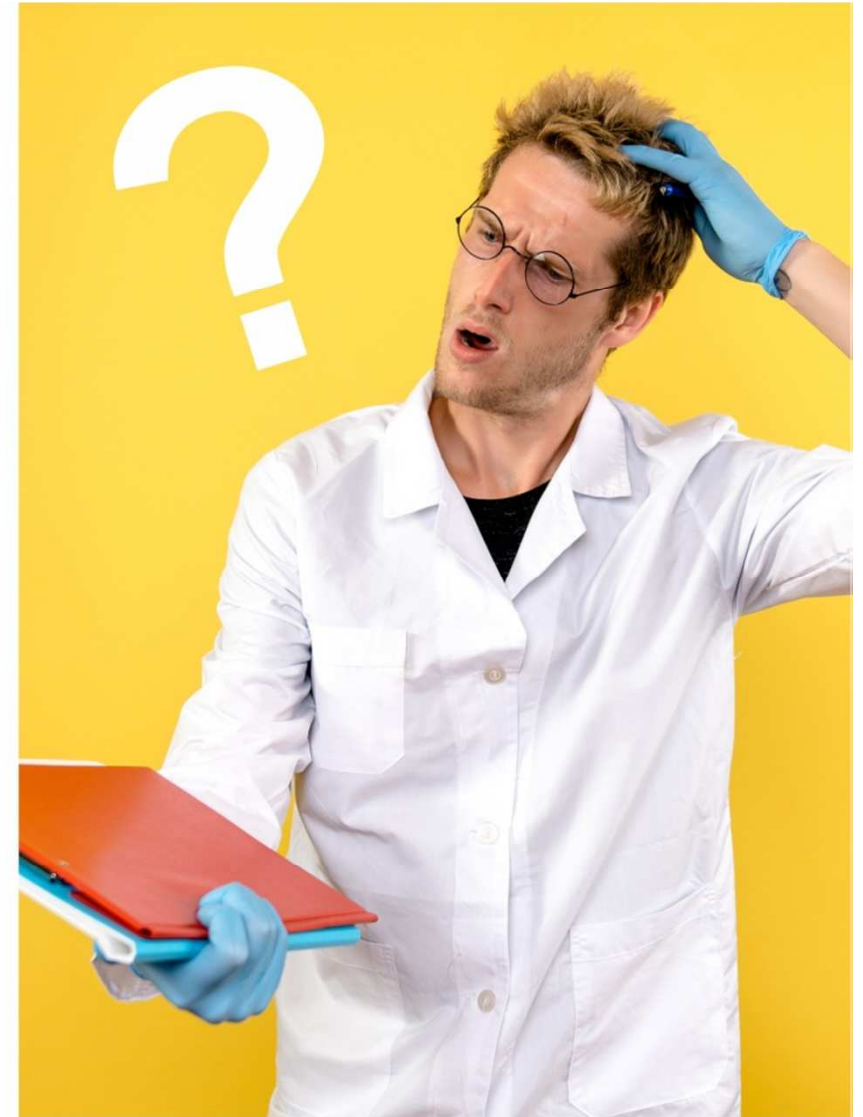
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What has changed since last year?



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Industry shifts

- Where do we start?
 - Agrochemical/Fertiliser/Diesel price increases and shortages - informed decisions
 - Changes to EU Reg 2026/765 MRL Compliance verification - need 3 degrees to decipher this!
 - Actives banned - how do we keep up to date?



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Climate pressures

- Past two wet years
 - What happened to your topsoil?
 - Tree damage, nutritional changes
 - Fruit damage
 - Secondary infection control
 - Pesticide application schedules?



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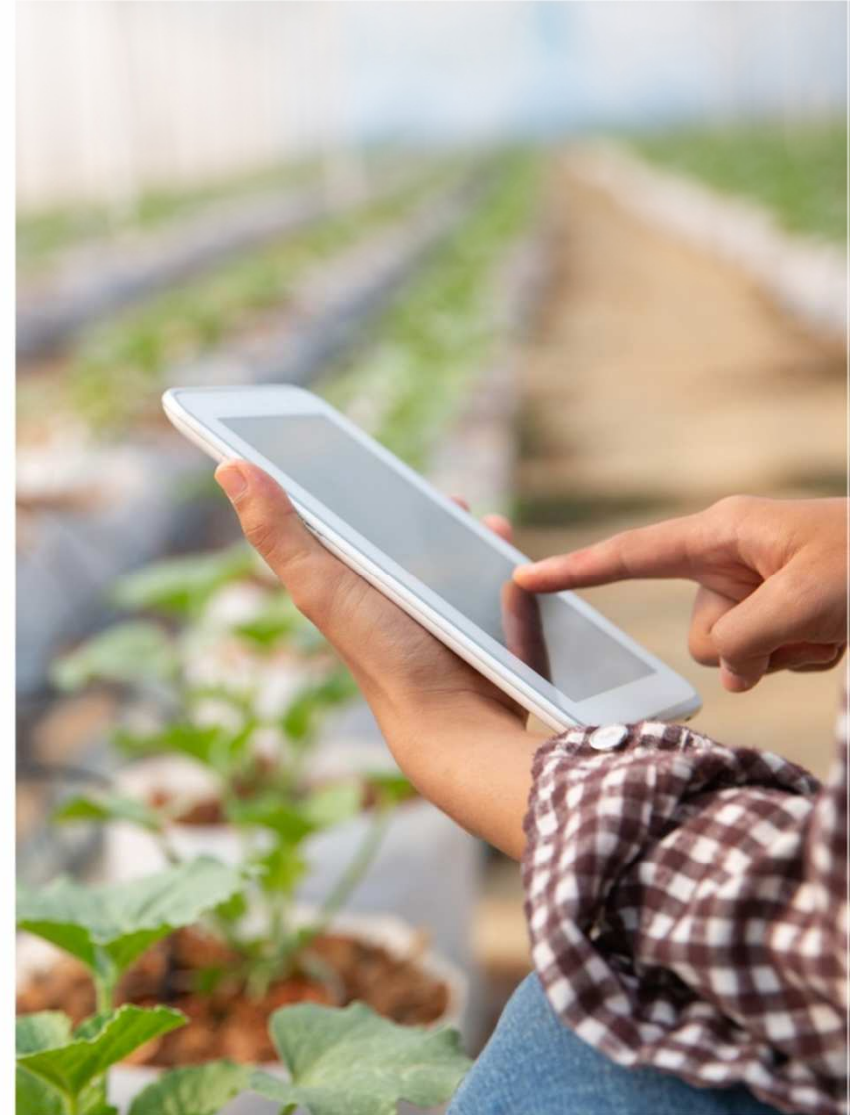
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“Intelligent” agriculture adoption

- “You can’t improve what you don’t measure”
- Massive datasets - interpretation?
- Toolbox? Which tool?
- What’s important?
- Is it just a sales pitch?



