Effects of early gibberellic acid on rachis and cluster shoulders length of INIA-G4

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Gibberellic Acid uses in tables grapes

- Early spray-rachis lengthening*

- Bloom time-thinning

- Fruit set-berry growth

Early GA3

- Rachis length
  - Structure??
- Shot berries
- **Manual thinning easiness**
- Pre-bloom + Bloom GA effect…..

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Gibberellic Acid for Table Grape Inflorescence Elongation: Is It Worth It?

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Abstract

Background and goals

Gibberellic acid (GA_3) is sometimes used at prebloom to help control cluster compactness, but controversy has been raised regarding its efficacy, particularly in table grape production. A trial was established to evaluate pre-bloom GA_3 on rachis length.

Methods and key findings

In GA_3-treated and untreated clusters, rachises were divided into three arbitrary segments. The increase in length of each segment was evaluated from a month before bloom until the beginning of summer. Prebloom GA_3 rapidly triggered rachis growth in length, but only in the middle and distal portions of the inflorescence. The top area was not affected. The standard table grape cluster tipping that followed eliminated the cluster distal portion and all GA_3 related rachis growth. GA_3-treated clusters had longer segments removed compared to untreated ones. Shot berries and rachis thickness were also increased, but cluster and berry weight remained the same.

Conclusions and significance

The effects of GA_3 on rachis length at prebloom can be discarded by other required standard table grape practices. The negative and cumulative effects should be considered when analyzing its usefulness. Knowing the benefits and disadvantages of this practice will help table grape growers to optimize plant growth regulator programs.

Key words: cluster structure, prebloom, thinning, tipping, viticultural practice

Introduction

Fruit production has specific parameters to classify quality. In table grapes, berry size and cluster shape are key aspects; to obtain proper quality characteristics, various agricultural practices are employed, including the use of plant growth regulators like gibberellic acid (GA_3). GA_3 has been used since the 1960s, initially to increase berry size, and then for thinning of seedless grapes (Weaver and McCune 1959, Lynn and Jensen 1966, Weaver and Pool 1971). Besides these uses, GA_3 can be sprayed prebloom for rachis elongation as part of cultural practices for table grapes and some winegrapes where rot is a major problem due to cluster compactness (Hed et al. 2011, Molitor et al. 2012, Gao et al. 2020). The rachis length indirectly determines cluster shape and compactness (Gao et al. 2020). With the same number of berries, a longer cluster is a looser cluster, hence the idea of elongating the rachis. Cluster compactness is particularly related to disease susceptibility (Hed et al. 2011, Molitor et al. 2012), therefore practices that help loosen clusters are key to producing good yields and quality. When trying to reduce compactness to decrease rot, Gao et al. (2020) tested GA_3 before bloom on Cabernet Sauvignon and Cabernet franc and obtained longer, looser clusters. Molitor et al. (2012) also obtained less compact clusters by using GA_3 prebloom on Sauvignon blanc, and they associated this characteristic to longer main rachises. Hed et al. (2011), however, found better results in decreasing winegrape rot using bloom sprays compared to prebloom, because cluster compactness was more influenced by the number of berries remaining on the rachis than the length of the rachis. Zinfandel clusters have also shown less compactness by the combination of longer rachis and reduced berry number (Miele et al. 1978). Shavrukov et al. (2004) demonstrated that rachis elongation was mainly due to cell expansion and that internode length of the rachis was crucial for cluster architecture. Rachis length is an important part of the architecture that determines compactness, and the length of the cluster internodes has been related to cell size (Shavrukov et al. 2004). However, cluster length in winegrapes is not an aspect of concern by itself, therefore the compactness analysis has not considered individually different segments of the inflorescence or the whole resultant cluster length. On the other hand, table grapes must follow specific quality parameters, including berry and cluster size aspects, and to obtain the proper features, manual

