FINAL REPORT

Evaluation of GCAU0001 and GCAU0002 for the control of bacterial speck (*Pseudomonas syringae* pv. *tomato*) and for crop safety in tomatoes cv. Grosse Lisse

Devonport, Tasmania, 2019

Protocol Number:
Bacterial Speck Copper Efficacy Protocol 2019v2 09102019

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Grochem Australia

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SUMMARY

At Devonport, Tasmania in 2019, a pot trial was conducted to evaluate GCAU0001 and GCAU0002 for the control of bacterial speck (*Pseudomonas syringae* pv. *tomato*) and for crop safety in tomatoes cv. Grosse Lisse. Treatments included:

- GCAU0001 at 1250, 2500 or 5000 mL/100 L,
- GCAU0002 at 100, 200 or 400 mL/100 L,
- Hydrocop 500 WG at 105 g/100 L,
- Red Copper 500 WG at 155 g/100 L,
- Bordeaux 200 WG at 280 g/100 L, with and without GCAU0003 at 400 mL/100 L at timing A,
- GCAU0003 at 200 or 400 mL/100 L, and
- an untreated control.

Treatments were applied as three foliar sprays (Timings A, B and C) with a spray interval of 7-8 days, beginning on 16/10/19 when tomatoes were at the 4-true leaves unfolded crop stage (BBCH 14), in a spray volume equivalent to 1,700 L/ha (sprayed to the point of run-off). The untreated control was sprayed with water only.

Bacterial speck was assessed at 7 days after application A (7DAAA), 8DAAB, 6DAAC, 14DAAC, 22DAAC and 28DAAC, when crop biomass and phytotoxicity were also assessed.

One day after each application, plants were inoculated with bacterial speck using a hand atomiser. The inoculum solution consisted of a suspension of bacterial cells in water. Inoculation 1 (17/10/19) was approximately 1.0 x 10^6 colony forming units/mL (CFU/mL) and was applied to the point of run-off. Plants were then kept in the glasshouse and misted every hour for two minutes. After 1 week, disease levels were very low, so inoculations 2 and 3 were conducted with a solution of approximately 4.2 x 10^5 CFU/mL and kept in a humidified chamber set to 80% humidity and 18°C for 4-6 hours before the unit was switched off and left overnight. Tomato plants were then moved back to the glasshouse under the conditions described above.

Bacterial speck incidence was very high in the trial area, with 100% of plants affected in untreated control plots at 8DAAB, and 100% of treated plants affected by 6DAAC. Treatments including Bordeaux took longer to reach 100% disease incidence than all other sprayed treatments.

Bacterial speck infection was first assessed at 7DAAA when all treatments had between 0.0-0.2% leaf area affected by old and new bacterial speck infections (Table 2). This increased to 58% leaf area affected by old and new bacterial speck infections in the untreated control at 14DAAC. At 22DAAC and 28DAAC, only new bacterial speck infections on tomato leaves were assessed.

Applications of Red Copper, Bordeaux and the GCAU0003 and Bordeaux spray program generally provided superior control of bacterial speck to all other sprayed treatments.

The addition of GCAU0003 to Bordeaux did not consistently enhance bacterial speck control compared to Bordeaux applied alone.

No obvious rate response was seen for GCAU0001 or GCAU0002, although bacterial speck severity was generally lower for the highest application rate of each than the lowest application rate.

GCAU0001 and GCAU0002 were generally equivalent to Hydrocop and GCAU0003 for bacterial speck control.

Significant leaf burn was seen for all GCAU0001 treatments at all assessment timings, with more leaf burn at higher GCAU0001 application rates. The level of damage decreased over time.

Biomass of tomato plants was equivalent for all treatments at all assessment timings

Under the prevailing conditions of this trial, GCAU0002, Hydrocop, Red Copper, Bordeaux and GCAU0003 were safe to tomatoes cv. Grosse Lisse.

INTRODUCTION

Aims

- To investigate the efficacy of GCAU0001 or GCAU0002 for the control of bacterial speck (*Pseudomonas syringae* pv. *tomato*) in tomatoes cv. Grosse Lisse.
- To determine the optimum rate of GCAU0001 or GCAU0002 for the control of bacterial speck in tomatoes.
- To compare GCAU0001 or GCAU0002 against Hydrocop 500 WG, Red Copper 500 WG or Bordeaux 200 WG for the control of bacterial speck.
- To examine the crop safety of GCAU0001 and GCAU0002 in tomatoes cv. Grosse Lisse.

Disease

Bacterial speck (*Pseudomonas syringae* pv. *tomato*)

MATERIALS AND METHODS

Products

Product name	Active ingredient (ai)	Concentration of active ingredient	Formulation	Batch number
GCAU0001*	copper	Not provided	Not provided	Not provided
GCAU0002*	copper	Not provided	Not provided	Not provided
Hydrocop 500 WG	copper present as cupric hydroxide	500 g/kg	Water dispersible granule	Not provided
Red Copper 500 WG	copper	500 g/kg	Water dispersible granule	Not provided
Bordeaux 200 WG	copper present as tribasic copper sulphate	200 g/kg	Water dispersible granule	Not provided
GCAU0003*	Not provided	Not provided	Not provided	Not provided

*Code name

Treatments

No.	Product	Product rate (mL or g/100 L)	Application	
			Timing	Schedule
1	Untreated control	Nil	N/A	Three foliar applications with a spray interval of 7-8 days, beginning on 16/10/19 when tomatoes were at the 4-true leaves unfolded crop stage (BBCH 14), in a spray volume equivalent to 1,700 L/ha (sprayed to the point of run-off)
2	GCAU0001	1250 mL	ABC	
3	GCAU0001	2500 mL	ABC	
4	GCAU0001	5000 mL	ABC	
5	GCAU0002	100 mL	ABC	
6	GCAU0002	200 mL	ABC	
7	GCAU0002	400 mL	ABC	
8	Hydrocop 500 WG	105 g	ABC	
9	Red Copper 500 WG	155 g	ABC	
10	Bordeaux 200 WG	280 g	ABC	
11	GCAU0003	200 mL	ABC	
12	GCAU0003	400 mL	ABC	
13	GCAU0003 + Bordeaux 200 WG	400 mL 280 g	A ABC	

Chronology of events

Date	Days after application timing (DAA#)	Crop stage		Event
		BBCH scale	Description	
01/10/19	-15DAAA	12	2 true leaves unfolded	Tomato seedlings transplanted
16/10/19	0DAAA	14	4 true leaves unfolded	Application A
17/10/19	1DAAA			Inoculation 1
23/10/19	7DAAA	16	6 true leaves unfolded	Bacterial speck assessment Crop biomass and phytotoxicity assessments Application B
24/10/19	1DAAB			Inoculation 2
31/10/19	8DAAB	17	7 true leaves unfolded	Bacterial speck assessment Crop biomass and phytotoxicity assessments Application C
01/11/19	1DAAC			Inoculation 3
06/11/19	6DAAC	18	8 true leaves unfolded	Bacterial speck assessment Crop biomass and phytotoxicity assessments
14/11/19	14DAAC	19	9 or more true leaves	Bacterial speck assessment Crop biomass and phytotoxicity assessments
22/11/19	22DAAC			Bacterial speck assessment Crop biomass and phytotoxicity assessments
28/11/19	28DAAC	51	First inflorescence visible	Bacterial speck assessment Crop biomass and phytotoxicity assessments

RESULTS

Table 1. Tomato bacterial speck incidence

No.	Treatment	Product rate (mL or g/100 L)	Timing	Tomato bacterial speck (*Pseudomonas syringae* pv. *tomato*) incidence (% leaves affected)					
				Existing + new infections				New infections	
				7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
1	Untreated control	Nil	N/A	20	100	100	100	100	100
2	GCAU0001	1250 mL	ABC	20	100	100	100	100	100
3	GCAU0001	2500 mL	ABC	0	100	100	100	100	100
4	GCAU0001	5000 mL	ABC	0	80	100	100	100	100
5	GCAU0002	100 mL	ABC	20	100	100	100	100	100
6	GCAU0002	200 mL	ABC	0	80	100	100	100	100
7	GCAU0002	400 mL	ABC	0	100	100	100	100	100
8	Hydrocop 500 WG	105 g	ABC	20	80	100	100	100	100
9	Red Copper 500 WG	155 g	ABC	0	80	100	100	100	100
10	Bordeaux 200 WG	280 g	ABC	0	60	100	100	100	100
11	GCAU0003	200 mL	ABC	0	100	100	100	100	100
12	GCAU0003	400 mL	ABC	0	100	100	100	100	100
13	GCAU0003 + Bordeaux 200 WG	400 mL 280 g	A ABC	0	60	100	100	100	100
			***P*-value**	0.7037	0.3398	1.0000	1.0000	1.0000	1.0000
			LSD (*P* ≤ 0.05)	NSD	NSD	NSD	NSD	NSD	NSD

DAA# = Days after application timing
NSD = No significant difference due to a P-value > 0.05