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“Hey Labserve, What’s new?”



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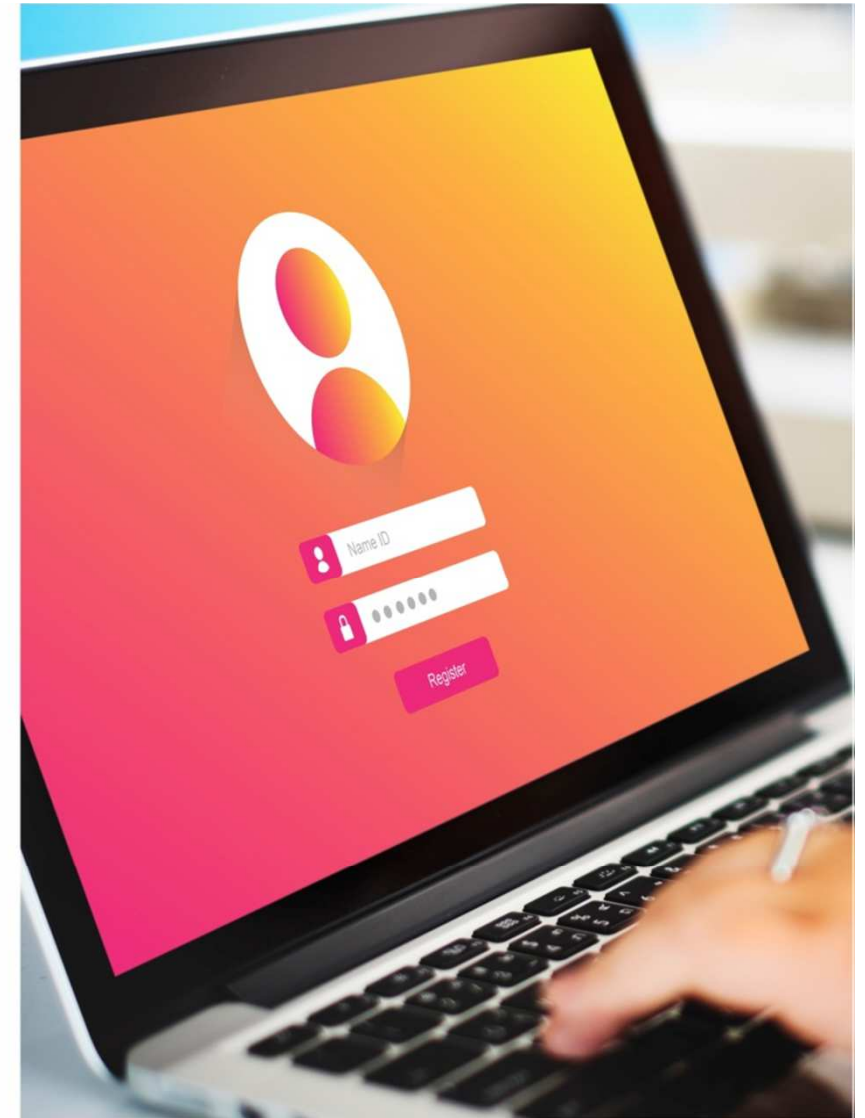
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Interactive client portal evolution

- Sample tracking
- Worked with Woolworths and others to fine tune MRL dashboards
- MRL summaries with applicable MRLs
- Soil, Leaf & water nutritional comparisons
- Water comparisons to norms
- Historical data and downloads in secure and usable formats
- Let's hope the demo works!
- <https://labserve.net/client-portal/login>



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Near-Infrared Spectroscopy

- Concurrent validation with Eurofins models
- Over 6000 unique ZA soils already tested for >30 parameters
- Testing correlation to many 100 000's samples in EF DB
- Soil health and nutrients
- Soil life – PLFA
- Soil carbon
- Quick, affordable, accurate!
- Sounds too good, would be without Eurofins 24 years and 1000's hours XP



