

INTELLIGENCE



Emerging Technologies

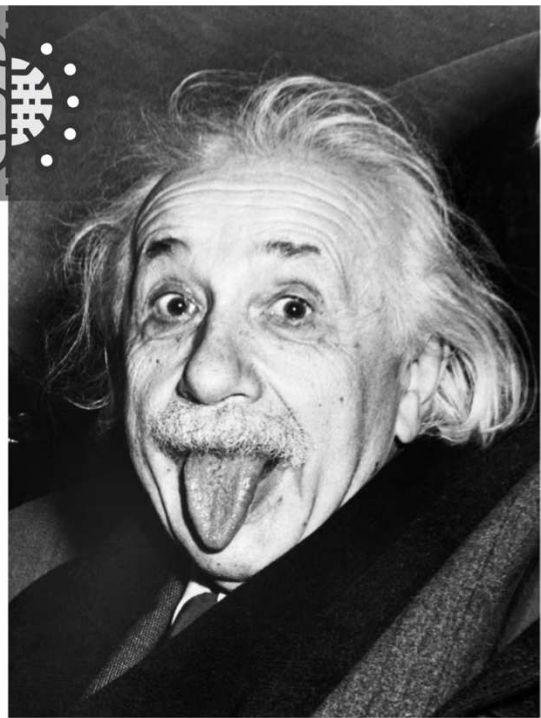


Data Trends



**Applied Research
in Agriculture**

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



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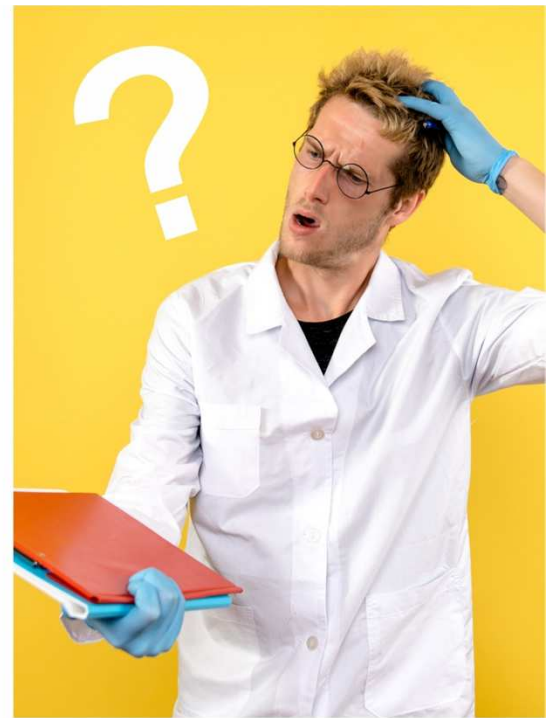


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What has changed since last year?



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Industry shifts

- Where do we start?
 - Agrochemical/Fertiliser/Diesel price increases and shortages - make 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?
 - Commodity price?



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Climate pressures

- Recent rainfall variability
- Wet years
 - What happened to your topsoil?
 - Tree damage, nutritional changes
 - Fruit damage
 - Secondary infection control
 - Pesticide application schedules?
- Super El Niño?



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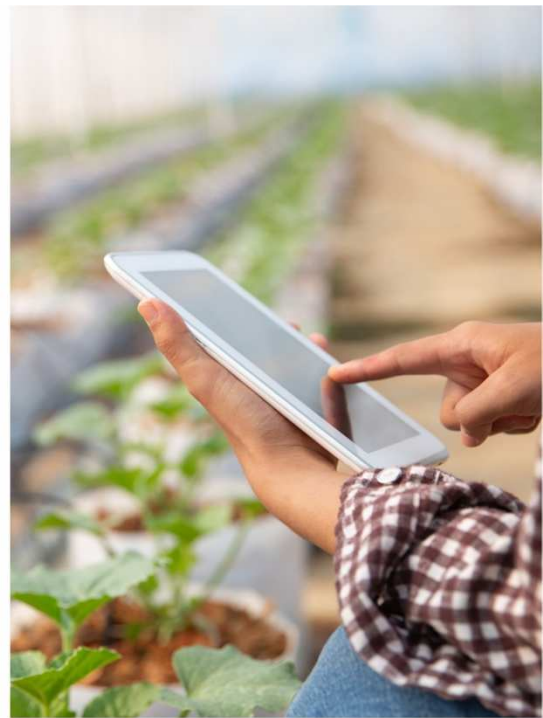
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“Intelligent” agriculture adoption

