

Interpretation of Leaf Analysis

Known and Lesser-known



By Dr. Pieter Raath

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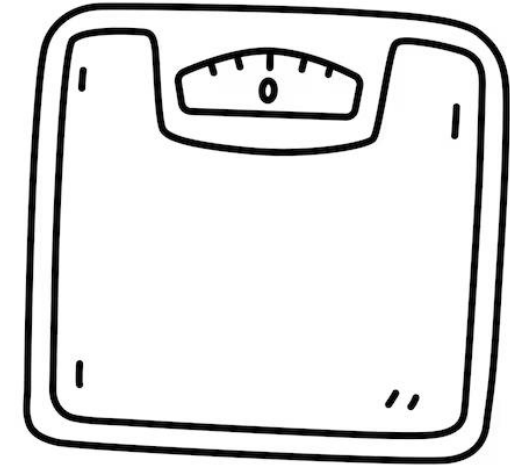
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Known Factors

1. Representative sampling protocol
2. Norms used
3. Purposes for leaf analysis



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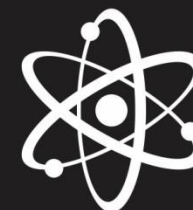
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Known Factors

1. Representative sampling protocol

The position of the leaves, as well as their age has a significant influence on their composition.



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Known Factors

1. Representative sampling protocol

Implications regarding their mobility within the plant...?

Mobility of nutrients within the plant

Mobile	Variably mobile	Immobile
N P K Mg	S Cu Zn Mo	Ca Mn B Fe

Known Factors



1. Representative sampling protocol

Implications regarding their mobility within the plant...?

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N P K Mg	S Cu Zn Mo	Ca Mn B Fe
When deficient, concentration <u>remains high</u> in young leaves		When deficient, concentration <u>drops quickly</u> in younger leaves

Known Factors



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Known Factors

1. Representative sampling protocol

Implications regarding their mobility within the plant...?

Mobility of nutrients within the plant

Mobile	Variably mobile	Immobile
N P K Mg	S Cu Zn Mo	Ca Mn B Fe
When deficient, concentration <u>remains high</u> in young leaves	Behaviour is complex, may move as older leaves become senescent	When deficient, concentration <u>drops quickly</u> in younger leaves

Known Factors



1. Representative sampling protocol

Implications of **nutrient mobility** regarding sampling:

- According to phenological stage?
- Before/after onset of ripening?
- Different positions for mobile vs immobile nutrients?

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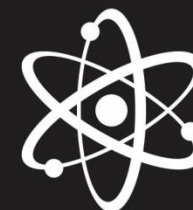
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1. Representative sampling protocol

Implications of **nutrient mobility** regarding sampling:

- According to phenological stage?
- Before/after onset of ripening?
- Different positions for mobile vs immobile nutrients?

Young leaves: sensitive for phloem-immobile nutrients
Older leaves: sensitive for phloem-mobile nutrients

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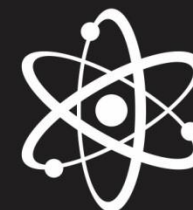
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1. Representative sampling protocol

Implications of **nutrient mobility** regarding sampling:

- According to phenological stage?
- Before/after onset of ripening?
- Different positions for mobile vs immobile nutrients?
- Location of fruit?

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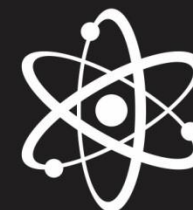
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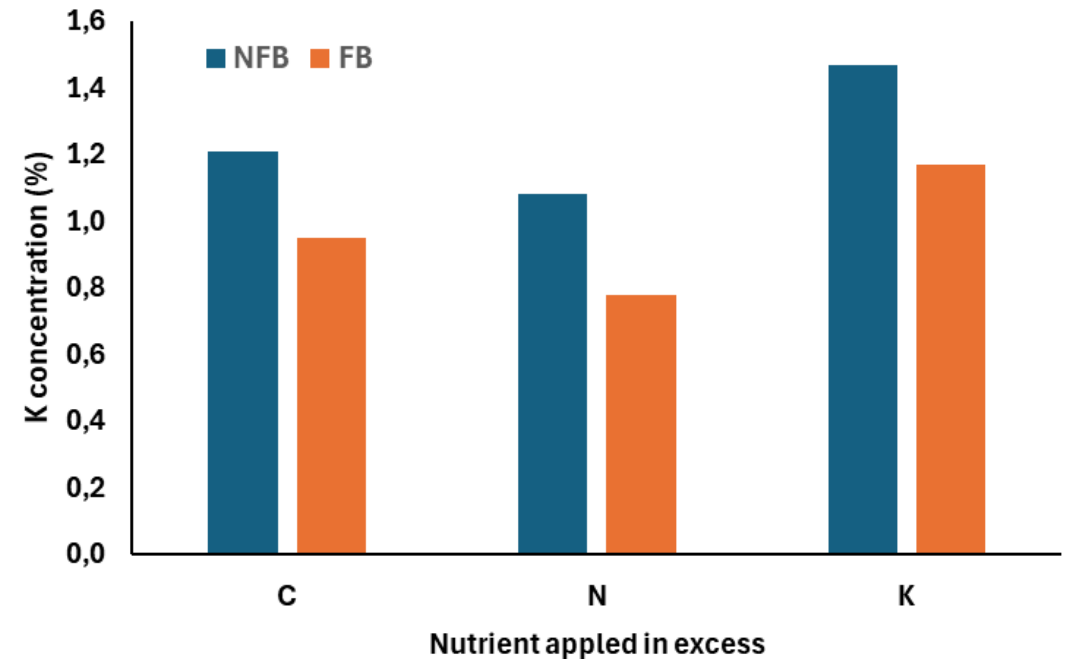
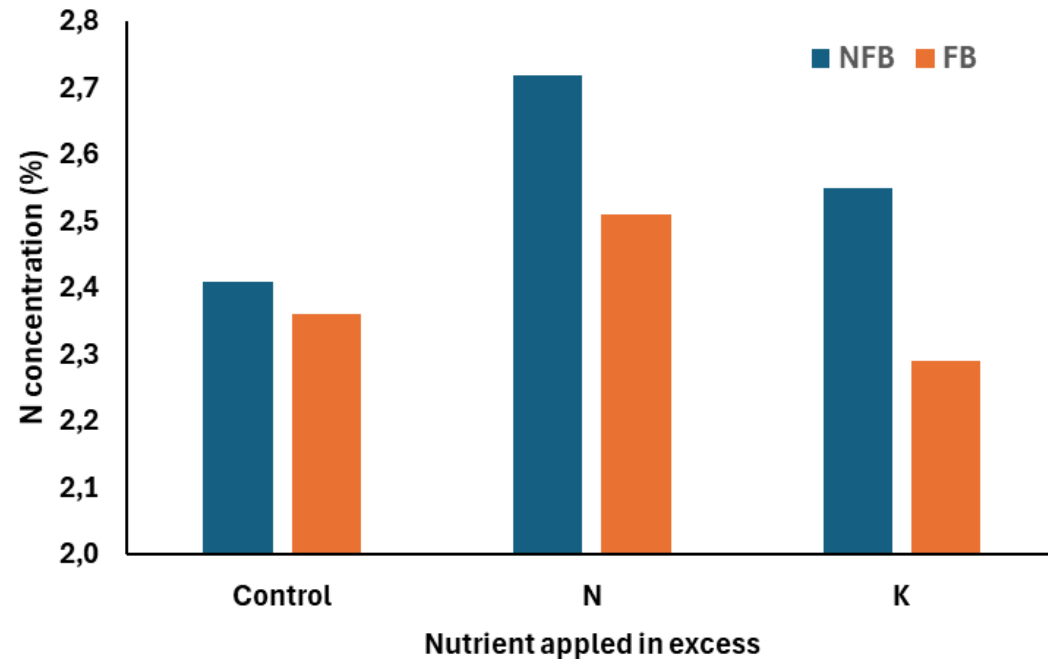