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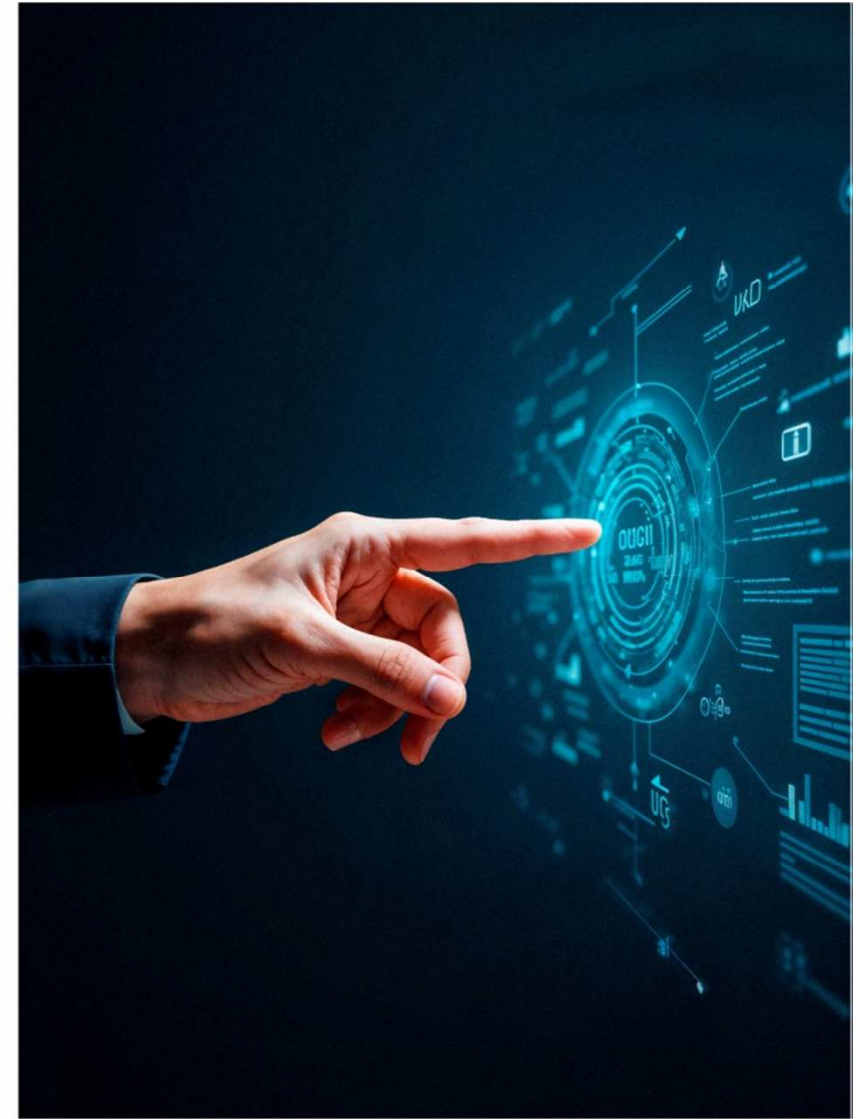
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So, what did we learn?



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What Thousands of Samples Reveal

- **MRLs**
 - Hey Larne; Go back to Client Portal MRL ...
- **Soils**
- **Water**
- **Leaves**



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Naughty Spinach



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MRLs

- **Citrus: exceedances**



Analyte	2023	2024	2025	Limit
Imazalil	1 x EU & SA		4 x EU & 5 x SA	4.000 ppm
Clothianidin			6 x EU & SA	0.010 ppm
Methoxyfenozide			4 x SA	0.500 ppm
Prothiofos			7 x EU	0.010 ppm
Thiabendazole			1 x SA & EU	7.000 ppm
Trifloxystrobin			4 x SA	0.100 ppm
Prochloraz	1 x EU			0.030 ppm

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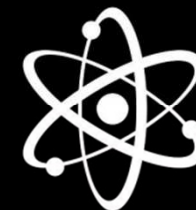
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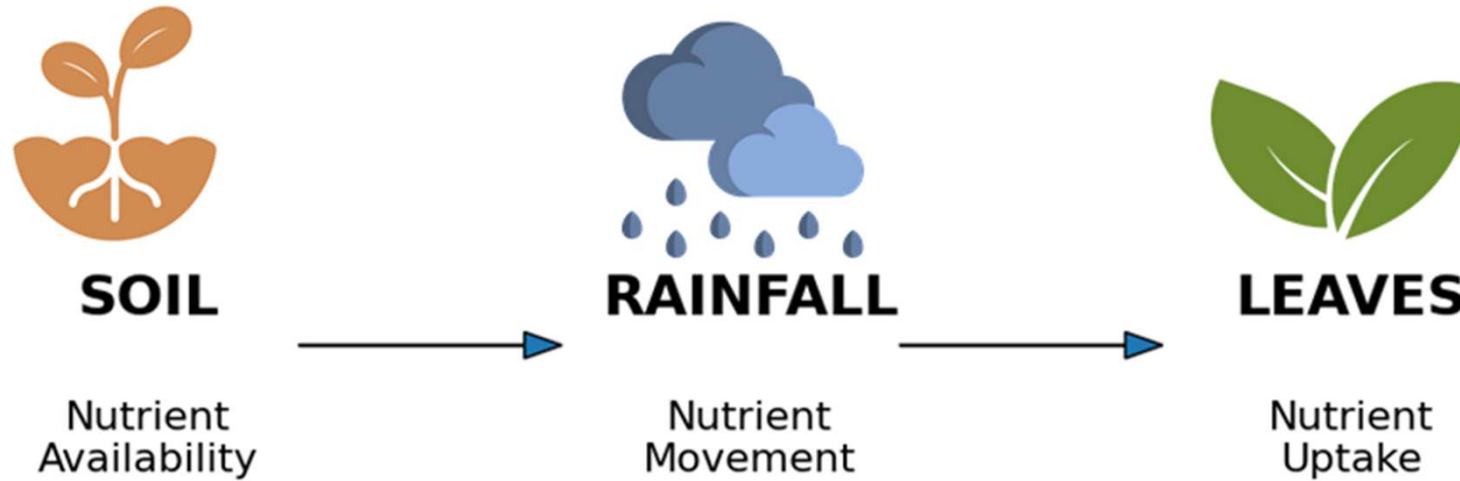
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Soils influence potential. Leaves reveal what happened.



*Our soil data explains what could happen.
Our leaf data shows what actually happened.*