Table 2. Tomato bacterial speck severity

No.	Treatment	Product rate (mL or g/100 L)	Timing	Tomato bacterial speck (*Pseudomonas syringae* pv. *tomato*) severity (% leaf area affected)					
				Existing + new infections				New infections	
				7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
1	Untreated control	Nil	N/A	0.2	2.4 abcd	48 ab	58	19 a	16 a
2	GCAU0001	1250 mL	ABC	0.2	2.6 abc	54 a	57	15 abcd	10 ab
3	GCAU0001	2500 mL	ABC	0.0	3.4 a	40 abc	52	16 abc	11 ab
4	GCAU0001	5000 mL	ABC	0.0	1.2 cde	48 ab	57	11 bcde	9 bcd
5	GCAU0002	100 mL	ABC	0.2	4.6 a	36 bcd	52	12 abcd	10 abcd
6	GCAU0002	200 mL	ABC	0.0	1.4 bcde	25 cd	54	11 bcde	10 abc
7	GCAU0002	400 mL	ABC	0.0	1.4 bcde	32 cd	54	18 ab	13 ab
8	Hydrocop 500 WG	105 g	ABC	0.2	1.4 bcde	34 bcd	53	8 de	8 abcd
9	Red Copper 500 WG	155 g	ABC	0.0	1.0 de	32 cd	48	6 e	5 d
10	Bordeaux 200 WG	280 g	ABC	0.0	0.6 e	26 cd	50	10 cde	4 d
11	GCAU0003	200 mL	ABC	0.0	2.8 ab	30 cd	44	14 abcd	13 ab
12	GCAU0003	400 mL	ABC	0.0	2.6 abc	33 bcd	58	13 abcd	9 abc
13	GCAU0003 + Bordeaux 200 WG	400 mL 280 g	A ABC	0.0	0.6 e	21 d	44	6 a	5 a
			***P*-value**	0.7037	0.0001	0.0021	0.5878	0.0020	0.0037
			LSD (*P* ≤ 0.05)	NSD	tL	15.6	NSD	tS	tL

Means followed by the same letter are not significantly different (P = 0.05, LSD)
DAA# = Days after application timing
NSD = No significant difference due to a P-value > 0.05
tL = Original plot means are presented with analysis of variance and letters of separation from data transformed using y = Log (x + 1)
tS = Original plot means are presented with analysis of variance and letters of separation from data transformed using y = SQRT (x + 0.5)

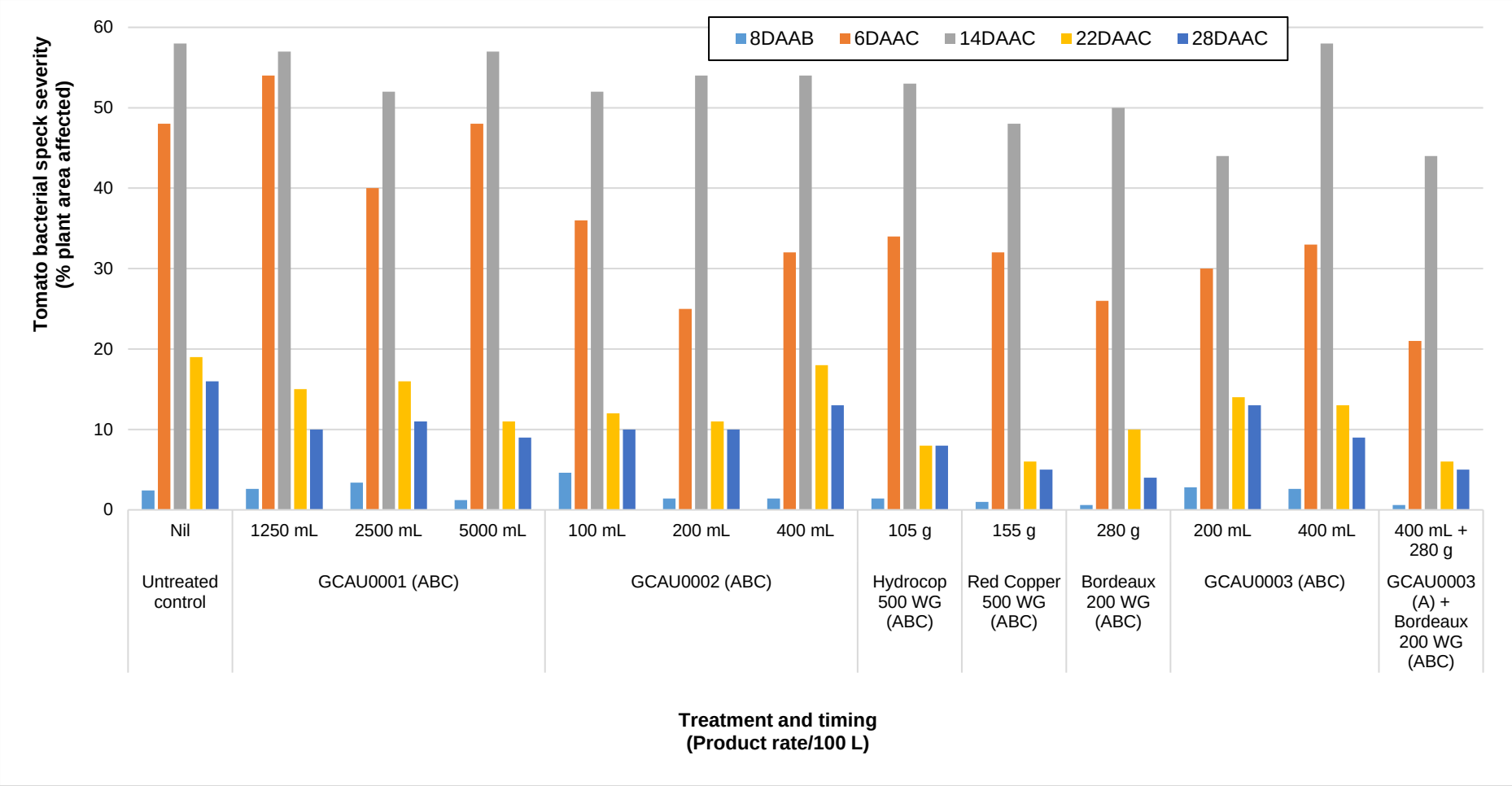


Figure 1: Tomato bacterial speck severity at 8DAAB, 6DAAC, 14DAAC, 22DAAC and 28DAAC

Table 3. Tomato plant biomass

No.	Treatment	Product rate (mL or g/100 L)	Timing	Tomato cv. Grosse Lisse plant biomass (% relative to the untreated control in each replicate)					
				7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
1	Untreated control	Nil	N/A	100	100	100	100	100	100
2	GCAU0001	1250 mL	ABC	103	103	101	103	98	102
3	GCAU0001	2500 mL	ABC	105	106	106	109	106	105
4	GCAU0001	5000 mL	ABC	99	100	98	103	100	101
5	GCAU0002	100 mL	ABC	102	100	103	101	101	102
6	GCAU0002	200 mL	ABC	104	107	98	103	104	105
7	GCAU0002	400 mL	ABC	104	107	101	105	103	101
8	Hydrocop 500 WG	105 g	ABC	101	100	105	102	99	100
9	Red Copper 500 WG	155 g	ABC	99	99	103	98	98	102
10	Bordeaux 200 WG	280 g	ABC	100	99	100	101	100	101
11	GCAU0003	200 mL	ABC	101	104	101	103	99	101
12	GCAU0003	400 mL	ABC	99	100	98	99	99	99
13	GCAU0003 + Bordeaux 200 WG	400 mL 280 g	A ABC	104	106	105	104	103	104
			***P*-value**	0.1296	0.0519	0.1738	0.1273	0.3410	0.8330
			LSD (*P* ≤ 0.05)	NSD	NSD	NSD	NSD	NSD	NSD

DAA# = Days after application timing
NSD = No significant difference due to a P-value > 0.05