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1. Representative sampling protocol

Norms are based on specific plant part/leaf sampled



NFB = non fruit bearing FB = fruit bearing

Known Factors



1. Representative sampling protocol

Norms are based on specific plant part/leaf sampled

Note *Labserve* sampling protocol guidelines on our website



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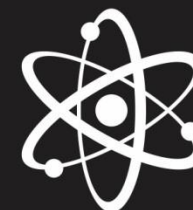
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Known Factors

1. Representative sampling protocol
2. Norms used

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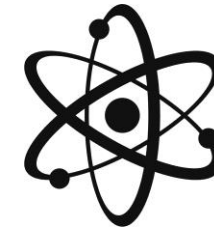
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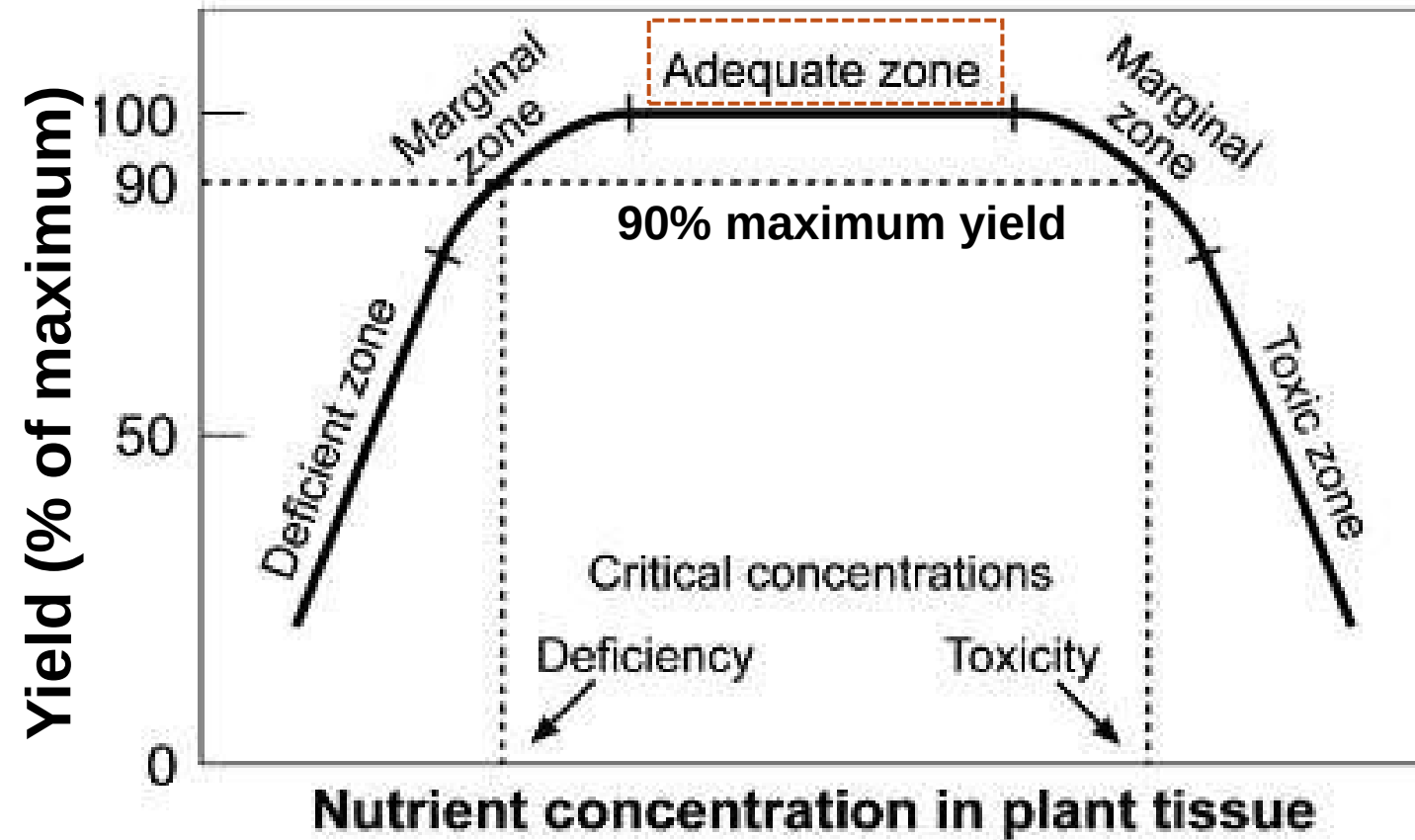
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2. Norms used

