

Phenological studies of *Protea cynaroides* (L.) 'Arctic Ice' following a synchronising winter pruning regime

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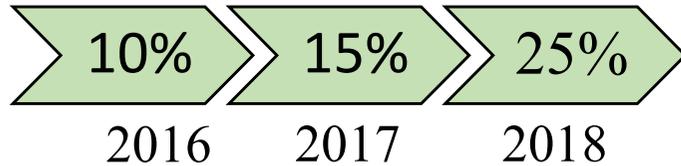


Ayoba® Arctic Ice



○ Production

Ayoba® Arctic Ice's contribution to *P. cynaroides* RSA exports



(O'Brien, 2019; Viljoen, 2019)

○ Rationale

- **Profitability** = plants/ha × quality long & straight stem product

(Nieuwoudt and Jacobs, 2010)

- **Production:** Autumn: Apr–May and Spring: Oct–Nov

(O'Brien, 2019)



○ Previous Research

- **Pruning:** synchronicity, advance flowering time, stem length

(Greenfield et al., 1994; Gerber et al., 1995; Hettasch et al., 1997)

- **Production system:** time of prune = annual or biennial

(Hettasch et al., 1997; Vivier, 2013)

- **Plasticity in genetics** for ‘open flowering window’ variants

(Greenfield, 1994; Jacobs, 2010; Malan and le Roux, 1995)

AIM: The effect of winter pruning on the regrowth phenology and flowering of *P. cynaroides* cv. Arctic Ice.

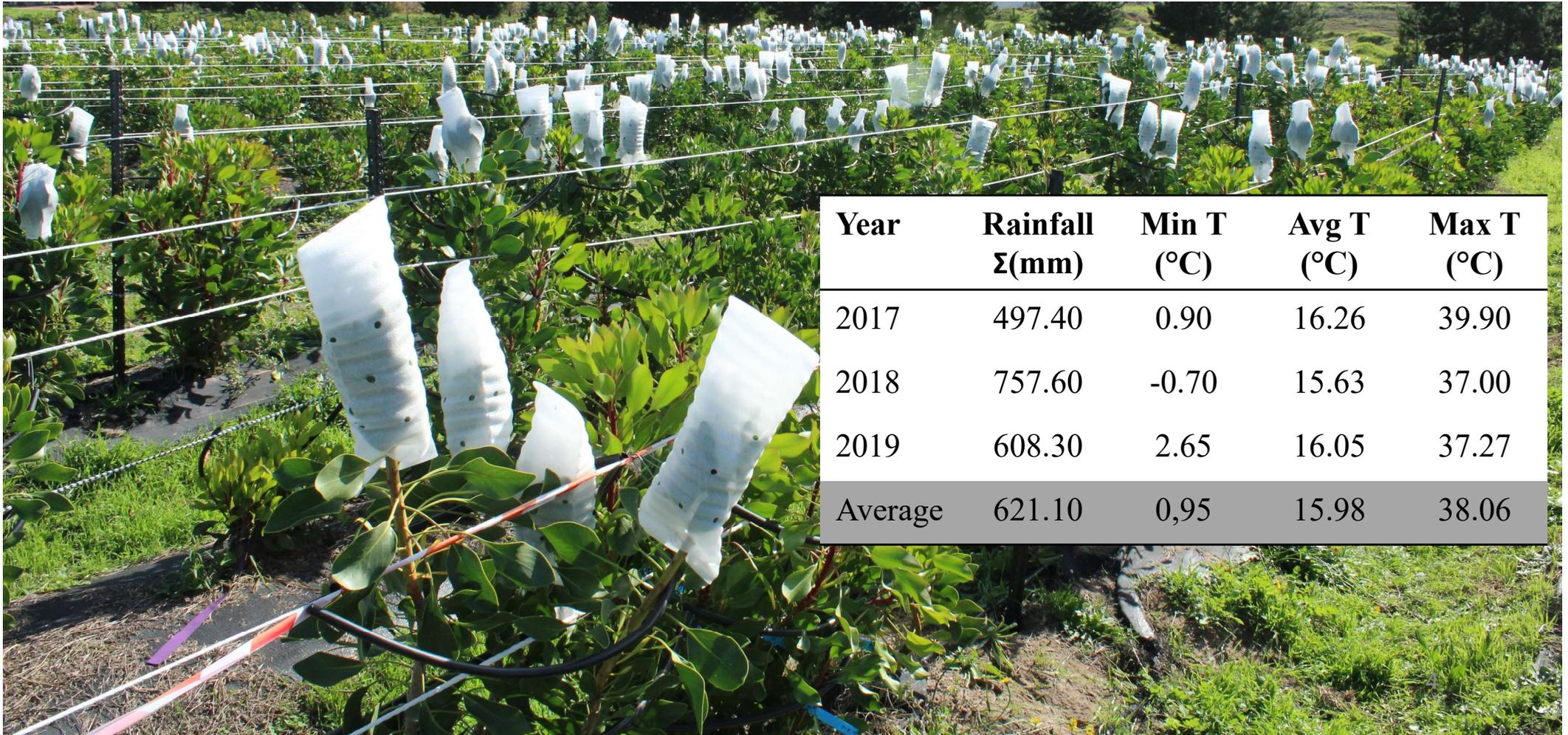
IMPLICATION: Intelligence on crop phenology serve as resource for location specific management of ‘Arctic Ice’.

Materials and Methods

Experimental site and plant material

Pomona Farm, Piket-Bo-Berg, Western Cape, South Africa

2015 established commercial 'Arctic Ice' orchard



Year	Rainfall Σ (mm)	Min T (°C)	Avg T (°C)	Max T (°C)
2017	497.40	0.90	16.26	39.90
2018	757.60	-0.70	15.63	37.00
2019	608.30	2.65	16.05	37.27
Average	621.10	0,95	15.98	38.06