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INIA-G4

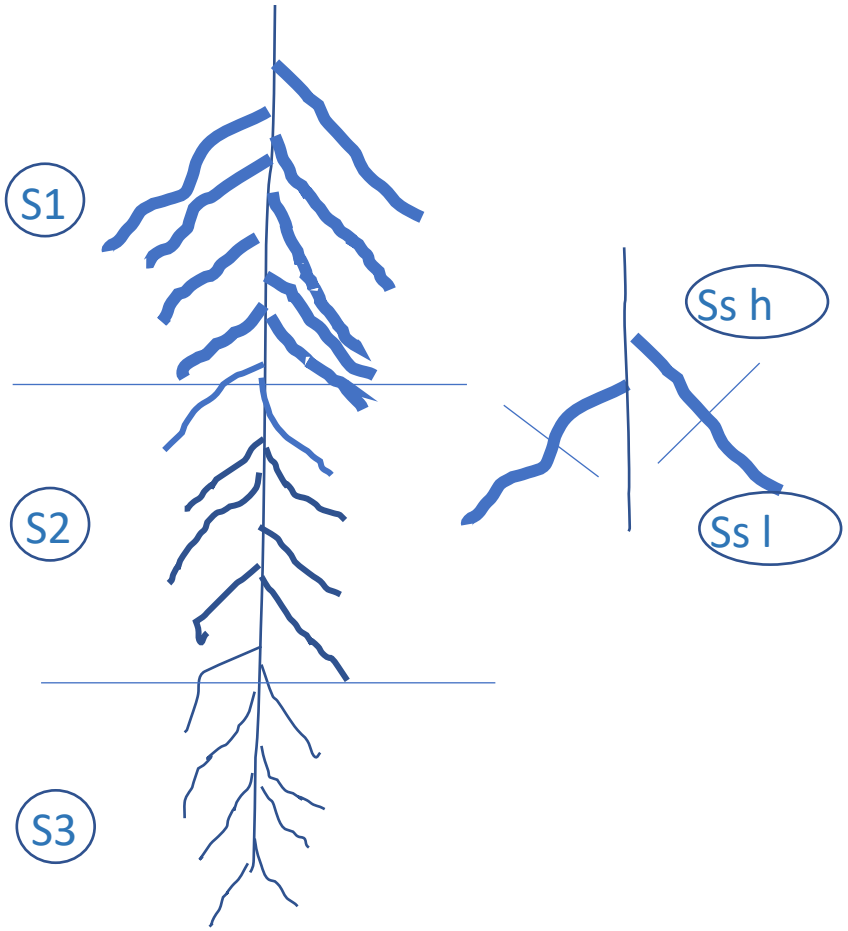
- Early white cv.
- High vigor
- High yield
- GA thinning
- GA for berry growth
- Easy to grow cv. (relatively low need of manual thinning, 90 berries/cluster)
- Maximize labor efficiency: pre-bloom GA?

M&M

- 4 treatments
  - 0 mg/L GA prebloom + 0 mg/L GA bloom
  - 0 mg/L GA prebloom + 5 mg/L GA bloom
  - 10 mg/L GA prebloom + 0 mg/L GA bloom
  - 10 mg/L GA prebloom + 5 mg/L GA bloom
- 5 clusters/treatment/plant
- 3 reps (plant)

Prebloom: October 28
Bloom: November 21

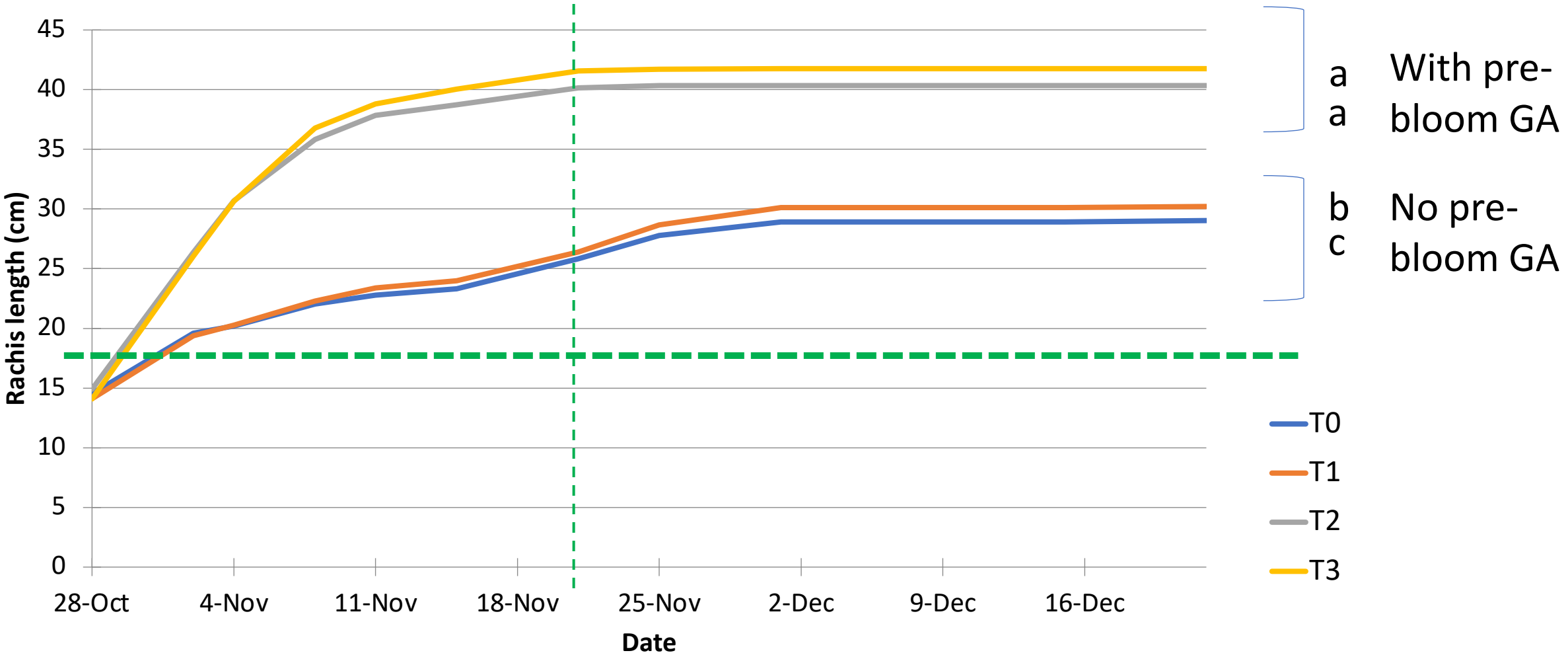
- Cluster marked by segments
  - Main rachis: 3 segment
  - Two top shoulders: 2 segments each