- “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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Near-Infrared Spectroscopy

- Concurrent validation with Eurofins models
- Over 9000 unique ZA soils already tested for >30 parameters
- Testing correlation to many 100 000's samples in Eurofins' DB
- Soil health and nutrients
- Soil life – PLFA equivalent
- Soil carbon
- Quick and affordable
- Sounds too good, would be without Eurofins 24 years and 1000's hours XP



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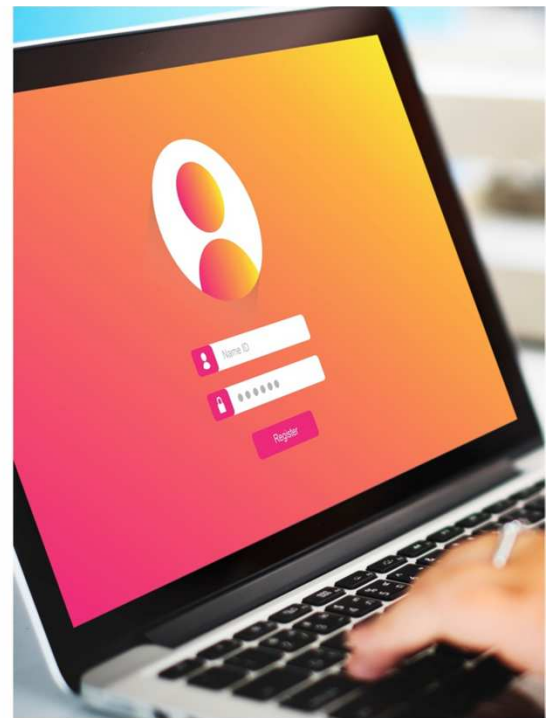
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Interactive client portal evolution

- 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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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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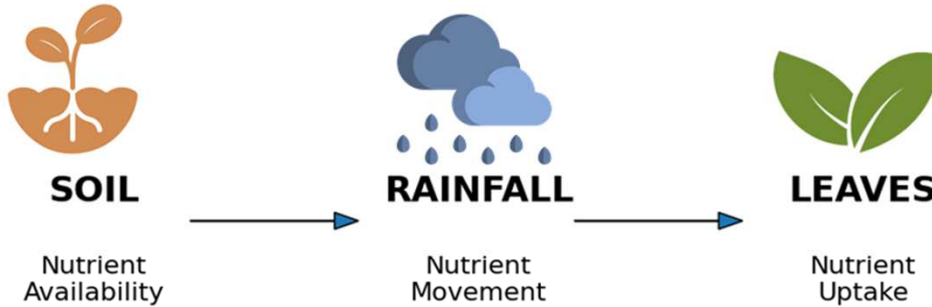
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Soils influence potential. Leaves reveal what happened.



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

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Soils

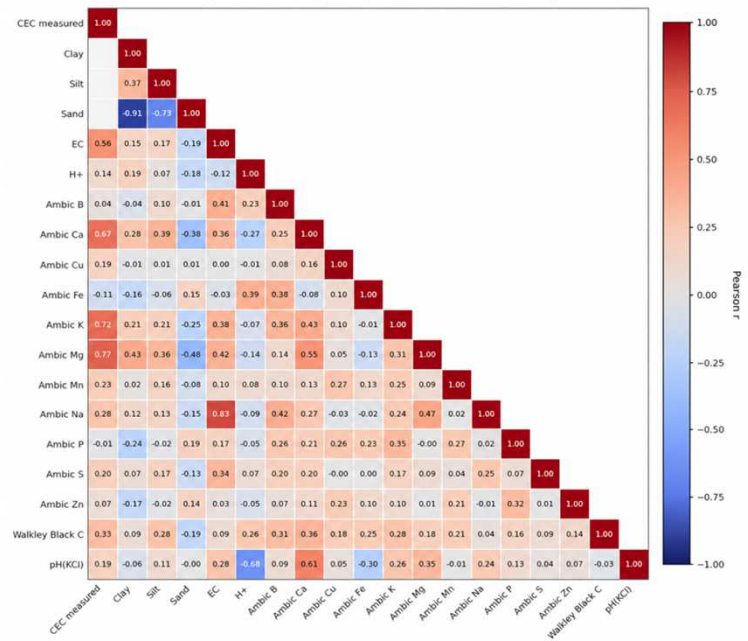
- Over 30 000 samples

- Pearson correlation coefficient:**

Pearson r measures the strength and direction of a linear relationship:

- **+1** = strongest positive
- **0** = no relationship
- **-1** = strongest negative

2026 ST Soil Correlation Matrix
(> 30 000 samples, pairwise available data)



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Soils

- What did 30 000+ samples reveal?