Materials and Methods

Pruning Trial

July 2017 (winter): Two year old plants cut back to bearers RCBD Expt. Design

March 2018: 12 Shoots per plant tagged on the second flush

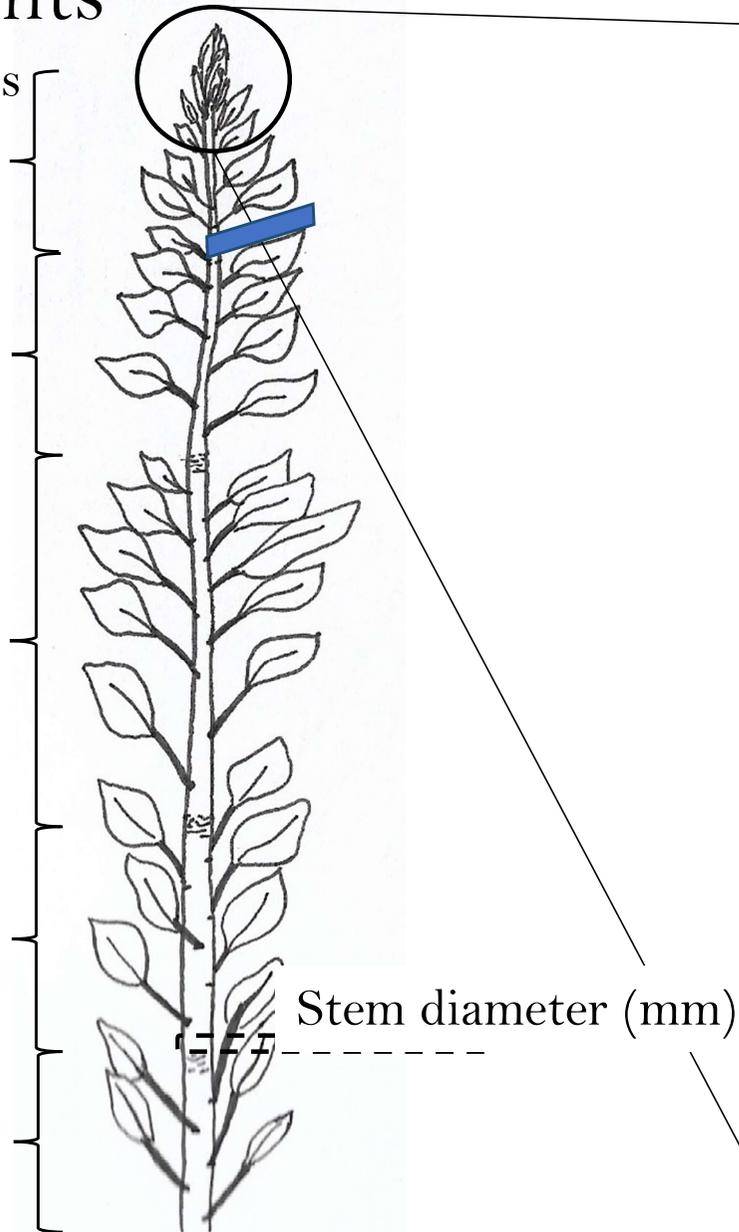


Materials and Methods

Measurements

2 - 4 week intervals

The number of flushes per shoot



Apical growth point activity



Greenpoint

Elongating



Hardening off

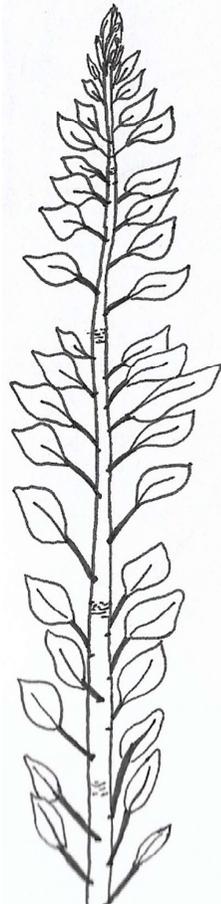
Dormant

Materials and Methods

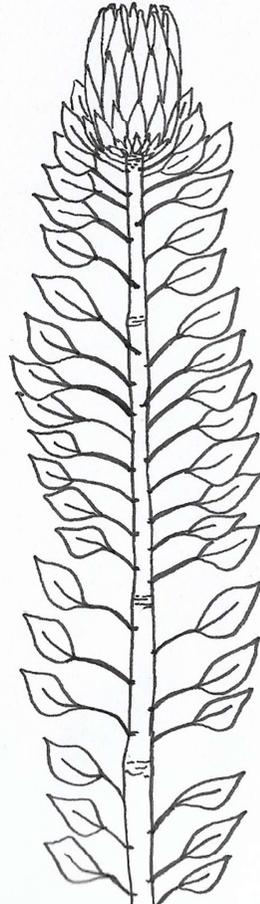
Measurements

Flowering outcomes

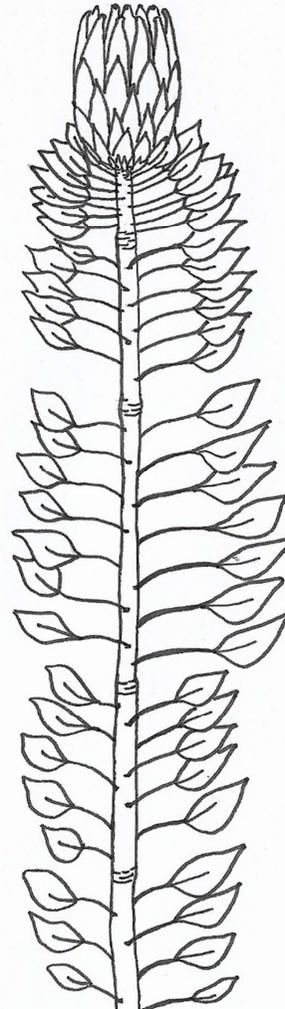
Non-flowering
shoots



