Fertility and bunch quality of *Vitis vinifera* L. cv. Prime as affected by GA_3 and other plant bioregulators

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Introduction

(1) GA_3 is used on several table grape cultivars for chemical thinning and sizing, to decrease manual labour inputs required in production of export quality grapes

(2) Observations/ reports from industry linked to GA_3 treatments:

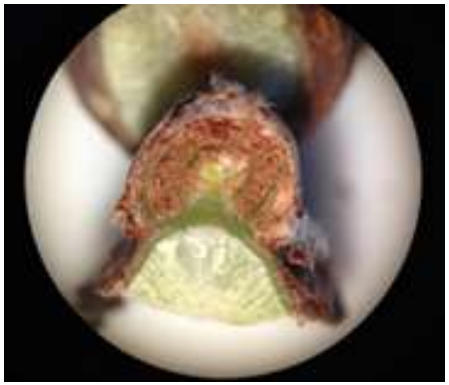
- decreased fertility
- decreased bunch quality (smaller bunches)
- few published research results

negative effect on fertility *(↓number and size of bunch primordia)*

Researcher(s)	Cultivar(s)
Orth (1990)	Muscat Seedless
Retamales et al. (1994)	Sultanina
Dokoozlian et al. (1995), (1998)	Redglobe, Thompson Seedless, Flame Seedless
Dokoozlian & Peacock (2001)	Crimson Seedless
Peacock (2003)	Ruby Seedless
Molitor et al. (2012)	Sauvignon Blanc

Introduction

Do GA_3 application methods affect fertility, production and quality?



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- **Fertility = *number of inflorescence primordia per bud*** (Swanepoel & Baard, 1988)

  initiated within the bud ***during the preceding season*** *(around flowering)*

  (Barnard, 1932; Swanepoel & Archer, 1988; Swanepoel & Baard, 1988; Iland *et al.*, 2011; Molitor *et al.*, 2012)

- ***Before, during and after flowering and set*** **(current season)**
  (2 weeks before to 10 weeks after flowering):
  - initiation of inflorescence primordia for the following season
    - *corresponds with timing of PBR applications for thinning*
  - differentiation of inflorescence primordia for the following season commences
    - *corresponds with timing of PBR applications for berry sizing*

Bud dissection; a) closed dormant bud, b) Bud that is opened, red ring indicate the inflorescence

Introduction

Project funded by SATI & Philagro (2014/15 – 2016/17):

"Return fertility of *Vitis vinifera* cv. Prime as affected by GA_3 application methods and volumes"

Project funded by Philagro (2018/19 – 2020/21):

"Evaluating GA_3 and other PGRs for thinning and sizing of Prime: Effect on bunch quality and return fertility"

Main objectives:

- Determine the effect of treatments on yield and bunch quality.
- Determine the effect of treatments on return fertility.

Prime trial (Western Cape): Material & Methods

Descriptor	Block
Farm name	Laborans
Cultivar	Prime
Rootstock	Ramsey
Year established	2000
Block size (ha)	4.54 (0.6ha = exp)
Grapevine spacing	3 m x 1.5 m
Trellis system	Gable
Soil texture	Clay loam
Irrigation system	Micro sprinkler
Pruning system	Cane (9 buds per cane)

Prime trial (Western Cape): Material & Methods

Treatment		Thinning spray bunches, shoots, leaves	Berry sizing spray bunches, shoots, leaves	Thinning application (2 ppm GA_3; 2g GA_3/ha)		Berry sizing application (15g GA_3/ha)	
Nr	Code			Application technique and volume	Phenological stage	Application technique and volume	Phenological stage
1	NoThin + Dip (Control)	X	X	No thinning		Dip	**7-8 mm berry diameter**
2	Thin + Dip	√	X	Spray conventional (mist blower) 1000 L/ha	**80% full bloom to 10% set** (vineyard overall) individual bunches marked according to 3 phenological stages at day of thinning treatment - 80-100% flowering - 10% set - 100% set	Dip	
3	Thin + 250 L/ha	√	√			Spray conventional (mist blower) 250 L/ha	
4	Thin + 500 L/ha	√	√			Spray conventional (mist blower) 500 L/ha	
5	Thin + 1000 L/ha	√	√			Spray conventional (mist blower) 1000 L/ha	
6	Thin + ESS	√	√			Spray with electrostatic spray pump (72 L/ha)	

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Prime trial (Western Cape): Material & Methods: Experimental layout

Row nr	Treatment nr (Colour code)														
	Vak	Vak	Vak	Vak	Vak	Vak	Vak	Vak	Vak	Vak	Vak	Vak	Vak	Vak	Vak
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
117	1	1	1	2	2	2	3	3	3	5	5	5	4	4	4
118	5	5	5	6	6	6	4	4	4	2	2	2	1	1	1
119	5	5	5	6	6	6	4	4	4	2	2	2	1	1	1
120	5	5	5	6	6	6	4	4	4	2	2	2	1	1	1
121	2	2	2	1	1	1	4	4	4	6	6	6	3	3	3
122	2	2	2	1	1	1	4	4	4	6	6	6	3	3	3
123	2	2	2	1	1	1	4	4	4	6	6	6	3	3	3
124	3	3	3	5	5	5	2	2	2	1	1	1	4	4	4
125	3	3	3	5	5	5	2	2	2	1	1	1	4	4	4
126	3	3	3	5	5	5	2	2	2	1	1	1	4	4	4
127	4	4	4	6	6	6	3	3	3	5	5	5	2	2	2
128	4	4	4	6	6	6	3	3	3	5	5	5	2	2	2
129	4	4	4	6	6	6	3	3	3	5	5	5	2	2	2
130	6	6	6	5	5	5	1	1	1	3	3	3	6	6	6
131	6	6	6	5	5	5	1	1	1	3	3	3	6	6	6
132	6	6	6	5	5	5	1	1	1	3	3	3	6	6	6

Treatment nr	Treatment Code	Treatment Colour code
1	No Thin + Dip (Control)	WHITE
2	Thin + Dip	RED
3	Thin + 250 L/ha	YELLOW
4	Thin + 500 L/ha	BLACK
5	Thin + 1000 L/ha	BLUE
6	Thin + ESS	GREEN

Randomized block design
6 Treatments, 5 repl= 30 exp plots

Exp plot allocated over 3 rows and 3 exp units
(45 vines/ exp plot)
(5 vines/exp unit)

central unit = data exp unit

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Prime trial (Western Cape): Material & Methods

During dormancy

(July/Aug)