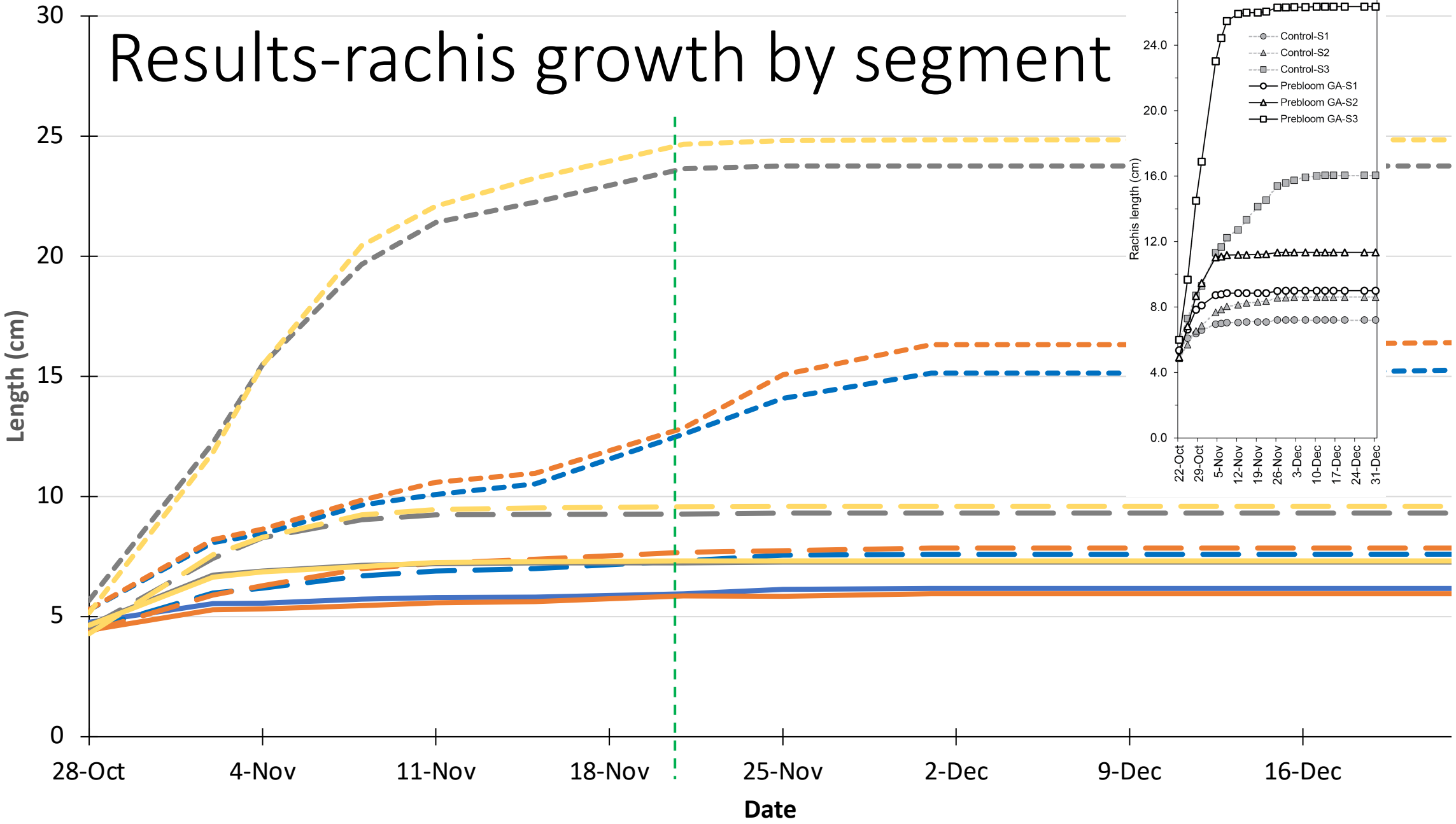
- Followed every 3-4 days up to 6 mm berry
  - Length growth of each segment