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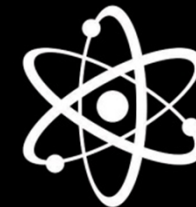
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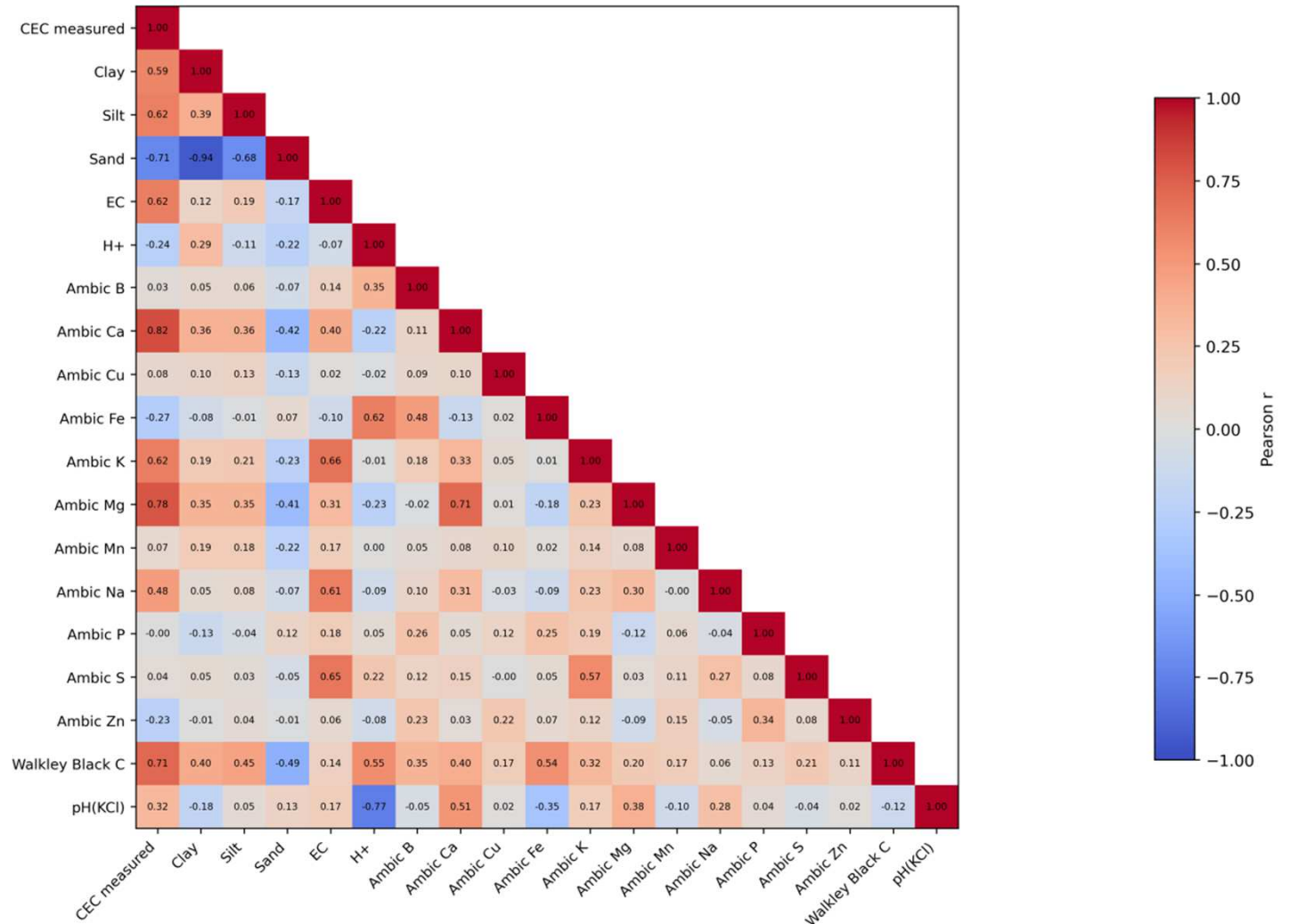
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Soils

- Over 17 000 samples
- Pearson correlation coefficient:
 - +1 = strong positive relationship
 - 0 = no relationship
 - -1 = strong negative relationship

$$\rho_{X,Y} = \frac{\text{cov}(X, Y)}{\sigma_X \sigma_Y}$$

Soil Parameter Correlation Matrix



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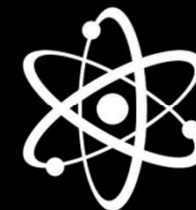
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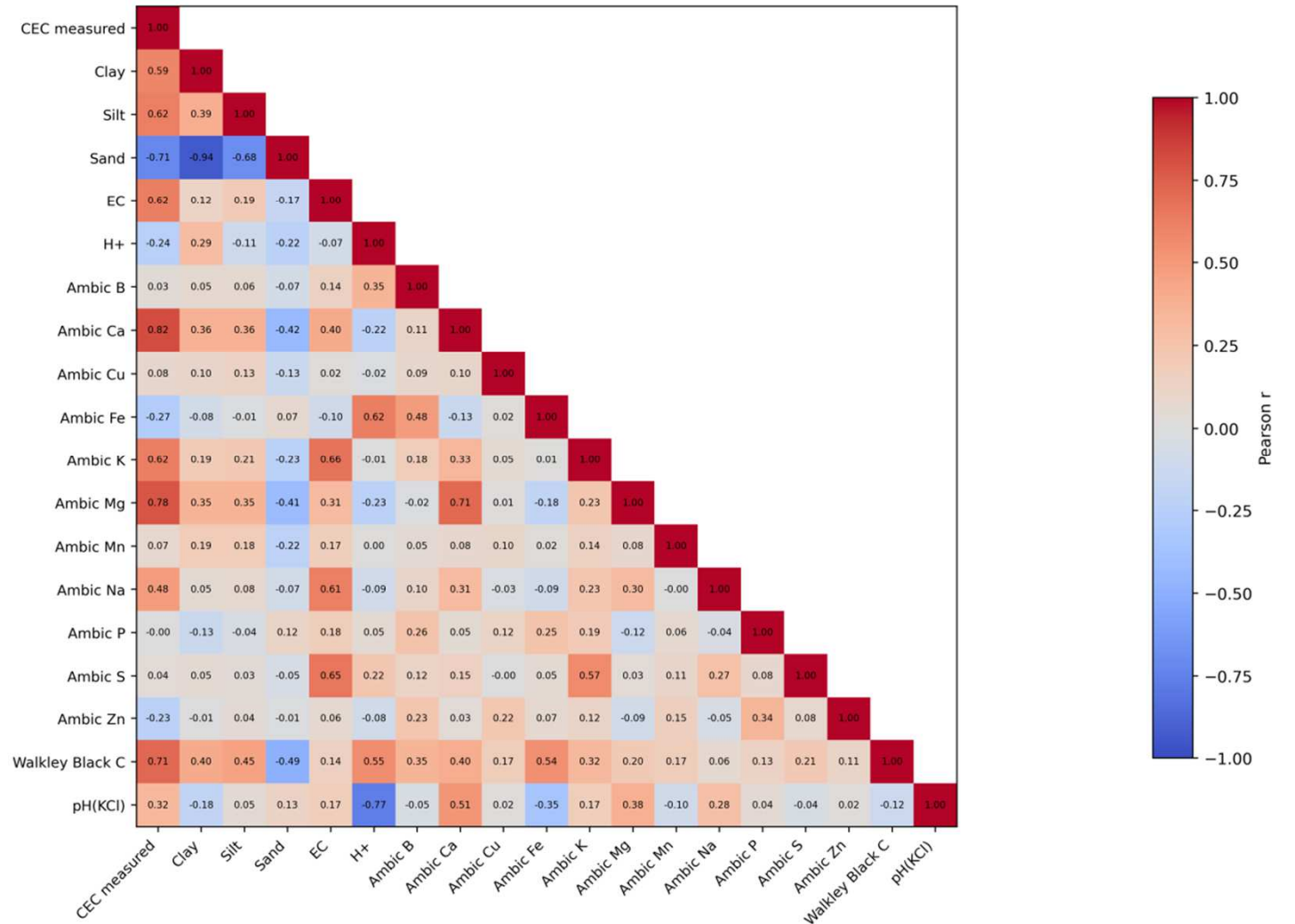
Soils