Potential fertility

Forced budding

Bud dissections

In new growing season

Actual fertility in vineyard after bud break when inflorescences were visible

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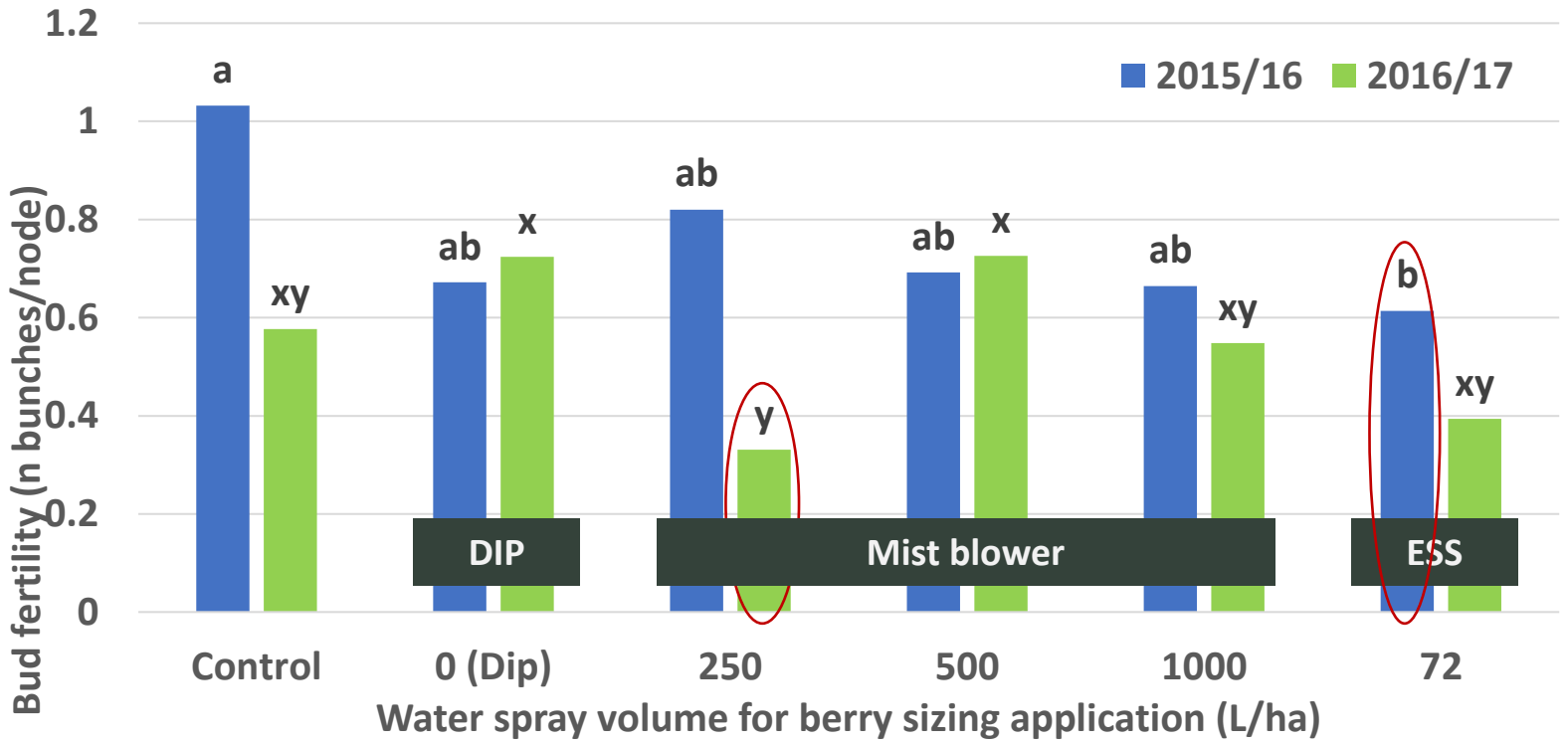
Prime trial (Western Cape): Results

Potential fertility in the seasons after treatment (forced bud break)



- ***Lower application volumes** were **associated with lower potential fertility***

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Prime trial (Western Cape): Results

Bunch length

Nr	Treatment	Bunch length (cm)	
		2014/15	2016/17
1	NoThin+Dip(Control	18.5 a	18.6 a
2	Thin+Dip	17.7 a	18.7 a
3	Thin+250L/ha	18.8 a	19.5 a
4	Thin+500L/ha	18.8 a	18.7 a
5	Thin+1000L/ha	17.3 a	18.5 a
6	Thin+ESS	19.5 a	18.0 a
	Means	18.4 a	18.7 a
	$LSD_{p=0.05}$	3.2	1.1

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Prime trial (Western Cape): Results

Quality: Berry size classification 2014/15

No.	Treatment	% Normal berries (> 15mm)	% Small berries (< 15mm >10mm)	% Shot berries
		Phenological stage during thinning appplication		
		10% set	10% set	10% set
1	Control (No thinning + Dip)	64.5 b	23.1 a	12.4 a
2	Thin + Dip	78.1 a	10.3 b	11.6 a
3	Thin + 250L/ha	74.6 ab	13.8 b	11.6 a
4	Thin + 500L/ha	78.0 a	7.53 b	14.5 a
5	Thin + 1000L/ha	75.5 a	11.7 b	12.8 a
6	Thin + ESS 72 L/ha	77.8 a	11.2 b	11.0 a
	Means	74.8	12.9	12.3
	$LSD_{p=0.05}$	10.5	6.74	8.02

T1 (Control):

- lowest % normal berries and highest % small berries
- affected bunch quality and manual bunch preparation required

Temp in both seasons favourable for chemical thinning (max around 30°C, min > 12°C)

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Prime trial (Western Cape): Results

Quality: Berry size classification: 2015/16

No.	Treatment	% Normal berries (> 15mm)	% Small berries (< 15mm >10mm)	% Shot berries
		Phenological stage during thinning appplication		
		10% set	10% set	10% set
1	Control (No thinning + Dip)	91.5 a	7.16 a	1.35 a
2	Thin + Dip	89.5 a	9.07 a	1.40 a
5	Thin + 1000L/ha	87.5 a	11.3 a	1.13 a
	Means	89.5	9.19	1.29
	$LSD_{p=0.05}$	4.50	4.56	1.28

No significant differences

Low % shot berries can be ascribed to a season effect.

Prime trial (Western Cape): Results

Time required for manual thinning *(compare treatments within seasons)*

Nr	Treatment	Time			
		2014/2015		2015/2016	
		per bunch (min)	per ha (h)	per bunch (min)	per ha (h)
1	Control (No thinning + Dip)	02:20 a	2578	01:02 ab	1149
2	Thin + Dip	01:24 b	1547	00:52 b	942
3	Thin + 250L/ha	01:40 ab	1758	01:10 a	1295
4	Thin + 500L/ha	02:00 ab	2238	01:10 a	1287
5	Thin + 1000L/ha	01:18 b	1442	00:54 ab	1011
6	Thin + ESS 72 L/ha	02:06 ab	2331	01:14 a	1329
	Means	01:48	1982	01:03	1169
	$LSD_{p=0.05}$	0.81		0.30	

Temp in both seasons favourable for chemical thinning (max around 30°C, min > 12°C)

Prime trial (Western Cape): Conclusion

- ***Lower spray application volumes*** and smaller droplet size were ***associated with lower fertility*** possibly due to more effective coverage obtained

- These preliminary results lead to further investigation (Prime trial in Northern Cape, from 2018/19)

Prime trial (Northern Cape):
Material & Methods: Experimental site

- ✓ Newgro farm, Kanoneiland, Lower Orange River region, Northern Cape
- ✓ 5 year old *Vitis vinifera* L. cv. Prime block (4.66 ha)
  - ➢ Grafted onto Ramsey rootstock
  - ➢ East – west row direction
  - ➢ 3.3m X 1.8m spacing
  - ➢ Trained onto a gable trellis system
  - ➢ Micro sprinkler irrigation system
  - ➢ Standard viticultural practices for the cultivar and region applied

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Prime trial (Northern Cape): Material & Methods:

Treatments: PGR trial on Prime in the Lower Orange River region

Treatment no	Colour code		Thinning application (from 10% set/ 110% flowering) (1 ppm GA_3 = 1 g GA_3/1000 L = 2.5g ProGibb®/1000 L) Dosage per ha: 1 g GA_3/ha = 2.5g ProGibb®/ha	Berry sizing application (7-8 mm berry diameter + 8-10 mm berry diameter) 20 ppm GA_3 = 20 g GA_3/1000 L = 50g ProGibb®/1000 L) Dosage per ha: 20 g GA_3/ha = 50 g ProGibb®/ha
1			No thinning	2 x 20 ppm GA_3 (dipping)
2			No thinning	2 x 20 ppm GA_3 (ESS)
3			No thinning	2 x 20 ppm GA_3 (Cima 250 L/ha)
4			No thinning	2 x 20 ppm GA3 (Cima 500 L/ha)
5			1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (dipping)
6			1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (ESS)
7			1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (Cima 250 L/ha)
8			1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (Cima 500 L/ha)
9			1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (dipping)
10			1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (ESS)
11			1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (Cima 250 L/ha)
12			1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA3 (Cima 500 L/ha)
13			1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (dipping)
14			1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (ESS)
15			1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (Cima 250 L/ha)
16			1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (Cima 500 L/ha)
17*			1% Urea (10% set + 3 days later)	2 x 20 ppm GA_3 (dipping)
			all thinning spray applications applied at 1000L/ha	ESS = Electrostatic spray pump
			*additional treatment included in 2019	Cima = Mist blower spray pump

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Prime trial (Northern Cape): Material & Methods:

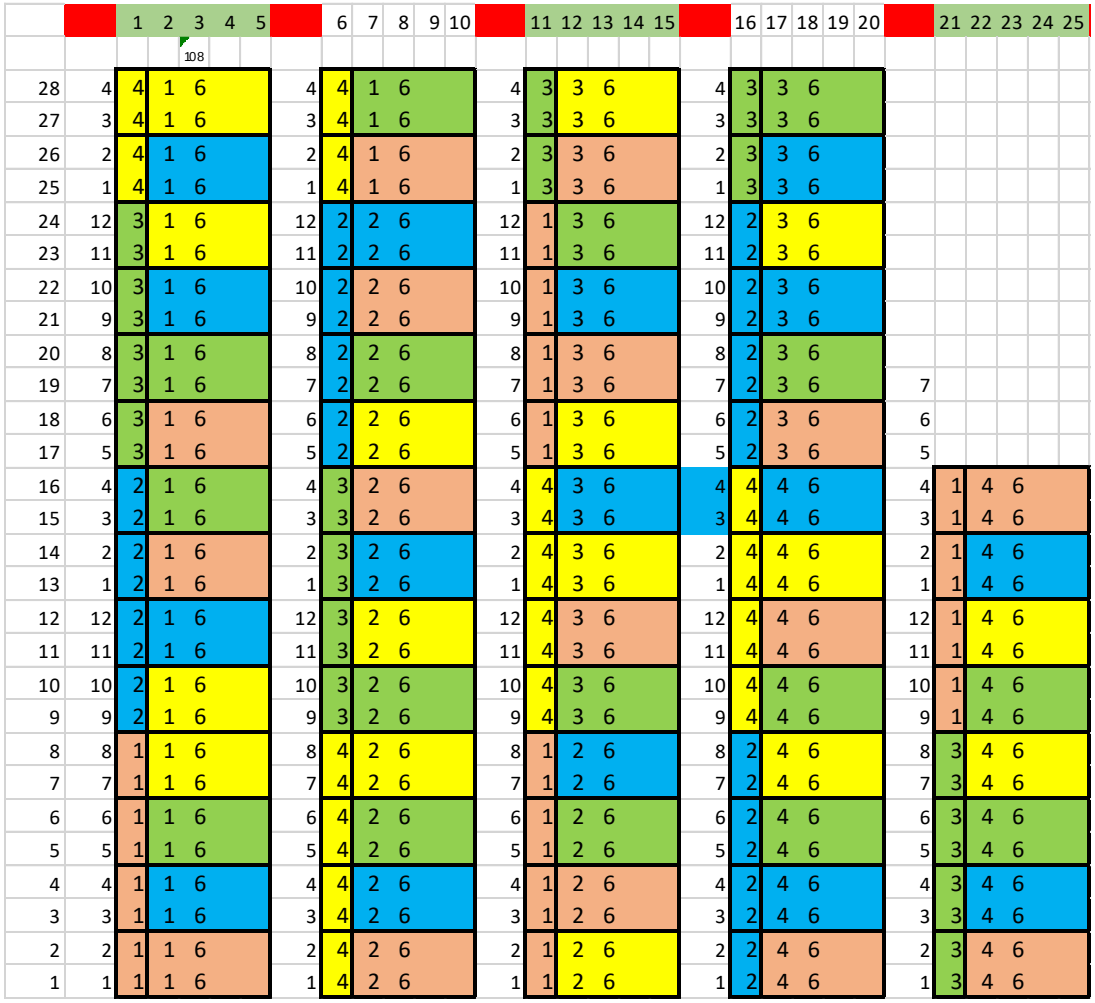

Fig 1: Experimental lay out of PGR trial on Prime, LOR

(16 treatments x 4 replicates, fully randomized split-plot design)

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Prime trial (Northern Cape): Material & Methods:

"Evaluating GA_3 and other PBRs for thinning and sizing of Prime: Effect on return fertility and bunch quality"

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PGR treatments/ application techniques

"Evaluating GA_3 and other PBRs for thinning and sizing of Prime: Effect on bunch quality and return fertility"

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Prime trial (Northern Cape): Material & Methods: Fertility assessment

During dormancy (July/Aug)

Potential fertility

- Forced budding
- Bud dissections

In new growing season

Actual fertility in vineyard after bud break when inflorescences were visible

Prime trial (Northern Cape):
Material & methods: Bunch measurements

Bunch length and mass

Upper 4 laterals:

- length
- no of berries per lateral: normal (≥ 16 mm); small (< 16 mm); Xsmall (< 10 mm)
- berry size (mass, length, diameter)