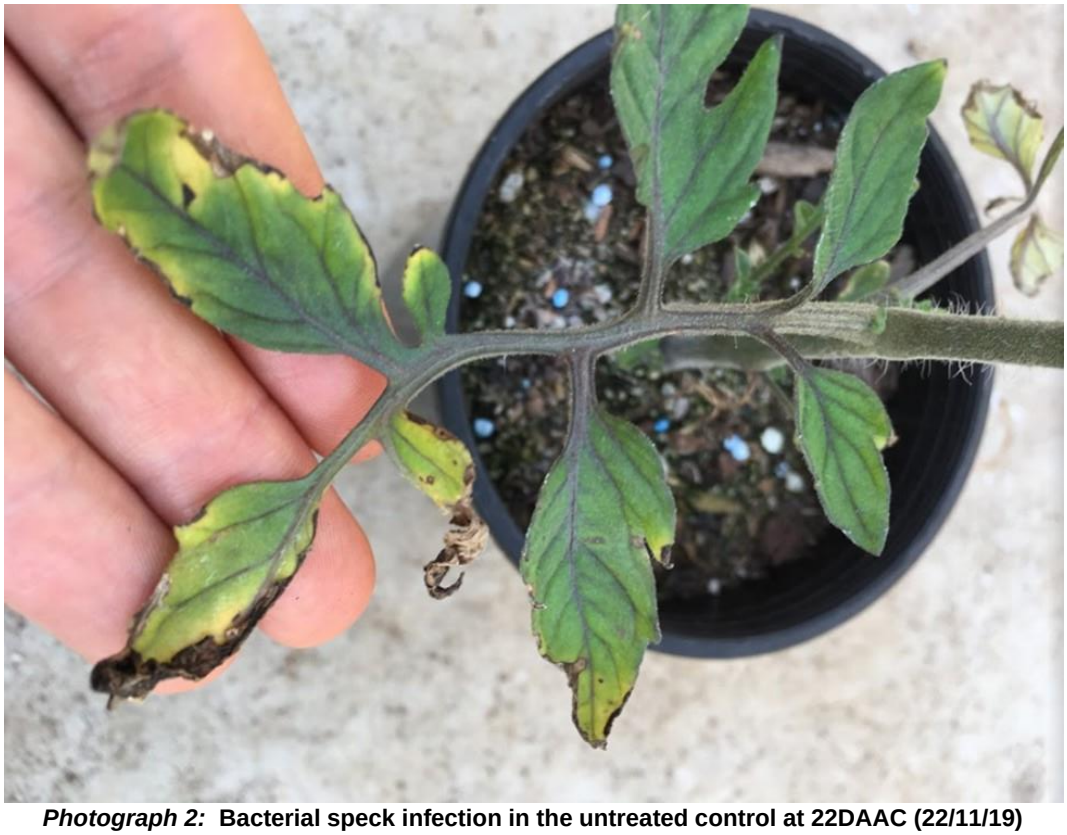
Table 4. Tomato leaf burn

No.	Treatment	Product rate (mL or g/100 L)	Timing	Tomato cv. Grosse Lisse leaf burn (% of leaf area affected)					
				7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
1	Untreated control	Nil	N/A	0.0 c	0.0 c	0.0 d	0.0 d	0.0 c	0.0 d
2	GCAU0001	1250 mL	ABC	1.2 b	1.2 b	1.2 c	1.0 c	0.6 b	0.4 c
3	GCAU0001	2500 mL	ABC	2.0 b	1.8 b	2.2 b	1.6 b	0.8 b	0.8 b
4	GCAU0001	5000 mL	ABC	4.0 a	3.4 a	3.8 a	3.2 a	1.8 a	1.4 a
5	GCAU0002	100 mL	ABC	0.0 c	0.0 c	0.0 d	0.0 d	0.0 c	0.0 d
6	GCAU0002	200 mL	ABC	0.2 c	0.0 c	0.0 d	0.0 d	0.0 c	0.0 d
7	GCAU0002	400 mL	ABC	0.0 c	0.0 c	0.0 d	0.0 d	0.0 c	0.0 d
8	Hydrocop 500 WG	105g	ABC	0.0 c	0.0 c	0.0 d	0.0 d	0.0 c	0.0 d
9	Red Copper 500 WG	155 g	ABC	0.0 c	0.0 c	0.0 d	0.0 d	0.0 c	0.0 d
10	Bordeaux 200 WG	280 g	ABC	0.2 c	0.0 c	0.0 d	0.0 d	0.0 c	0.0 d
11	GCAU0003	200 mL	ABC	0.2 c	0.0 c	0.0 d	0.0 d	0.0 c	0.0 d
12	GCAU0003	400 mL	ABC	0.2 c	0.0 c	0.0 d	0.0 d	0.0 c	0.0 d
13	GCAU0003 + Bordeaux 200 WG	400 mL 280 g	A ABC	0.0 c	0.0 c	0.0 d	0.0 d	0.0 c	0.0 d
			***P*-value**	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
			LSD (*P* ≤ 0.05)	tA	tA	0.56	tA	0.39	0.32

Means followed by the same letter are not significantly different (P = 0.05, LSD)
DAA# = Days after application timing
tA = Original plot means are presented with analysis of variance and letters of separation from data transformed using y = Arcsine square root percent (x)

PHOTOGRAPHS

Photograph 1: **Bacterial speck culture, prior to trial initiation**



Photograph 2: **Bacterial speck infection in the untreated control at 22DAAC (22/11/19)**

DISCUSSION

At Devonport, Tasmania in 2019, a pot trial was conducted to evaluate GCAU0001and GCAU0002 for the control of bacterial speck (*Pseudomonas syringae* pv. *tomato*) and for crop safety in tomatoes cv. Grosse Lisse. Treatments were applied as three foliar sprays (Timings A, B and C) with a spray interval of 7-8 days, beginning on 16/10/19 when tomatoes were at the 4-true leaves unfolded crop stage (BBCH 14), in a spray volume equivalent to 1,700 L/ha (sprayed to the point of run-off). The untreated control was sprayed with water only.

Tomato seedlings were transplanted from punnets into 1.3 L pots, with a single plant per pot. Plants were kept outdoors until the commencement of the trial 15 days later on 16/10/19. One day after each application, plants were inoculated with bacterial speck using a hand atomiser. The inoculum solution consisted of a suspension of bacterial cells in water. Inoculation 1 (17/10/19) was approximately 1.0×10^6 colony forming units/mL (CFU/mL) and was applied to the point of run-off. Plants were then kept in the glasshouse and misted every hour for two minutes. After 1 week, disease levels were very low, so inoculations 2 and 3 were conducted with a solution of approximately 4.2×10^5 CFU/mL and kept in a humidified chamber set to 80% humidity and 18°C for 4-6 hours before the unit was switched off and left overnight. Tomato plants were then moved back to the glasshouse under the conditions described above.

Bacterial speck incidence was very high in the trial area, with 100% of plants affected in untreated control plots at 8 days after application B (8DAAB), and 100% of treated plants affected by 6DAAC (Table 1). Treatments including Bordeaux 200 WG took longer to reach 100% disease incidence than all other sprayed treatments.

Bacterial speck infection was first assessed at 7DAAA when all treatments had between 0.0-0.2% leaf area affected by old and new bacterial speck infections (Table 2). This increased to 58% leaf area affected by old and new bacterial speck infections in the untreated control at 14DAAC. At 22DAAC and 28DAAC, only new bacterial speck infections on tomato leaves were assessed.

Applications of Red Copper 500 WG, Bordeaux and the GCAU0003 and Bordeaux spray program generally provided superior control of bacterial speck to all other sprayed treatments, although the addition of GCAU0003 to Bordeaux did not consistently enhance bacterial speck control compared to Bordeaux applied alone. No obvious rate response was seen for GCAU0001or GCAU0002, although bacterial speck severity was generally lower for the highest application rate of each than the lowest application rate (Table 2). GCAU0001 and GCAU0002 were generally equivalent to Hydrocop 500 WG and GCAU0003.

At the same time as each bacterial speck assessment, plants were also assessed for any sign of general phytotoxicity including, but not limited to yellowing, necrosis and plant growth/development effects. Leaf burn was the only phytotoxic symptom seen in the trial, with all GCAU0001 treatments causing significant leaf burn at all assessment timings (Table 4). A rate response was evident, with more leaf burn at higher GCAU0001 application rates, although the level of damage decreased over time from 4.0% leaf area affected at 7DAAA to 1.4% leaf area affected at 28DAAC after treatment with GCAU0001 at 5000 mL/100 L. The biomass of tomato plants was equivalent for all treatments at all assessment timings (Table 3). Under the prevailing conditions of this trial, GCAU0002, Hydrocop, Red Copper, Bordeaux and GCAU0003 were safe to tomatoes cv. Grosse Lisse.

CONCLUSIONS

- Applications of Red Copper 500 WG, Bordeaux 200 WG and the GCAU0003 (NUL 3367) and Bordeaux spray program generally provided superior control of bacterial speck (*Pseudomonas syringae* pv. *tomato*) to all other sprayed treatments.
- The addition of GCAU0003 to Bordeaux did not consistently enhance bacterial speck control compared to Bordeaux applied alone.
- No obvious rate response was seen for GCAU0001 or GCAU0002, although bacterial speck severity was generally lower for the highest application rate of each than the lowest application rate.
- GCAU0001 and GCAU0002 were generally equivalent to Hydrocop 500 WG and GCAU0003 (NUL 3367) for bacterial control.
- Significant leaf burn was seen for all GCAU0001 treatments at all assessment timings, with more leaf burn at higher GCAU0001 application rates. The level of damage decreased over time.
- Biomass of tomato plants was equivalent for all treatments at all assessment timings
- Under the prevailing conditions of this trial, GCAU0002, Hydrocop, Red Copper, Bordeaux and GCAU0003 were safe to tomatoes cv. Grosse Lisse.