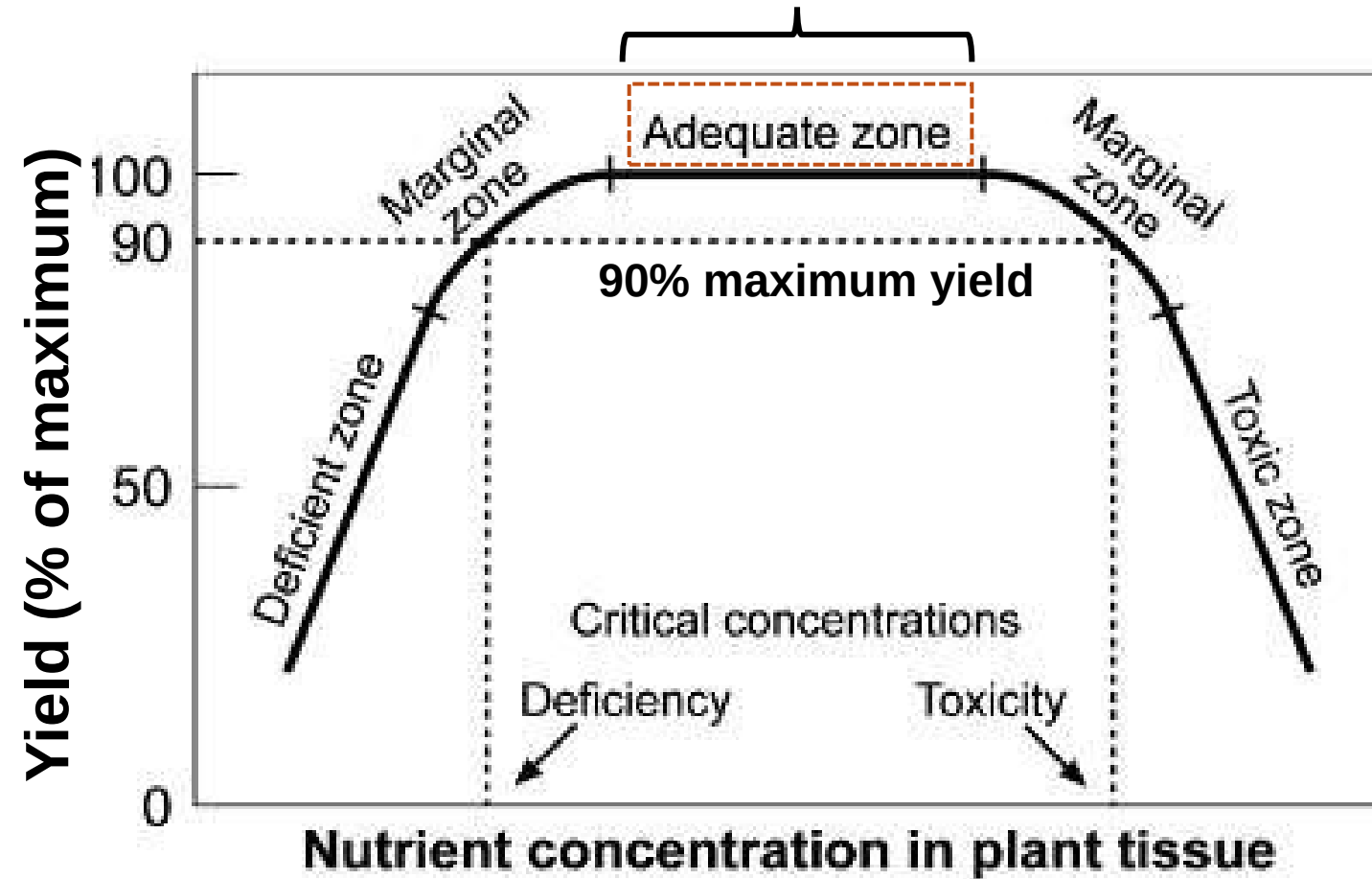


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Known Factors

2. Norms used



Known Factors

1. Representative sampling protocol
2. Norms used
3. Purposes for leaf analysis

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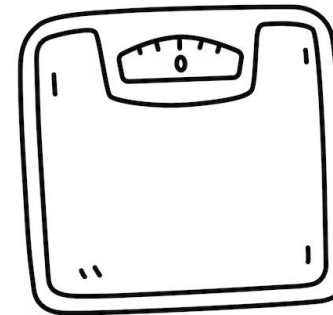
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Known Factors

3. Purposes for leaf analysis

Must make distinction between **three purposes** for testing:

- Diagnostic testing
- Monitoring
- Predictive testing



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3. Purposes for leaf analysis

Must make distinction between **three purposes** for testing:

- **Diagnostic testing**

To diagnose the cause for poor plant performance

No standards – compare good and bad areas

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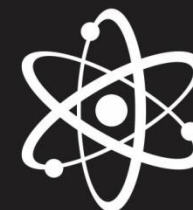
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3. Purposes for leaf analysis

Must make distinction between **three purposes** for testing:

- Diagnostic testing
- **Monitoring**
To assess adequacy of current fertilisation practices
Compare nutritional status in successive years

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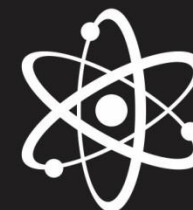
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3. Purposes for leaf analysis

Must make distinction between **three purposes** for testing:

- Diagnostic testing
- **Monitoring**
To assess adequacy of current fertilisation practices
Compare nutritional status in successive years
How does leaf norms apply here?

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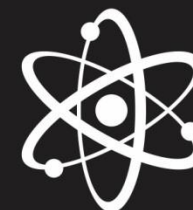
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3. Purposes for leaf analysis

Must make distinction between **three purposes** for testing:

- Diagnostic testing
- Monitoring
- **Predictive testing**
Analysis of leaves **early in season** to predict likelihood of nutrient deficiency later in season

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Known Factors

3. Purposes for leaf analysis

Must make distinction between **three purposes** for testing:

- Diagnostic testing
- Monitoring
- **Predictive testing**
Analysis of leaves **early in season** to predict likelihood of nutrient deficiency later in season
E.g., fruit-set samples for grapevines, pre-bloom petiole NO_3 in table grapes

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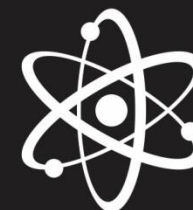
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Lesser-known Factors

1. Variation
2. Sensitivity to reflect soil applications
3. Effects of washing of samples



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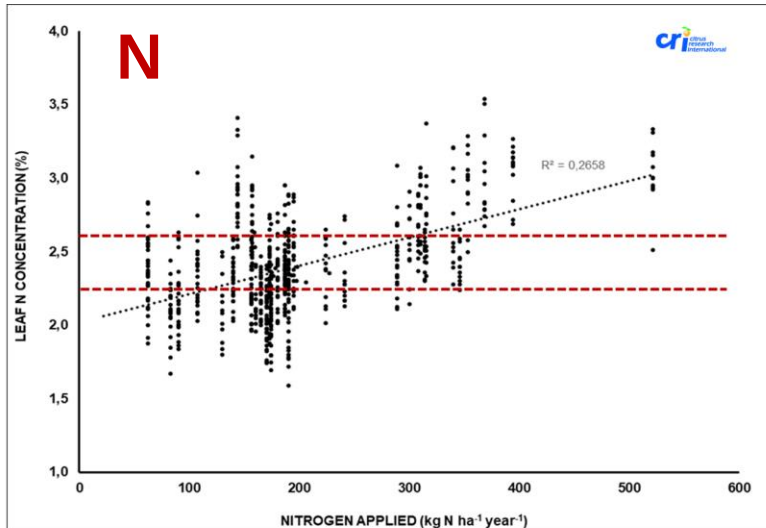
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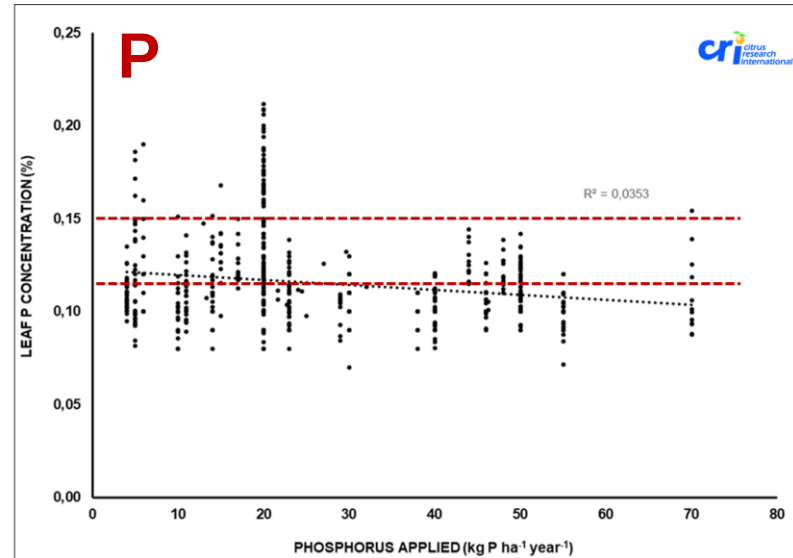
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Lesser-known Factors

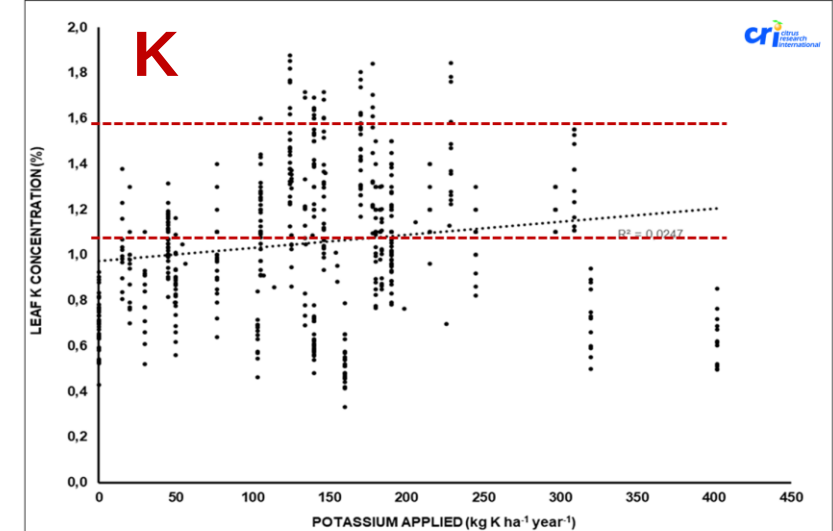
1. Variation



Correlation between applied N fertiliser and leaf N concentration at 14 experimental sites during the 2021/22 to 2023/24 seasons.



Correlation between applied P fertiliser and leaf P concentration at 14 experimental sites during the 2021/22 to 2023/24 seasons.