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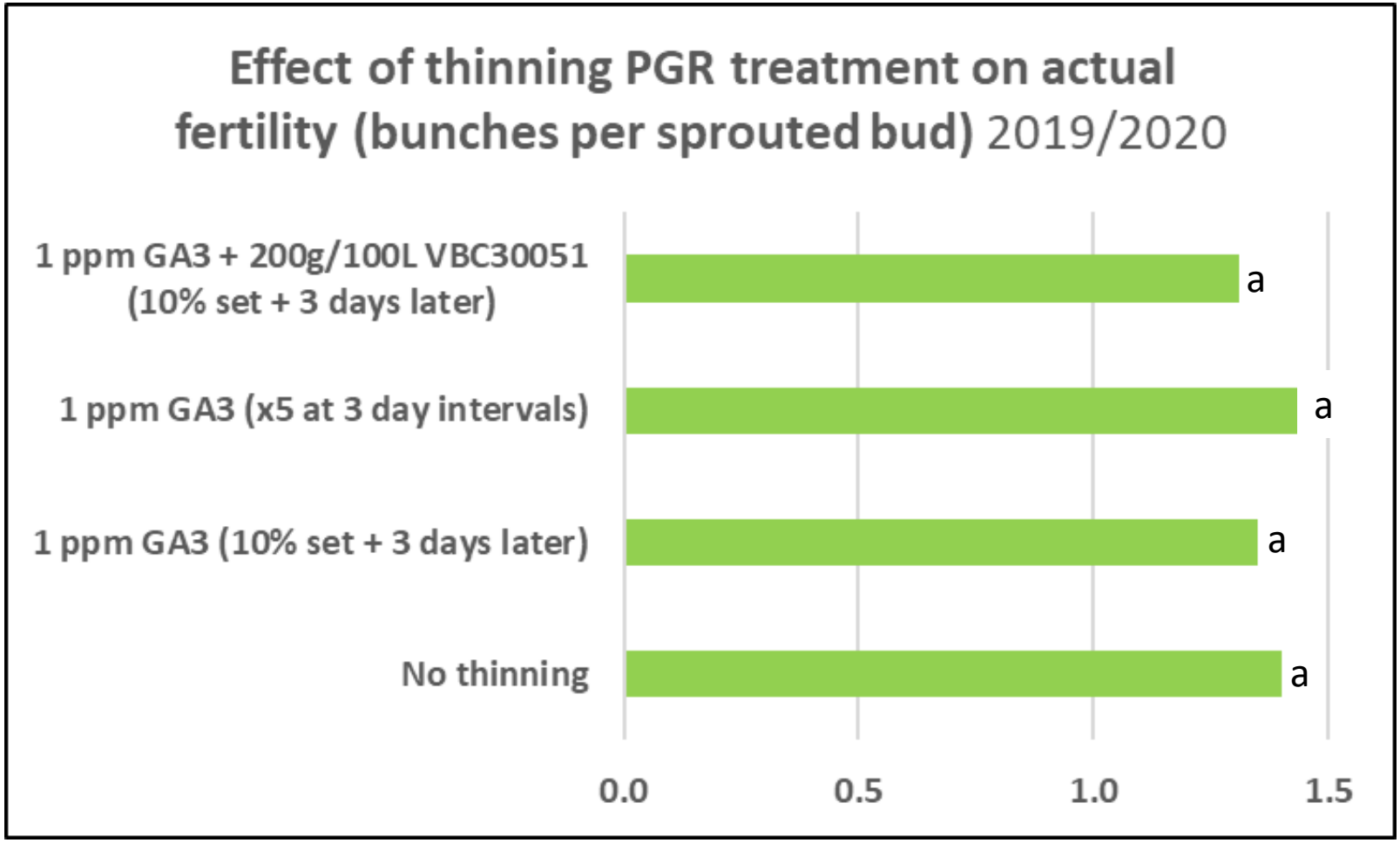
Results: Fertility

Potential fertility (July 2019): no significant differences

Actual fertility (Sept/Oct 2019): some significant differences

Treatment no	Sprayed for thinning	Sprayed for sizing	**Thinning application** (from 10% set/ 110% flowering) (1 ppm GA_3 = 1 g GA_3/1000 L = 2.5g ProGibb®/1000 L) Dosage per ha: 1 g GA_3/ha = 2.5g ProGibb®/ha	**Berry sizing application** (7-8 mm berry + 8-10 mm berry) 20 ppm GA_3 = 20 g GA_3/1000 L = 50g ProGibb®/1000 L) Dosage per ha: 20 g GA_3/ha = 50 g ProGibb®/ha	Bunches per sprouted bud	
1	X	X	No thinning	2 x 20 ppm GA_3 (dipping)	1.46	abc
2	X	√√	No thinning	2 x 20 ppm GA_3 (ESS)	1.48	ab
3	X	√√	No thinning	2 x 20 ppm GA_3 (Cima 250 L/ha)	1.32	bcd
4	X	√√	No thinning	2 x 20 ppm GA3 (Cima 500 L/ha)	1.33	bcd
5	√√	X	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (dipping)	1.44	abcd
6	√√	√√	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (ESS)	1.43	abcd
7	√√	√√	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (Cima 250 L/ha)	1.19	d
8	√√	√√	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA3 (Cima 500 L/ha)	1.34	bcd
9	√√√√√	X	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (dipping)	1.67	a
10	√√√√√	√√	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (ESS)	1.40	bcd
11	√√√√√	√√	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (Cima 250 L/ha)	1.27	bcd
12	√√√√√	√√	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA3 (Cima 500 L/ha)	1.41	abcd
13	√√	X	1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (dipping)	1.39	bcd
14	√√	√√	1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (ESS)	1.31	bcd
15	√√	√√	1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (Cima 250 L/ha)	1.32	bcd
16	√√	√√	1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (Cima 500 L/ha)	1.21	cd

Results: Actual fertility (Sep/Oct 2019)



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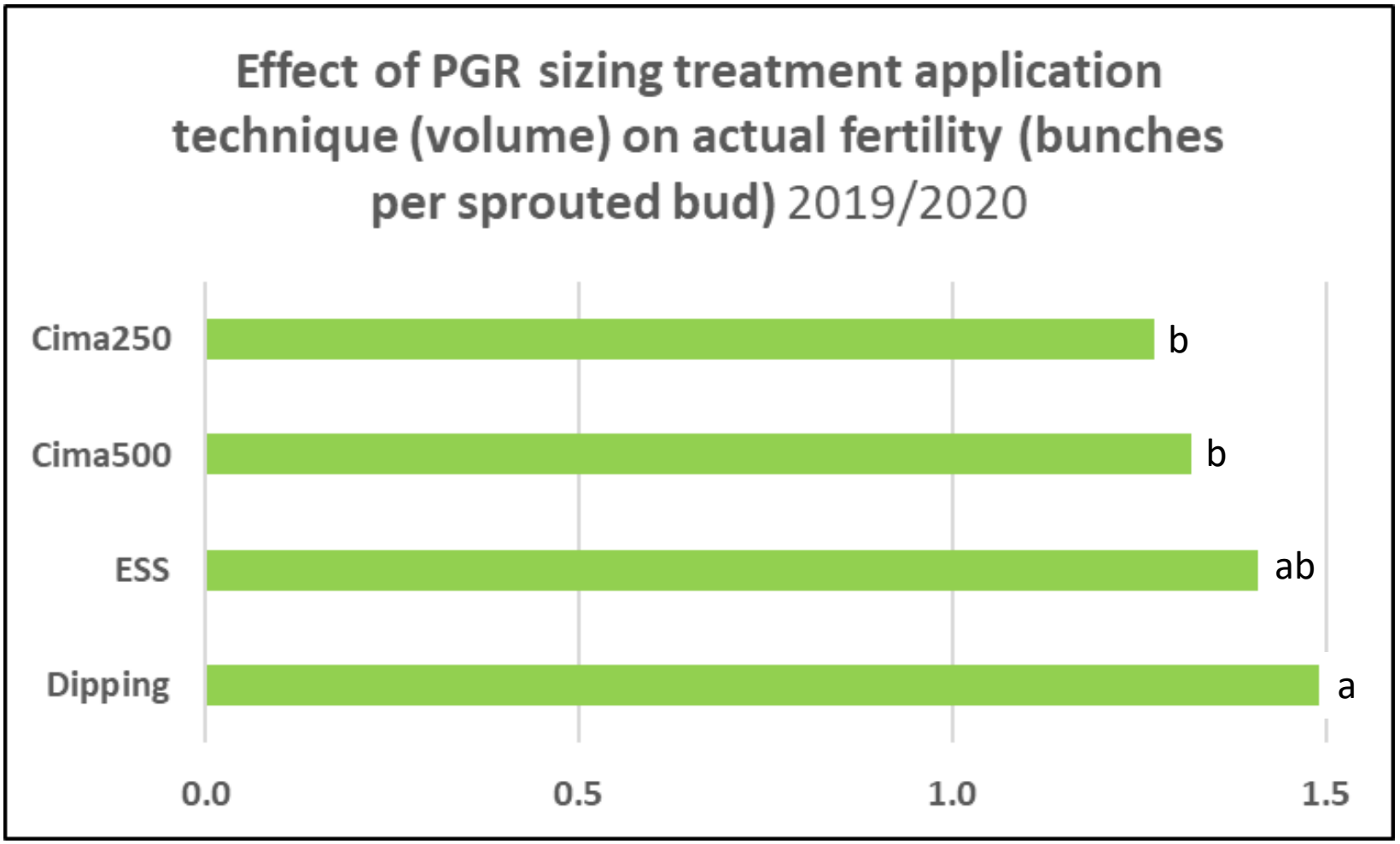
Results: Actual fertility (Sep/Oct 2019)