Key Observation:

Walkley Black C ($r = 0.71$) showed a stronger relationship with CEC than Clay % ($r = 0.59$).

While clay remains an important determinant of nutrient holding capacity, the stronger relationship between Walkley Black carbon and CEC suggests that soil organic matter may play an equally important role in nutrient retention. This supports current industry efforts to improve soil health and carbon levels.

Soil Parameter Correlation Matrix



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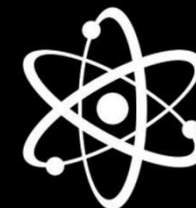
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Soils

- What surprised us in 17 000+ soil samples?

Expected	Observed
Clay strongly linked to CEC	Confirmed
Carbon strongly linked to CEC	Stronger than expected
Some nutrients follow theory closely	P behaved independently of CEC



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Soils

	Extractable N ^a mg/kg	NH4-N ^b mg/kg	NO3-N ^b mg/kg	EC ^c mS/cm	Ambic Na mg/kg	pH(KCl) pH units	H ⁺ ^d cmol/kg	Ambic Mn mg/kg	Ambic S mg/kg	Ambic B mg/kg
2023	18	12.5	3.7	0.329	55	5.35	0.748	26	44	0.30
2024	22	13.2	4.7	0.454	50	5.34	0.731	25	56	0.46
2025	25	12.6	19.9	0.377	56	5.35	0.736	21	54	0.48

•2023 (4676) + 2025 (6985) + 2026 (5176):

Excluding the Cape, nurseries and possible chemical trials

^a Samples tested: 2023 (253) + 2024 (194) + 2026 (255)

^b Samples tested: 2023 (119) + 2024 (62) + 2026 (182)

^c Samples tested: 2023 (1431) + 2024 (1800) + 2026 (1382)

^d Samples tested: 2023 (1214) + 2024 (1873) + 2026 (1270)

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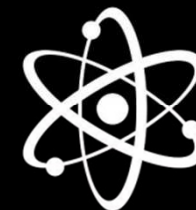
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Soils

Key Findings:

- NO₃-N increased substantially (3.7 → 19.9 mg/kg)
- B increased consistently (0.30 → 0.48 mg/kg)
- pH & H⁺ remained stable
- Soil Mn declined while Leaf Mn increased

What the data suggests:

- Wet years may increase N availability
- Soil chemistry remained remarkably stable
- Nutrient availability can change without major changes in soil chemistry

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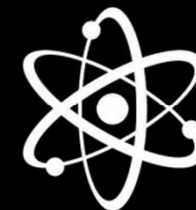
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Soils

Does our data support current industry trends?

Current focus	Supported by data?
Soil health	✓
Carbon building	✓
Precision fertilisation	✓
Texture-specific management	✓



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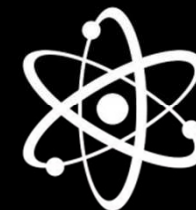
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Water - Borehole - remote wildlife area

Your Reference		Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024	Oct 2024	Nov 2024	Dec 2024	Jan 2025	Feb 2025	Mar 2025	Apr 2025	May 2025	Jun 2025	Jul 2025	Aug 2025	Sep 2025	Oct 2025	Nov 2025	Dec 2025
Parameter:	Unit:	Results:																							
Dissolved Sodium	mg/l	304	247	325	339	298	331	99	91	89	181	237	80	241	297	275	274	350	5.6	218	4.3	5.2	297	197	156
Conductivity	mS/m	224	183	252	253	239	233	86	88	88	154	208	76	199	245	242	253	291	5	191	5	5	215	150	132
Total Alkalinity	mg/l	430	420	586	520	493	488	264	282	225	371	422	191	464	525	474	482	482	<15	381	<15	38	478	398	389
Chloride	mg/l	499	396	593	513	382	426	148	164	124	302	468	115	466	423	435	473	600	<20	374	<20	<20	409	336	209
Total Coliform	MPN/100 ml	<1	2420	9	<1	165	<1	<1	<1	<1	<1	3	32	19	>201	201	>201	118	<1	18	1	<1	27	>201	613
E. coli	MPN/100 ml	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	10	<1	2	1	<1	<1	<1	<1	<1	1	<1

Substantial reductions during June, August and September 2025. As these may reflect treatment or operational adjustments rather than environmental conditions, they were excluded from the rainfall-related trend assessment.



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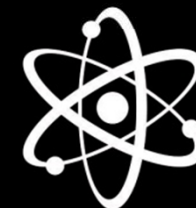
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Water - Borehole - remote wildlife area

- **Groundwater chemistry was more stable than expected**


Considering the significant rainfall differences between years, one might expect stronger shifts in Na, EC & Cl, yet the chemistry remained relatively consistent. This suggests that the aquifer may buffer climatic variability better than soils and plants and that groundwater chemistry appears relatively buffered against short-term climatic variation

- **Microbiology responded more than chemistry**

Microbial indicators changed substantially compared to the chemistry. This suggests that rainfall can influence microbial transport faster than it alters groundwater chemistry.

