HORTGRO
Growing Fruit IQ

Technical Symposium 2026

Rest-breaking alternatives for apple and pear production

Chad van Wyk | Provar

Can hydrogen cyanamide and mineral oil be replaced?

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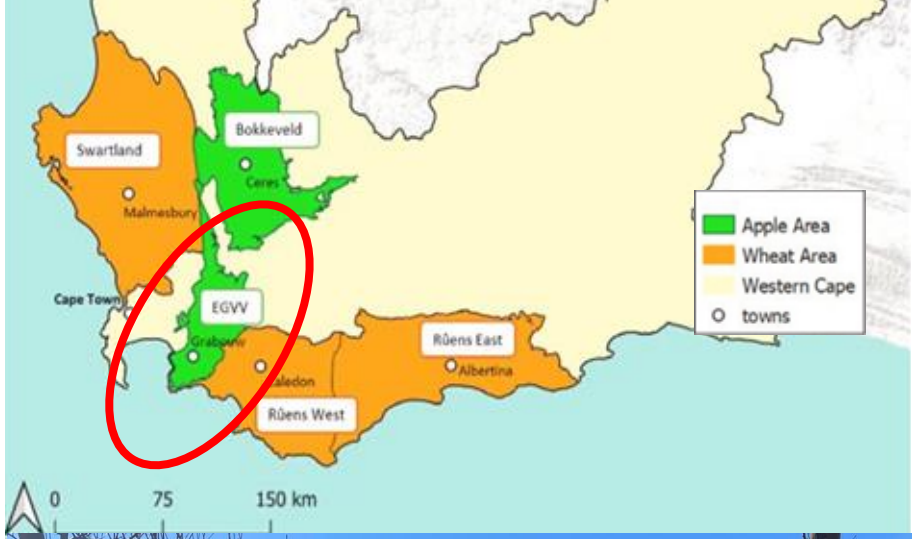
Introduction

- Chilling requirement (CR)
  - Amount of cold necessary for cv. to break rest after winter
  - Insufficient cold = delayed foliation
    - Reduced, delayed and protracted budbreak
    - Basal dominant tree architecture
    - Reduced yield and fruit quality

In South Africa:

- Marginal chill — EGVV region (<1000 Utah Chill Units)
- Rely on chemical rest breaking agents
  - ➢ Hydrogen Cyanamide (HC)
  - ➢ Mineral oil (MO)

At risk of regulatory withdrawal



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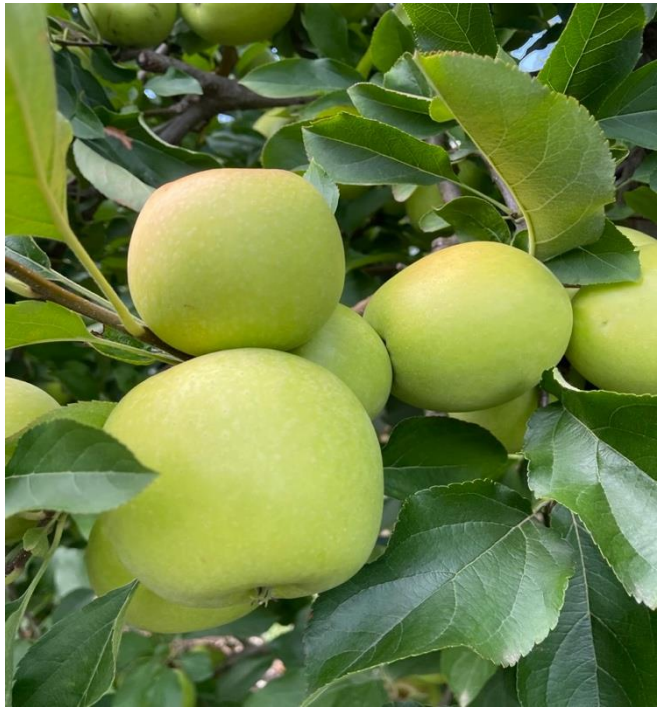
Plant Material and Site Description

- EGVV region; Grabouw
- 670-870 Utah Chilling Units (UCU) (Hortgro, 2019-2022)



‘Golden Delicious’
- Eikenhof farm
- 1000-1200 UCU

(Erez, 2000; Finetto, 2014)

‘Cripps Red’
- Molteno farm
- 976 UCU

(Parkes *et al*, 2020)

‘Packham’s Triumph’
- Applegarth farm
- 750+ hours below 7 °C

(Kretzschmar *et al*, 2011)

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What did we evaluate?

Chemicals:

• Hydrogen cyanamide (HC) [Dormex®] • Mineral oil (MO) [Ampron]		
• Potassium Nitrate (KNO_3) • Ammonium Nitrate (NH_4NO_3)	Nitrogen products	Alternatives
• Vegetable oil [MProve oil™]	Mineral Oil Alternative	
• Seaweed extract [BIOCEL™] • Aminex®	Biostimulants	

Rest breaking: Treatment Design

Cv.	'Golden Delicious'		'Cripps Red' and 'Packham's Triumph'	
Tr.	1st application	2nd application	1st application	2nd application
T1	1% + 3% MO	0	0.5% HC +3% MO	0
T2	3% HC	0.5% HC + 3% MO	2% HC	0.25% HC + 3% MO
T3	3% HC	3% VO + 3% KNO_3	2% HC	2% VO + 3% KNO_3
T4	3% HC	3% VO + 1.5% NH_4NO_3	2% HC	2% VO+ 1.5% NH_4NO_3
T5	3% HC	3% VO + Biostimulants	2% HC	2% VO + Biostimulants
T6	0	0.5% HC + 3% MO	0	0.25% HC + 3% MO
T7	0	3% VO +3% KNO_3	0	2% VO+ 3% KNO_3
T8	0	3% VO + 1.5% NH_4NO_3	0	2% VO + 1.5% NH_4NO_3
T9	0	3% VO + Biostimulants	0	2% VO + Biostimulants
T10	0	1% HC + 3% MO	0	0.5% HC + 3% MO

HC = Dormex® (520 g/L hydrogen cyanamide)
MO = Mineral oil (Ampron®)
KNO_3 = Potassium nitrate
NH_4NO_3 = Ammonium nitrate
VO = MProve Oil™ (vegetable oil)
Biostimulants = 0.2% BIOCEL™ + 0.5% Aminex®