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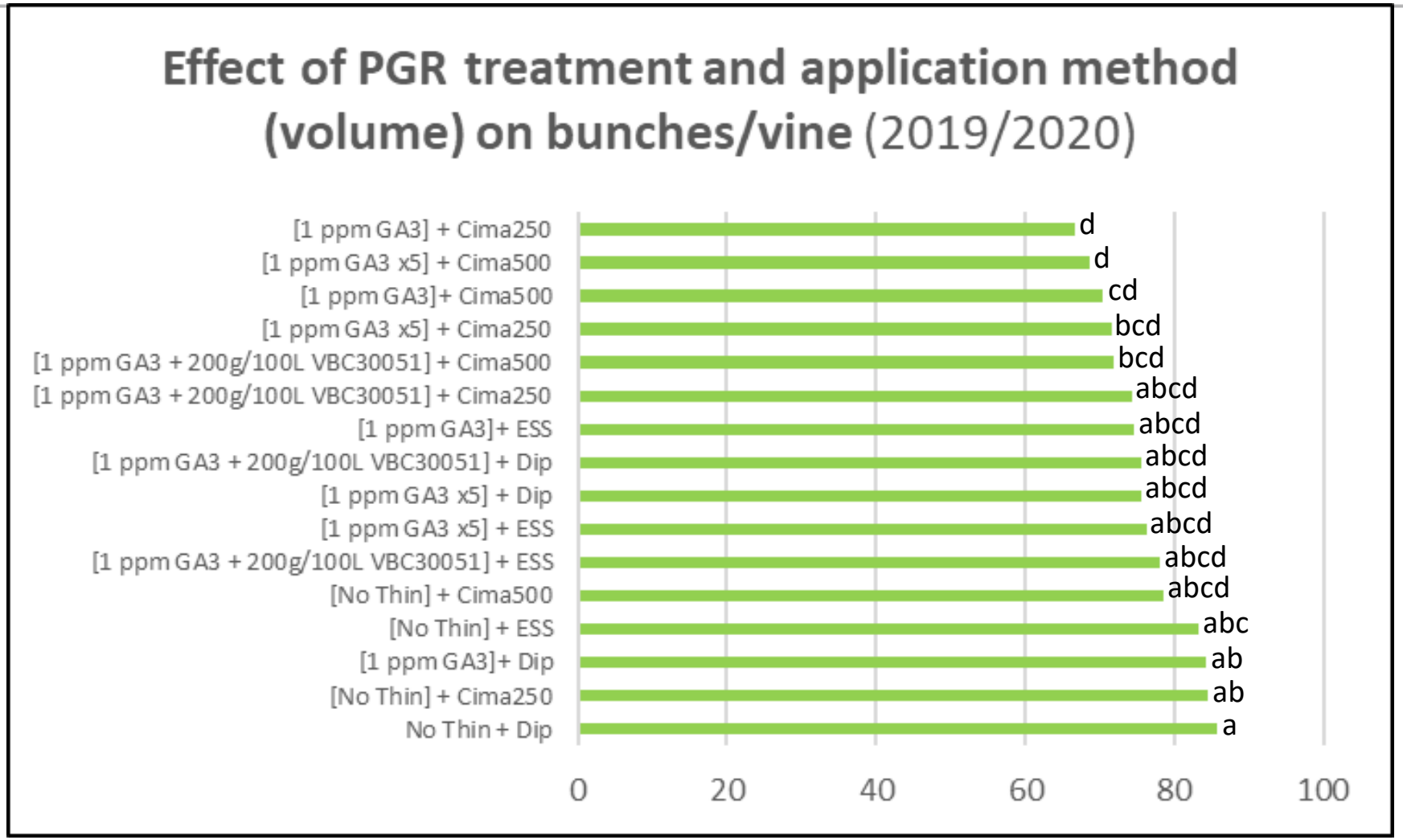
Results: Bunches/vine (Sep/Oct 2019)