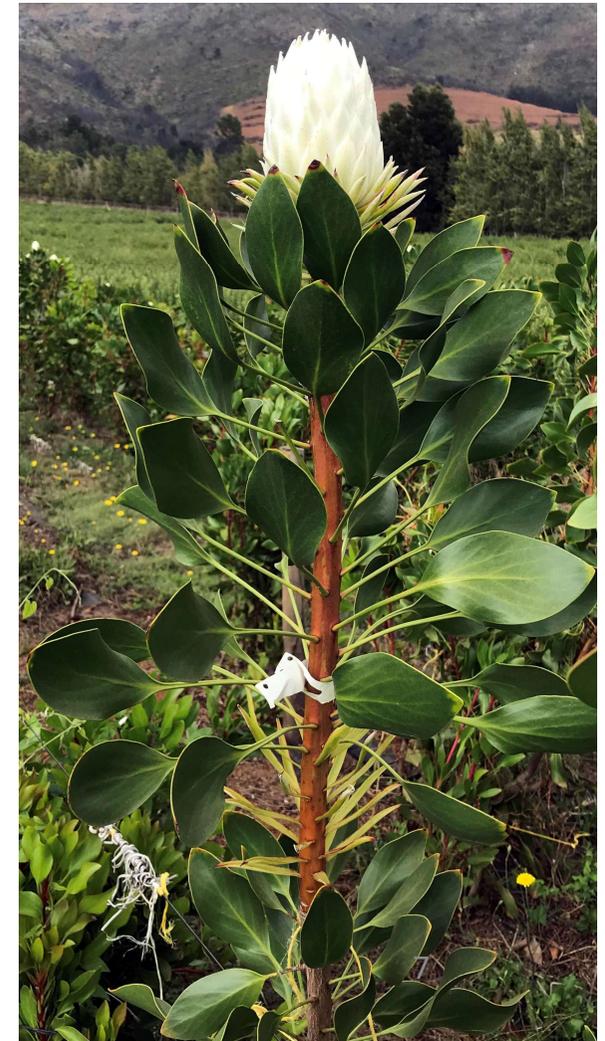
Four flush
flowering shoots



Five flush
flowering shoots



Harvest Date
for each tagged stem



Materials and Methods

Predictive Data Mining

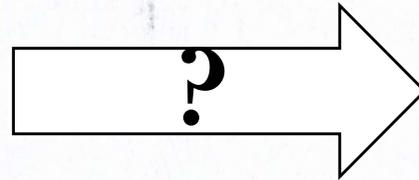
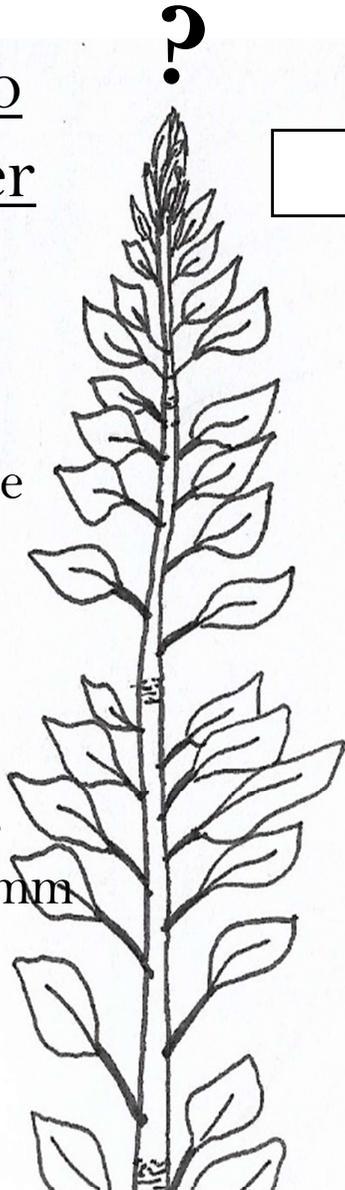
1. Likelihood to produce a flower

Input variables:

- Flowering outcome
- Shoot diameter
- Flush count

Prediction variables:

- 3, 4, 5 flush shoots
- Shoot diam. 1–30 mm



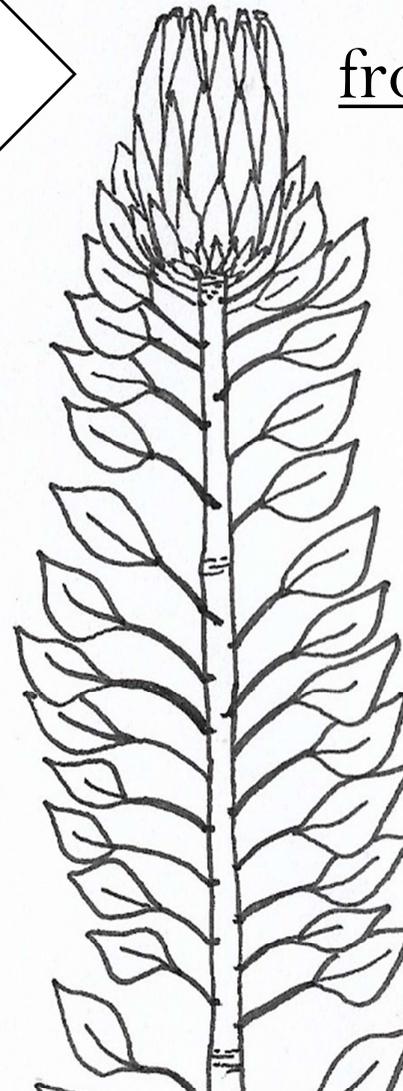
2. Estimated time from prune to harvest

Input variables:

- Days prune to harvest
- Shoot diameter
- Flush count

Prediction variables:

- 4, 5 flush shoots
- Shoot diam. 1–30 mm



Materials and Methods

Statistical Analysis

Statistica® software 13.5.0

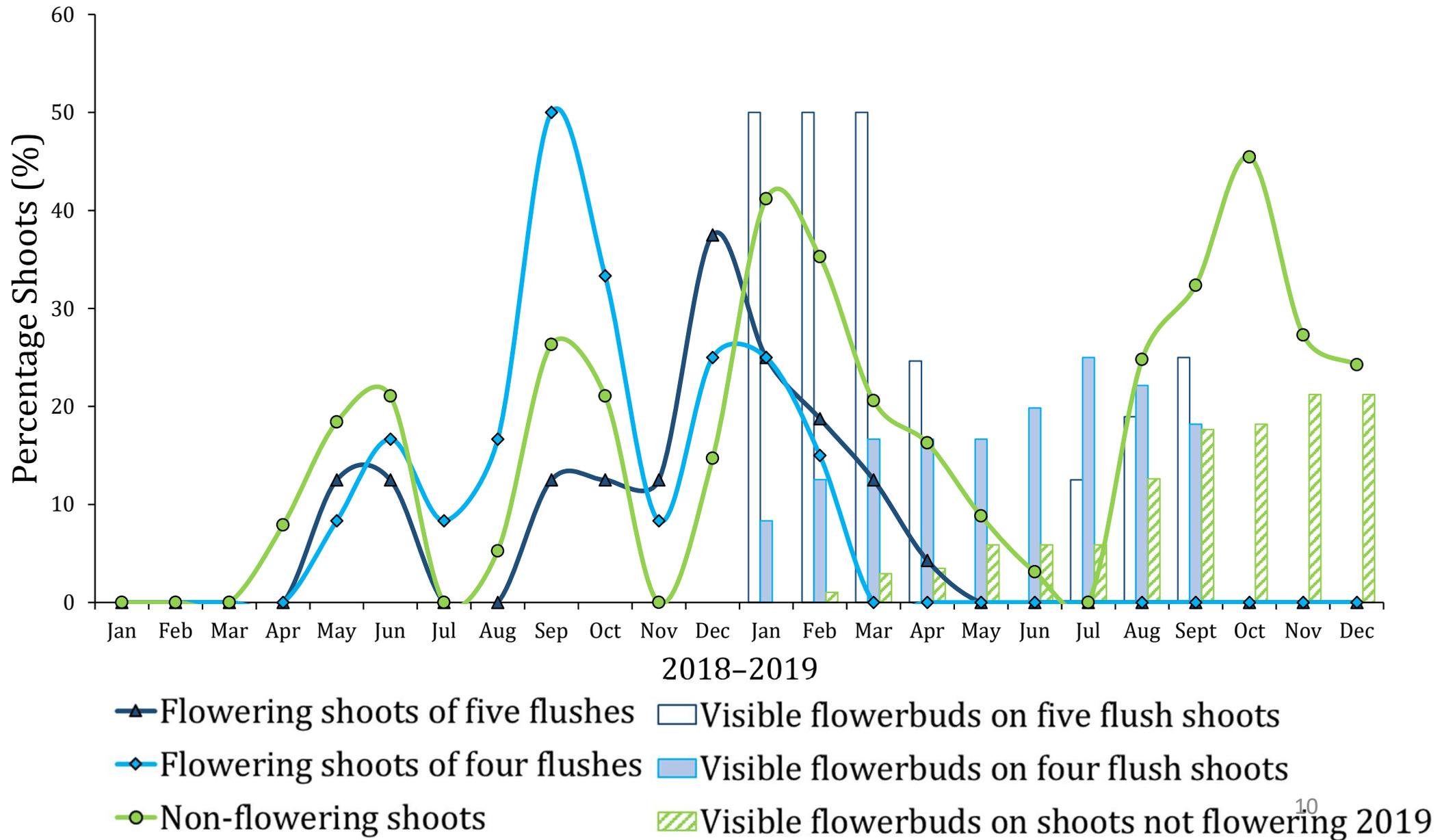
(TIBCO Statistica® 13.5.0, 2018)

- Two-way repeated measures ANOVA (**RANOVA**): stem diameter increase
- **ANOVA**: harvest data
- **Predictive Data Mining and Deployment for a Continuous Output Variable**
- Means were separated at $p < 5\%$ (Fisher's LSD test)



Results

Flushing phenology of pruned 'Arctic Ice'



Results

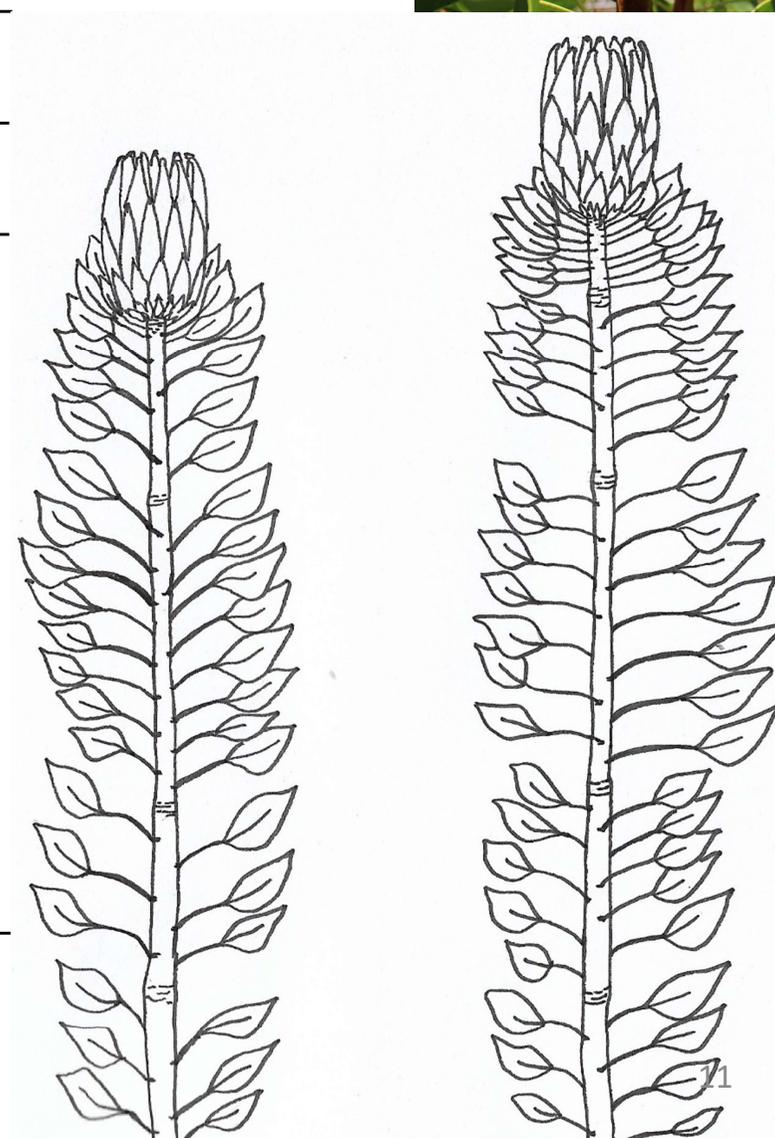
Flushing phenology of pruned 'Arctic Ice'



Individual Flushes ^a	Mean length±SE (cm)	
	Four flush flowering shoot	Five flush flowering shoot
1: Spring/summer	22.8±0.38	22.0±0.31
2: Autumn	22.8±0.33	23.9±0.53
3: Spring	41.6±1.02	35.9±1.18
4: Summer	32.7±0.80	32.0±1.24
5: Summer	n.a ^b	18.1±0.95
Mean shoot length	119.9±1.35	113.8±2.35