CEC :

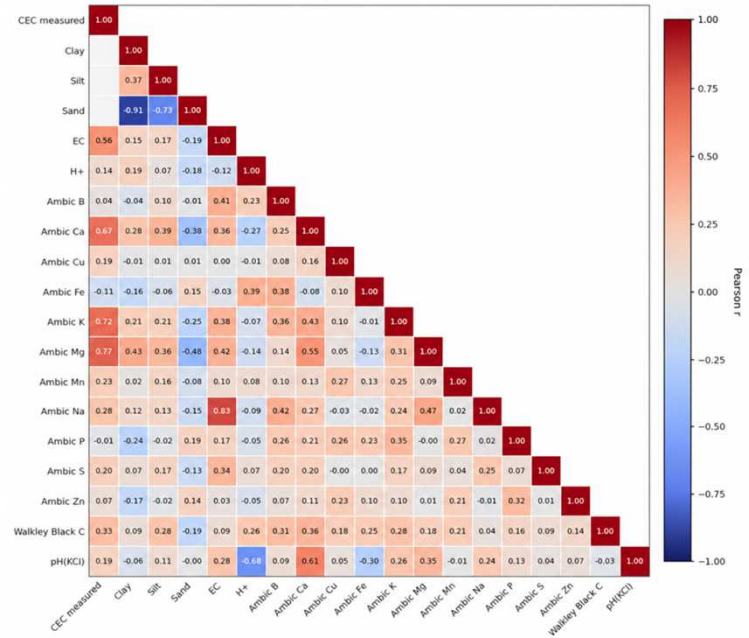
- CEC $\leftrightarrow$ Ca $r = 0.67$
- CEC $\leftrightarrow$ Mg $r = 0.77$
- CEC $\leftrightarrow$ K $r = 0.72$
- CEC $\leftrightarrow$ Na $r = 0.28$

But...

- CEC $\leftrightarrow$ P $r \approx 0.00$
- AEC?

Correlation $\neq$ causation

2026 ST Soil Correlation Matrix
(> 30 000 samples, pairwise available data)



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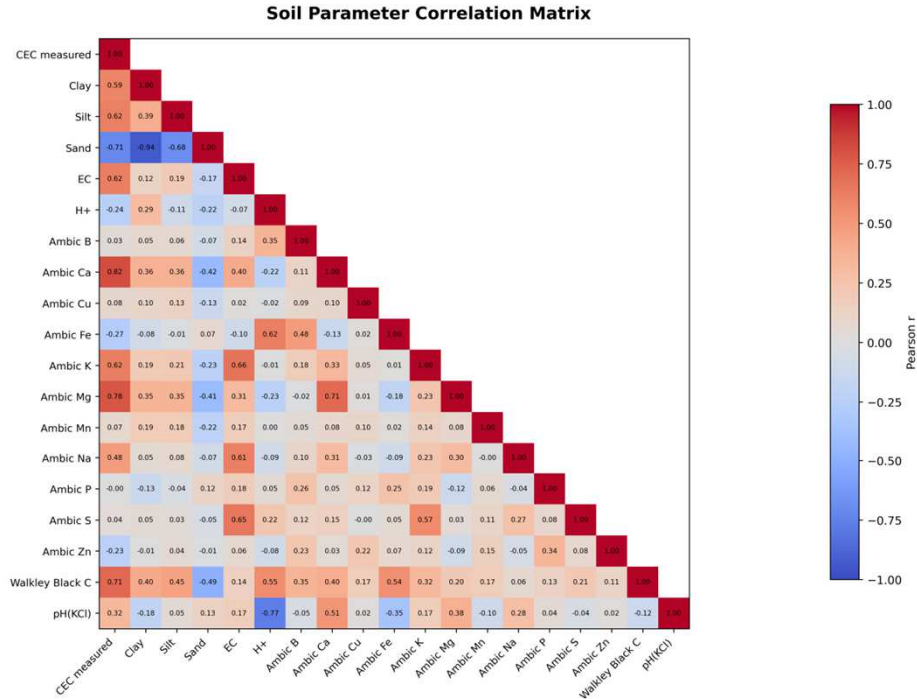


Soils

Key Observation from Northern region:

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

Clay remains an important determinant of CEC, but Walkley Black Carbon showed a stronger association with CEC in these samples.