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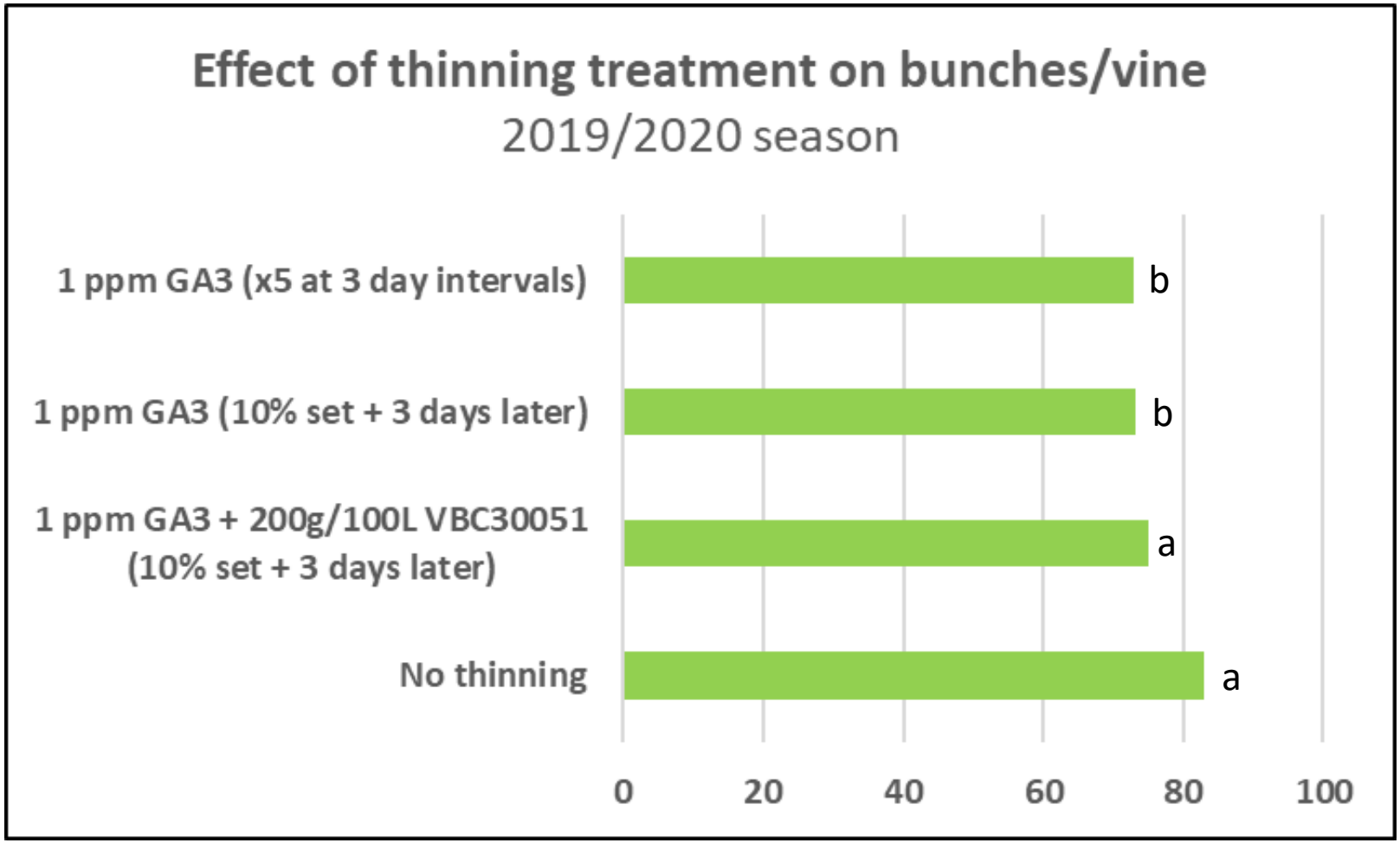
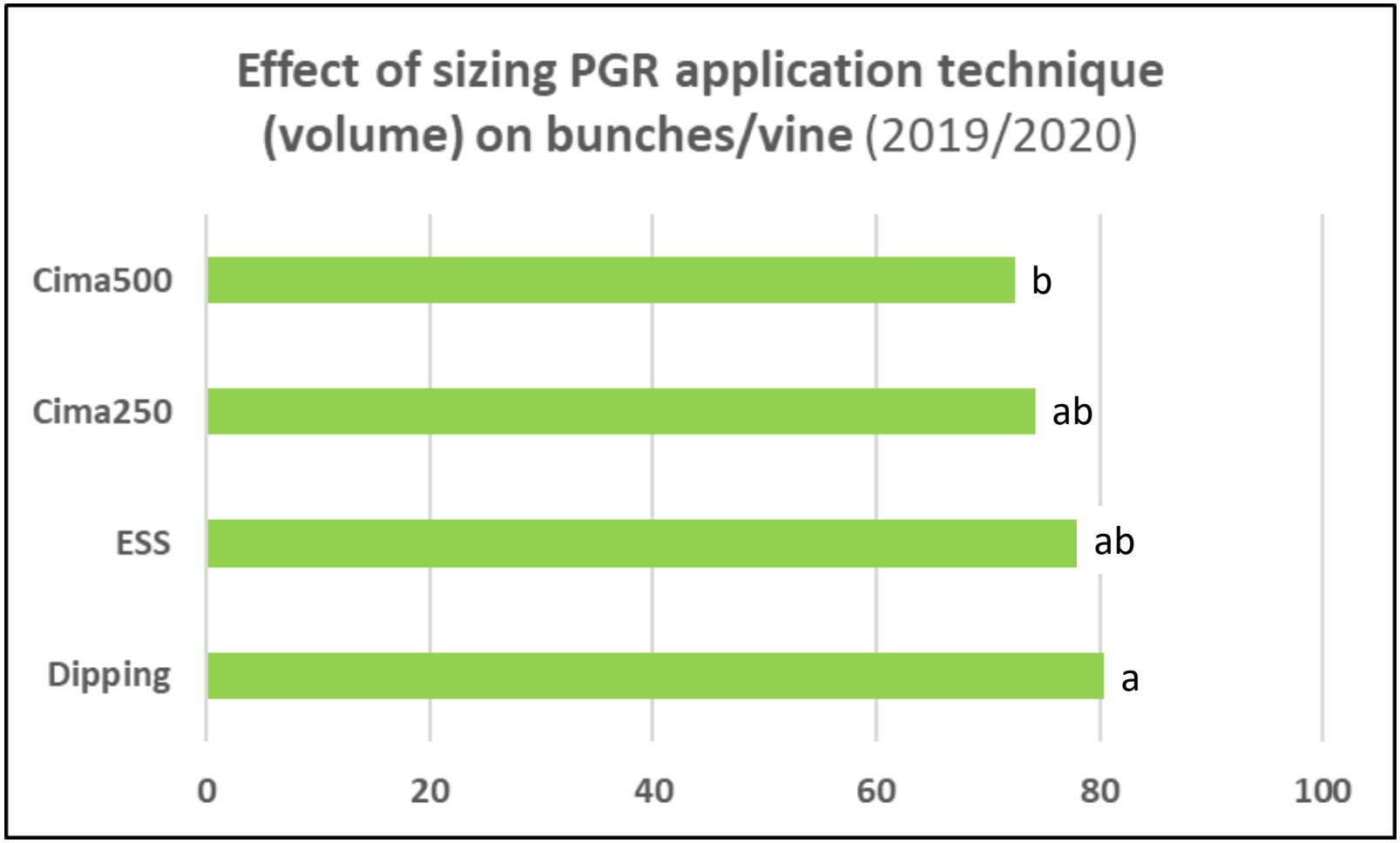
Results: Bunches/vine (Sep/Oct 2019)



Results: Bunches/vine (Sep/Oct 2019)



Results: Bunch quality (2018/19 & 2019/20)

No significant differences between treatments for:

Bunch length (also did not differ significantly between seasons)

Total lateral length

Bunch length (cm) (average of 2 seasons 2018/19 & 2019/20)				
	Sizing			
Thin	**Dip**	**ESS**	**C250**	**C500**
Cont	22.04 a	21.60 a	22.57 a	20.55 a
GAx2	21.12 a	20.34 a	20.96 a	22.30 a
GAx5	21.45 a	21.49 a	21.53 a	21.12 a
GA VBC	21.14 a	21.83 a	20.94 a	21.65 a

Results: Bunch quality (2018/19 & 2019/20)

Significant differences between treatments for:

Bunch compactness score and total no berries/cm lateral

all thinning treatments < control (less compact)

no significant differences between thinning treatments

Total no of XS (**shot berries**)/cm lateral

Dip; ESS < Cima250

no significant difference between Dip/ ESS/ Cima500

Results: Bunch quality (2018/19 & 2019/20)

Treatment no	Thinning application (from 10% set/ 110% flowering) (1 ppm GA_3 = 1 g GA_3/1000 L = 2.5g ProGibb®/1000 L) Dosage per ha: 1 g GA_3/ha = 2.5g ProGibb®/ha	Berry sizing application (7-8 mm berry + 8-10 mm berry) 20 ppm GA_3 = 20 g GA_3/1000 L = 50g ProGibb®/1000 L) Dosage per ha: 20 g GA_3/ha = 50 g ProGibb®/ha	Berry size classification (%) (average of 2 seasons 2018/19 & 2019/2020)			
			Normal (≥ 16 mm)	Small (≥ 16 mm)	Shot berries (<10mm)	Small+Shot berries
1	No thinning	2 x 20 ppm GA_3 (dipping)	95.5 a	3.95 a	0.52 a	4.46 a
2	No thinning	2 x 20 ppm GA_3 (ESS)	92.0 a	6.26 a	1.70 a	7.96 a
3	No thinning	2 x 20 ppm GA_3 (Cima 250 L/ha)	89.8 a	8.27 a	1.97 a	10.25 a
4	No thinning	2 x 20 ppm GA3 (Cima 500 L/ha)	95.2 a	3.66 a	1.11 a	4.77 a
5	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (dipping)	94.3 a	4.77 a	0.99 a	5.75 a
6	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (ESS)	95.5 a	3.61 a	0.86 a	4.47 a
7	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (Cima 250 L/ha)	94.0 a	4.28 a	1.72 a	6.00 a
8	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA3 (Cima 500 L/ha)	94.4 a	3.65 a	1.94 a	5.59 a
9	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (dipping)	92.3 a	6.59 a	1.15 a	7.73 a
10	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (ESS)	96.3 a	3.16 a	0.59 a	3.75 a
11	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (Cima 250 L/ha)	93.2 a	5.15 a	1.62 a	6.77 a
12	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA3 (Cima 500 L/ha)	95.3 a	3.91 a	0.81 a	4.72 a
13	1 ppm GA3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (dipping)	96.3 a	3.31 a	0.39 a	3.70 a
14	1 ppm GA3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (ESS)	96.8 a	2.22 a	0.99 a	3.21 a
15	1 ppm GA3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (Cima 250 L/ha)	95.5 a	3.30 a	1.23 a	4.52 a
16	1 ppm GA3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (Cima 500 L/ha)	95.9 a	3.25 a	0.87 a	4.12 a
17	1% Ureum (10% set + 3 days later)	2 x 20 ppm GA_3 (dipping)	97.3 a	2.65 a	0.08 a	2.73 a