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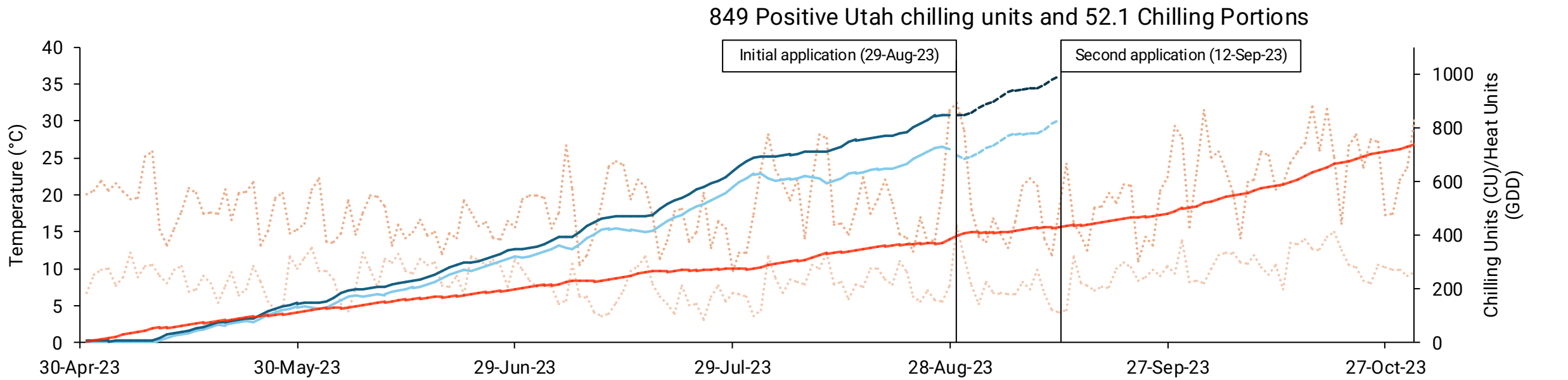
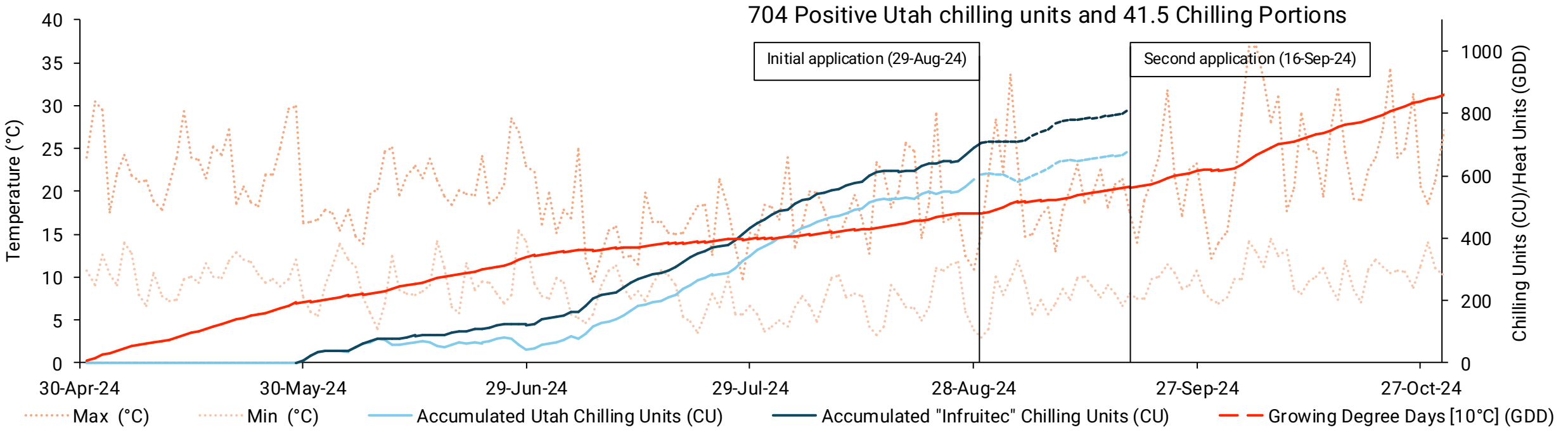

849 Positive Utah chilling units and 52.1 Chilling Portions
Initial application (29-Aug-23)
Second application (12-Sep-23)
Temperature (°C)
Chilling Units (CU)/Heat Units (GDD)
0
5
10
15
20
25
30
35
40
0
200
400
600
800
1000
30-Apr-23
30-May-23
29-Jun-23
29-Jul-23
28-Aug-23
27-Sep-23
27-Oct-23


704 Positive Utah chilling units and 41.5 Chilling Portions
Initial application (29-Aug-24)
Second application (16-Sep-24)
Temperature (°C)
Chilling Units (CU)/Heat Units (GDD)
0
5
10
15
20
25
30
35
40
0
200
400
600
800
1000
30-Apr-24
30-May-24
29-Jun-24
29-Jul-24
28-Aug-24
27-Sep-24
27-Oct-24
Max (°C)
Min (°C)
Accumulated Utah Chilling Units (CU)
Accumulated "Infruitec" Chilling Units (CU)
Growing Degree Days [10°C] (GDD)

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What was measured?

140 traits collected on 5 categories:

- Bud break
- Fruit set and yield
- Fruit quality and maturity etc.
- Vigour
- Return bloom

DA selected variables

Discriminant analysis identified 7 key treatment drivers

1. Total bud break
2. Day of full bloom
3. Start of vegetative bud break
4. Start of reproductive bud break
5. Return bloom (next season impact on yield)
6. Spur length
7. Shoot length