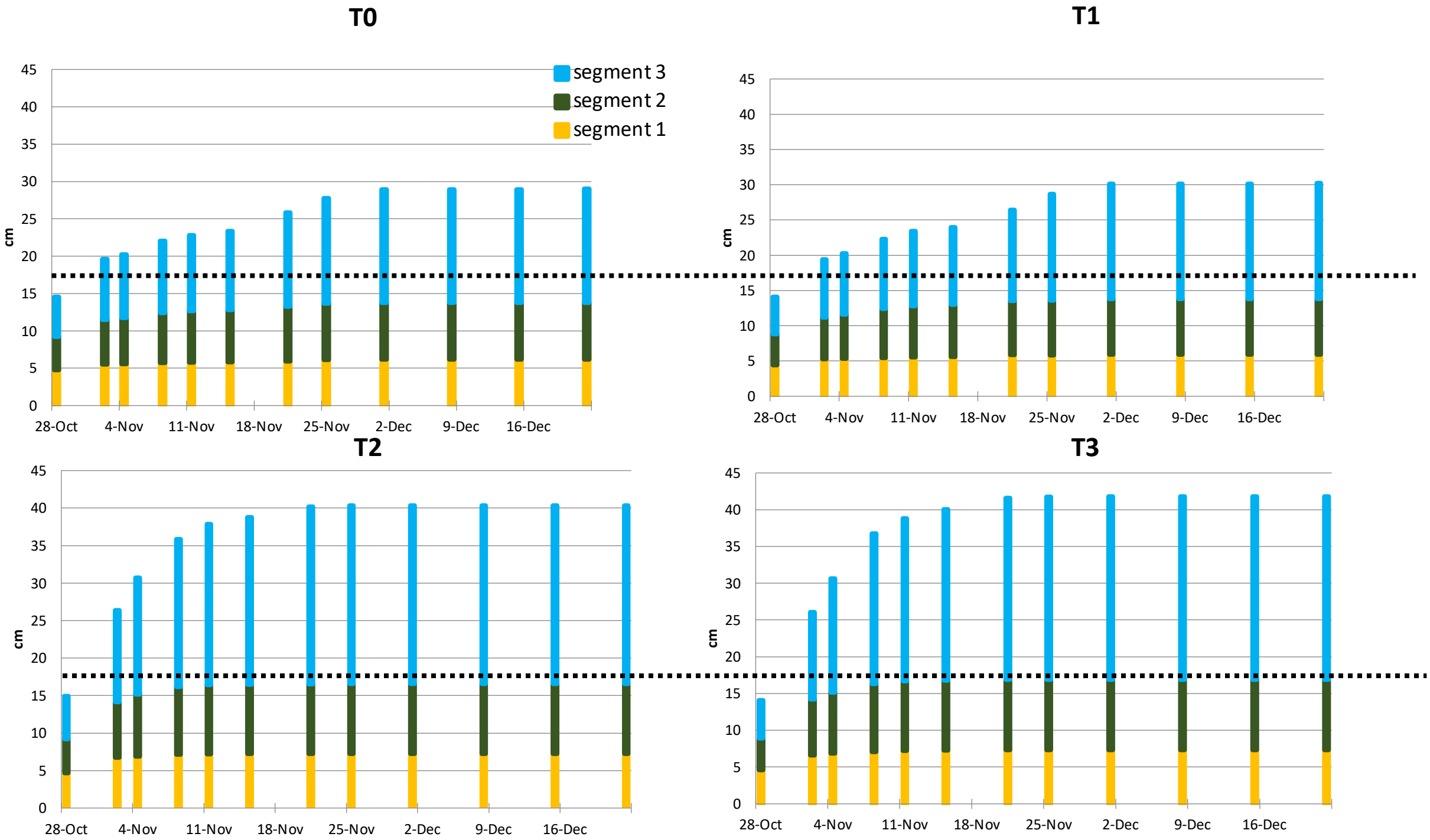
- Manual thinning
  - Shot berries (category 1 (no shot berries) to 3 (high presence of shot berries)
  - Number and weight of discarded berries
  - Weight of discarded rachis