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Results: Bunch quality (2018/19 & 2019/20)

Small (<16mm) & XSmall (<10 mm) berries/ cm (average of 2 seasons 2018/19 & 2019/20)		
	Cont C250	0.185 a
	Cont ESS	0.130 ab
	GAx5 Dip	0.122 abc
	GAx5 C250	0.079 bcd
	GAx2 Dip	0.078 bcd
	Cont Dip	0.078 bcd
	Cont C500	0.074 bcd
	GAx2 C250	0.071 bcd
	GAx2 C500	0.071 bcd
	GA VBC C250	0.058 cd
	GAx5 C500	0.057 d
	GAx2 ESS	0.056 cd
	GA VBC C500	0.055 cd
	Ureum Dip	0.052 cd
	GAx5 ESS	0.046 d
	GA VBC Dip	0.046 d
	GA VBC ESS	0.034 d

Results: Berry size

Berry mass (g) (2018/19)							
	Sizing						
Thin	Dip		ESS		C250		C500	
Cont	6.14	a	6.67	a	6.09	a	6.64	a
GAx2	6.40	a	7.14	a	6.15	a	6.08	a
GAx5	6.64	a	7.43	a	6.93	a	6.41	a
GA VBC	6.67	a	7.46	a	6.60	a	6.53	a
Means	6.46	y	7.17	x	6.44	y	6.41	y

Berry diameter (mm) (2018/19)							
	Sizing						
Thin	Dip		ESS		C250		C500	
Cont	19.6	a	20.0	a	19.4	a	20.2	a
GAx2	19.9	a	20.2	a	19.7	a	19.4	a
GAx5	19.9	a	20.9	a	20.5	a	19.9	a
GA VBC	20.4	a	20.9	a	20.4	a	20.1	a
Means	19.9	y	20.50	x	20.00	y	19.9	y

Results: Berry size

Treat-ment no	Sprayed for thinning	Sprayed for sizing	Thinning application (from 10% set/ 110% flowering) (1 ppm GA_3 = 1 g GA_3/1000 L = 2.5g ProGibb®/1000 L) Dosage per ha: 1 g GA_3/ha = 2.5g ProGibb®/ha	Berry sizing application (7-8 mm berry + 8-10 mm berry) 20 ppm GA_3 = 20 g GA_3/1000 L = 50g ProGibb®/1000 L) Dosage per ha: 20 g GA_3/ha = 50 g ProGibb®/ha	Berry mass (g) (2019/20)	
1	X	X	No thinning	2 x 20 ppm GA_3 (dipping)	7.54	a
2	X	√√	No thinning	2 x 20 ppm GA_3 (ESS)	6.18	a
3	X	√√	No thinning	2 x 20 ppm GA_3 (Cima 250 L/ha)	6.09	a
4	X	√√	No thinning	2 x 20 ppm GA3 (Cima 500 L/ha)	7.01	a
5	√√	X	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (dipping)	8.52	a
6	√√	√√	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (ESS)	7.17	a
7	√√	√√	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (Cima 250 L/ha)	7.04	a
8	√√	√√	1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA3 (Cima 500 L/ha)	7.83	a
9	√√√√√	X	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (dipping)	8.48	a
10	√√√√√	√√	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (ESS)	7.87	a
11	√√√√√	√√	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (Cima 250 L/ha)	7.43	a
12	√√√√√	√√	1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA3 (Cima 500 L/ha)	8.29	a
13	√√	X	1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (dipping)	8.71	a
14	√√	√√	1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (ESS)	7.43	a
15	√√	√√	1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (Cima 250 L/ha)	7.23	a
16	√√	√√	1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (Cima 500 L/ha)	8.01	a

Berry mass (g) 2019/20		
ESS	7.174	a
Dip	6.463	b
C250	6.442	b
C500	6.416	b

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Results: Bunch mass

Treatment no	Colour code		Thinning application (from 10% set/ 110% flowering) (1 ppm GA_3 = 1 g GA_3/1000 L = 2.5g ProGibb®/1000 L) Dosage per ha: 1 g GA_3/ha = 2.5g ProGibb®/ha	Berry sizing application (7-8 mm berry + 8-10 mm berry) 20 ppm GA_3 = 20 g GA_3/1000 L = 50g ProGibb®/1000 L) Dosage per ha: 20 g GA_3/ha = 50 g ProGibb®/ha
1			No thinning	2 x 20 ppm GA_3 (dipping)
2			No thinning	2 x 20 ppm GA_3 (ESS)
3			No thinning	2 x 20 ppm GA_3 (Cima 250 L/ha)
4			No thinning	2 x 20 ppm GA3 (Cima 500 L/ha)
5			1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (dipping)
6			1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (ESS)
7			1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA_3 (Cima 250 L/ha)
8			1 ppm GA_3 (10% set + 3 days later)	2 x 20 ppm GA3 (Cima 500 L/ha)
9			1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (dipping)
10			1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (ESS)
11			1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA_3 (Cima 250 L/ha)
12			1 ppm GA_3 (x5 at 3 day intervals)	2 x 20 ppm GA3 (Cima 500 L/ha)
13			1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (dipping)
14			1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (ESS)
15			1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (Cima 250 L/ha)
16			1 ppm GA_3 + 200g/100L VBC30051(10% set) + 1 ppm GA_3 3 days later)	2 x 20 ppm GA_3 (Cima 500 L/ha)
17*			1% Urea (10% set + 3 days later)	2 x 20 ppm GA_3 (dipping)

Nr	Bunch mass (g) (average 2018/19 & 2019/20)	
T1	854.6	a
T9	783.7	ab
T13	722.4	abc
T5	713.4	abcd
T12	708.9	abcde
T10	694.5	bcde
T4	690.4	bcde
T17	679.1	bcde
T11	668.6	bcde
T3	666.3	bcde
T2	629.2	cdef
T8	612	cdef
T15	592.7	cdef
T16	574.4	cdef
T14	565.5	def
T6	564.2	ef
T7	503.8	f

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Results: Bunch quality (2018/19 & 2019/20)