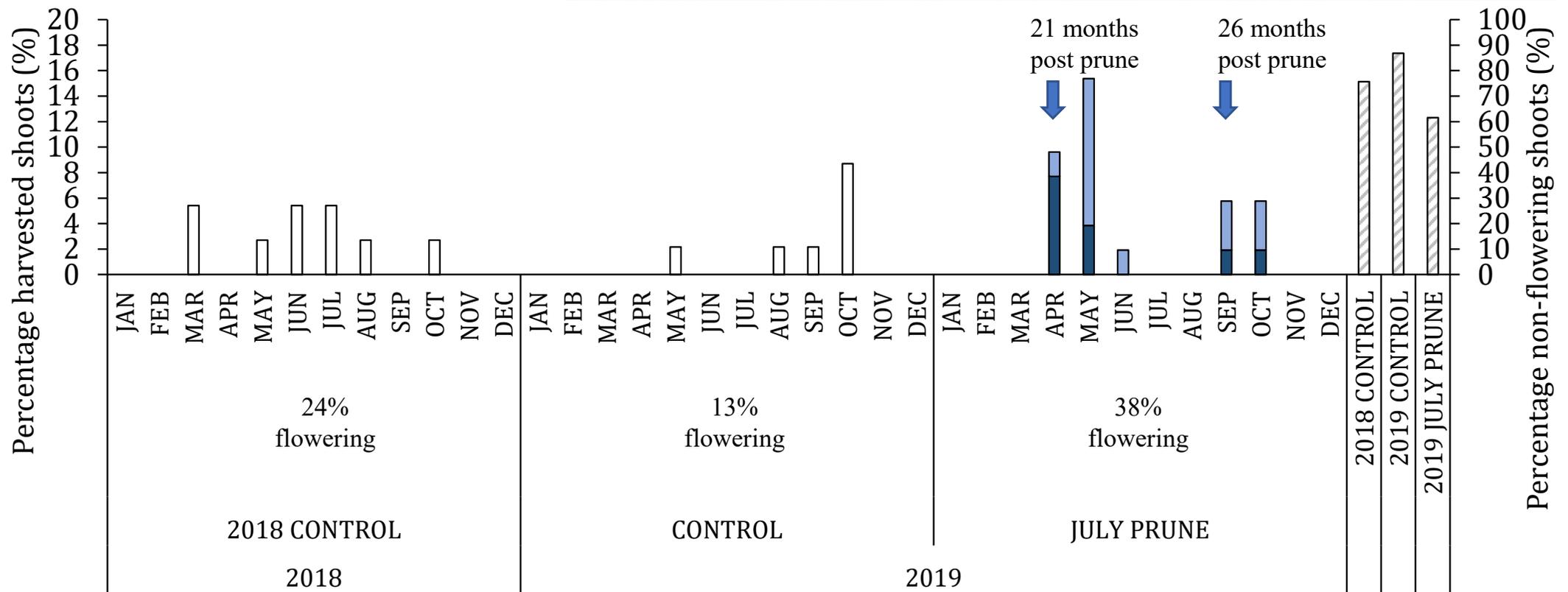
^aCounted from bearers; proximally to distally

^bnot applicable



Results

Harvest data

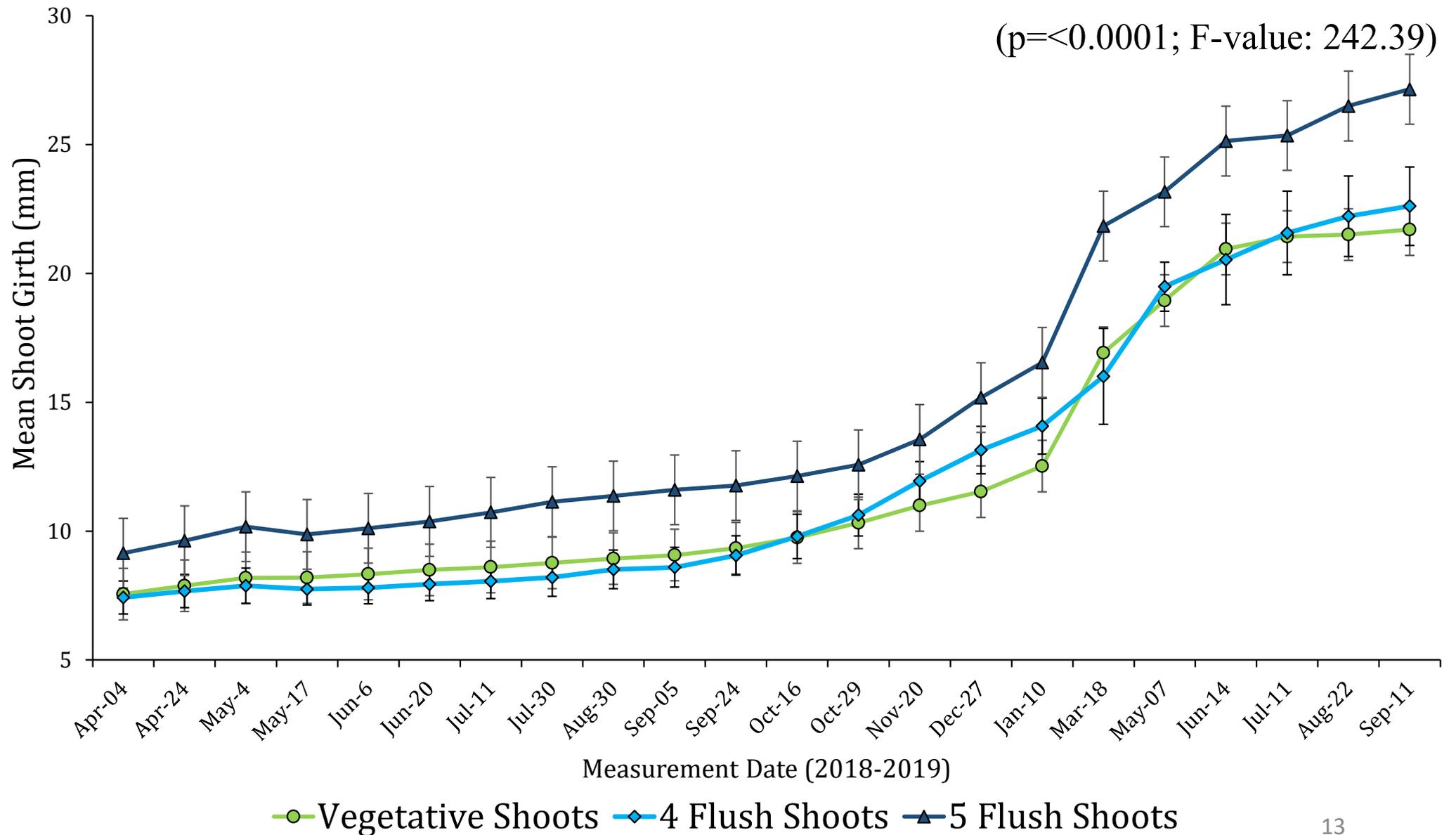


Flower harvest from July prune and control plants for 2018–2019

Control plant flowers
 Five Flush Flowers
 Four Flush Flowers
 Non-flowering shoots