Results-rachis length growth



Results-rachis growth by segment

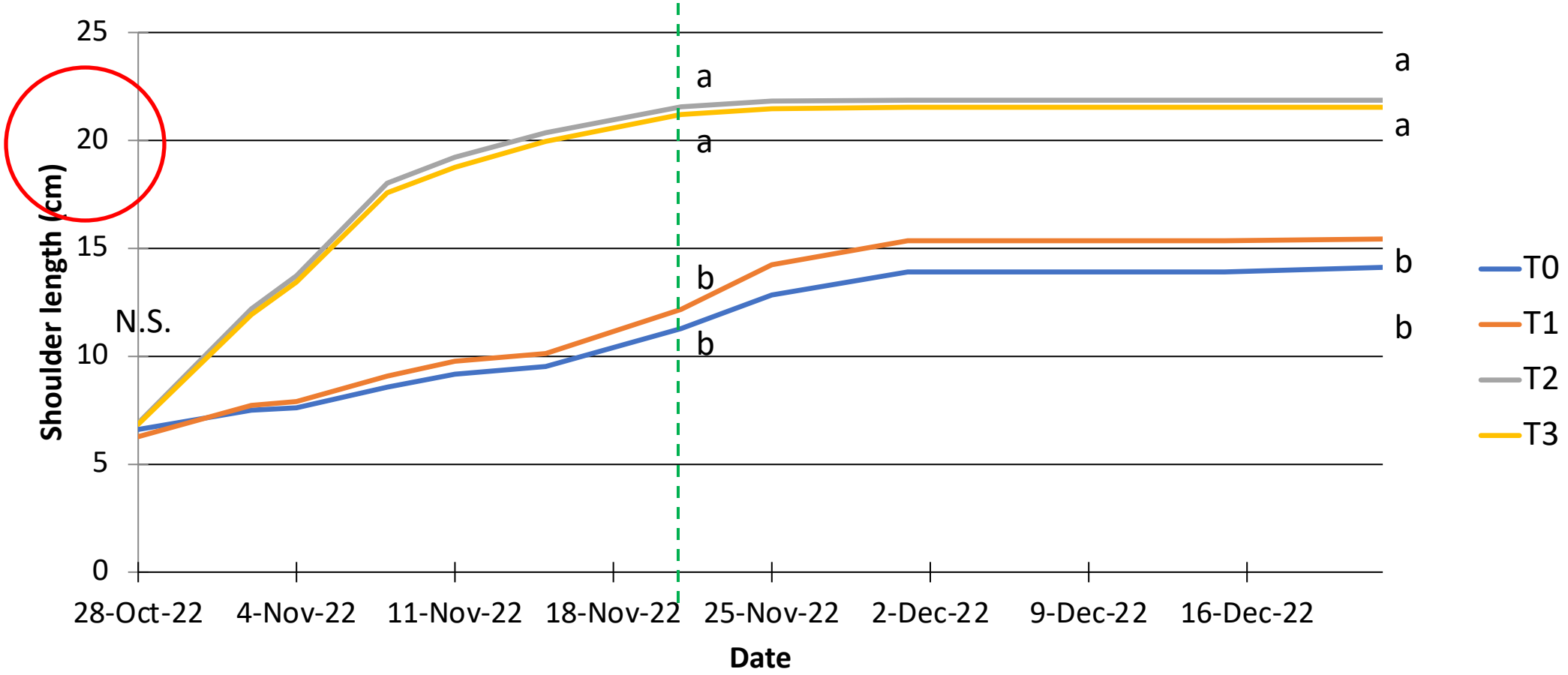



T0
T1
T2
T3
segment 3
segment 2
segment 1
cm
0
5
10
15
20
25
30
35
40
45
28-Oct
4-Nov
11-Nov
18-Nov
25-Nov
2-Dec
9-Dec
16-Dec

Results-rachis growth by segment

	Pre-bloom length (cm) (28-oct)			Bloom (cm) (21-nov)			Pre-manual thinning (cm) (22-dec)		
	S1	S2	S3	S1	S2	S3	S1	S2	S3
T0	4.77	4.47	5.29	5.94 b	7.32 b	12.59 b	6.17 b	7.60 b	15.26 b
T1	4.43	4.38	5.29	5.87 b	7.68 b	12.85 b	5.95 b	7.85 b	16.41 b
T2	4.67	4.56	5.68	7.24 a	9.27 a	23.65 a	7.27 a	9.31 a	23.76 a
T3	4.64	4.29	5.16	7.32 a	9.58 a	24.66 a	7.32 a	9.59 a	24.85 a
Significance	N.S.	N.S.	N.S.	0.0008	0.011	0.0001	0.0001	0.0114	0.0001
				≈22% Δ	≈26% Δ	≈90% Δ	≈20% Δ	≈22% Δ	≈50% Δ

Results-shoulder growth

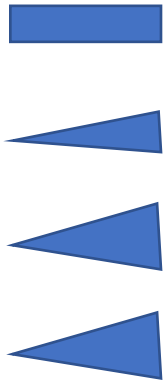


1st and 2nd shoulders are “mirrors”