No Thin

GA_3 x 2

GA_3 x 5

GA_3 + VBC0051

Ureum

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Results: Thinning time

Manual Thinning time (1st thinning action) (2019/2020)				
Treatment	hours/ha	min/bunch	s/bunch	
Control	1191	1.55	93	
GAx2	1134	1.48	89	
GAx5	894	1.17	70	
GA VBC	911	1.19	71	
(1684 vines/ha; 28 bunches/vine)				

High % Normal (≥ 16mm) berries: 89.80 - 96.80%
Low % Shot berries: 0.39 - 1.97%
% Small (< 16mm) & Shot: 3.21 - 10.25%

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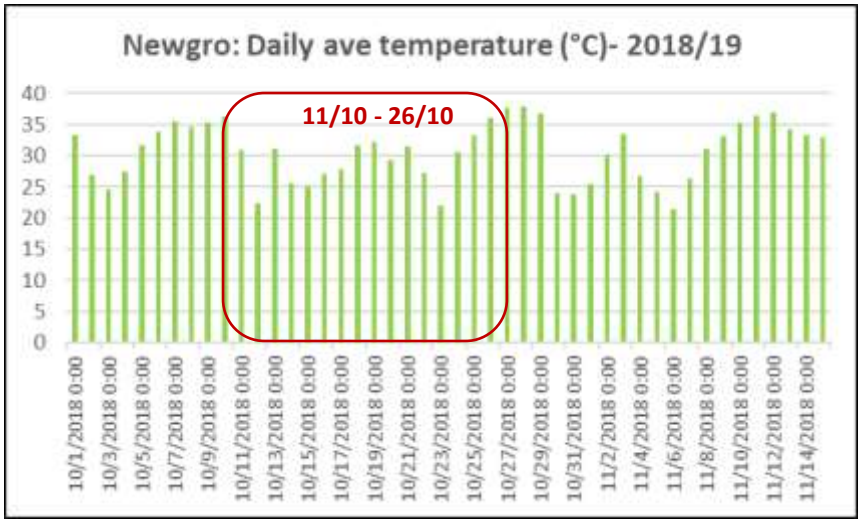
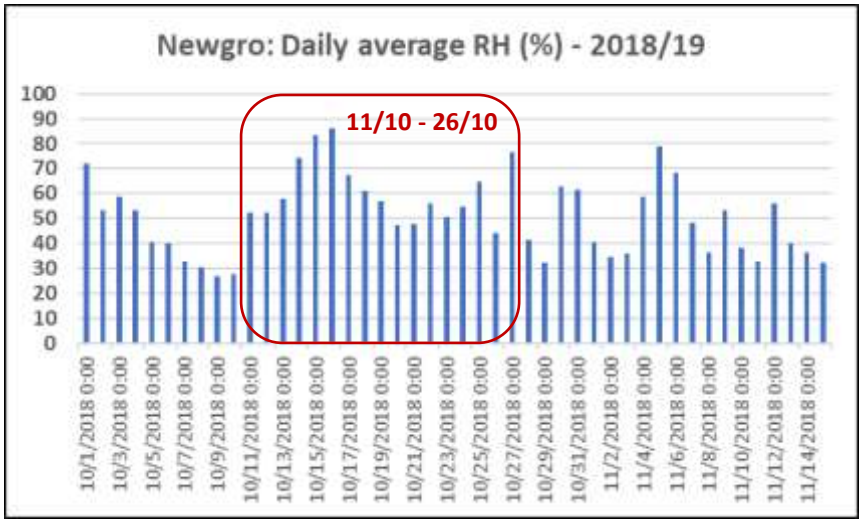
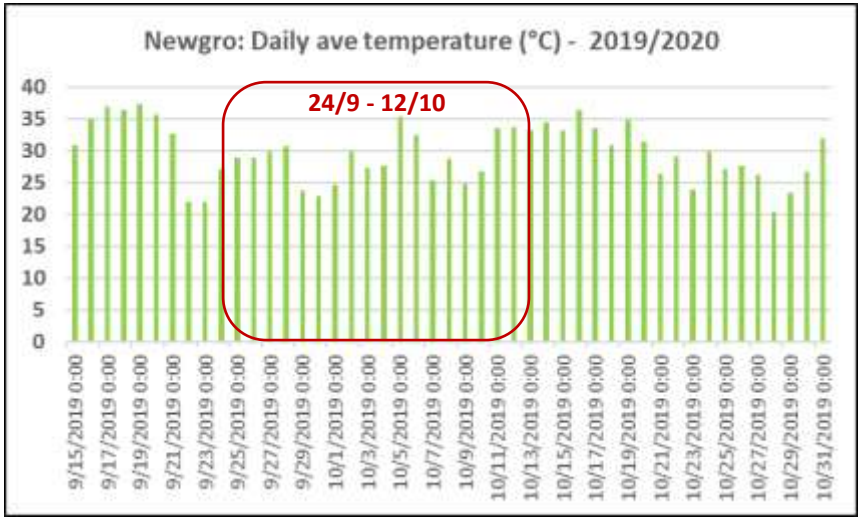
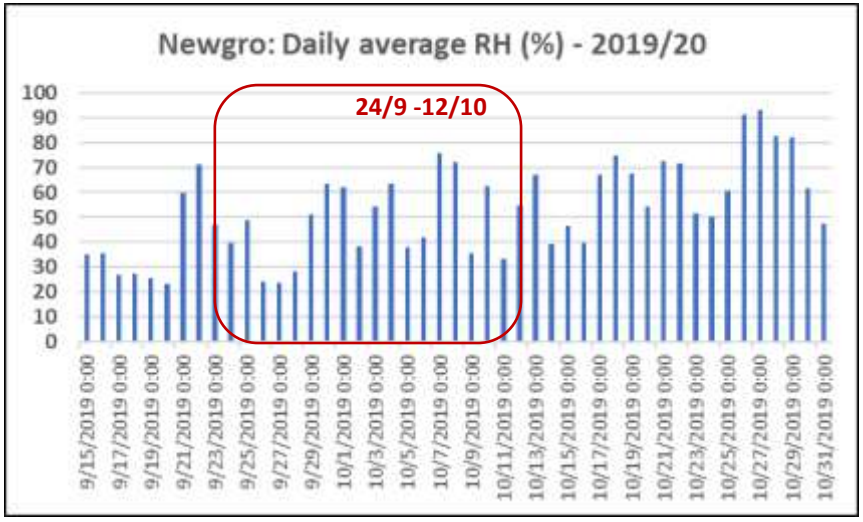
Results: Temp and Relative humidity









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Prime trial (Northern Cape): Conclusion

- Preliminary results:

  Return fertility data of one season (2019/2020)

  More bunches per vine with GA_3+VBC thinning treatment compared to the other thinning treatments

  Bunch quality data of 2 seasons (2018/19 & 2019/20)

  no significant effect on bunch length

  significant effect on bunch mass

  some treatments looked promising regarding evenness of berry size, but results did not show significant differences

- Trial to be continued for one more season.

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Research Team

- Eunice Avenant (SU, SATI)
- Jan Avenant (ARC Infruitec-Nietvoorbij)
- Post-graduate students (SU DVO & SAGWRI)
- BSc Agric 4th year Internship students (DVO & SAGWRI)
- Members of ARC Viticulture Division (collaborators) (Nietvoorbij and Upington)

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- SASEV
- Villa Crop

TECHNICAL SUPPORT/ INPUTS

- Philagro
- Laborans team
- Newgro team
- Rovic Leers
- ARC Infruitec-Nietvoorbij Viticulture staff
- US Viticulture Table grape students

PRODUCTS SUPPLIED

- Philagro