Correlation between applied K fertiliser and leaf K concentration at 14 experimental sites during the 2021/22 to 2023/24 seasons.

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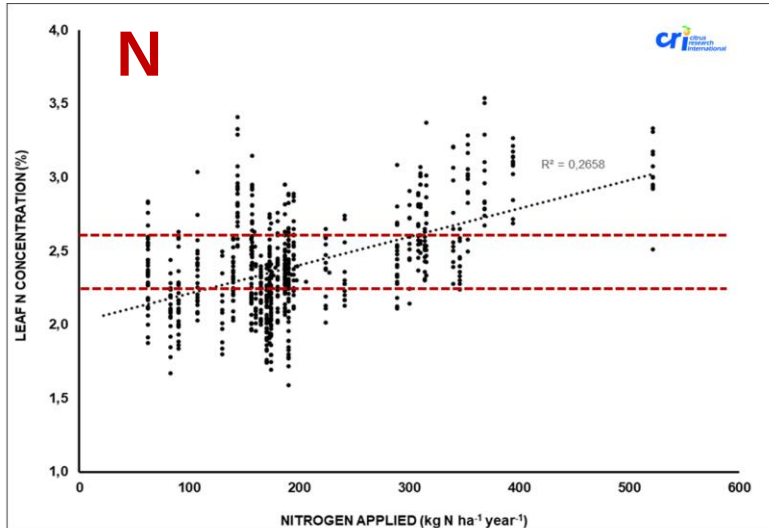
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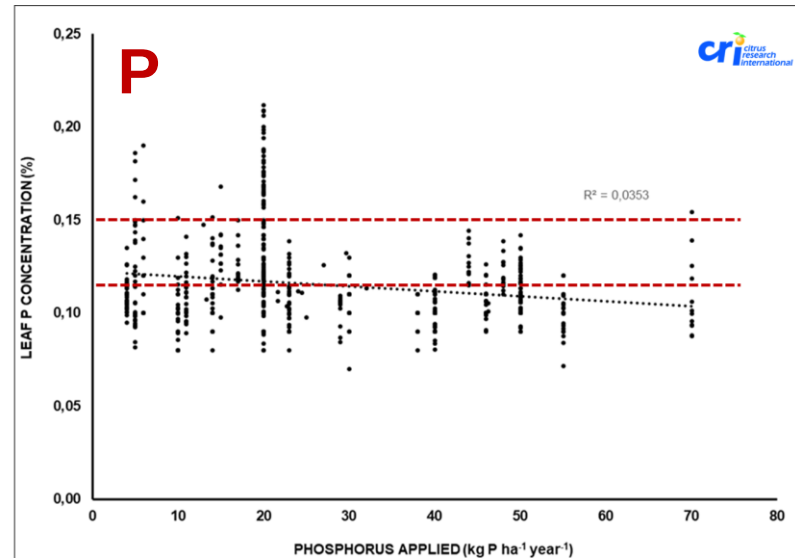


Lesser-known Factors

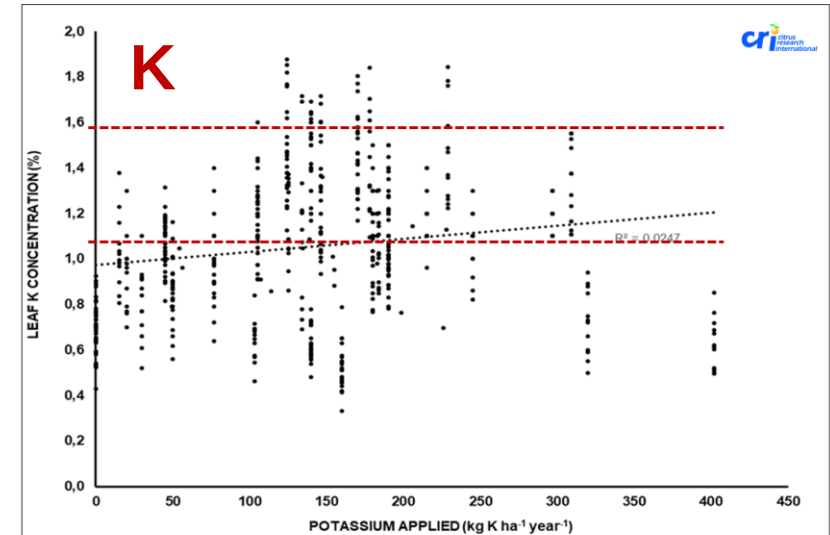
2. Sensitivity to reflect soil applications



Correlation between applied N fertiliser and leaf N concentration at 14 experimental sites during the 2021/22 to 2023/24 seasons.



Correlation between applied P fertiliser and leaf P concentration at 14 experimental sites during the 2021/22 to 2023/24 seasons.



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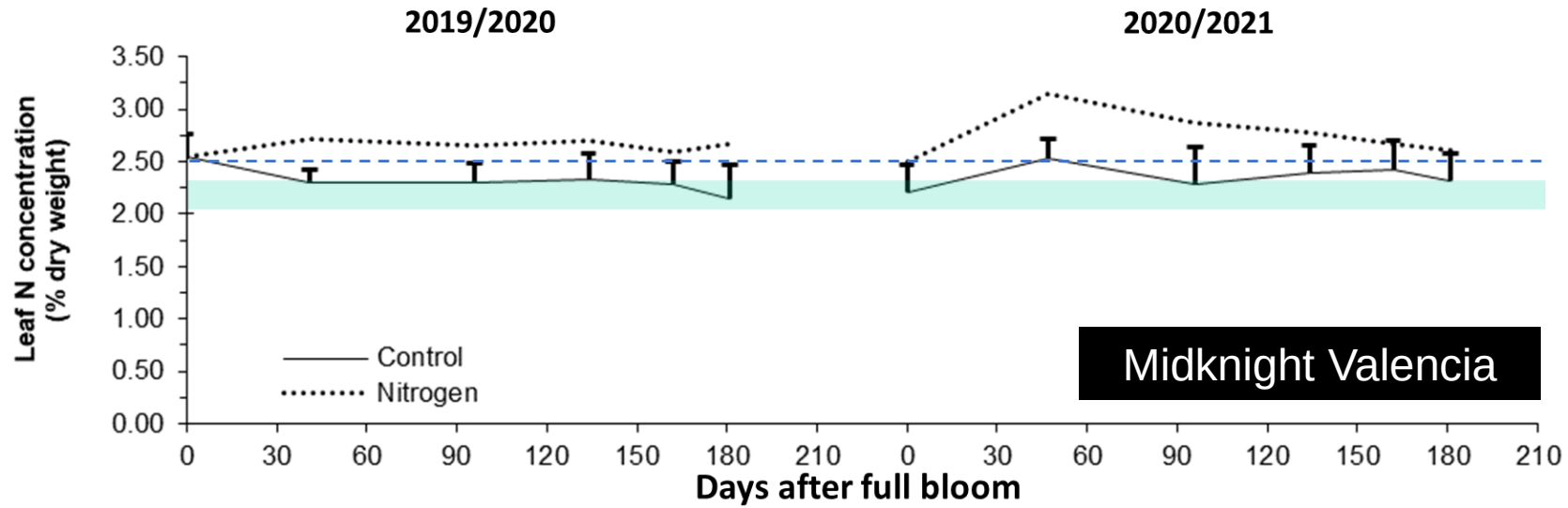
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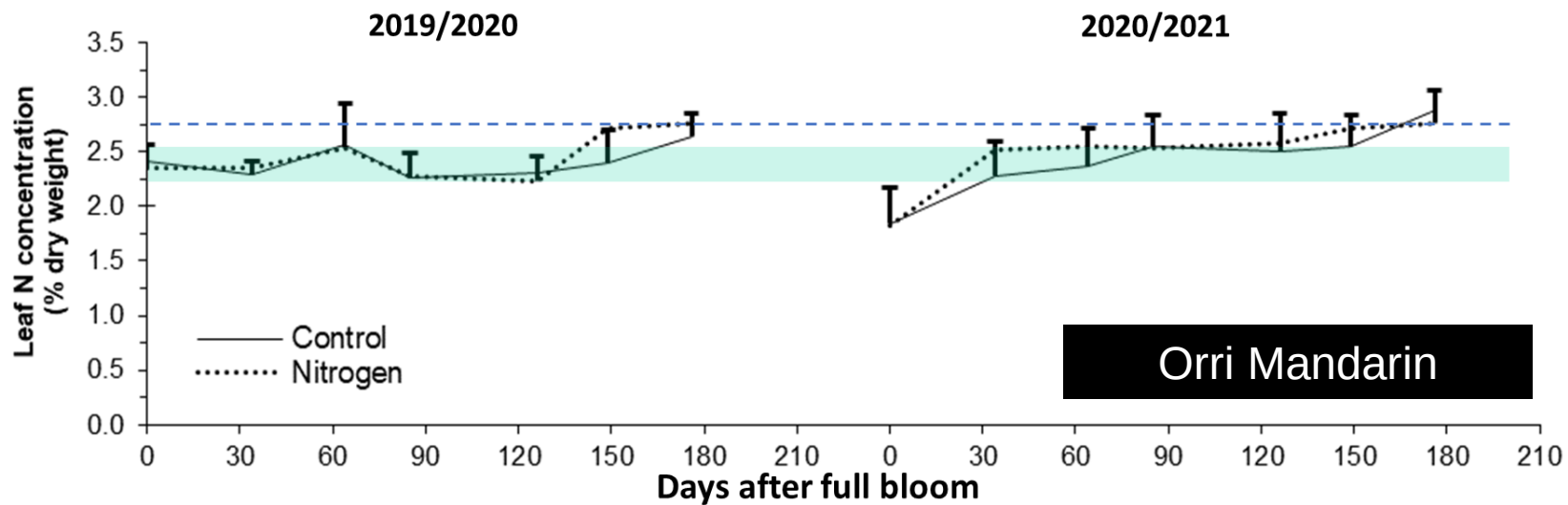