- **Total Coliforms and E.coli tell different stories**

The increase in Total Coliforms was not matched by a similar increase in E.coli. Not all microbial indicators respond equally to rainfall and environmental change.

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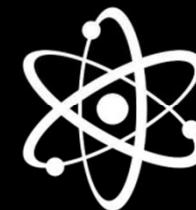
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Water – River water

Number of Months Above Irrigation Risk Threshold (>4000 MPN/100ml)

Year	Exceeded Threshold
2015	0
2019	0
2024	0
2025	7

Most irrigation-risk exceedances occurred during or immediately adjacent to the wet season, suggesting that rainfall and runoff may play an important role in microbial water quality.

Month	Location	E. coli (MPN/100ml)			
		2015	2019	2024	2025
January	Above WWTW	82	387	1414	7070
January	Below WWTW	1553	2420	1011	4605
February	Above WWTW	137	579	866	190
February	Below WWTW	2420	1203	1414	9930
March	Above WWTW	88	2420	299	735
March	Below WWTW	488	56	1986	1240
April	Above WWTW	119	201	230	1125
April	Below WWTW	152	2420	495	2440
May	Above WWTW	3	101	775	430
May	Below WWTW	61	22	290	2175
June	Above WWTW	85	28	120	65
June	Below WWTW	15	124	145	12100
July	Above WWTW	19	172	200	830
July	Below WWTW	866	27	140	7765
August	Above WWTW	84	42	60	42
August	Below WWTW	214	5	1540	2420
September	Above WWTW	158	73	30	50
September	Below WWTW	2420	116	65	12100
October	Above WWTW	91	291	75	160
October	Below WWTW	2420	308	455	7765
November	Above WWTW	96	172	117	365
November	Below WWTW	56	49	2420	1825
December	Above WWTW	921	113	1090	1350
December	Below WWTW	186	260	2420	6015

High risk when irrigating crops that are eaten raw: ≥ 4000 (MPN/100ml)

*From NMMP (National Microbiological Monitoring Programme)

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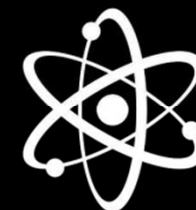
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Leaves

- Citrus
- Macadamia
- Avocado



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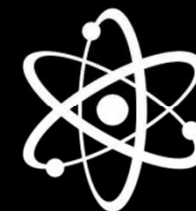
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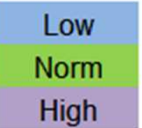
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Citrus



	N %	P %	K %	Ca %	Mg %	S %	Na mg/kg	Zn mg/kg	Cu mg/kg	Mn mg/kg	Fe mg/kg	B mg/kg	Mo* mg/kg	Cl** %
2024	2.08	0.11	1.02	3.28	0.36	0.27	900	26	16.3	72	122	73	0.10	0.058
2025	2.57	0.13	1.32	3.09	0.33	0.27	400	30	11.7	108	149	80	0.24	0.134
2026	2.53	0.13	1.14	3.66	0.39	0.33	235	36	21.2	165	156	79	0.53	0.043

•2024 (550) + 2025 (406) + 2026 (734):

- February to April
- Excluding the Cape, nurseries and possible chemical trials
- *Samples tested: 2024 (298) + 2025 (243) + 2026 (313)
- **Samples tested: 2024 (57) + 2025 (21) + 2026 (73)



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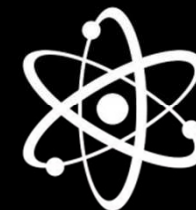
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Macadamia

Low
Norm
High

	N %	P %	K %	Ca %	Mg %	S %	Na mg/kg	Zn mg/kg	Cu mg/kg	Mn mg/kg	Fe mg/kg	B mg/kg	Mo* mg/kg	Si** mg/kg	Cl*** %
Early '24	1.47	0.09	0.57	0.73	0.10	0.17	371	15	12.0	763	75	47	0.15	2373	0.013
Late '24	1.45	0.07	0.61	0.70	0.08	0.14	99	14	9.1	721	95	49	0.29	2777	0.022
Early '25	1.53	0.08	0.61	0.64	0.09	0.15	113	14	8.4	682	80	31	0.20	2653	0.020
Late '25	1.49	0.08	0.65	0.70	0.09	0.17	118	14	8.8	727	117	44	0.79	3659	0.021
Early '26	1.67	0.10	0.67	0.72	0.09	0.18	61	11	7.4	753	92	31	0.31	4891	0.062

• **2024 - 2026:**

- Early 2024 (581), late 2024 (1785), early 2025 (734), late 2025 (2723), early 2026 (1375)
- Early = January to March & Late = October to December
- Excluding nurseries and possible chemical trials
- *Samples tested: Early '24 (335), Late '24 (1263), Early '25 (546), Late '25 (1835), Early '26 (1198)
- **Samples tested: Early '24 (142), Late '24 (245), Early '25 (322), Late '25 (1005), Early '26 (999)
- ***Samples tested: Early '24 (127), Late '24 (424), Early '25 (313), Late '25 (227), Early '26 (11)



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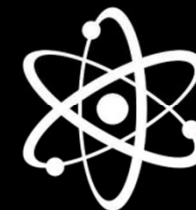
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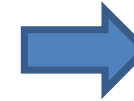
Avocado

Low
Norm
High

	N %	P %	K %	Ca %	Mg %	S %	Na mg/kg	Zn mg/kg	Cu mg/kg	Mn mg/kg	Fe mg/kg	B mg/kg	Mo* mg/kg	Cl** %
2024	2.22	0.11	0.77	1.15	0.51	0.23	574	30	193	317	102	37	0.98	0.080
2025	2.53	0.12	0.80	1.04	0.47	0.21	98	28	130	280	100	40	2.19	0.023
2026	2.46	0.13	0.79	1.28	0.48	0.22	34	29	158	306	109	32	1.08	0.068

- **2024 (690) + 2025 (604) + 2026 (655):**
 - February to May
 - Excluding the Cape, nurseries and possible chemical trials
 - *Samples tested: 2024 (382) + 2025 (351) + 2026 (385)
 - **Samples tested: 2024 (174) + 2025 (159) + 2026 (153)

Soil



2024
2025
2026

	Ave. Cu mg/kg	Max. Cu mg/kg
2024	44	445
2025	56	596
2026	21	202

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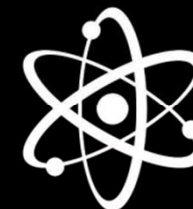
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Leaves

Overall Cross-Crop Trends

Nutrient	General trend
N	↑
Mo	↑↑
Na	↓↓↓
Fe	↑
Zn	↑
Mn	↑ (especially citrus)

Multiple crops are moving in the same direction.