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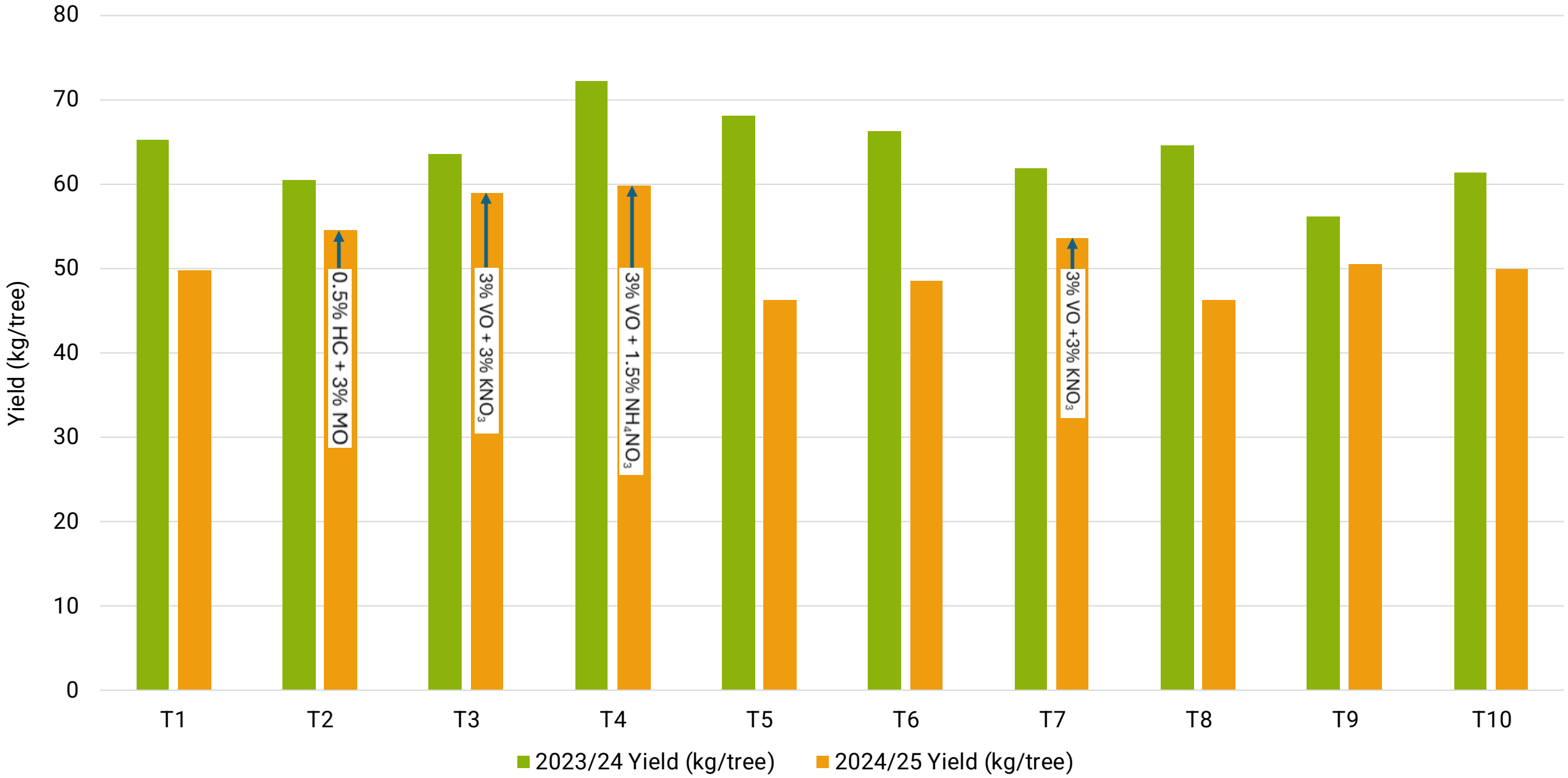
Golden Delicious



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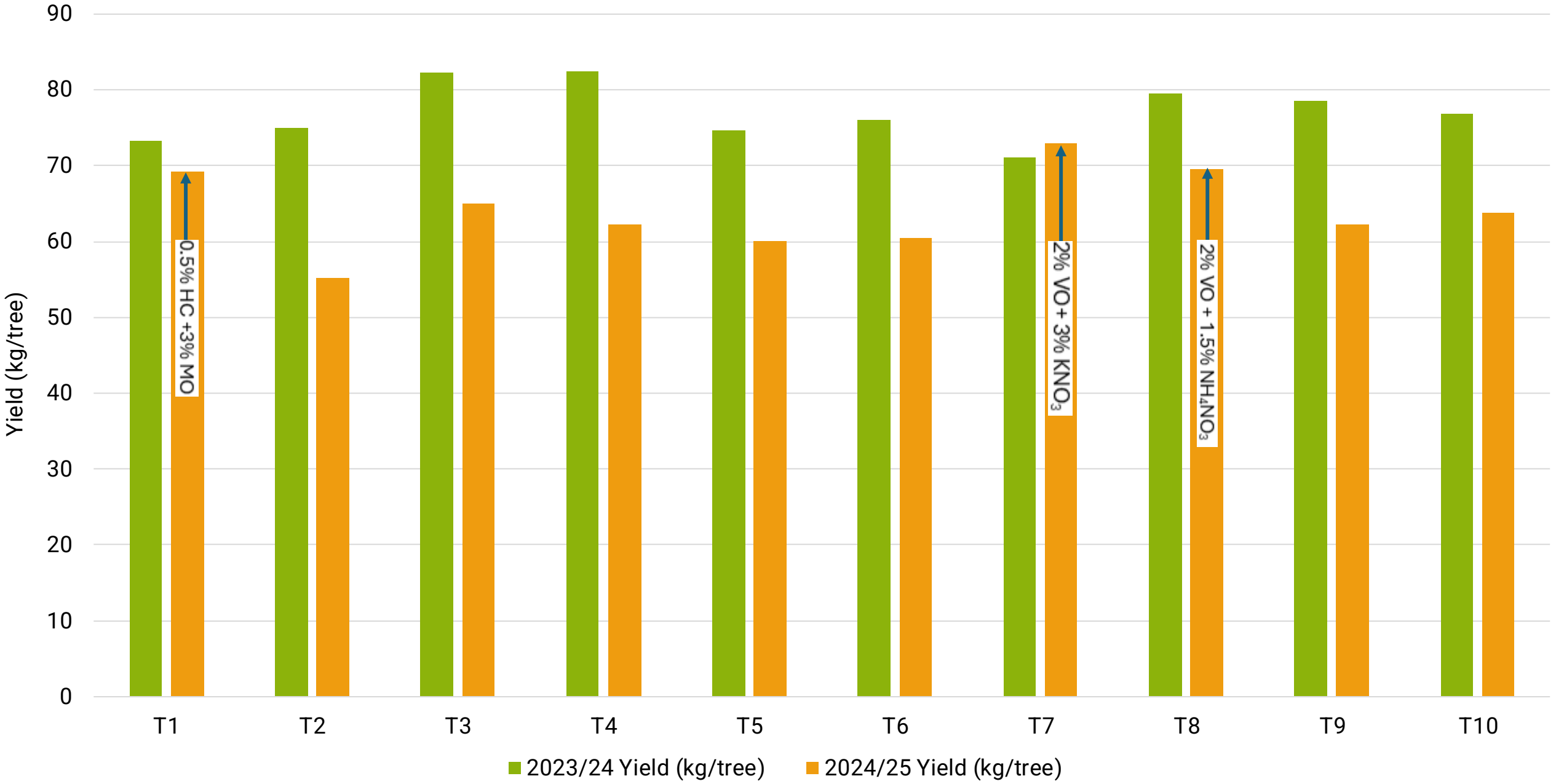
Cripps Red