Results

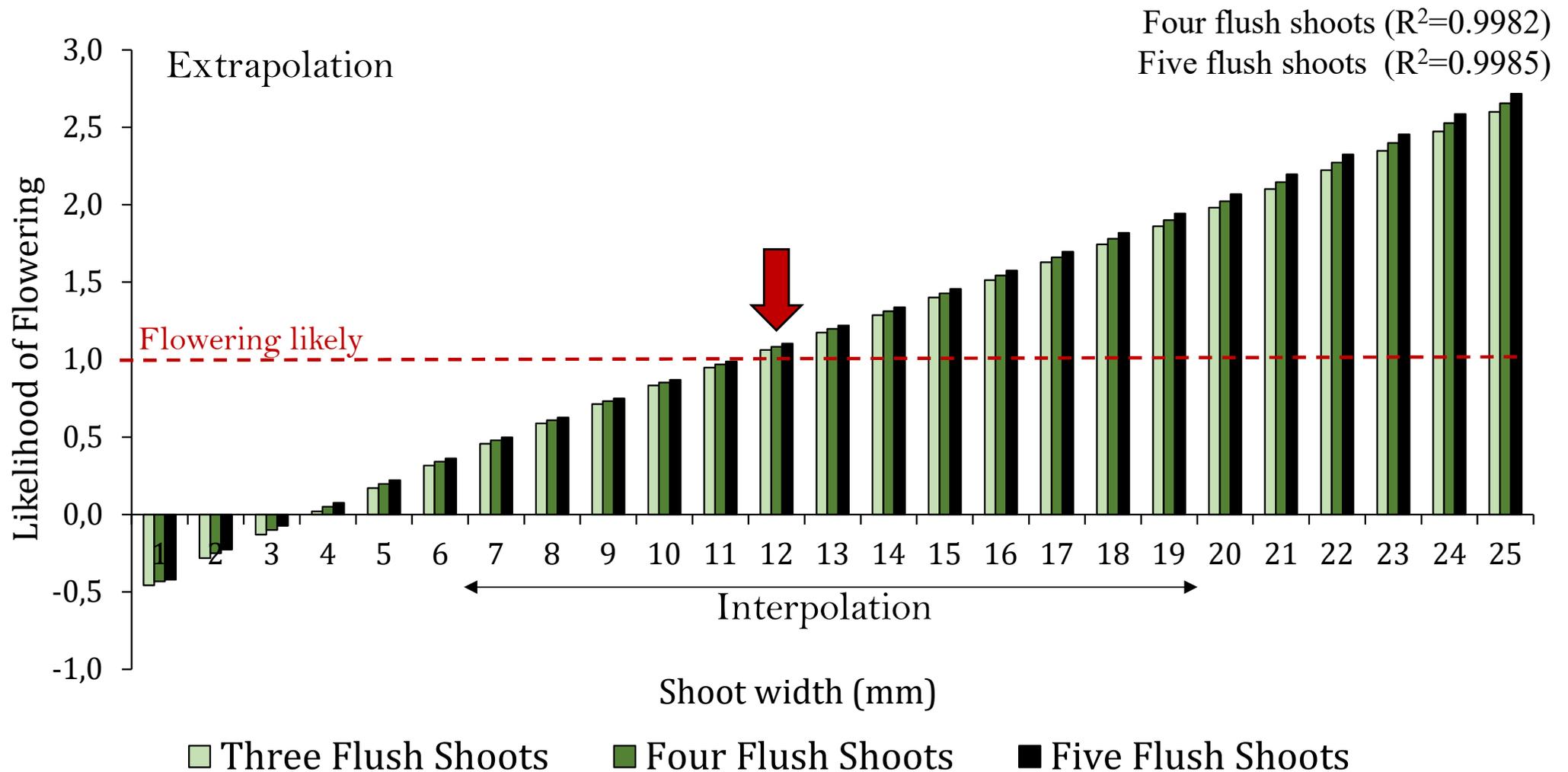
Shoot diameter



Results

Flowering probabilities

1. Likelihood to produce a flower during 2019

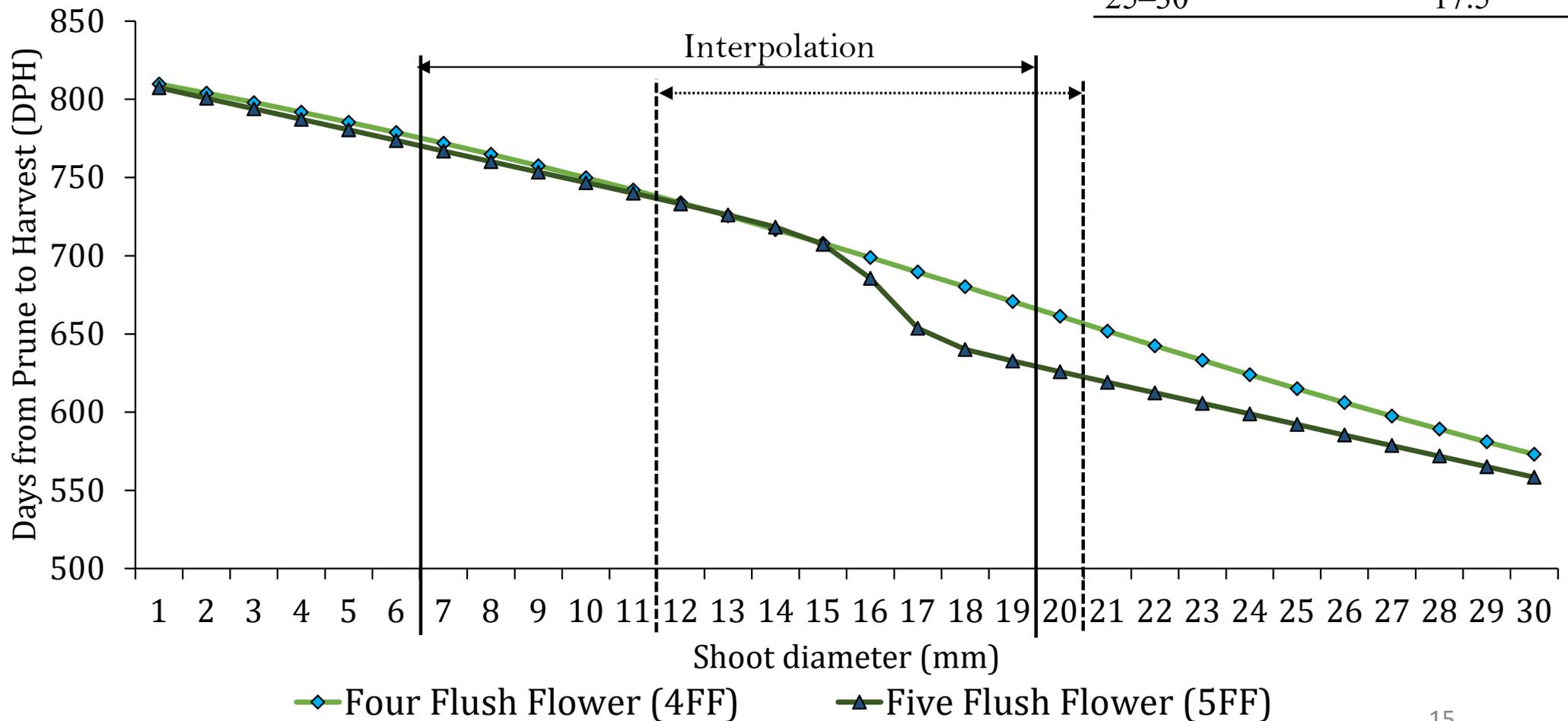


Results

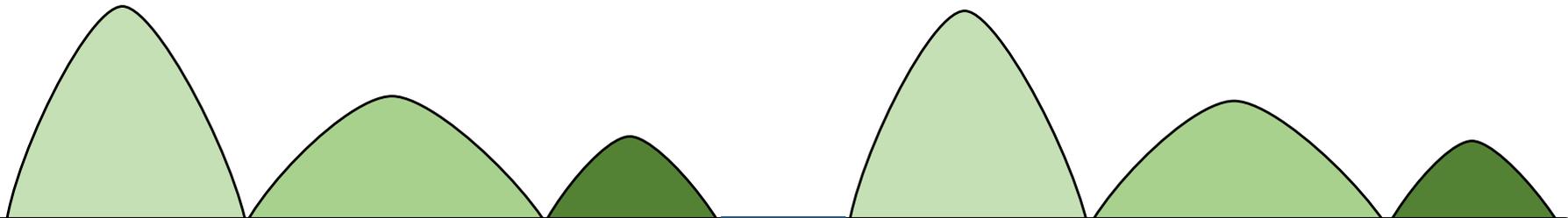
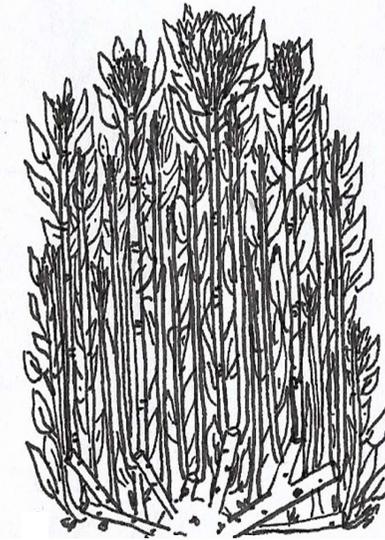
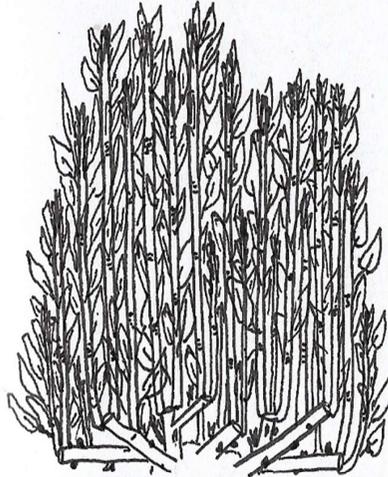
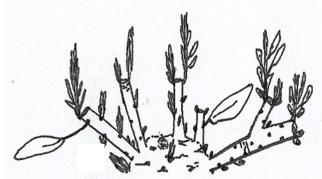
Flowering probabilities

2. DPH: Days from Prune to Harvest

5FF versus 4FF DPH	
Stem diameter category (mm)	Acceleration to harvest (days)
1–5	3.9
5–10	4.4
10–15	0.2
15–20	32.5
20–25	27.7
25–30	17.5



Discussion



Winter pruning	Spring Flush	Summer Flush	Autumn Flush	Spring Flush	Summer Flush	Autumn Flush
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Southern Hemisphere