That usually indicates:

- climate influence,
- regional environmental effects,
- or widespread management changes.

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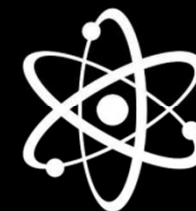
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Leaves

Rainfall Influence on Nutrient Levels

Higher rainfall was associated with general trend across multiple crop types:

- Higher average leaf nitrogen concentrations: increased mineralisation, improved root activity, increased nitrate movement & longer active growth periods
- Higher average manganese concentrations (especially for Citrus): increased solubility and availability
- Significantly lower sodium concentrations: leaching, dilution & lower salt accumulation

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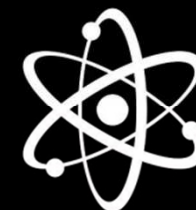
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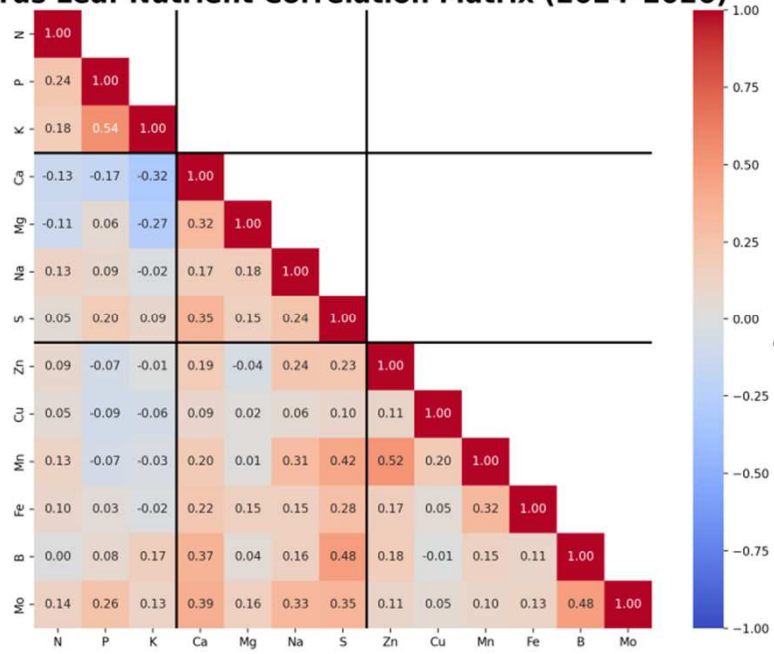
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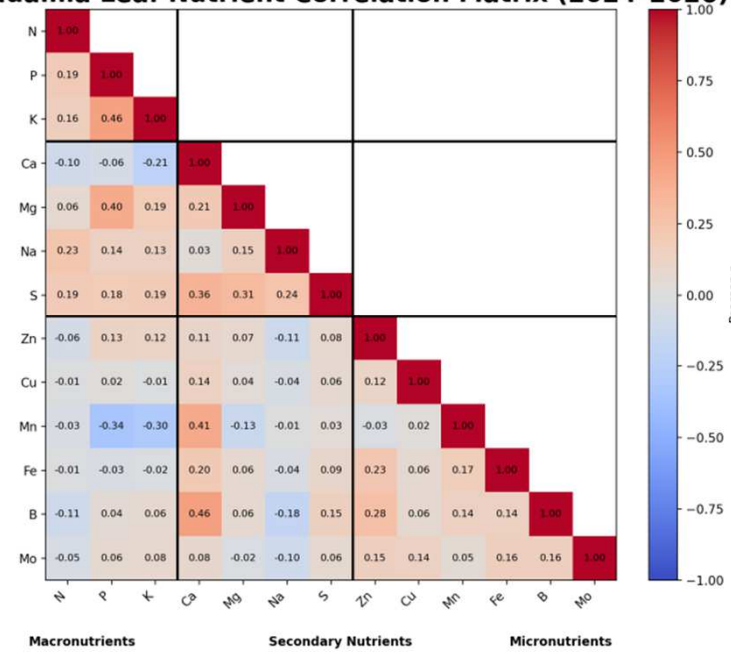
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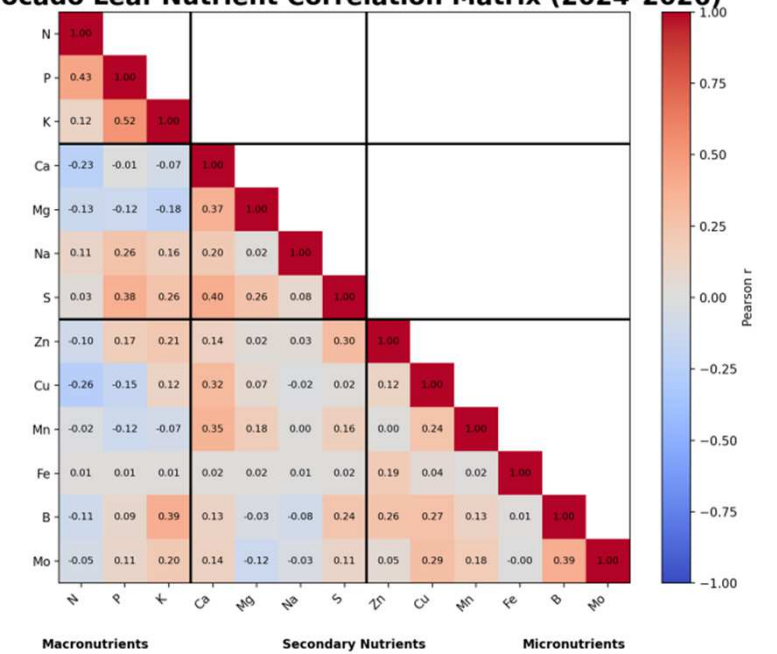
Citrus Leaf Nutrient Correlation Matrix (2024-2026)