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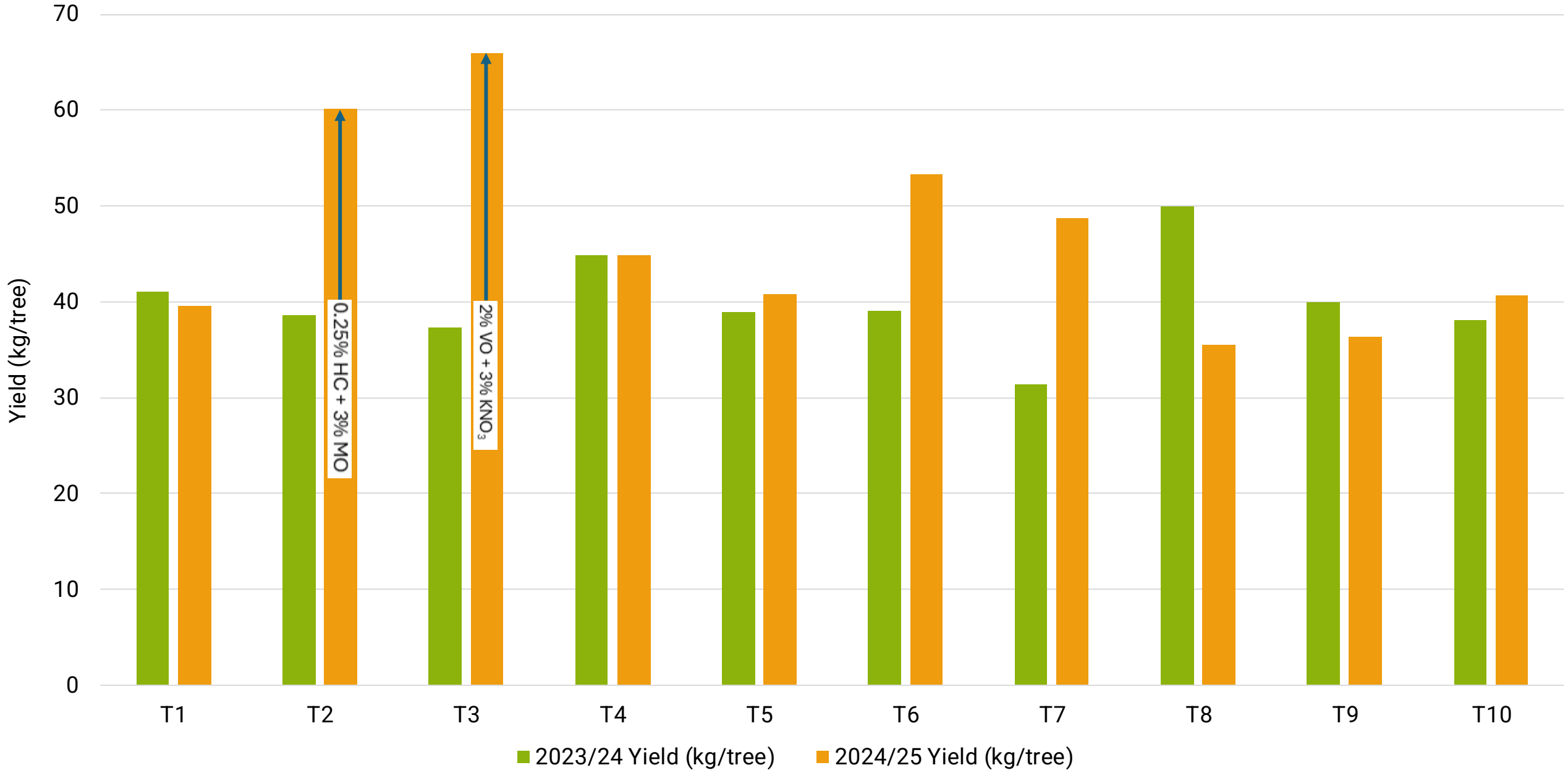
Packham's Triumph