APPENDICES

Appendix i. Trial details

Site details

Location	Devonport, Tasmania, Australia, 7310
GPS co-ordinates	-41.191410, 146.323264
Soil type	Tomato and vegetable raising mix
Soil texture	Potting mix
Crop	Tomatoes
Variety	Grosse Lisse
Trial design	Randomised complete block
Replications	5
Plot size	1 pot (1.3 L)
Plant density	1 plant per pot
Transplanting date	01/10/19
Harvest date	N/A – Trial not harvested
Irrigation type	Overhead sprinklers

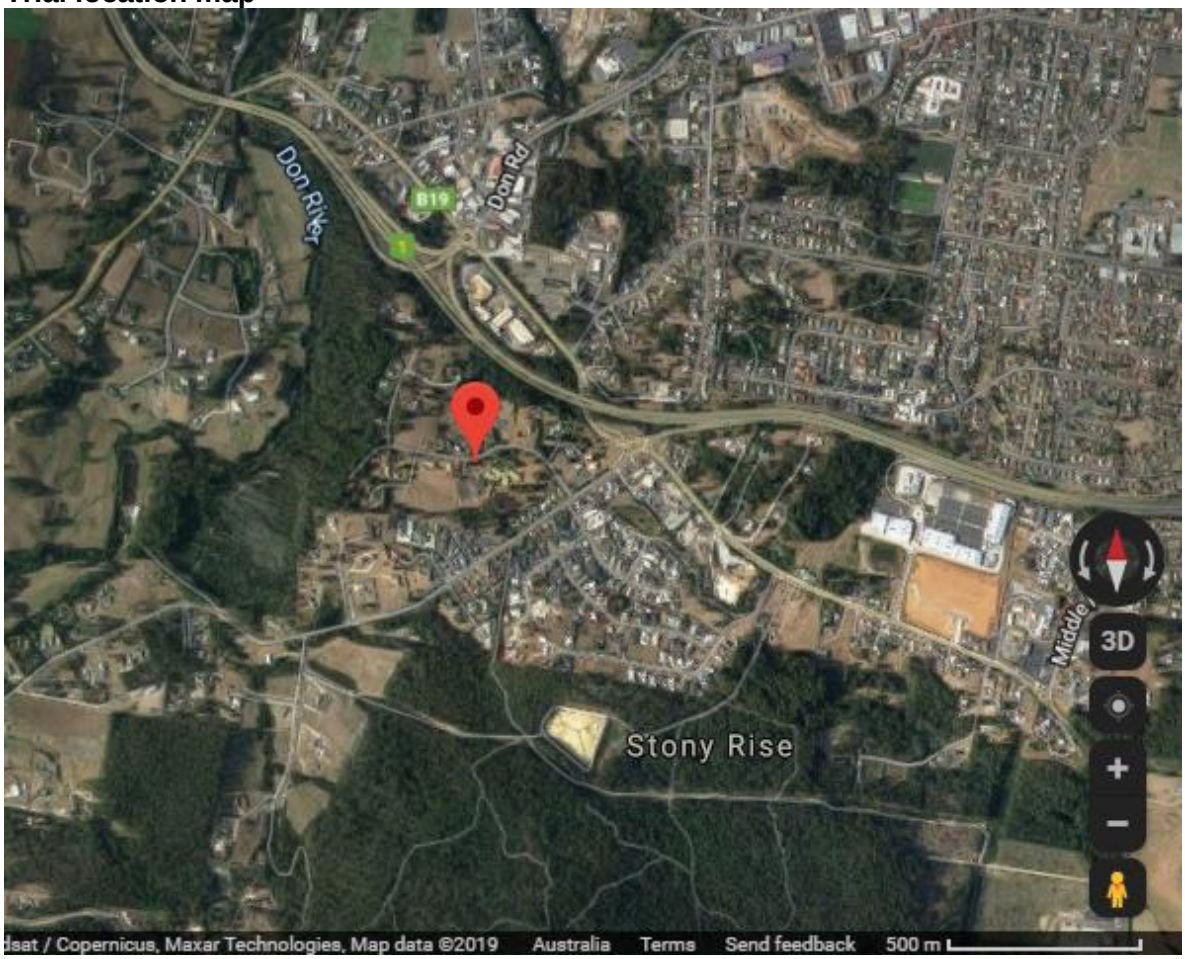
Trial plan

501 6	502 9	503 5	504 1	505 11	506 4	507 3	508 8	509 12	510 10	511 7	512 13	513 2
401 13	402 1	403 4	404 2	405 8	406 9	407 10	408 7	409 11	410 3	411 6	412 12	413 5
301 4	302 6	303 7	304 12	305 1	306 5	307 13	308 2	309 9	310 8	311 11	312 3	313 10
201 12	202 2	203 10	204 3	205 13	206 11	207 9	208 5	209 6	210 7	211 1	212 4	213 8
101 11	102 8	103 13	104 9	105 7	106 3	107 4	108 10	109 1	110 2	111 12	112 5	113 6

↓N

Plot number (3 digits)
Treatment number (1 to 2 digits)
Different colour for each replicate block

Trial location map



Application details – spray

Application equipment			
Method	Dilute foliar spray to the point of run-off		
Equipment	Cabinet track sprayer		
Nozzle type	TeeJet TXVK-26 cone jet nozzle		
Nozzle number and spacing	1 nozzle, centred		
Spray quality	Medium		
Spray volume (L/ha)	1700		
Pressure (kPa)	200		
Ground speed	1 kph		
Treatment applications			
Application timing	A	B	C
Dates	16/10/19	23/10/19	31/10/19
Days after application timing	0DAAA	7DAAA	8DAAB
Times	10:30-12:00	16:10-16:40	14:00-14:30
Treatments applied	1-13*	1-13*	1-13*
Temperature (°C)	14	18	19
Relative humidity (%)	66	62	67
Delta T	3.3	4.8	4.0
Cloud cover (%)	N/A	N/A	N/A
Wind direction	N/A	N/A	N/A
Wind speed (kph)	0	0	0
Soil moisture	Moist	Moist	Moist
Leaf wetness	Dry	Dry	Dry
Disease level	Nil	Low	Moderate
Crop stage description	4 true leaves unfolded	6 true leaves unfolded	7 true leaves unfolded
Crop stage (BBCH)	14	16	17

* The untreated control was sprayed with water only

Assessments

Bacterial speck assessments						
Dates	23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Days after application timing	7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
Sample size	Whole plot					
Method	The percentage of each plant with bacterial speck (*Pseudomonas syringae* pv. *tomato*) symptoms was visually estimated. Incidence was calculated using ARM2019. At 7DAAA, 8DAAB, 6DAAC and 14DAAC, leaves with new and existing infections were assessed, with senesced leaves rated as 100% disease severity. At 22DAAC and 28DAAC, only new infections were assessed.					
Crop biomass assessment						
Dates	23/10/198	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Days after application timing	7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
Sample size	Whole plot					
Method	Each plant was visually compared relative to the untreated control plant in each replicate and biomass was estimated as a percentage of the untreated control (100%).					
Crop phytotoxicity assessments						
Dates	23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Days after application timing	7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
Sample size	Whole plot					
Method	Plants visually assessed for any sign of general phytotoxicity including, but not limited to yellowing, necrosis and plant growth/development effects. Leaf necrosis was scored as a percentage of total leaf area affected.					

Statistical analysis	Analysis of variance (ANOVA) test and Fisher's least significant difference (LSD) test were conducted using ARM2019. When data violated the assumptions of ANOVA (homogeneity of variance and normality) data correction transformations were conducted. Original plot means are presented in Results tables with analysis of variance and letters of separation from transformed data. Note, treatment data with the same number but different letters of separation can result from statistics relying on transformed data.

Appendix ii. Statistical analysis

Tomato bacterial speck incidence

Pest Name					Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck
Crop Name					Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
Crop Variety					Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
Rating Date					23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Part Rated					PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
Rating Type					PESINC	PESINC	PESINC	PESINC	PESINC	PESINC
Rating Unit					%	%	%	%	%	%
Crop Stage Majority					16	17	18	21	55	59
Trt-Eval Interval					7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
ARM Action Codes					TIO[2]	TIO[6]	TIO[10]	TIO[14]	TIO[18]	TIO[22]
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	3	7	11	15	19	23
1	Untreated control				20a	100a	100a	100a	100a	100a
2	GCAU0001	1250	mL/100 L	ABC	20a	100a	100a	100a	100a	100a
3	GCAU0001	2500	mL/100 L	ABC	0a	100a	100a	100a	100a	100a
4	GCAU0001	5000	mL/100 L	ABC	0a	80a	100a	100a	100a	100a
5	GCAU0002	100	mL/100 L	ABC	20a	100a	100a	100a	100a	100a
6	GCAU0002	200	mL/100 L	ABC	0a	80a	100a	100a	100a	100a
7	GCAU0002	400	mL/100 L	ABC	0a	100a	100a	100a	100a	100a
8	Hydrocop 500 WG	105	g/100 L	ABC	20a	80a	100a	100a	100a	100a
9	Red Copper 500 WG	155	g/100 L	ABC	0a	80a	100a	100a	100a	100a
10	Bordeaux 200 WG	280	g/100 L	ABC	0a	60a	100a	100a	100a	100a
11	GCAU0003	200	mL/100 L	ABC	0a	100a	100a	100a	100a	100a
12	GCAU0003	400	mL/100 L	ABC	0a	100a	100a	100a	100a	100a
13	GCAU0003	400	mL/100 L	A	0a	60a	100a	100a	100a	100a
	Bordeaux 200 WG	280	g/100 L	ABC						
LSD P=.05					31.7	40.6	.	.	.	.
Standard Deviation					24.9	31.9	0.0	0.0	0.0	0.0
CV					405.21	36.41	0.0	0.0	0.0	0.0
Bartlett's X2					0.00	0.439	0.00	0.00	0.00	0.00
P(Bartlett's X2)					.	0.994	.	.	.	.
Skewness					3.7358*	-2.3492*	.	.	.	.
Kurtosis					12.3351*	3.6295*	.	.	.	.
Replicate F					0.866	1.736	0.000	0.000	0.000	0.000
Replicate Prob(F)					0.4912	0.1576	1.0000	1.0000	1.0000	1.0000
Treatment F					0.742	1.157	0.000	0.000	0.000	0.000
Treatment Prob(F)					0.7037	0.3398	1.0000	1.0000	1.0000	1.0000

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL
Could not calculate LSD (% mean diff) for columns 11,15,19,23 because error mean square = 0