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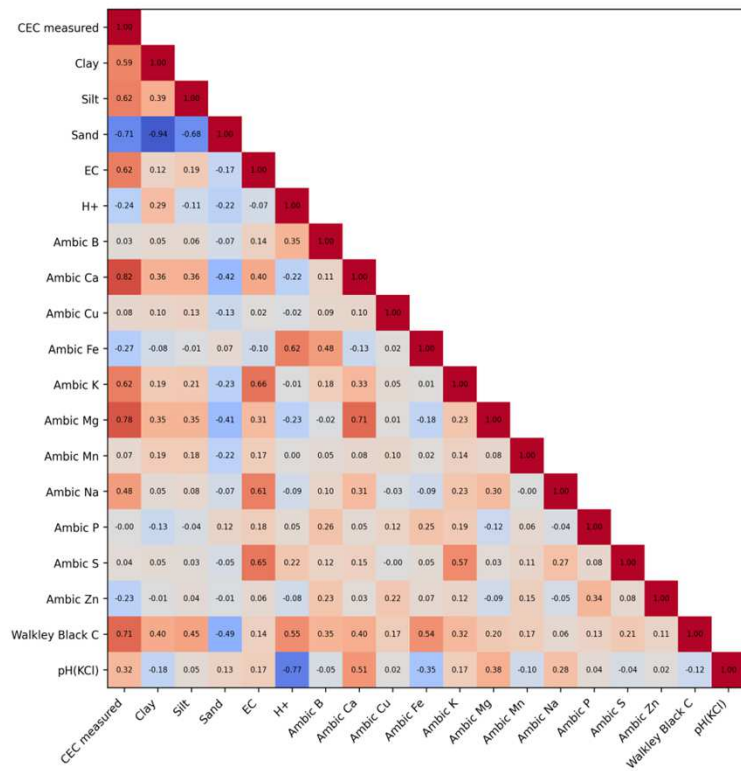
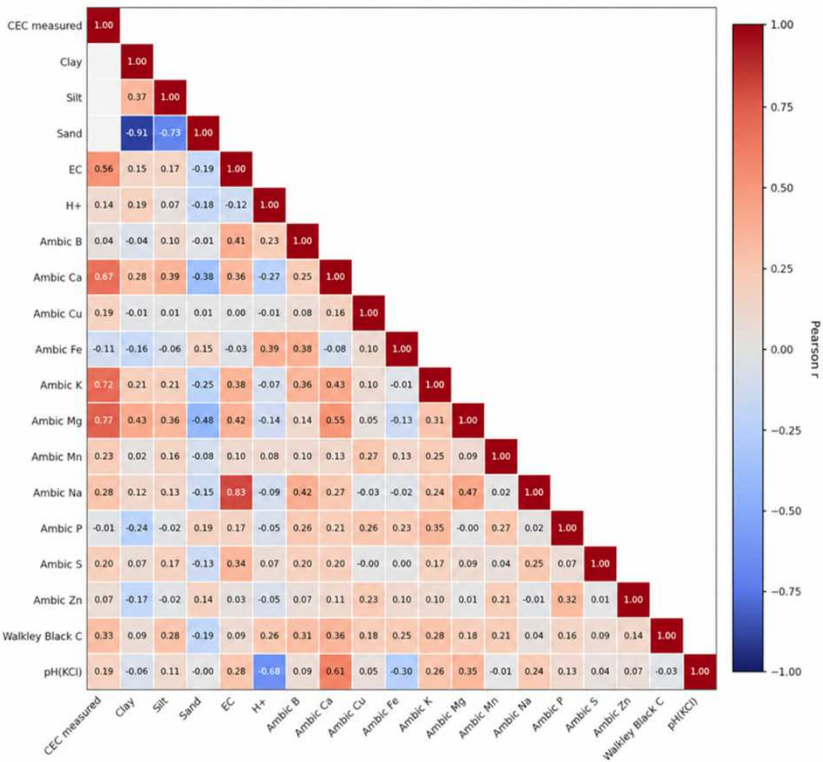
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Southern regions



Soils – Southern regions

	NH4-N ^a mg/kg	NO3-N ^a mg/kg	EC ^b mS/cm	Ambic Na mg/kg	pH(KCl) pH units	H+ ^c cmol/kg	Ambic Mn mg/kg	Ambic S ^d mg/kg	Ambic B ^d mg/kg
2023	6.7	4.8	0.330	68	5.52	0.520	6.3	41	0.28
2024	2.6	1.1	0.360	73	5.66	0.540	6.9	42	0.44
2025	3.1	1.6	0.370	74	5.56	0.570	6.7	41	0.43