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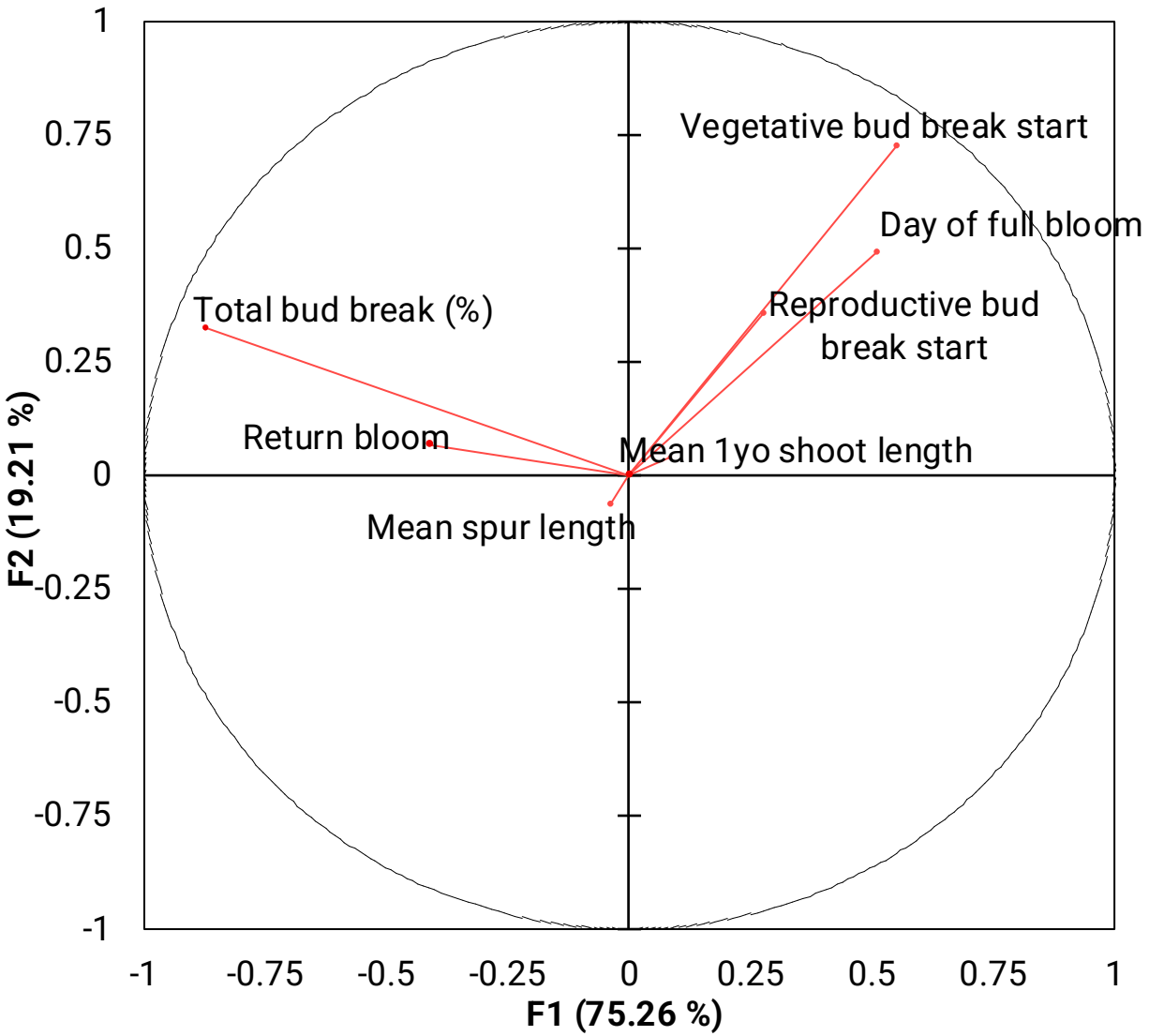
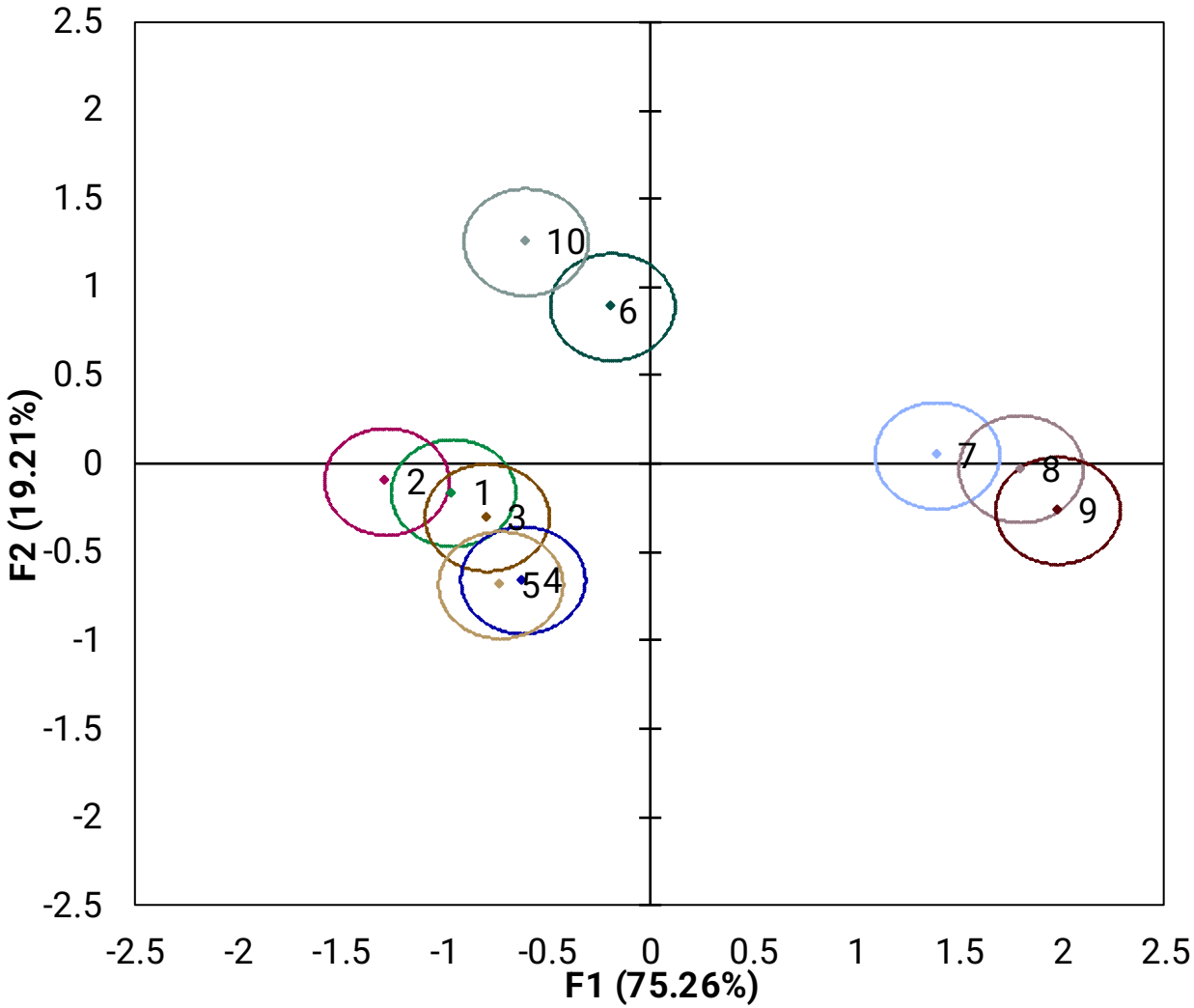
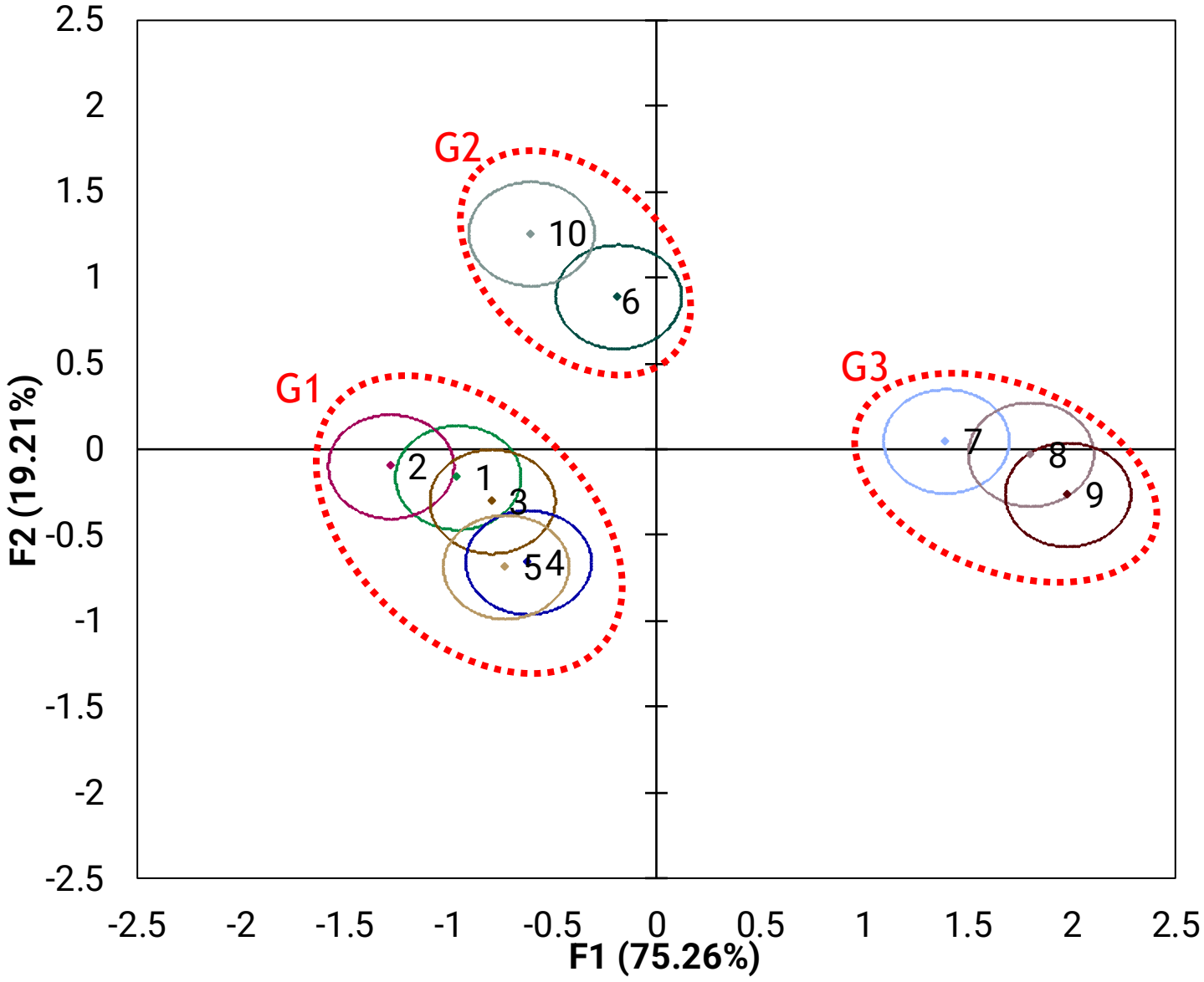