Rating Type
PESINC = pest incidence

Tomato bacterial speck severity

Pest Name				Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck
Crop Name				Tomato	Tomato	Tomato	Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
Crop Variety				Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
Rating Date				23/10/19	31/10/19	31/10/19	06/11/19	14/11/19	22/11/19	22/11/19	28/11/19	28/11/19
Part Rated				PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
Rating Type				PESSEV	PESSEV	PESSEV	PESSEV	PESSEV	PESSEV	PESSEV	PESSEV	PESSEV
Rating Unit				%AREA	%AREA	%AREA	%AREA	%AREA	%AREA	%AREA	%AREA	%AREA
Crop Stage Majority				16	17	17	18	21	55	55	59	59
Trt-Eval Interval				7DAAA	8DAAB	8DAAB	6DAAC	14DAAC	22DAAC	22DAAC	28DAAC	28DAAC
ARM Action Codes						TL[6]				TS[18]		TL[22]
Trt No.	Treatment Name	Rate	Rate Unit / Appl Code	2	6	29	10	14	18	31	22	30
1	Untreated control			0.2a	2.4bcd	2.1a-d	48ab	58a	19a	19a	16a	14a
2	GCAU0001	1250mL/100 L	ABC	0.2a	2.6bc	2.4abc	54a	57a	15abc	14a-d	10a-d	10ab
3	GCAU0001	2500mL/100 L	ABC	0.0a	3.4ab	3.3a	40abc	52a	16abc	16abc	11abc	11ab
4	GCAU0001	5000mL/100 L	ABC	0.0a	1.2cd	1.0cde	48ab	57a	11cde	11b-e	9a-d	7bcd
5	GCAU0002	100mL/100 L	ABC	0.2a	4.6a	4.0a	36bcd	52a	12b-e	12a-d	10a-d	8a-d
6	GCAU0002	200mL/100 L	ABC	0.0a	1.4cd	1.2b-e	25cd	54a	11b-e	10b-e	10a-d	9abc
7	GCAU0002	400mL/100 L	ABC	0.0a	1.4cd	1.4b-e	32cd	54a	18ab	17ab	13ab	12ab
8	Hydrocop 500 WG	105g/100 L	ABC	0.2a	1.4cd	1.2b-e	34bcd	53a	8de	8de	8bcd	8a-d
9	Red Copper 500 WG	155g/100 L	ABC	0.0a	1.0cd	0.9de	32cd	48a	6e	6e	5cd	4d
10	Bordeaux 200 WG	280g/100 L	ABC	0.0a	0.6d	0.5e	26cd	50a	10cde	9cde	4d	4d
11	GCAU0003	200mL/100 L	ABC	0.0a	2.8abc	2.6ab	30cd	44a	14a-d	13a-d	13ab	11ab
12	GCAU0003	400mL/100 L	ABC	0.0a	2.6bc	2.3abc	33bcd	58a	13a-e	12a-d	9bcd	8abc
13	GCAU0003 + Bordeaux 200 WG	400mL/100 L + 280g/100 L	A ABC	0.0a	0.6d	0.5e	21d	44a	6e	19a	5a	14a
LSD P=.05				0.32	1.84	1.05 - 2.05	15.6	14.7	6.7	5.7 - 7.5	6.9	4.1 - 7.1
Standard Deviation				0.25	1.44	0.18t	12.3	11.6	5.3	0.7t	5.5	0.2t
CV				405.21	72.19	42.94t	34.83	22.07	43.09	21.5t	58.57	22.38t
Bartlett's X2				0.00	26.996	4.588	15.25	9.65	22.926	20.255	38.064	22.296
P(Bartlett's X2)				.	0.008*	0.97	0.228	0.647	0.028*	0.062	0.001*	0.034*
Skewness				3.7358*	1.9404*	0.0057	0.3109	-0.0389	0.5971*	-0.0169	1.5742*	-0.3033
Kurtosis				12.3351*	6.3207*	0.0444	0.6564	-0.4101	0.0798	-0.3243	3.5085*	0.1181
Replicate F				0.866	0.424	1.564	2.672	3.649	0.694	0.732	0.995	1.369
Replicate Prob(F)				0.4912	0.7903	0.1991	0.0431	0.0113	0.6001	0.5744	0.4195	0.2588
Treatment F				0.742	3.374	4.268	3.178	0.863	3.020	3.198	2.007	2.963
Treatment Prob(F)				0.7037	0.0013	0.0001	0.0021	0.5878	0.0032	0.0020	0.0443	0.0037

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)
t=Mean descriptions are reported in transformed data units, and are not de-transformed
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL

Rating Type
PESSEV = pest severity
ARM Action Codes
TL[6] = LOG([6]+ 1)
TS[18] = SQR([18] + .5)
TL[22] = LOG([22]+ 1)

Tomato plant biomass

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	4	8	12	16	20	24
	Crop Name				Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
	Crop Variety				Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
	Rating Date				23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
	Part Rated				PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
	Rating Type				BIOMAS	BIOMAS	BIOMAS	BIOMAS	BIOMAS	BIOMAS
	Rating Unit				%RELB	%RELB	%RELB	%RELB	%RELB	%RELB
	Crop Stage Majority				16	17	18	21	55	59
	Trt-Eval Interval				7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
	ARM Action Codes									
1	Untreated control			ABC	100a	100a	100a	100a	100a	100a
2	GCAU0001	1250	mL/100 L	ABC	103a	103a	101a	103a	98a	102a
3	GCAU0001	2500	mL/100 L	ABC	105a	106a	106a	109a	106a	105a
4	GCAU0001	5000	mL/100 L	ABC	99a	100a	98a	103a	100a	101a
5	GCAU0002	100	mL/100 L	ABC	102a	100a	103a	101a	101a	102a
6	GCAU0002	200	mL/100 L	ABC	104a	107a	98a	103a	104a	105a
7	GCAU0002	400	mL/100 L	ABC	104a	107a	101a	105a	103a	101a
8	Hydrocop 500 WG	105	g/100 L	ABC	101a	100a	105a	102a	99a	100a
9	Red Copper 500 WG	155	g/100 L	ABC	99a	99a	103a	98a	98a	102a
10	Bordeaux 200 WG	280	g/100 L	ABC	100a	99a	100a	101a	100a	101a
11	GCAU0003	200	mL/100 L	ABC	101a	104a	101a	103a	99a	101a
12	GCAU0003	400	mL/100 L	ABC	99a	100a	98a	99a	99a	99a
13	GCAU0003	400	mL/100 L	A	104a	106a	105a	104a	103a	104a
	Bordeaux 200 WG	280	g/100 L	ABC						
	LSD P=.05				4.9	6.5	6.5	6.4	6.6	6.9
	Standard Deviation				3.9	5.1	5.1	5.0	5.2	5.4
	CV				3.82	5.01	5.03	4.88	5.14	5.34
	Bartlett's X2				11.005	12.527	7.099	9.494	14.499	26.934
	P(Bartlett's X2)				0.443	0.251	0.791	0.576	0.207	0.005*
	Skewness				0.495	1.4507*	-0.0371	-0.0257	-0.485	0.1065
	Kurtosis				-0.2991	2.4391*	-0.6921	-0.2437	0.7524	3.7166*
	Replicate F				3.284	9.243	4.108	6.836	0.969	5.889
	Replicate Prob(F)				0.0185	0.0001	0.0061	0.0002	0.4333	0.0006
	Treatment F				1.580	1.945	1.458	1.588	1.156	0.598
	Treatment Prob(F)				0.1296	0.0519	0.1738	0.1273	0.3410	0.8330

Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL

Rating Type
BIOMAS = biomass
Rating Unit
%RELB = relative values to untreated control per plot