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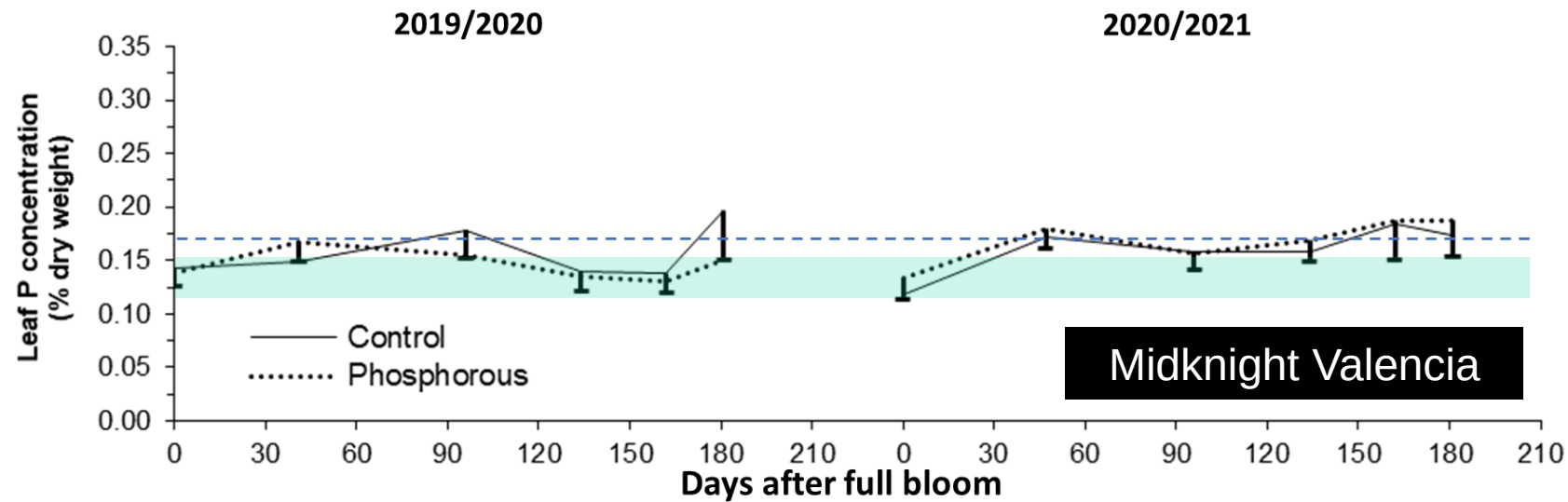


Midnight Valencia

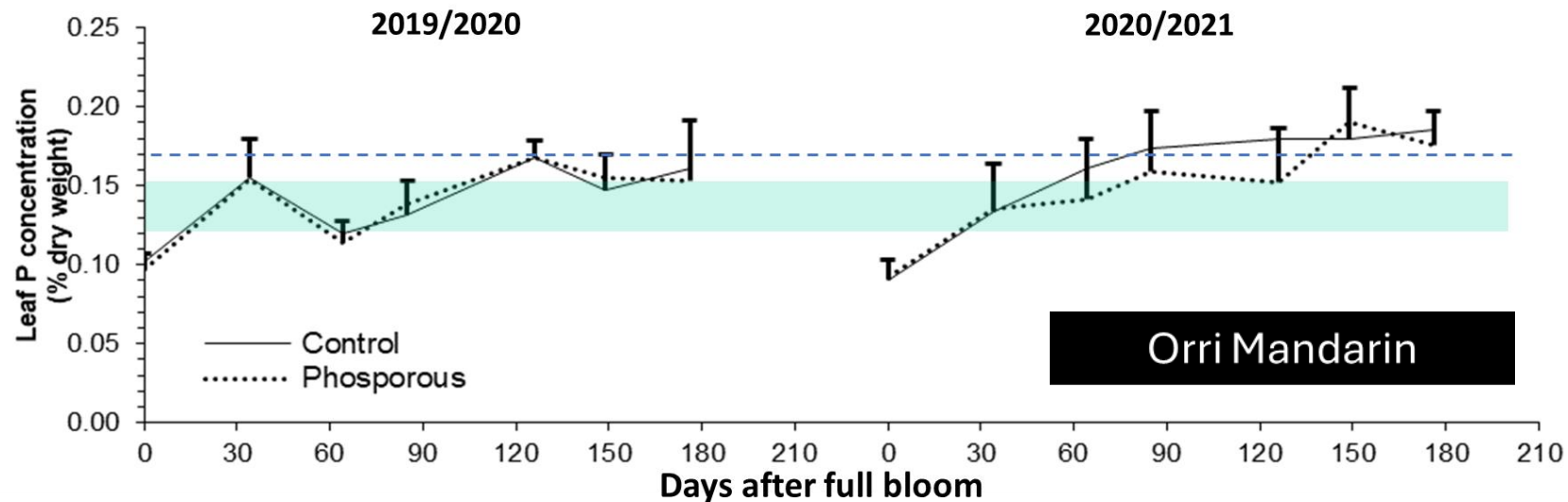
Seasonal changes in leaf N concentration of citrus as affected by fertilisation rates of 200% of the normally applied rate (control).