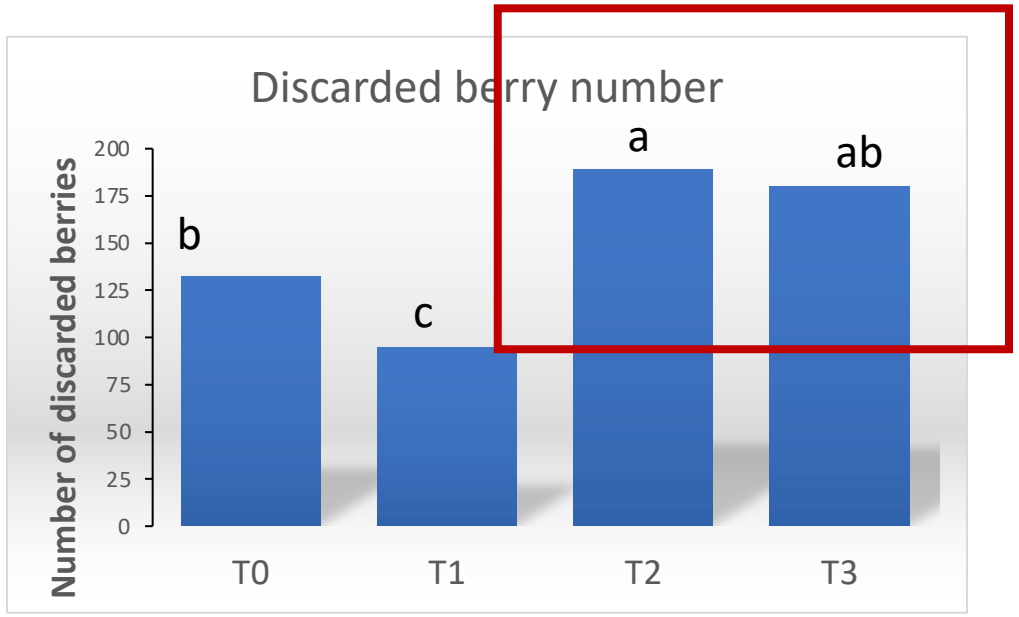
Results-shoulder length growth ratio (22 dec/28 oct)

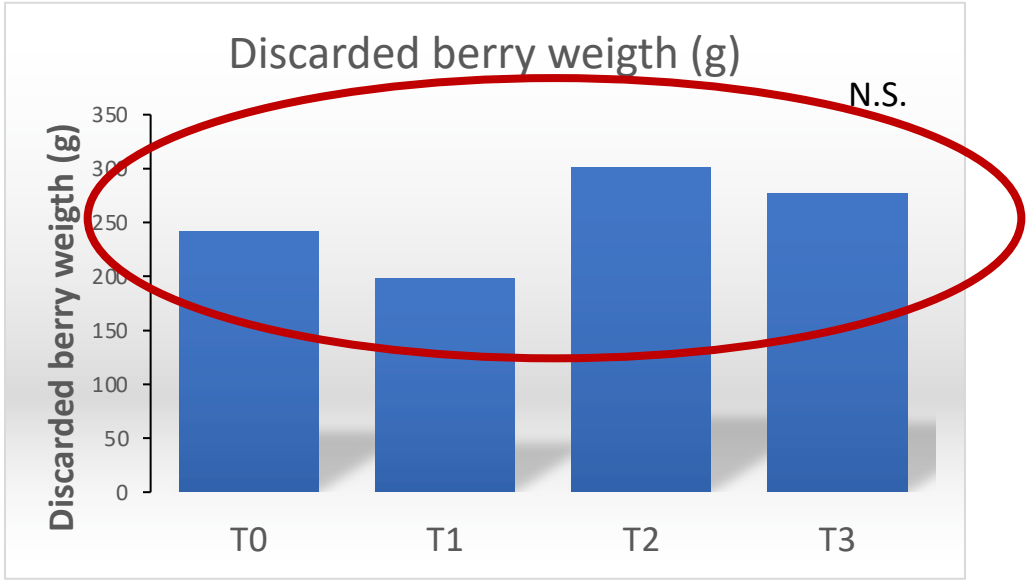
	Top shoulder segment	Distal shoulder segment
T0	1.91 b	2.44 b
T1	2.18 b	2.85 b
T2	2.70 a	3.70 a
T3	2.72 a	3.66 a