Tomato leaf burn

Crop Name				Tomato	Tomato	Tomato	Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
Crop Variety				Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
Rating Date				23/10/19	23/10/19	31/10/19	31/10/19	06/11/19	14/11/19	14/11/19	22/11/19	28/11/19
Part Rated				PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
Rating Type				PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN
Rating Unit				%AREA	%AREA	%AREA	%AREA	%AREA	%AREA	%AREA	%AREA	%AREA
Crop Stage Majority					16	16	17	17	18	21	21	55
Trt-Eval Interval				7DAAA	7DAAA	8DAAB	8DAAB	6DAAC	14DAAC	14DAAC	22DAAC	28DAAC
ARM Action Codes					TA[1]		TA[5]			TA[13]		
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code								
1	Untreated control				0.0d	0.0c	0.0c	0.0c	0.0d	0.0c	0.0d	0.0c	0.0d
2	GCAU0001	1250	mL/100 L	ABC	1.2bc	1.2b	1.2b	1.2b	1.2c	1.0b	1.0c	0.6b	0.4c
3	GCAU0001	2500	mL/100 L	ABC	2.0b	1.9b	1.8b	1.7b	2.2b	1.6b	1.6b	0.8b	0.8b
4	GCAU0001	5000	mL/100 L	ABC	4.0a	3.6a	3.4a	3.2a	3.8a	3.2a	3.0a	1.8a	1.4a
5	GCAU0002	100	mL/100 L	ABC	0.0d	0.0c	0.0c	0.0c	0.0d	0.0c	0.0d	0.0c	0.0d
6	GCAU0002	200	mL/100 L	ABC	0.2cd	0.0c	0.0c	0.0c	0.0d	0.0c	0.0d	0.0c	0.0d
7	GCAU0002	400	mL/100 L	ABC	0.0d	0.0c	0.0c	0.0c	0.0d	0.0c	0.0d	0.0c	0.0d
8	Hydrocop 500 WG	105	g/100 L	ABC	0.0d	0.0c	0.0c	0.0c	0.0d	0.0c	0.0d	0.0c	0.0d
9	Red Copper 500 WG	155	g/100 L	ABC	0.0d	0.0c	0.0c	0.0c	0.0d	0.0c	0.0d	0.0c	0.0d
10	Bordeaux 200 WG	280	g/100 L	ABC	0.2cd	0.0c	0.0c	0.0c	0.0d	0.0c	0.0d	0.0c	0.0d
11	GCAU0003	200	mL/100 L	ABC	0.2cd	0.0c	0.0c	0.0c	0.0d	0.0c	0.0d	0.0c	0.0d
12	GCAU0003	400	mL/100 L	ABC	0.2cd	0.0c	0.0c	0.0c	0.0d	0.0c	0.0d	0.0c	0.0d
13	GCAU0003	400	mL/100 L	A	0.0d	0.0c	0.0c	0.0c	0.0d	0.0c	0.0d	0.0c	0.0d
	Bordeaux 200 WG	280	g/100 L	ABC									
LSD P=.05					1.06	0.37 - 1.46	0.72	0.56 - 0.77	0.56	0.65	0.45 - 0.65	0.39	0.32
Standard Deviation					0.83	1.98t	0.57	1.05t	0.44	0.51	0.92t	0.30	0.25
CV					135.52	86.38t	115.34	57.03t	79.31	114.63	52.27t	123.43	127.22
Bartlett's X2					30.118	5.759	7.007	4.355	3.957	4.596	2.655	1.657	0.205
P(Bartlett's X2)					0.001*	0.451	0.03*	0.113	0.138	0.032*	0.103	0.437	0.903
Skewness					3.3944*	1.6311*	2.775*	1.7817*	2.3947*	3.0606*	1.8127*	2.7671*	2.3926*
Kurtosis					14.051*	2.018*	7.6689*	2.0058*	5.2153*	10.1528*	2.2873*	8.3409*	5.25*
Replicate F					0.940	0.232	1.026	1.171	1.475	1.382	1.491	1.000	0.356
Replicate Prob(F)					0.4489	0.9189	0.4036	0.3356	0.2245	0.2541	0.2197	0.4168	0.8383
Treatment F					9.991	17.053	16.915	58.686	36.133	17.863	70.572	15.583	14.416
Treatment Prob(F)					0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

Means followed by same letter or symbol do not significantly differ (P=.05, LSD)
t=Mean descriptions are reported in transformed data units, and are not de-transformed
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL

Rating Type
PHYGEN = phytotoxicity - general / injury
ARM Action Codes
TA[1] = Arcsine square root percent([1])
TA[5] = Arcsine square root percent([5])
TA[13] = Arcsine square root percent([13])

Appendix iii. Plot data

Tomato bacterial speck incidence

Pest Name					Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck
Crop Name					Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
Crop Variety					Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
Rating Date					23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Part Rated					PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
Rating Type					PESINC	PESINC	PESINC	PESINC	PESINC	PESINC
Rating Unit					%	%	%	%	%	%
Crop Stage Majority					16	17	18	21	55	59
Trt-Eval Interval					7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
ARM Action Codes					TIO[2]	TIO[6]	TIO[10]	TIO[14]	TIO[18]	TIO[22]
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	3	7	11	15	19	23
1	Untreated control				109	0	100	100	100	100	100
					211	0	100	100	100	100	100
					305	100	100	100	100	100	100
					402	0	100	100	100	100	100
					504	0	100	100	100	100	100
					Mean =	20	100	100	100	100	100
2	GCAU0001	1250	mL/100 L	ABC	110	0	100	100	100	100	100
					202	0	100	100	100	100	100
					308	100	100	100	100	100	100
					404	0	100	100	100	100	100
					513	0	100	100	100	100	100
					Mean =	20	100	100	100	100	100
3	GCAU0001	2500	mL/100 L	ABC	106	0	100	100	100	100	100
					204	0	100	100	100	100	100
					312	0	100	100	100	100	100
					410	0	100	100	100	100	100
					507	0	100	100	100	100	100
					Mean =	0	100	100	100	100	100
4	GCAU0001	5000	mL/100 L	ABC	107	0	100	100	100	100	100
					212	0	100	100	100	100	100
					301	0	0	100	100	100	100
					403	0	100	100	100	100	100
					506	0	100	100	100	100	100
					Mean =	0	80	100	100	100	100
5	GCAU0002	100	mL/100 L	ABC	112	100	100	100	100	100	100
					208	0	100	100	100	100	100
					306	0	100	100	100	100	100
					413	0	100	100	100	100	100
					503	0	100	100	100	100	100
					Mean =	20	100	100	100	100	100
6	GCAU0002	200	mL/100 L	ABC	113	0	100	100	100	100	100
					209	0	100	100	100	100	100
					302	0	100	100	100	100	100
					411	0	100	100	100	100	100
					501	0	0	100	100	100	100
					Mean =	0	80	100	100	100	100
7	GCAU0002	400	mL/100 L	ABC	105	0	100	100	100	100	100
					210	0	100	100	100	100	100
					303	0	100	100	100	100	100
					408	0	100	100	100	100	100
					511	0	100	100	100	100	100
					Mean =	0	100	100	100	100	100
8	Hydrocop 500 WG	105	g/100 L	ABC	102	0	100	100	100	100	100
					213	0	0	100	100	100	100
					310	0	100	100	100	100	100
					405	0	100	100	100	100	100
					508	100	100	100	100	100	100
					Mean =	20	80	100	100	100	100
9	Red Copper 500 WG	155	g/100 L	ABC	104	0	100	100	100	100	100
					207	0	100	100	100	100	100
					309	0	100	100	100	100	100
					406	0	100	100	100	100	100
					502	0	0	100	100	100	100
					Mean =	0	80	100	100	100	100
10	Bordeaux 200 WG	280	g/100 L	ABC	108	0	100	100	100	100	100
					203	0	100	100	100	100	100
					313	0	100	100	100	100	100
					407	0	0	100	100	100	100
					510	0	0	100	100	100	100
					Mean =	0	60	100	100	100	100

Pest Name					Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck
Crop Name					Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
Crop Variety					Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
Rating Date					23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Part Rated					PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
Rating Type					PESINC	PESINC	PESINC	PESINC	PESINC	PESINC
Rating Unit					%	%	%	%	%	%
Crop Stage Majority					16	17	18	21	55	59
Trt-Eval Interval					7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
ARM Action Codes					TIO[2]	TIO[6]	TIO[10]	TIO[14]	TIO[18]	TIO[22]
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	3	7	11	15	19	23
11	GCAU0003	200	mL/100 L	ABC	101	0	100	100	100	100	100
					206	0	100	100	100	100	100
					311	0	100	100	100	100	100
					409	0	100	100	100	100	100
					505	0	100	100	100	100	100
					Mean =	0	100	100	100	100	100
12	GCAU0003	400	mL/100 L	ABC	111	0	100	100	100	100	100
					201	0	100	100	100	100	100
					304	0	100	100	100	100	100
					412	0	100	100	100	100	100
					509	0	100	100	100	100	100
					Mean =	0	100	100	100	100	100
13	GCAU0003	400	mL/100 L	A	103	0	100	100	100	100	100
	Bordeaux 200 WG	280	g/100 L	ABC	205	0	100	100	100	100	100
					307	0	100	100	100	100	100
					401	0	0	100	100	100	100
					512	0	0	100	100	100	100
					Mean =	0	60	100	100	100	100