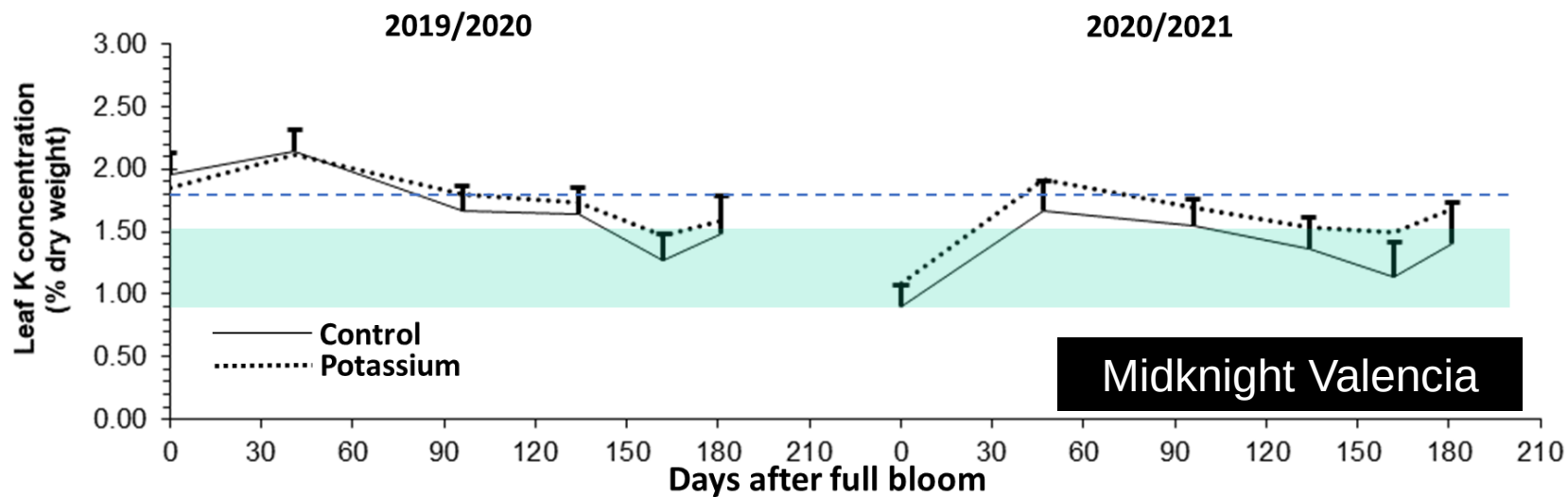


Orri Mandarin

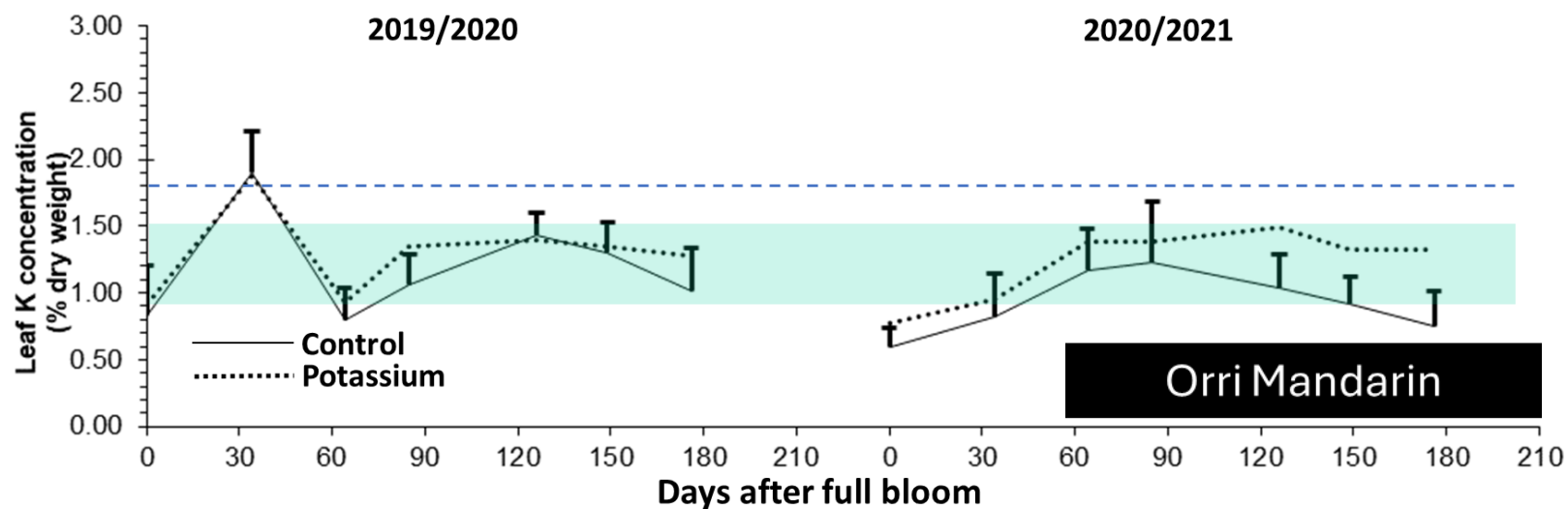


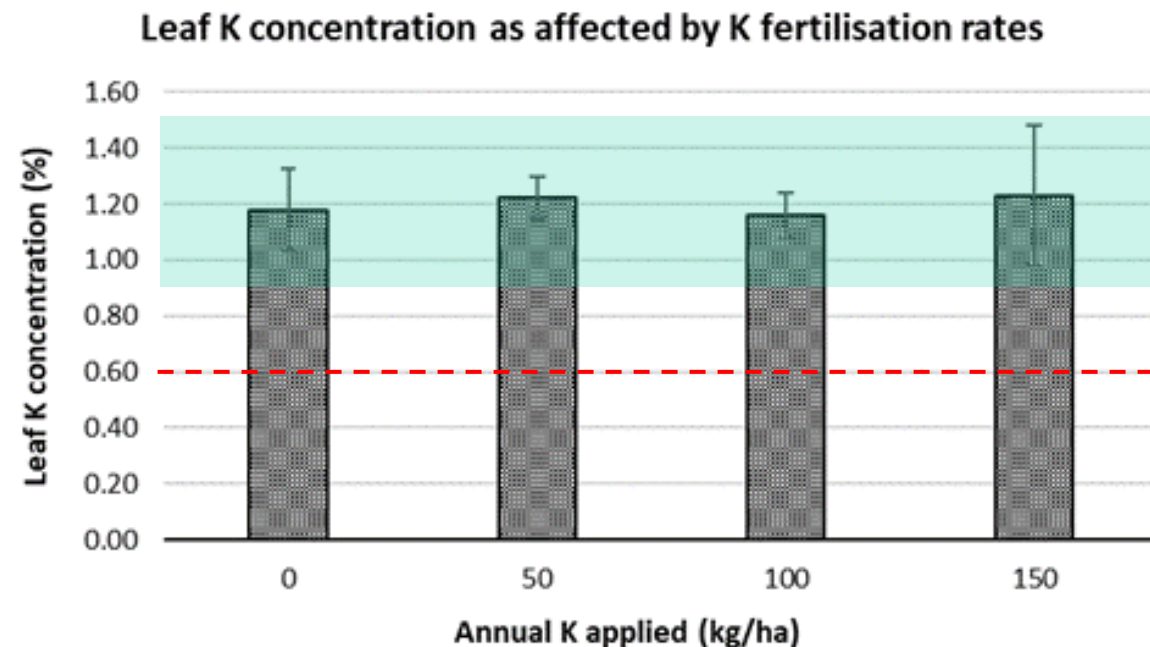
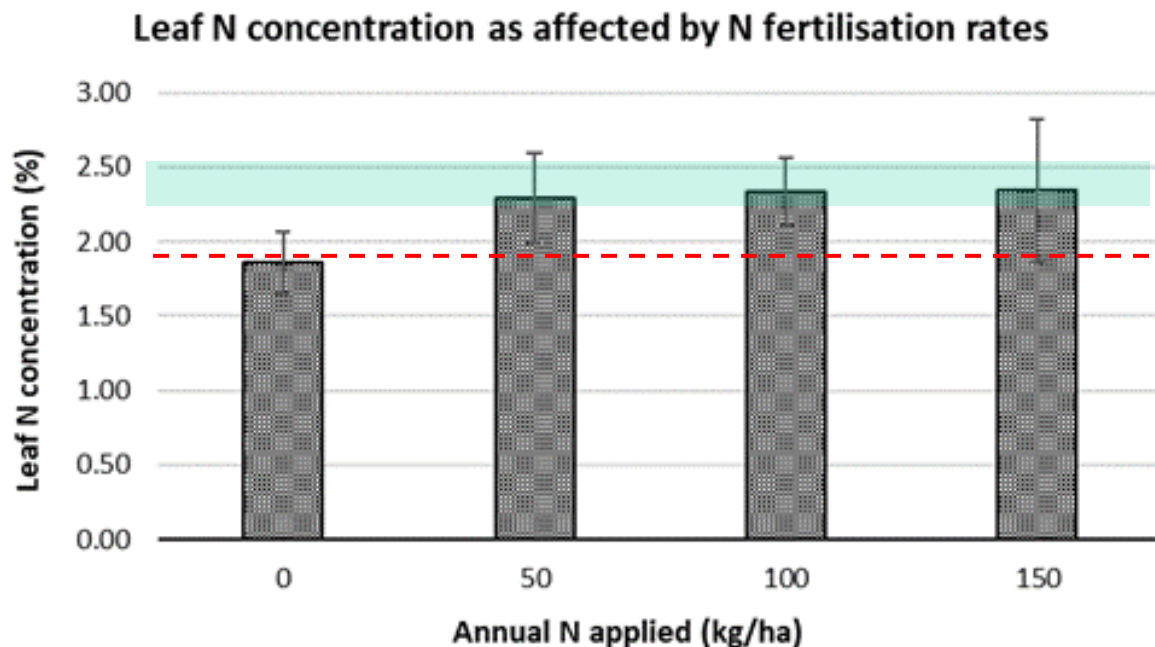
Seasonal changes in leaf P concentration of citrus as affected by fertilisation rates of 200% of the normally applied rate (control).