Vegetative bud break start
Day of full bloom
Reproductive bud break start
Total bud break (%)
Return bloom
Mean 1yo shoot length
Mean spur length
F2 (19.21 %)
F1 (75.26 %)
1
0.75
0.5
0.25
0
-0.25
-0.5
-0.75
-1
-1
-0.75
-0.5
-0.25
0
0.25
0.5
0.75
1


10
6
7
8
9
2
1
3
5
4
F2 (19.21%)
F1 (75.26%)
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
2.5



Group 1 (G1): Treatments including an initial HC application (T1-T5)

Group 2 (G2): Treatments including a single late application of HC + MO (T6 and T10)

Group 3 (G3): Single, later application of alternatives

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Treatment			Total bud break	Day of full bloom	Start of vegetative bud break	Start of reproductive bud break	Return bloom	Mean spur length	Mean 1yo shoot length
Nr.	**Initial application**	**Second application**							
T1	HC + MO	0	93 ± 0.5	98 ± 0.7	96 ± 0.8	96 ± 0.4	61 ± 3.6	46 ± 4.6	53 ± 4.3
T2	HC	Lower HC + MO	95 ± 0.7	97 ± 0.7	96 ± 0.9	95 ± 0.5	63 ± 4.3	47 ± 4.7	61 ± 5.4
T3	HC	VO + KNO_3	92 ± 1.4	97 ± 0.7	96 ± 0.8	95 ± 0.5	58 ± 2.7	52 ± 3.0	57 ± 4.2
T4	HC	VO + NH_4NO_3	91 ± 1.3	97 ± 0.7	96 ± 1.1	95 ± 0.5	60 ± 4.5	55 ± 3.0	62 ± 6.3
T5	HC	VO + Biostimulants	92 ± 0.9	97 ± 0.7	96 ± 1.0	95 ± 0.6	63 ± 4.3	58 ± 3.0	55 ± 4.9
T6	0	Lower HC + MO	93 ± 1.0	99 ± 0.3	98 ± 0.4	96 ± 0.8	58 ± 4.2	49 ± 2.6	60 ± 3.4
T7	0	VO + KNO_3	84 ± 2.6	99 ± 0.3	98 ± 0.3	96 ± 0.7	53 ± 4.1	50 ± 2.4	60 ± 4.8
T8	0	VO + NH_4NO_3	82 ± 2.7	99 ± 0.2	98 ± 0.3	97 ± 0.6	46 ± 3.1	51 ± 4.3	63 ± 5.0
T9	0	VO + Biostimulants	81 ± 3.5	99 ± 0.2	98 ± 0.4	96 ± 0.9	49 ± 4.1	48 ± 2.7	59 ± 4.7
T10	0	HC + MO	95 ± 1.2	99 ± 0.3	98 ± 0.3	96 ± 0.9	64 ± 4.1	54 ± 4.8	59 ± 5.0
Treatment groups according to centroids (Fig. 1)			**Mean ± SE**	**Mean ± SE**	**Mean ± SE**	**Mean ± SE**	**Mean ± SE**	**Mean ± SE**	**Mean ± SE**
G1	Initial application containing HC (T1-T5)		93 ± 0.7	97 ± 0.1	96 ± 0.1	95 ± 0.1	61 ± 1	51 ± 2.3	58 ± 1.7
G2	Later application of HC + MO (T6, T10)		94 ± 1.1	99 ± 0.0	98 ± 0.1	96 ± 0.1	61 ± 2.9	51 ± 2.1	59 ± 0.3
G3	**Later application of alternatives only (T7-T9)**		**82 ± 0.7**	**99 ± 0.1**	**98 ± 0.0**	**96 ± 0.1**	**49 ± 2.2**	**50 ± 0.9**	**61 ± 1.3**
Combined treatment groupings (G)			**Mean ± SE**	**Mean ± SE**	**Mean ± SE**	**Mean ± SE**	**Mean ± SE**	**Mean ± SE**	**Mean ± SE**
G1&2	HC containing treatments (T1-T5, T6, T10)		93 ± 0.6	98 ± 0.2	97 ± 0.4	95 ± 0.2	61 ± 0.9	51 ± 1.6	58 ± 1.2
G2&3	Late/second applications (T6-T10)		87 ± 2.9	99 ± 0.1	98 ± 0.0	96 ± 0.1	54 ± 3.1	50 ± 0.9	60 ± 0.5