Tomato bacterial speck severity

Pest Name				Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck
Crop Name				Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
Crop Variety				Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
Rating Date				23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Part Rated				PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
Rating Type				PESSEV	PESSEV	PESSEV	PESSEV	PESSEV	PESSEV
Rating Unit				%AREA	%AREA	%AREA	%AREA	%AREA	%AREA
Crop Stage Majority				16	17	18	21	55	59
Trt-Eval Interval				7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
ARM Action Codes									
Trt No.	Treatment Name	Rate Rate Unit	Appl Code	Plot	2	6	10	14	18	22
1	Untreated control			109	0.00	1.0	60	50	20	30
				211	0.00	2.0	80	70	15	10
				305	1.00	3.0	40	80	20	10
				402	0.00	5.0	30	40	20	10
				504	0.00	1.0	30	50	20	20
				Mean =	0.20	2.4	48	58	19	16
2	GCAU0001	1250mL/100 L	ABC	110	0.00	3.0	50	55	20	10
				202	0.00	2.0	70	65	25	10
				308	1.00	5.0	50	75	5	10
				404	0.00	2.0	60	65	15	10
				513	0.00	1.0	40	25	10	8
				Mean =	0.20	2.6	54	57	15	10
3	GCAU0001	2500mL/100 L	ABC	106	0.00	4.0	30	35	15	10
				204	0.00	3.0	50	75	20	10
				312	0.00	5.0	50	60	15	10
				410	0.00	3.0	50	40	15	15
				507	0.00	2.0	20	50	15	10
				Mean =	0.00	3.4	40	52	16	11
4	GCAU0001	5000mL/100 L	ABC	107	0.00	2.0	50	50	10	2
				212	0.00	1.0	60	60	10	15
				301	0.00	0.0	30	70	15	20
				403	0.00	2.0	60	60	10	5
				506	0.00	1.0	40	45	10	5
				Mean =	0.00	1.2	48	57	11	9
5	GCAU0002	100mL/100 L	ABC	112	1.00	2.0	40	50	15	25
				208	0.00	3.0	30	50	10	8
				306	0.00	5.0	40	50	10	8
				413	0.00	3.0	40	50	15	5
				503	0.00	10.0	30	60	10	3
				Mean =	0.20	4.6	36	52	12	10
6	GCAU0002	200mL/100 L	ABC	113	0.00	2.0	30	60	15	10
				209	0.00	3.0	40	60	10	10
				302	0.00	1.0	20	70	10	15
				411	0.00	1.0	30	40	20	10
				501	0.00	0.0	5	40	2	3
				Mean =	0.00	1.4	25	54	11	10
7	GCAU0002	400mL/100 L	ABC	105	0.00	2.0	40	40	10	8
				210	0.00	1.0	30	50	10	15
				303	0.00	1.0	25	60	15	10
				408	0.00	1.0	25	50	25	15
				511	0.00	2.0	40	70	30	15
				Mean =	0.00	1.4	32	54	18	13
8	Hydrocop 500 WG	105g/100 L	ABC	102	0.00	2.0	40	55	5	10
				213	0.00	0.0	35	50	10	10
				310	0.00	2.0	40	70	10	10
				405	0.00	2.0	25	30	10	5
				508	1.00	1.0	30	60	5	5
				Mean =	0.20	1.4	34	53	8	8
9	Red Copper 500 WG	155g/100 L	ABC	104	0.00	1.0	50	60	5	5
				207	0.00	1.0	30	30	3	1
				309	0.00	2.0	25	50	10	5
				406	0.00	1.0	50	50	10	10
				502	0.00	0.0	3	50	3	2
				Mean =	0.00	1.0	32	48	6	5
10	Bordeaux 200 WG	280g/100 L	ABC	108	0.00	1.0	40	50	5	5
				203	0.00	1.0	25	40	10	5
				313	0.00	1.0	15	60	15	3
				407	0.00	0.0	30	40	5	5
				510	0.00	0.0	20	60	15	2
				Mean =	0.00	0.6	26	50	10	4

Pest Name				Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck	Bacterial speck
Crop Name				Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
Crop Variety				Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
Rating Date				23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Part Rated				PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
Rating Type				PESSEV	PESSEV	PESSEV	PESSEV	PESSEV	PESSEV
Rating Unit				%AREA	%AREA	%AREA	%AREA	%AREA	%AREA
Crop Stage Majority				16	17	18	21	55	59
Trt-Eval Interval				7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
ARM Action Codes									
Trt No.	Treatment Name	Rate Rate Unit	Appl Code	Plot	2	6	10	14	18	22
11	GCAU0003	200mL/100 L	ABC	101	0.00	1.0	30	40	10	5
				206	0.00	3.0	20	40	8	10
				311	0.00	2.0	30	50	20	30
				409	0.00	5.0	30	30	25	10
				505	0.00	3.0	40	60	8	10
				Mean =	0.00	2.8	30	44	14	13
12	GCAU0003	400mL/100 L	ABC	111	0.00	5.0	40	70	15	10
				201	0.00	3.0	40	60	10	10
				304	0.00	3.0	30	50	20	10
				412	0.00	1.0	5	60	10	10
				509	0.00	1.0	50	50	8	3
				Mean =	0.00	2.6	33	58	13	9
13	GCAU0003	400mL/100 L	A	103	0.00	1.0	35	50	10	5
	Bordeaux 200 WG	280g/100 L	ABC	205	0.00	1.0	20	40	5	3
				307	0.00	1.0	25	60	3	5
				401	0.00	0.0	5	30	3	2
				512	0.00	0.0	20	40	10	10
				Mean =	0.00	0.6	21	44	6	5

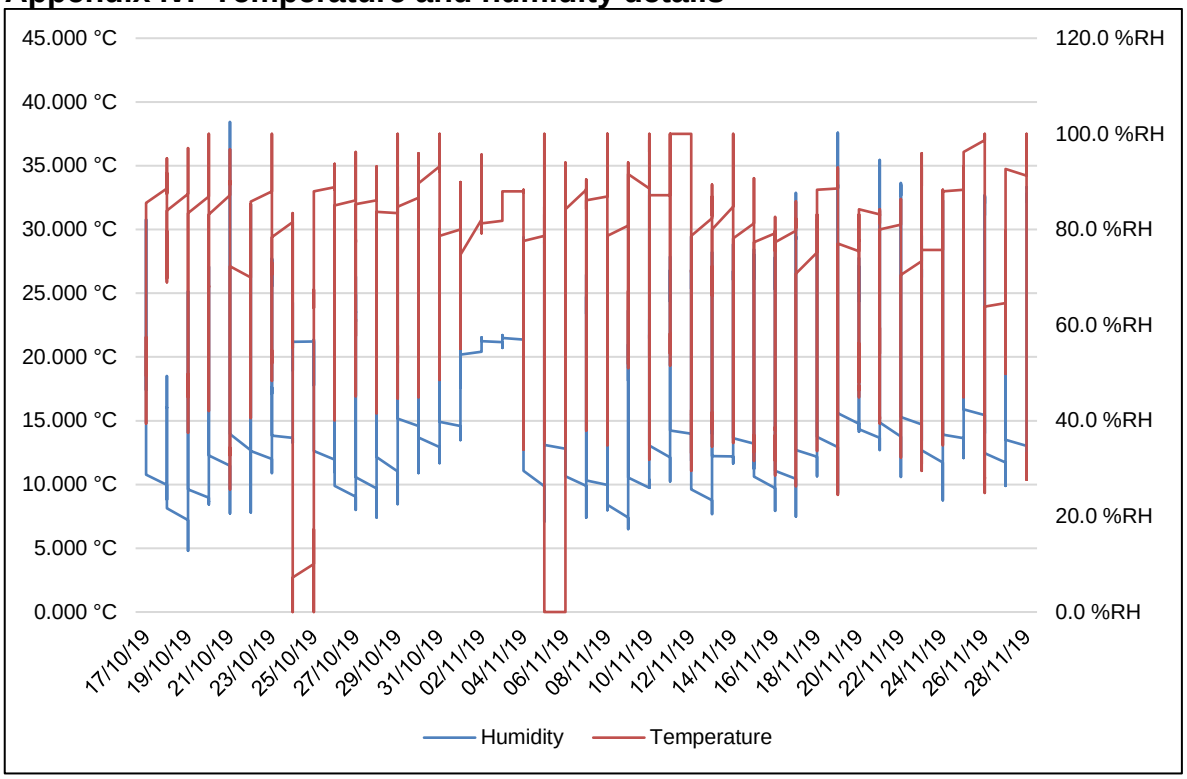
Tomato plant biomass

Crop Name					Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
Crop Variety					Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
Rating Date					23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Part Rated					PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
Rating Type					BIOMAS	BIOMAS	BIOMAS	BIOMAS	BIOMAS	BIOMAS
Rating Unit					%RELB	%RELB	%RELB	%RELB	%RELB	%RELB
Crop Stage Majority					16	17	18	21	55	59
Trt-Eval Interval					7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
ARM Action Codes										
Trt No.	Treatment Name	Rate	Unit	Appl Code	Plot	4	8	12	16	20	24
1	Untreated control				109	100	100	100	100	100	100
					211	100	100	100	100	100	100
					305	100	100	100	100	100	100
					402	100	100	100	100	100	100
					504	100	100	100	100	100	100
				Mean =		100	100	100	100	100	100
2	GCAU0001	1250	mL/100 L	ABC	110	110	105	110	110	110	100
					202	100	100	95	105	90	100
					308	95	90	100	95	90	95
					404	110	120	100	110	95	110
					513	100	100	100	95	105	105
				Mean =		103	103	101	103	98	102
3	GCAU0001	2500	mL/100 L	ABC	106	110	105	105	110	105	100
					204	100	100	100	105	100	100
					312	100	100	110	105	110	105
					410	110	120	110	115	110	120
					507	105	105	105	110	105	100
				Mean =		105	106	106	109	106	105
4	GCAU0001	5000	mL/100 L	ABC	107	100	100	90	100	100	100
					212	100	105	95	105	100	100
					301	95	100	100	100	100	95
					403	100	100	110	105	95	105
					506	100	95	95	105	105	105
				Mean =		99	100	98	103	100	101
5	GCAU0002	100	mL/100 L	ABC	112	100	100	105	105	105	100
					208	100	100	105	100	100	100
					306	100	95	95	95	100	100
					413	105	105	110	105	100	105
					503	105	100	100	100	100	105
				Mean =		102	100	103	101	101	102
6	GCAU0002	200	mL/100 L	ABC	113	105	105	100	105	105	100
					209	105	105	95	105	105	95
					302	105	100	95	95	100	100
					411	105	120	100	110	105	120
					501	100	105	100	100	105	110
				Mean =		104	107	98	103	104	105
7	GCAU0002	400	mL/100 L	ABC	105	110	105	105	105	100	105
					210	100	100	105	105	100	100
					303	100	100	90	100	105	100
					408	105	120	105	115	110	100
					511	105	110	100	100	100	100
				Mean =		104	107	101	105	103	101
8	Hydrocop 500 WG	105	g/100 L	ABC	102	100	100	110	100	100	110
					213	100	100	105	105	100	100
					310	100	95	95	90	90	80
					405	105	105	110	110	100	105
					508	100	100	105	105	105	105
				Mean =		101	100	105	102	99	100
9	Red Copper 500 WG	155	g/100 L	ABC	104	100	100	100	100	100	110
					207	95	100	110	100	100	100
					309	95	90	100	90	85	90
					406	105	105	105	105	100	100
					502	100	100	100	95	105	110
				Mean =		99	99	103	98	98	102
10	Bordeaux 200 WG	280	g/100 L	ABC	108	95	95	90	95	95	100
					203	105	100	110	110	100	100
					313	100	100	95	95	100	100
					407	105	105	110	110	105	105
					510	95	95	95	95	100	100
				Mean =		100	99	100	101	100	101