Seasonal changes in leaf K concentration of citrus as affected by fertilisation rates of 200% of the normally applied rate (control).





Nitrogen and K concentration of Nadorcott leaves sampled in March 2022 on mature (spring flush) shoots bearing terminal fruit – one year of total annual fertilisation received.

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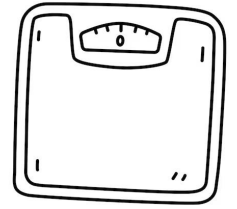
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Conclusions



Observations regarding citrus leaf nutrient concentrations:

-  Beware of sample variation – don't make much of fine-tuning to norms
-  As little as 50 kg N/ha was sufficient to raise the leaf N concentration above the minimum norm – additional N did not raise the leaf N concentration further
-  Soil with clay, and $K > 120$ mg/kg, neither zero nor 150 kg K/ha resulted in different foliar K concentrations

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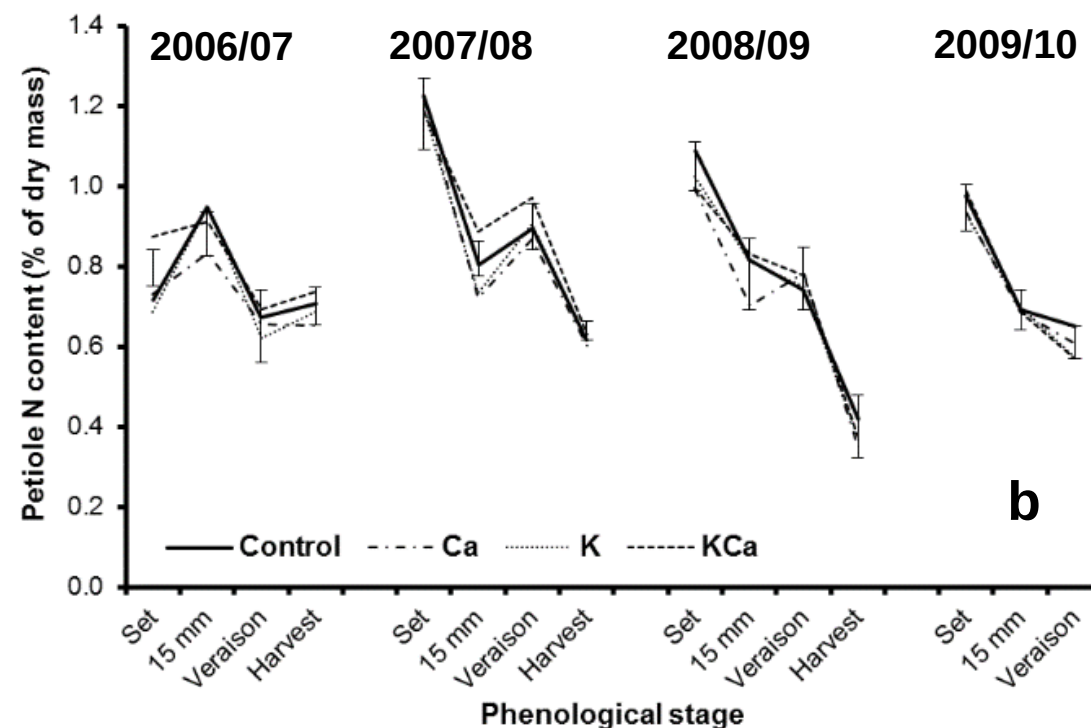
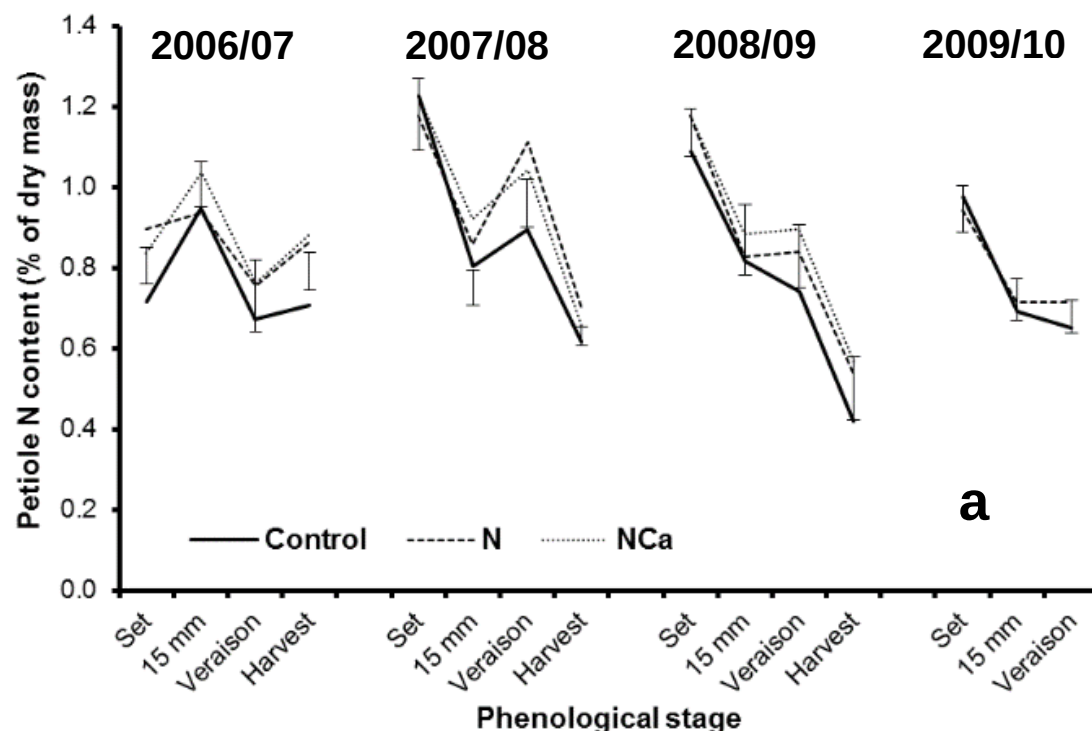
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Petiole N concentrations of Prime Seedless vines on a sandy soil in Paarl as (a) affected by excessive fertilisation with N containing fertilisers and (b) excessive fertilisation with Ca and K respectively, or in combination.