Top shoulder segment	Distal shoulder segment
N.S.	
b	a
b	a
b	a



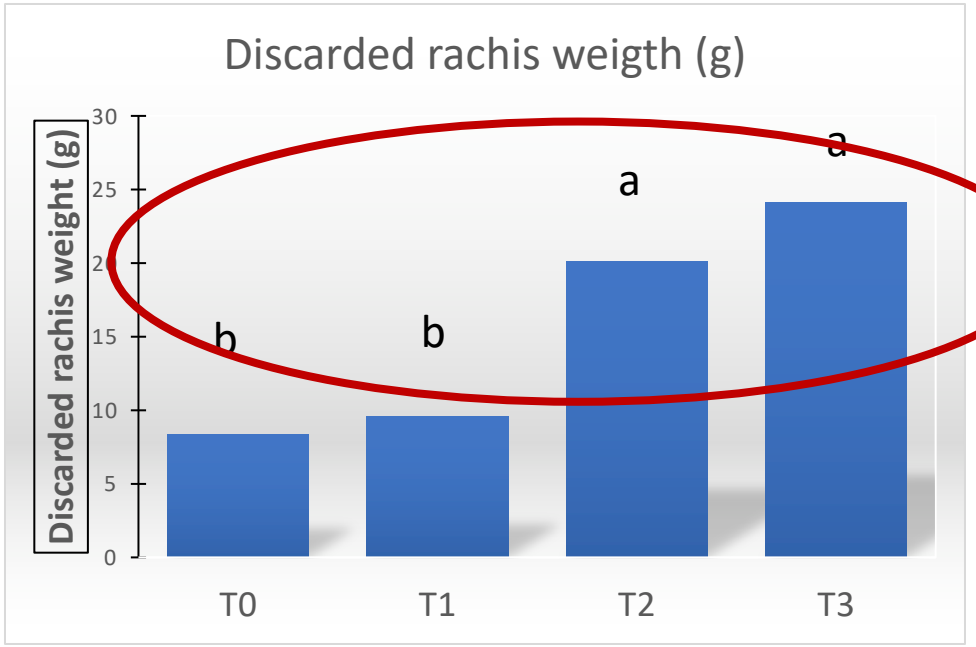
Results-manual thinning

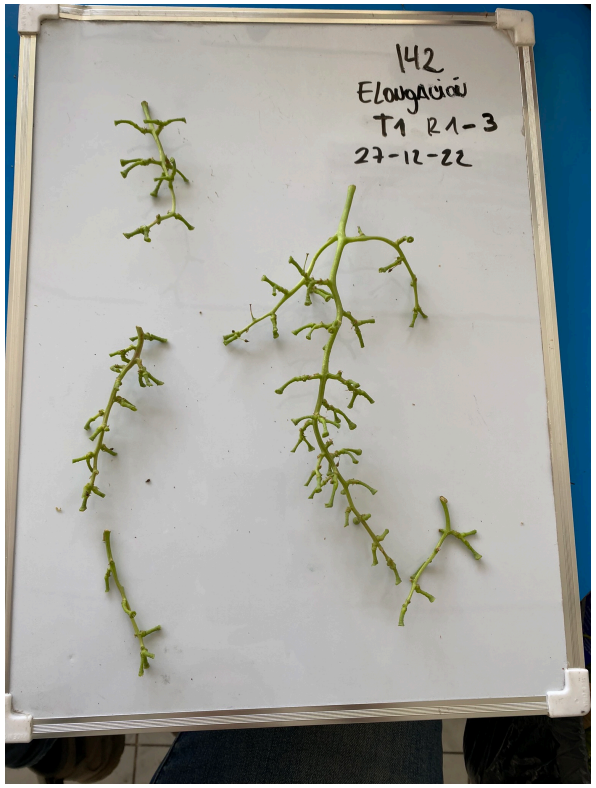


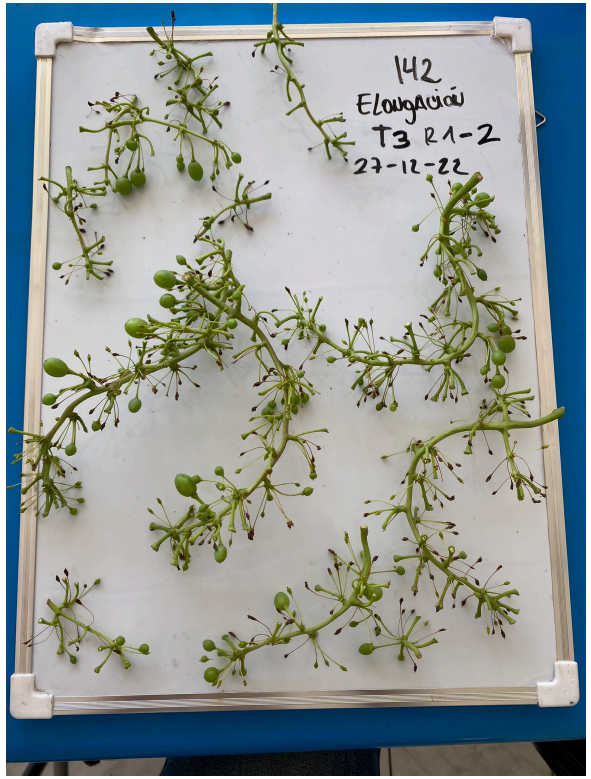


- Pre-bloom GA decreases thinning
- Bloom GA for thinning effect with no previous GA
- More small berries retained