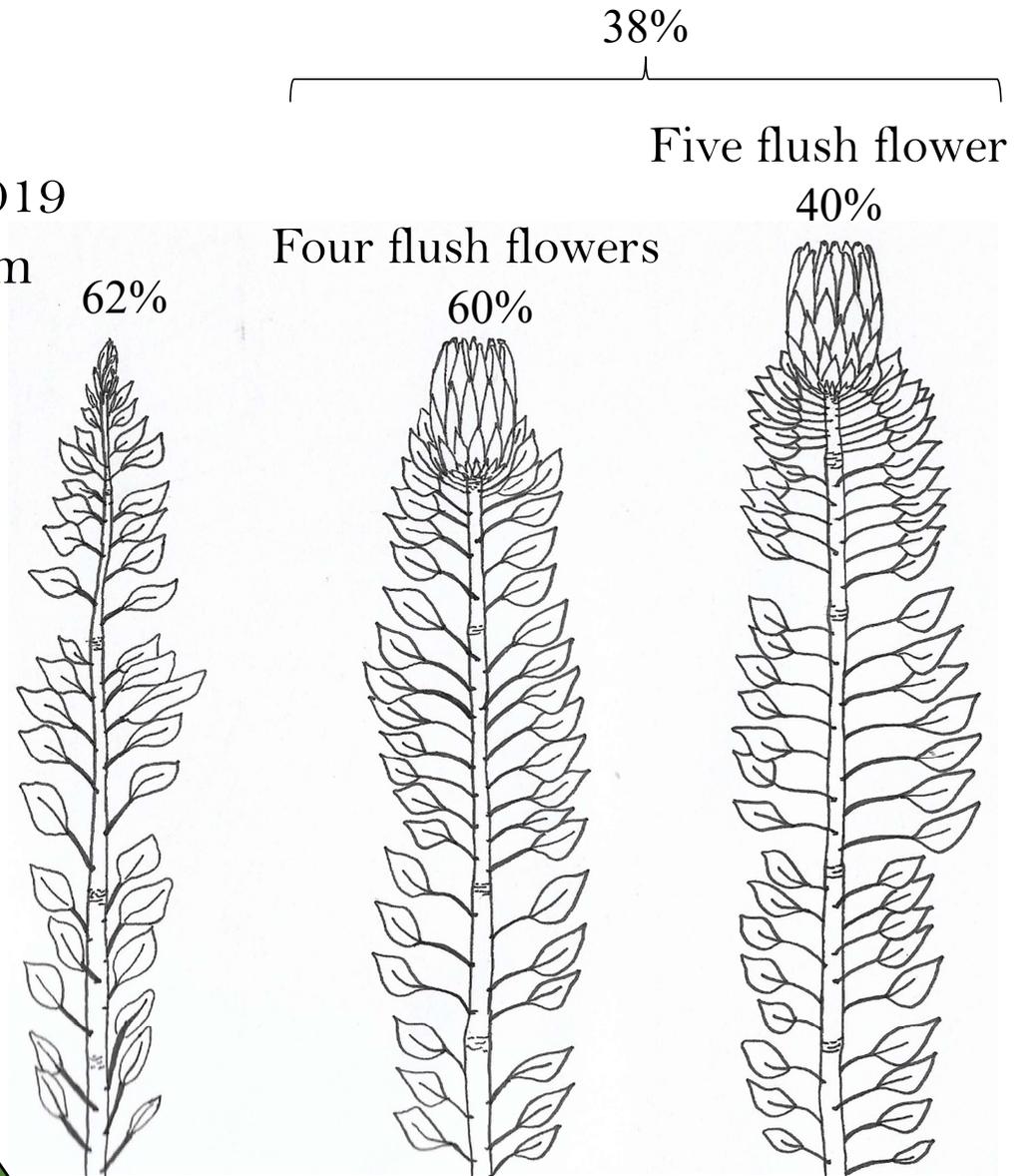
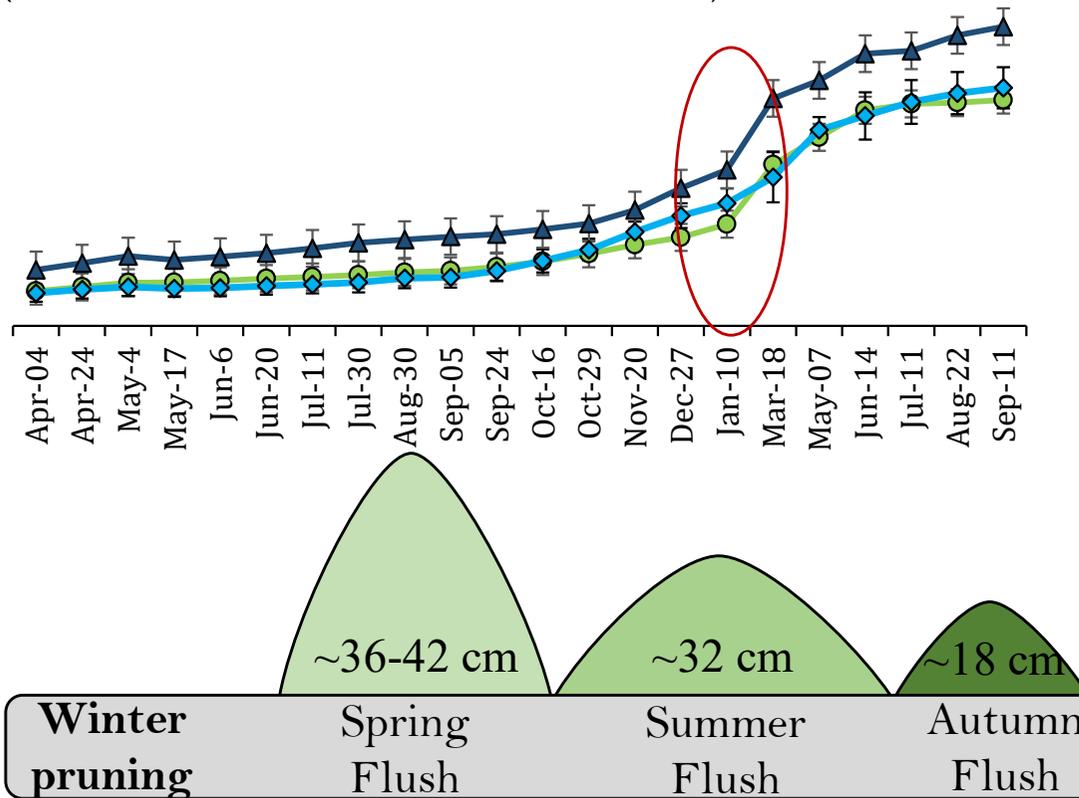
Discussion

Parameters:

stem diameter and -amount of flushes Jan. 2019

- Likelihood to flower: A stem diam. ≥ 12 mm
- Estimated DPH: 5FF 16–18 mm ca. 40d

(Hoffman, 2006; McConchie et al., 2014)



Winter pruning Spring Flush Summer Flush Autumn Flush

Southern Hemisphere

Conclusions

- Flowerbuds observed Jan 2019 and Jul 2019
- Trial harvest periods Apr–Jun and Sept–Oct 2019 (bimodal)
- Flower initiation: summer and autumn (Dupee and Goodwin, 1990)
- Time from prune to harvest 21–27 months (‘Lady Di’) (Gerber et al., 2001)
- 4FF harvested Apr–Jun and 5FF Apr–May
- 33% 4FF 25% 5FF harvested Sep–Oct
- Mean DPH for 4FF is; ca. 715 d and 5FF; ca. 674 d (‘Pink Ice’) (Vivier, 2013)



Acknowledgements

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Western Cape, RSA

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saam vorentoe · masiye phambili · forward together

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Dr Lynn Hoffman

Dr Eugenie-Lien Louw

Prof Gerard Jacobs

A close-up photograph of a bouquet of white protea flowers. The flowers are in various stages of bloom, with some showing their characteristic pointed, overlapping petals. The green foliage is dense and provides a strong contrast to the white blooms. The lighting is soft, highlighting the texture of the petals.

Thank you

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