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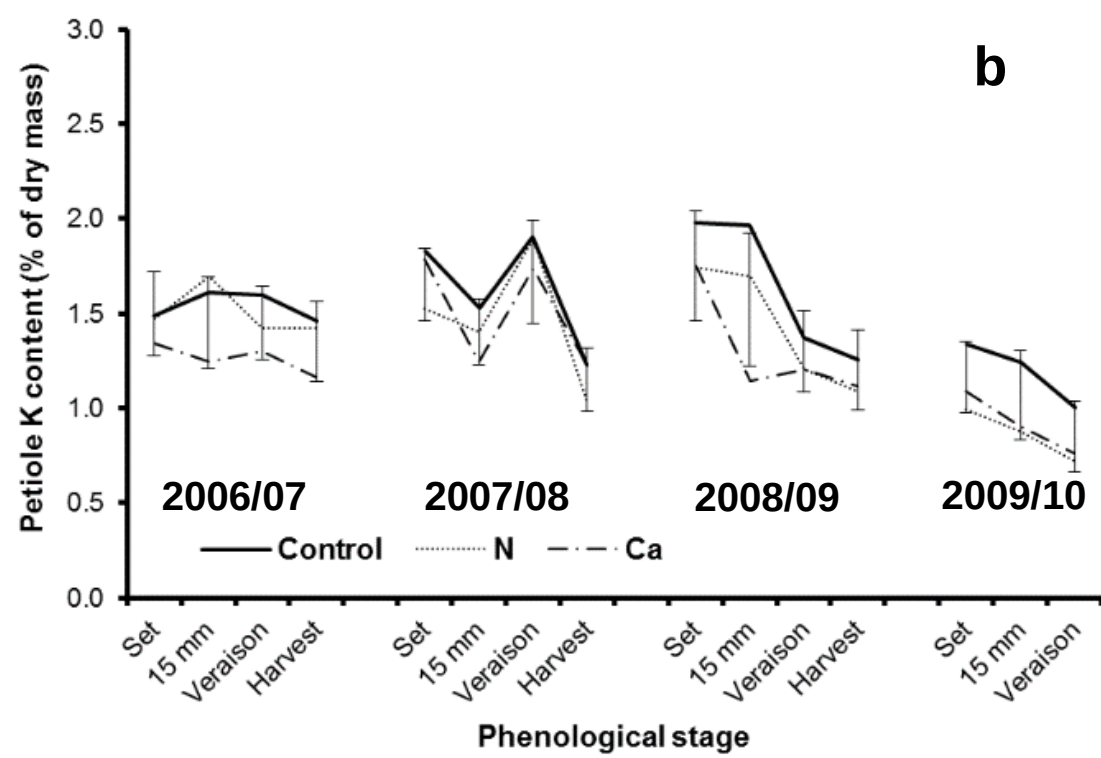
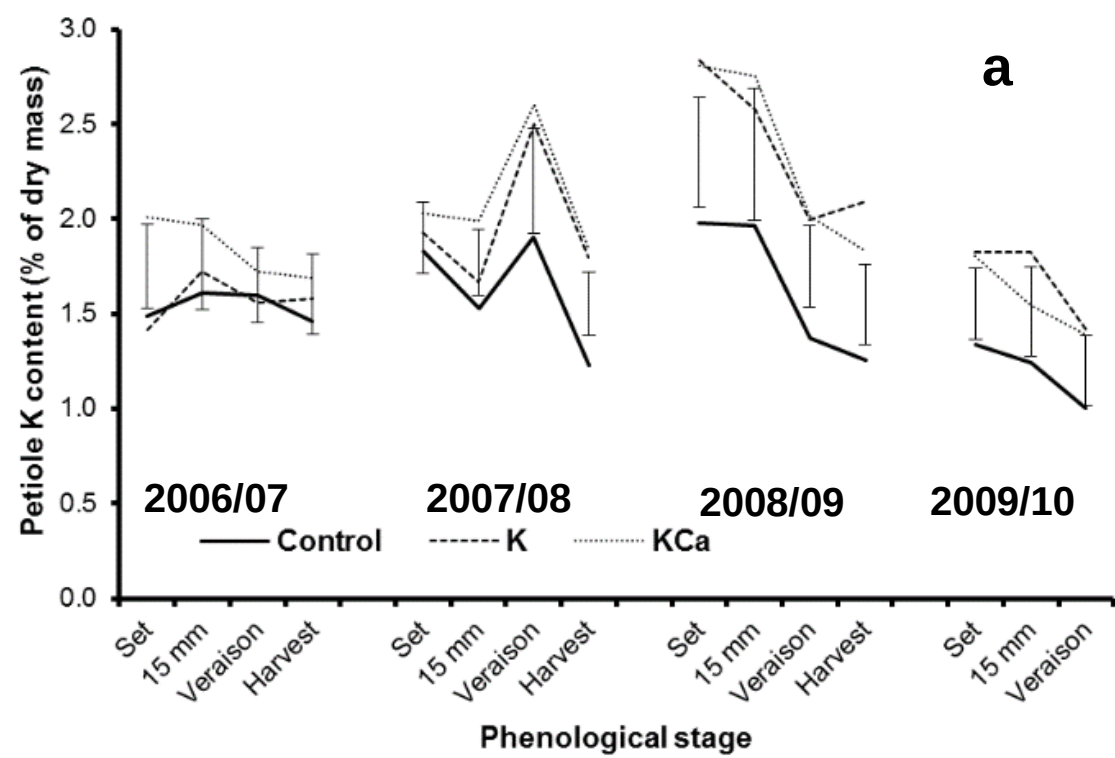
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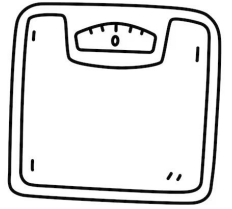


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Petiole K concentrations of Prime Seedless vines grown on a sandy soil in Paarl as (a) affected by excessive fertilisation with K containing fertilisers and (b) excessive fertilisation with N and Ca respectively.

Conclusions



Observations regarding grape leaf nutrient concentrations:

-  N only starts reflecting in the petioles from 155 mm berry size onwards
-  K starts reflecting in the petioles already from set
-  Whereas N nutrition is not much affected by K and Ca, the uptake of K is strongly affected by excessive N and especially Ca.

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3. Effects of washing of citrus leaf samples on nutrient concentration (Labanauskas, 1966)

Nutrient	Unwashed	Detergent wash	Detergent/acid wash
N (%)	2,53	2,56	2,55
P (%)	0,15	0,15	0,15
K(%)	1,07	1,08	1,07
Ca (%)	3,97	3,97	3,96
Mg (%)	0,42	0,41	0,42
Na (%)	0,061	0,066	0,065
Cu (mg/kg)	5,6	5,1	5,0
Zn (mg/kg)	123	68	65
Mn (mg/kg)	182	94	92
Fe (mg/kg)	186	61	61
B (mg/kg)	367	368	369

**Even a bathroom
scale's value
is determined by
the user's wisdom
to interpret the
measurement
in context**



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Thank You • Dankie

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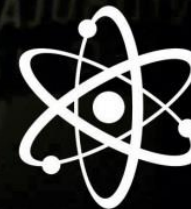
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