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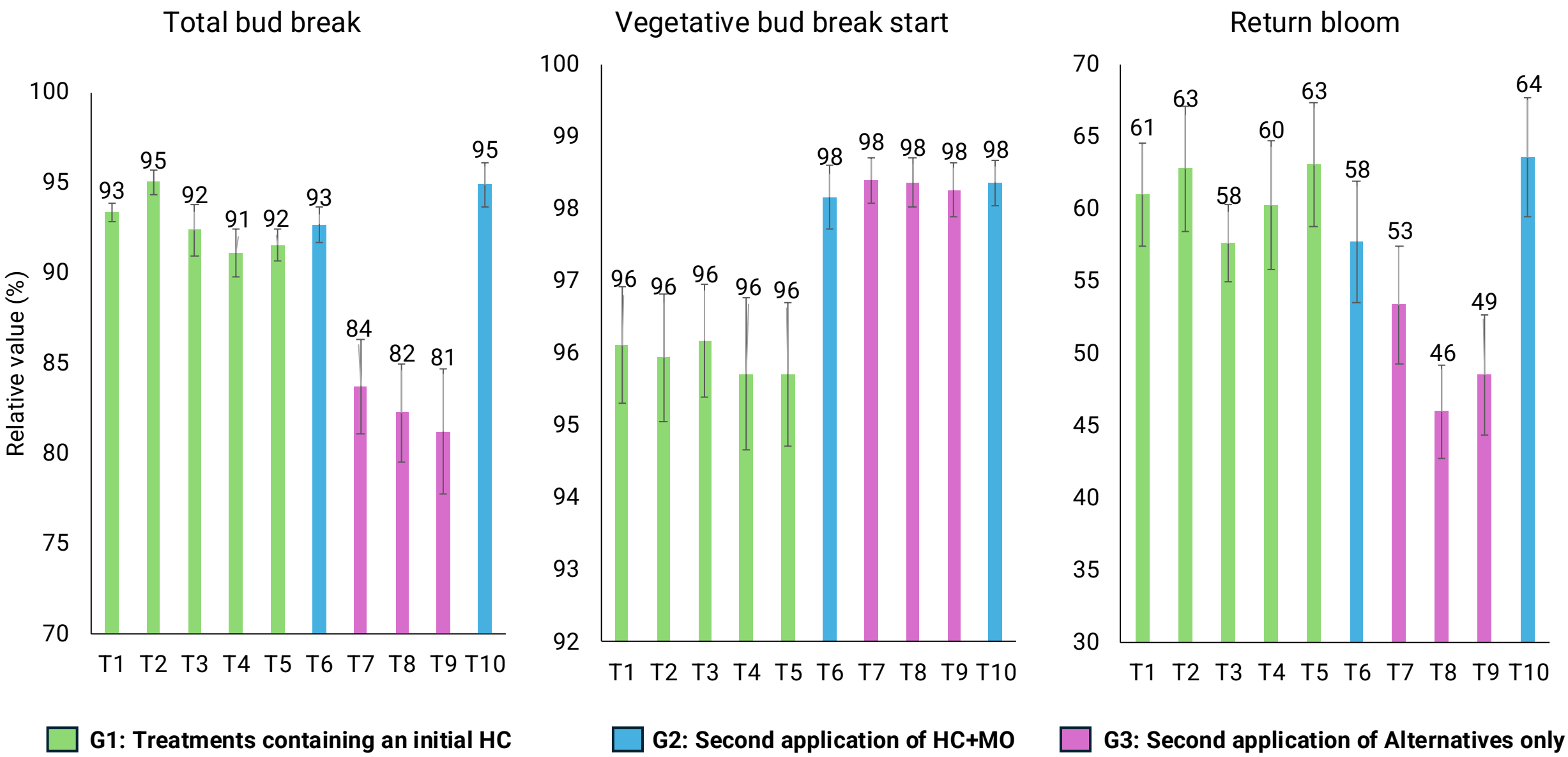