•2023 (9380) + 2024 (10343) + 2025 (10531):

Excluding the Northern Region, nurseries and possible chemical trials

^a Samples tested: 2023 (73) + 2024 (18) + 2025 (92)

^b Samples tested: 2023 (8695) + 2024 (9532) + 2025 (9180)

^c Samples tested: 2023 (7826) + 2024 (10305) + 2025 (10463)

^d Samples tested: 2023 (8040) + 2024 (6236) + 2025 (6444)



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Soils – Southern regions



Key Findings:

- Inorganic N ($\text{NH}_4\text{-N}$ & $\text{NO}_3\text{-N}$) decreased
- pH & H^+ remained stable
- B increased overall
(0.28 → 0.43 mg/kg)
- EC & Na increased marginally

What the data suggests:

- Soil chemistry remained remarkably stable
- Nutrient availability can change without major changes in soil chemistry (pH)
- Increasing EC and Na monitoring: particularly where irrigation and salinity are already concerns.
- Regional conditions matter: the southern and northern datasets do not show the same nutrient trajectory

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Soils – Northern regions

	Extractable N ^a mg/kg	NH ₄ -N ^b mg/kg	NO ₃ -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) + 2024 (6985) + 2025 (5176):

Excluding the Cape, nurseries and possible chemical trials

^a Samples tested: 2023 (253) + 2024 (194) + 2025 (255)

^b Samples tested: 2023 (119) + 2024 (62) + 2025 (182)

^c Samples tested: 2023 (1431) + 2024 (1800) + 2025 (1382)

^d Samples tested: 2023 (1214) + 2024 (1873) + 2025 (1270)



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Soils - Northern regions



Key Findings:

- $\text{NO}_3\text{-N}$ 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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Soils

What does the soil data tell us?

1. Soil properties interact

CEC, carbon and texture show meaningful relationships, but not all nutrients follow the same pattern.

2. Nutrients don't all respond to the same drivers

Anionic P vs. Ca, Mg, K Cations

3. Context matters

The Southern and Northern datasets show different year-on-year nutrient patterns alongside different rainfall histories.

Bottom line:

A soil result is a snapshot of a dynamic system - interpretation needs context.



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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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Leaves

- Citrus
- Grapes – Leaf Blade Veraison
- Plums



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Citrus – Southern region

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
2024	2.40	0.12	1.09	2.94	0.33	0.27	1100	72	21.5	95	156	82	0.41
2025	2.77	0.13	1.27	2.87	0.35	0.24	600	78	14.3	97	177	70	0.44
2026	2.72	0.13	1.33	3.33	0.40	0.32	510	84	20.3	113	190	78	0.55

•2024 (1542) + 2025 (1582) + 2026 (1609):

- February to April
- Excluding the North, nurseries and possible chemical trials
- *Samples tested: 2024 (317) + 2025 (534) + 2026 (464)



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Citrus – Northern region

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
2024	2.08	0.11	1.02	3.28	0.36	0.27	900	26	16.3	72	122	73	0.10
2025	2.57	0.13	1.32	3.09	0.33	0.27	400	30	11.7	108	149	80	0.24
2026	2.53	0.13	1.14	3.66	0.39	0.33	235	36	21.2	165	156	79	0.53

•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)



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Grapes – Leaf Blade Veraison

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
2024	2.30	0.20	0.86	1.94	0.34	0.21	500	43	70	92	183	52	0.35
2025	2.36	0.21	1.00	1.97	0.37	0.19	400	54	112	108	196	52	0.73
2026	2.36	0.18	0.83	1.96	0.38	0.21	326	42	108	115	182	46	0.43

•2024 (659) + 2025 (442) + 2026 (561):

- January and February
- Excluding the North, nurseries and possible chemical trials
- *Samples tested: 2024 (328) + 2025 (67) + 2026 (107)



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Plums

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
2024	2.42	0.16	2.33	2.38	0.54	0.15	400	44	9.6	79	171	42	0.17
2025	2.68	0.20	2.60	2.60	0.51	0.14	200	37	10.9	86	167	38	0.16
2026	2.75	0.19	2.20	2.33	0.57	0.18	201	53	10.1	125	212	33	0.41

•2024 (158) + 2025 (198) + 2026 (238):

- January and February
- Excluding the North, nurseries and possible chemical trials



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Leaves

Overall Cross-Crop Trends (2024-2026)

Nutrient	Overall trend
N	↑
Mo	↑
Na	↓
Fe	↑
Zn	↑
Mn	↑

Overall direction from 2024 → 2026 across Citrus, Grapes and Plums.