Macadamia Leaf Nutrient Correlation Matrix (2024-2026)



Avocado Leaf Nutrient Correlation Matrix (2024-2026)



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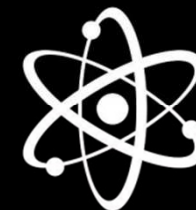
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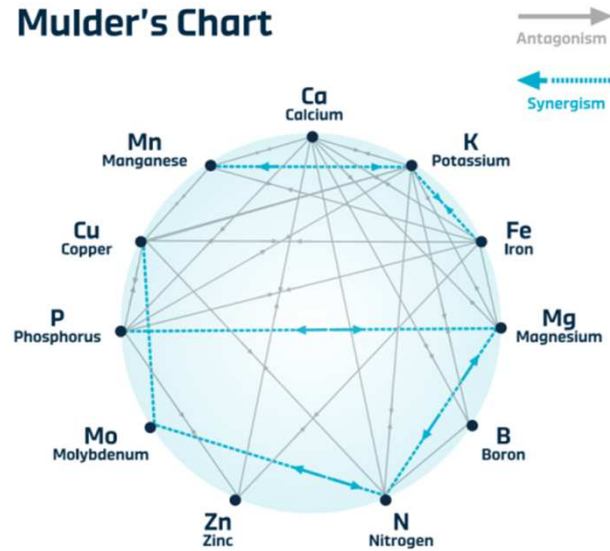
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Mulder's Chart



Relationship	Mulder Prediction	Citrus	Macadamia	Avocado	Observation
P-K	Weak / antagonistic	0.54	0.46	0.52	Contradicts theory
B-Mo	Not emphasised	0.48	0.16	0.39	Emerging relationship
Zn-Mn	Synergistic	0.52	-0.03	0.00	Crop dependent
K-Mg	Antagonism	-0.27	0.19	-0.18	Mixed
K-Ca	Antagonism	-0.32	-0.21	-0.07	Generally supported

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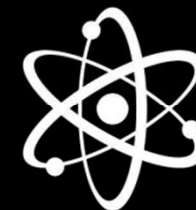
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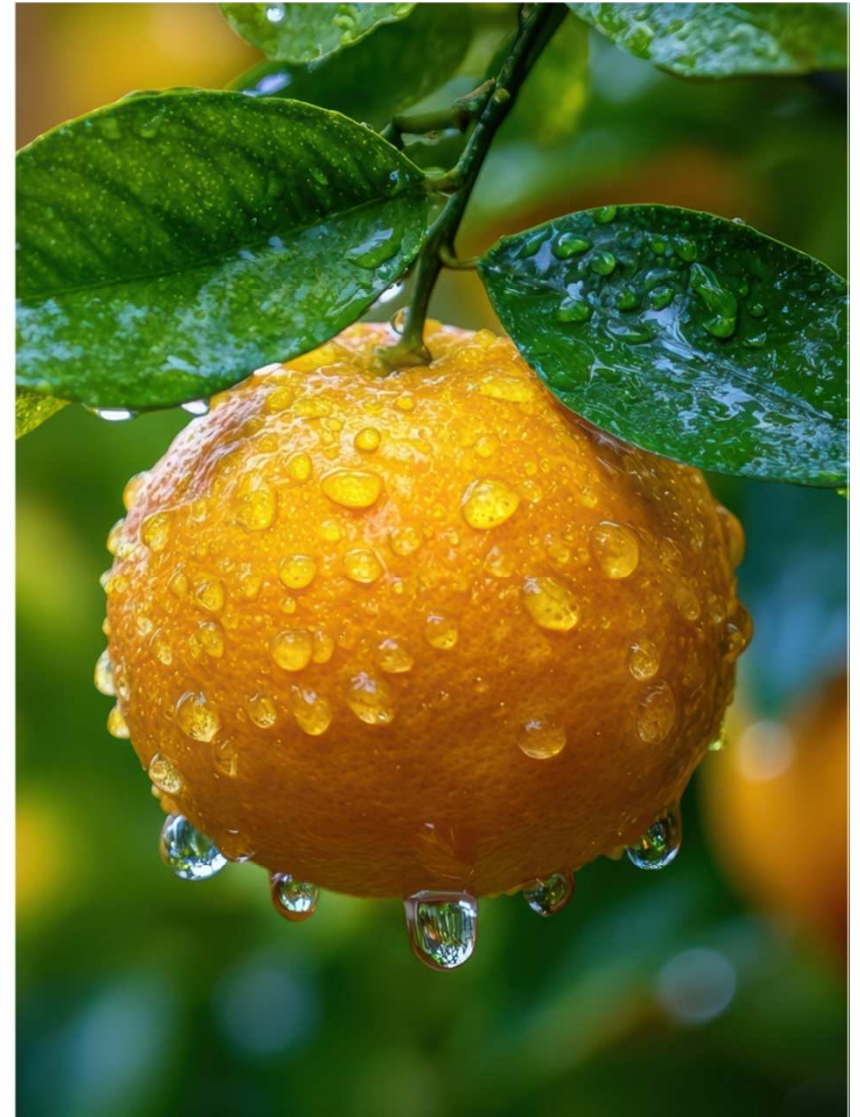
Leaves & Soil

What the Data Suggests

- ✓ Wet years promote stronger nitrogen uptake
- ✓ Nutrient balance shifts during wetter seasons
- ✓ Long-term trends are becoming more important than individual results
- ✓ Monitoring trends may be more valuable than relying only on fixed norms
- ✓ Climate variability is increasingly influencing nutrient management decisions

Take home message:

The data suggests that rainfall does not simply influence growth, it influences nutrient behaviour itself. As seasonal variability increases, nutrient interpretation may need to become more dynamic, crop-specific and season-specific



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Thank you • Dankie!

References:

Eurofins datasheets
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Labserve website & Client Portal

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