Crop Name					Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
Crop Variety					Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
Rating Date					23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Part Rated					PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
Rating Type					BIOMAS	BIOMAS	BIOMAS	BIOMAS	BIOMAS	BIOMAS
Rating Unit					%RELB	%RELB	%RELB	%RELB	%RELB	%RELB
Crop Stage Majority					16	17	18	21	55	59
Trt-Eval Interval					7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
ARM Action Codes										
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	4	8	12	16	20	24
11	GCAU0003	200	mL/100 L	ABC	101	100	100	100	90	95	100
					206	100	100	100	110	95	105
					311	100	95	95	100	95	90
					409	110	120	110	115	110	110
					505	95	105	100	100	100	100
					Mean =	101	104	101	103	99	101
12	GCAU0003	400	mL/100 L	ABC	111	100	100	90	100	105	100
					201	100	100	100	105	100	100
					304	95	100	95	100	105	95
					412	95	100	105	90	90	100
					509	105	100	100	100	95	100
					Mean =	99	100	98	99	99	99
13	GCAU0003	400	mL/100 L	A	103	110	120	110	100	105	110
	Bordeaux 200 WG	280	g/100 L	ABC	205	100	105	110	105	100	100
					307	110	100	105	110	110	105
					401	100	100	100	105	100	100
					512	100	105	100	100	100	105
					Mean =	104	106	105	104	103	104

Tomato leaf burn

Crop Name					Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
Crop Variety					Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
Rating Date					23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Part Rated					PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
Rating Type					PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN
Rating Unit					%AREA	%AREA	%AREA	%AREA	%AREA	%AREA
Crop Stage Majority						16	17	18	21	55
Trt-Eval Interval					7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
ARM Action Codes										
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	1	5	9	13	17	21
1	Untreated control				109	0.0	0.0	0.0	0.0	0.0	0.0
					211	0.0	0.0	0.0	0.0	0.0	0.0
					305	0.0	0.0	0.0	0.0	0.0	0.0
					402	0.0	0.0	0.0	0.0	0.0	0.0
					504	0.0	0.0	0.0	0.0	0.0	0.0
					Mean =	0.0	0.0	0.0	0.0	0.0	0.0
2	GCAU0001	1250	mL/100 L	ABC	110	1.0	1.0	1.0	1.0	1.0	1.0
					202	1.0	1.0	1.0	1.0	0.0	0.0
					308	1.0	1.0	1.0	1.0	1.0	0.0
					404	2.0	2.0	2.0	1.0	1.0	1.0
					513	1.0	1.0	1.0	1.0	0.0	0.0
					Mean =	1.2	1.2	1.2	1.0	0.6	0.4
3	GCAU0001	2500	mL/100 L	ABC	106	1.0	1.0	2.0	1.0	0.0	0.0
					204	1.0	1.0	1.0	1.0	1.0	1.0
					312	3.0	2.0	2.0	2.0	1.0	1.0
					410	2.0	3.0	3.0	2.0	1.0	1.0
					507	3.0	2.0	3.0	2.0	1.0	1.0
					Mean =	2.0	1.8	2.2	1.6	0.8	0.8
4	GCAU0001	5000	mL/100 L	ABC	107	3.0	4.0	4.0	3.0	2.0	1.0
					212	1.0	1.0	2.0	1.0	1.0	1.0
					301	5.0	5.0	5.0	5.0	3.0	2.0
					403	3.0	2.0	3.0	2.0	1.0	1.0
					506	8.0	5.0	5.0	5.0	2.0	2.0
					Mean =	4.0	3.4	3.8	3.2	1.8	1.4
5	GCAU0002	100	mL/100 L	ABC	112	0.0	0.0	0.0	0.0	0.0	0.0
					208	0.0	0.0	0.0	0.0	0.0	0.0
					306	0.0	0.0	0.0	0.0	0.0	0.0
					413	0.0	0.0	0.0	0.0	0.0	0.0
					503	0.0	0.0	0.0	0.0	0.0	0.0
					Mean =	0.0	0.0	0.0	0.0	0.0	0.0
6	GCAU0002	200	mL/100 L	ABC	113	0.0	0.0	0.0	0.0	0.0	0.0
					209	1.0	0.0	0.0	0.0	0.0	0.0
					302	0.0	0.0	0.0	0.0	0.0	0.0
					411	0.0	0.0	0.0	0.0	0.0	0.0
					501	0.0	0.0	0.0	0.0	0.0	0.0
					Mean =	0.2	0.0	0.0	0.0	0.0	0.0
7	GCAU0002	400	mL/100 L	ABC	105	0.0	0.0	0.0	0.0	0.0	0.0
					210	0.0	0.0	0.0	0.0	0.0	0.0
					303	0.0	0.0	0.0	0.0	0.0	0.0
					408	0.0	0.0	0.0	0.0	0.0	0.0
					511	0.0	0.0	0.0	0.0	0.0	0.0
					Mean =	0.0	0.0	0.0	0.0	0.0	0.0
8	Hydrocop 500 WG	105	g/100 L	ABC	102	0.0	0.0	0.0	0.0	0.0	0.0
					213	0.0	0.0	0.0	0.0	0.0	0.0
					310	0.0	0.0	0.0	0.0	0.0	0.0
					405	0.0	0.0	0.0	0.0	0.0	0.0
					508	0.0	0.0	0.0	0.0	0.0	0.0
					Mean =	0.0	0.0	0.0	0.0	0.0	0.0
9	Red Copper 500 WG	155	g/100 L	ABC	104	0.0	0.0	0.0	0.0	0.0	0.0
					207	0.0	0.0	0.0	0.0	0.0	0.0
					309	0.0	0.0	0.0	0.0	0.0	0.0
					406	0.0	0.0	0.0	0.0	0.0	0.0
					502	0.0	0.0	0.0	0.0	0.0	0.0
					Mean =	0.0	0.0	0.0	0.0	0.0	0.0
10	Bordeaux 200 WG	280	g/100 L	ABC	108	0.0	0.0	0.0	0.0	0.0	0.0
					203	1.0	0.0	0.0	0.0	0.0	0.0
					313	0.0	0.0	0.0	0.0	0.0	0.0
					407	0.0	0.0	0.0	0.0	0.0	0.0
					510	0.0	0.0	0.0	0.0	0.0	0.0
					Mean =	0.2	0.0	0.0	0.0	0.0	0.0

Crop Name					Tomato	Tomato	Tomato	Tomato	Tomato	Tomato
Crop Variety					Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse	Grosse Lisse
Rating Date					23/10/19	31/10/19	06/11/19	14/11/19	22/11/19	28/11/19
Part Rated					PLANT -	PLANT -	PLANT -	PLANT -	PLANT -	PLANT -
Rating Type					PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN	PHYGEN
Rating Unit					%AREA	%AREA	%AREA	%AREA	%AREA	%AREA
Crop Stage Majority						16	17	18	21	55
Trt-Eval Interval					7DAAA	8DAAB	6DAAC	14DAAC	22DAAC	28DAAC
ARM Action Codes										
Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Plot	1	5	9	13	17	21
11	GCAU0003	200	mL/100 L	ABC	101	0.0	0.0	0.0	0.0	0.0	0.0
					206	0.0	0.0	0.0	0.0	0.0	0.0
					311	1.0	0.0	0.0	0.0	0.0	0.0
					409	0.0	0.0	0.0	0.0	0.0	0.0
					505	0.0	0.0	0.0	0.0	0.0	0.0
					Mean =	0.2	0.0	0.0	0.0	0.0	0.0
12	GCAU0003	400	mL/100 L	ABC	111	1.0	0.0	0.0	0.0	0.0	0.0
					201	0.0	0.0	0.0	0.0	0.0	0.0
					304	0.0	0.0	0.0	0.0	0.0	0.0
					412	0.0	0.0	0.0	0.0	0.0	0.0
					509	0.0	0.0	0.0	0.0	0.0	0.0
					Mean =	0.2	0.0	0.0	0.0	0.0	0.0
13	GCAU0003	400	mL/100 L	A	103	0.0	0.0	0.0	0.0	0.0	0.0
	Bordeaux 200 WG	280	g/100 L	ABC	205	0.0	0.0	0.0	0.0	0.0	0.0
					307	0.0	0.0	0.0	0.0	0.0	0.0
					401	0.0	0.0	0.0	0.0	0.0	0.0
					512	0.0	0.0	0.0	0.0	0.0	0.0
					Mean =	0.0	0.0	0.0	0.0	0.0	0.0

Appendix iv. Temperature and humidity details