Multiple crops are moving
in the same direction.

That usually indicates:

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



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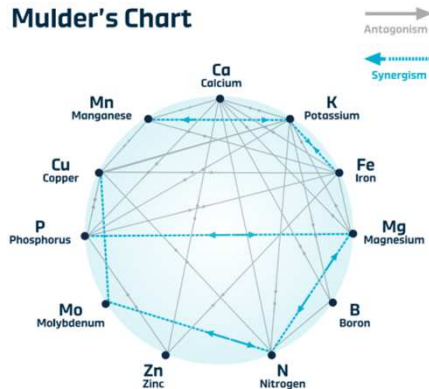
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Leaves

Mulder's Chart



Relationship	Mulder Prediction	Citrus	Grape	Plum	Observation
P-K	Antagonism	0.43	0.27	0.37	Contradicts theory
Ca-Mg	Antagonism	0.25	0.36	0.61	Contradicts theory
Mn-Zn	Not emphasised	0.35	0.18	0.40	Emerging relationship
Ca-P	Antagonism	-0.13	0.25	-0.07	Mixed
P-Mg	Synergism	0.20	0.05	-0.03	Mixed
K-Ca	Antagonism	-0.38	-0.03	-0.17	Generally supported

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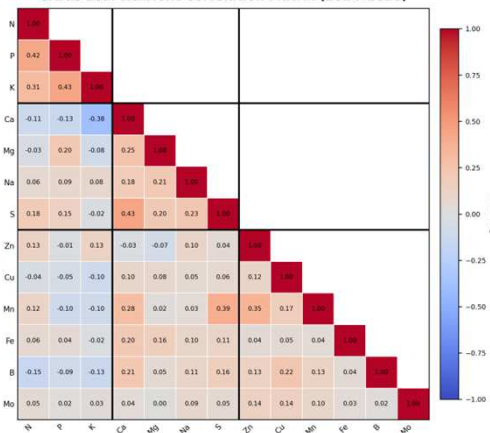
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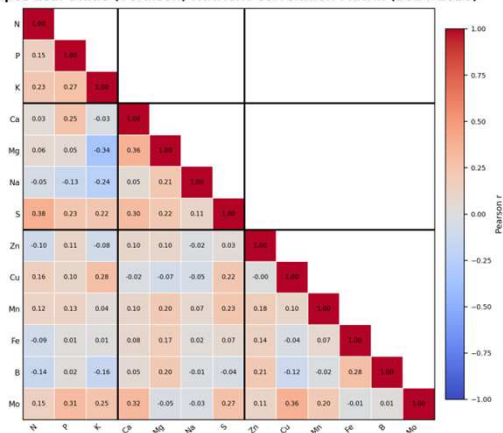
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Leaves

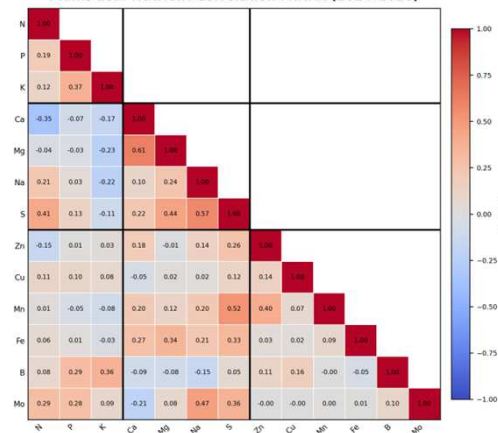
Citrus Leaf Nutrient Correlation Matrix (2024-2026)



Grapes Leaf Blade (Veraison) Nutrient Correlation Matrix (2024-2026)



Plums Leaf Nutrient Correlation Matrix (2024-2026)



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Leaves & Soil

What the Data Suggests

- ✓ Nutrient balance shifts during wetter seasons
- ✓ Multi-year 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 is associated with changes in nutrient behaviour, not just plant growth. 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
EU Reg 2026/765 MRL Compliance verification
Eurofins Graauw MRL data
Stock photos by Freepik.com
Labserve website & Client Portal
Labserve LIMS/Database

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