G1: Treatments containing an initial HC application

G2: Second application of HC+MO

G3: Second application of Alternatives only

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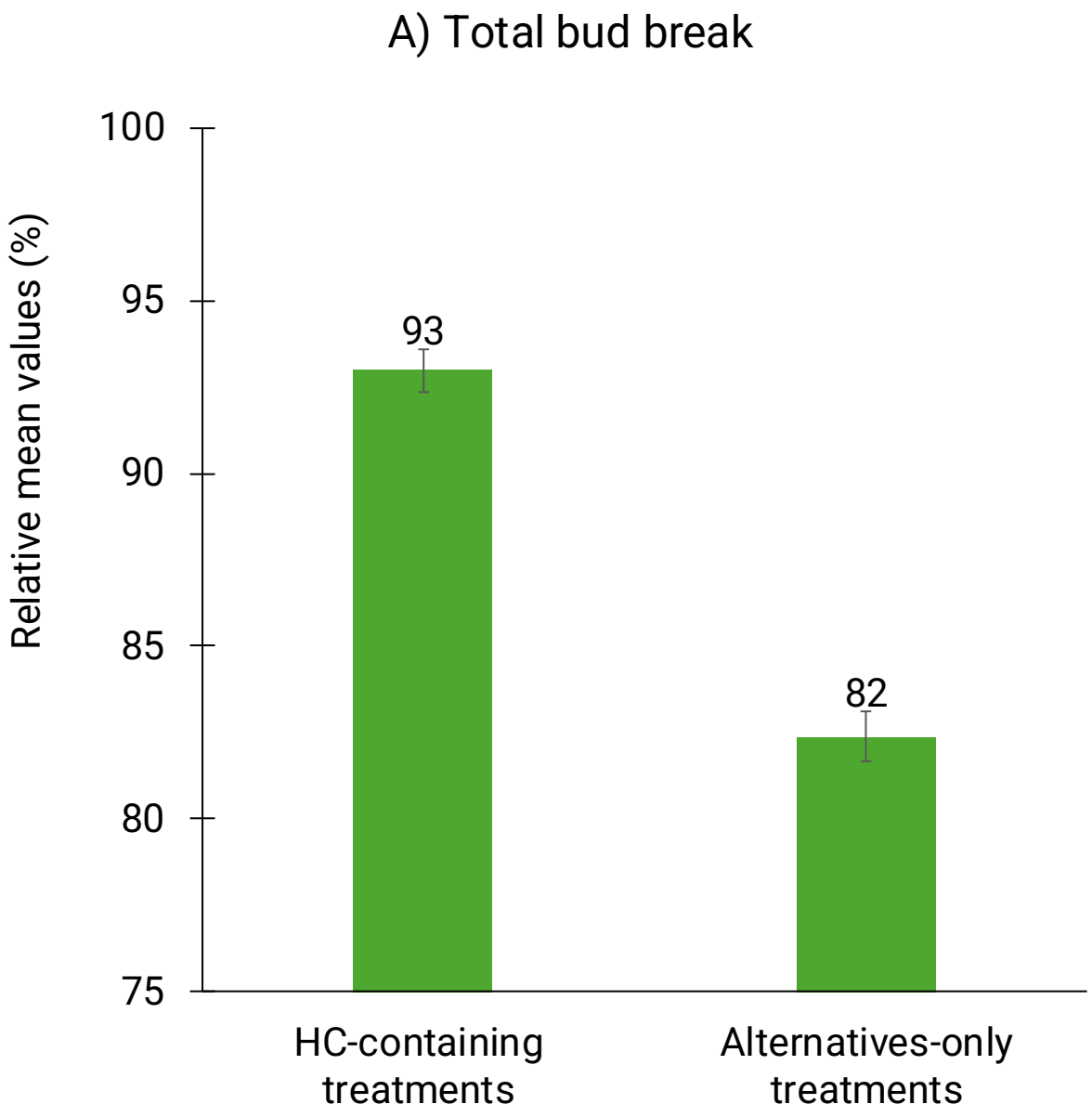
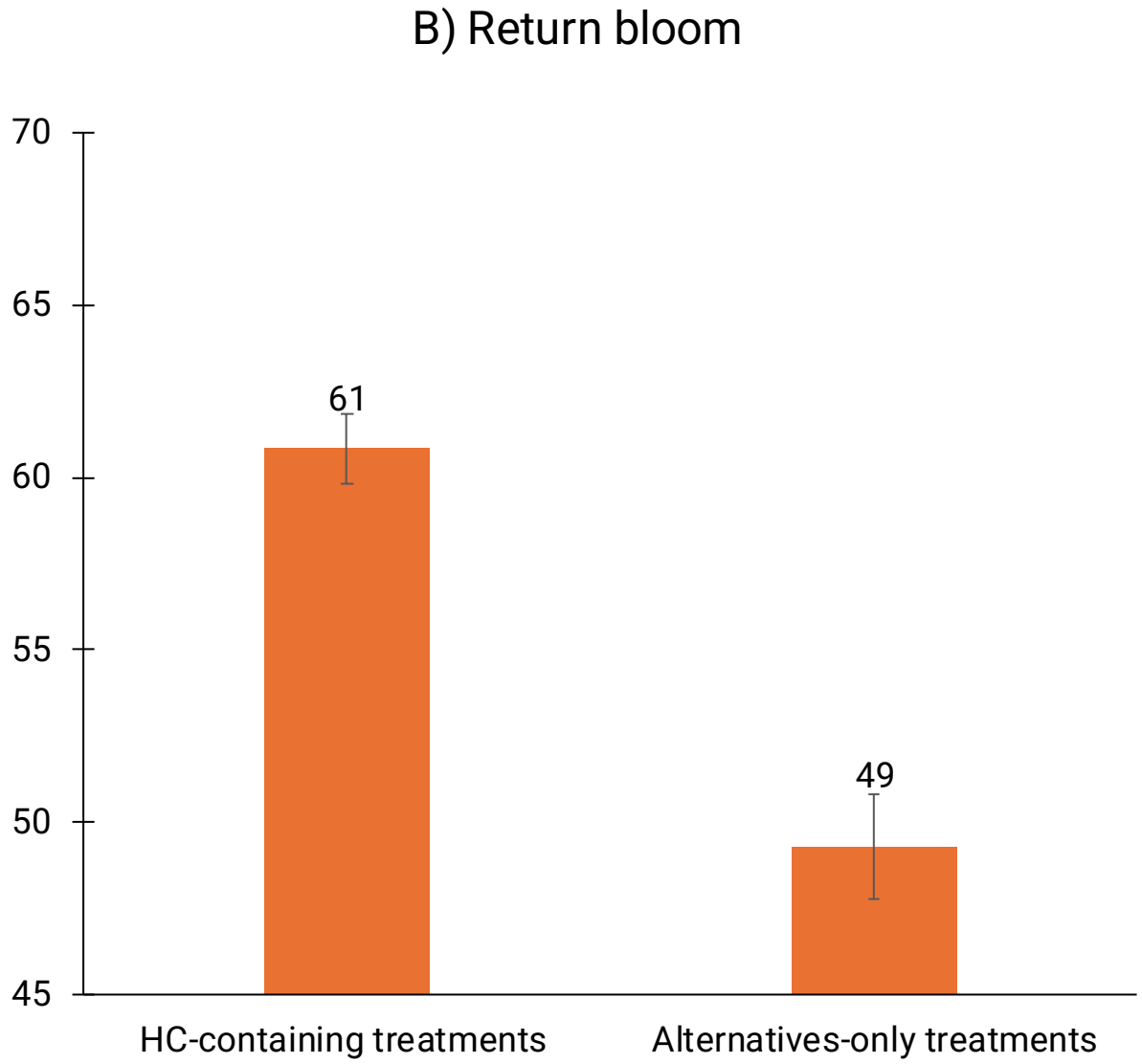

A) Total bud break
Relative mean values (%)
100
95
90
85
80
75
93
82
HC-containing treatments
Alternatives-only treatments


B) Return bloom
70
65
60
55
50
45
61
49
HC-containing treatments
Alternatives-only treatments

What was found in this trial?

Hydrogen cyanamide remains the most effective driver of vegetative bud break and return bloom

- +11% higher total bud break
- +12% higher return bloom

Expect reduced bud break and return bloom, especially in warm winters

Seasonal effect and climate change

Mineral oil may not be critical – VO looks promising but needs more testing

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What was found in this trial?

No HC? – alternatives show some promise with Cripps Red and Packham's Triumph

Golden Delicious showed the largest treatment differences = highest chill cultivar in the trial

Packham's had the smallest treatment differences

Vegetative bud break is more responsive than reproductive bud break

Busy with stone fruit trials – Laetitia, Angeleno & Songold

HC remains our best option – new trials to test rest breaking programs vs HC

Research Team and Acknowledgements

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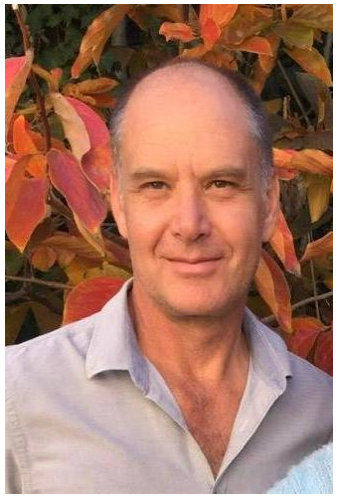

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