Results-manual thinning

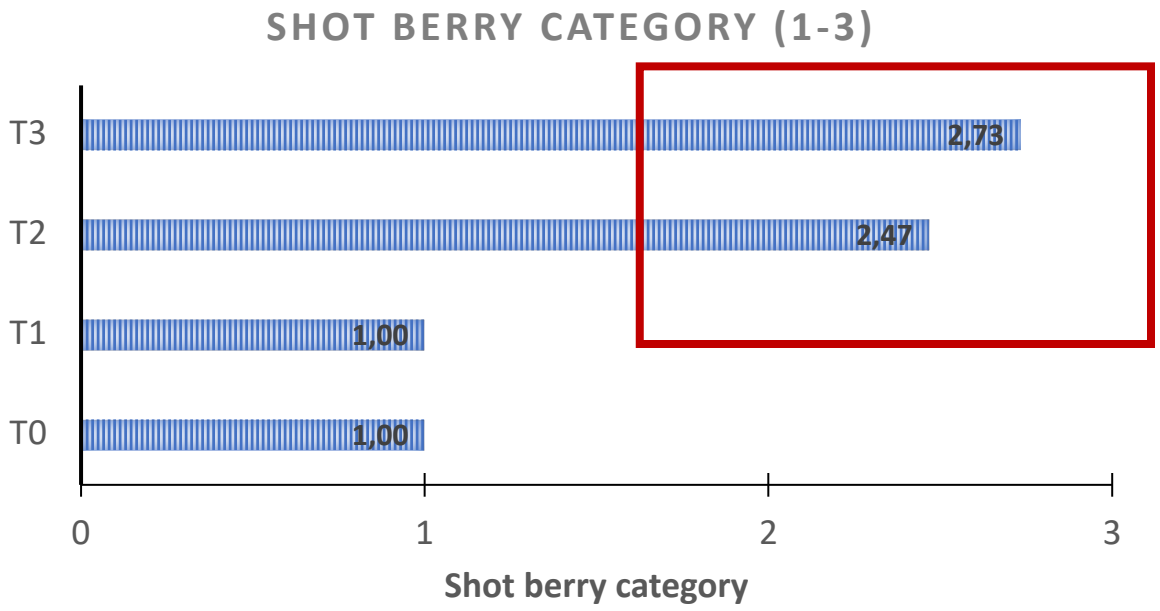


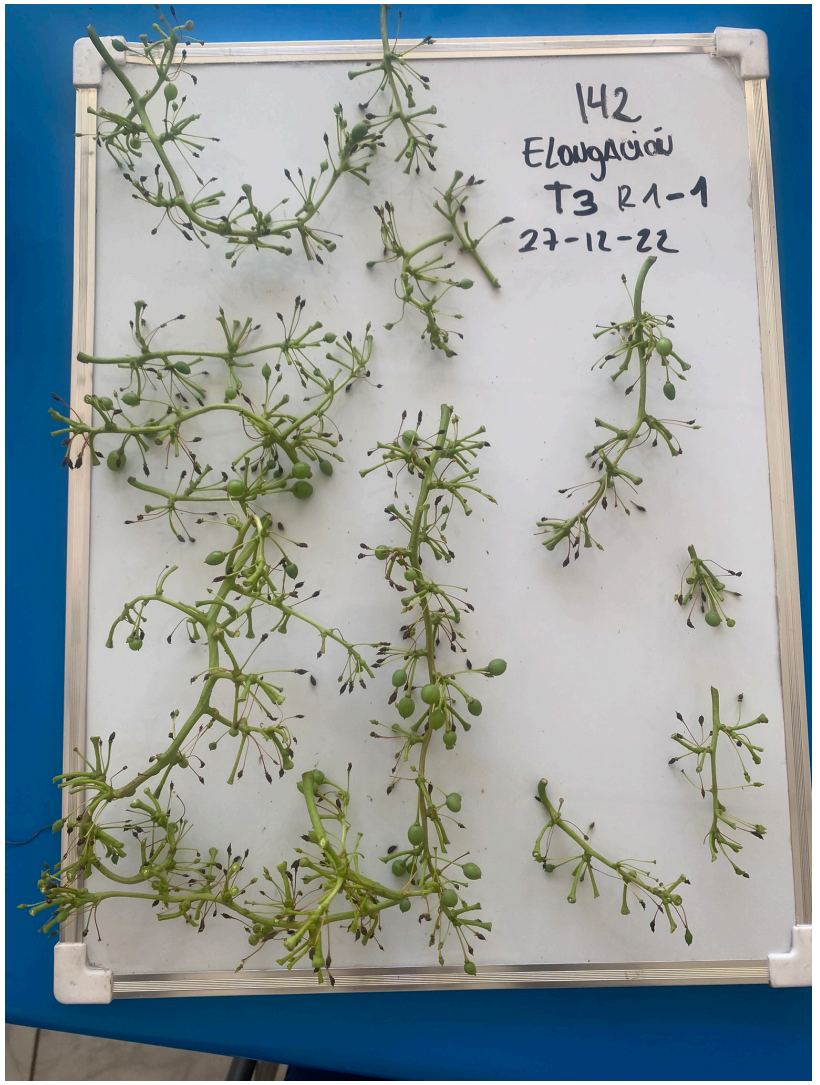




- Enlarge, thick rachis

Results-manual thinning/cluster quality





- Pre-bloom GA increases shot berry number

Conclusions

- Pre-bloom GA mostly influences distal ends
- Bloom GA is effective as thinner if no GA has been applied previously, otherwise it tends to increase retained berries
- Shot berries result from early GA applications
- Remaining question is a not so early not thinning spray effect….

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