



UNIVERSITY OF
GEORGIA

Disease Management Options in Vidalia Onion



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Botrytis leaf blight (BLB) was widespread and moderately severe in 2024



Efficacy of individual fungicides on Botrytis leaf Blight (BLB)

Treatments and rate per acre	Application frequency	AUDPC
Rovral 1.5 pt	4	740.0 b
Scala 18 fl oz	4	830.0 ab
Luna Flex 12 fl oz	4	655.0 b
Omega 500 1 pt	4	580.0 b
Miravis Prime 11.4 fl oz	4	680.0 b
Merivon 11 fl oz	4	915.0 ab
Elysis 10 fl oz	4	710.0 b
Non-treated check	-	862.5 a

- Merivon and Scala have been consistently slipping since last three years
- Luna Tranquility has Luna and Scala. Slipping of Scala may put pressure on Luna component of the fungicide (not good for fungicide resistance management)
- Luna Flex can be an alternative. This fungicide is labeled on onion; Luna+Difenoconazole. It has similar efficacy as Luna Tranquility.

Ranking of Fungicides with Respect to their Efficacy on Stemphylium

Fungicides	Efficacy
Luna Flex	Moderate
Inspire super	Moderate
Miravis Prime	Moderate
Quadris top	Moderate-to-low
Pristine	Moderate-to-low
Switch	Moderate-to-low
Merivon	Low-to-No efficacy
Rovral	Low-to-No efficacy
Omega 500	No efficacy
Scala	No efficacy

QUITE HARD TO CONTROL PAST SPRING 2024

PRESENCE OR INTRODUCTION OF HIGHLY AGGRESSIVE STEMPHYLIUM



Downy mildew was observed in 2024; Moderate but was managed well by our growers



Onion Downy Mildew Fungicide Program Trial 2024

Fungicide and rate per acre	Frequency of application	AUDPC
Ridomil Gold Copper 2 lb	ABC	682.5 c
Reason	ABC	927.5 b
Ridomil Gold Copper 2 lb Nordox 1 lb	ABC ABC	835.5 bc
Orondis Ultra 8 fl oz	ABC	888.1 bc
Nordox 1 lb	ABC	1260.0 a
Omega 500 1 pt	ABC	726.2 bc
Non-treated		1338.7 a

Ranking of Fungicides with Respect to their Efficacy on Downy Mildew

Fungicides	Efficacy
Omega 500	Moderate
Ridomil Gold Copper	Moderate
Orondis Ultra	Moderate
Zampro	Moderate
Bravo	Moderate-to-low
Reason	Moderate-to-low
Phosphite	Low efficacy
Bravo	Low efficacy
Revus	No efficacy
Previcur Flex	No efficacy

“REASON” WAS RE-EVALUATED BASED ON GROWER’S RECOMMENDATION: IT STILL HAS SOME LIFE LEFT IN IT

Jan-Feb 15-20:

Rely on Bravo, Phosphite
(Low Risk of Downy)

Feb 21-April 12

(Moderate to High Risk of Downy) :

- Ridomil Gold Copper
- Omega 500
- Orondis Ultra
- Zampro
- Can use Bravo and Phosphite in rotation

OMEGA 500 Label

Crop	Diseases	Rate per Acre	Instructions
Onion, Bulb Subgroup 3-07A	Botrytis leaf blight (<i>Botrytis squamosa</i>) Botrytis neck rot (<i>Botrytis allii</i>) Downy mildew (<i>Peronospora destructor</i>) Purple blotch (<i>Alternaria porri</i>)	16 fl oz (0.521 lb ai)	<p>Application Directions: Initiate applications when conditions are favorable for disease development or when first disease symptoms appear. Repeat applications on a 7- to 10-day schedule. Use sufficient water to obtain adequate coverage but no less than 5 gallons per acre.</p> <p>Restrictions: DO NOT make more than 6 applications of Omega 500F per acre per year. DO NOT apply more than 96 fl oz (3.13 lb ai) of Omega 500F per acre per year. DO NOT use an adjuvant with Omega 500F on this crop. DO NOT apply within 7 days of harvest (7-day PHI). Restricted Entry Interval, REI = 24 hours for hand weeding activities and 12 hours for all other activities. The maximum single use rate is 16 fl oz (0.521 lb ai)/A with the shortest RTI of 7 days.</p> <p>Omega 500F may be applied through sprinkler system irrigation equipment on onions. See irrigation use directions preceding this section.</p>

Includes all members of the Subgroup 3-07A, Onion, Bulb, including: daylily, bulb; fritillaria, bulb; garlic, bulb; garlic, great-headed, bulb; garlic, serpent, bulb; lily, bulb; onion, bulb; onion, Chinese, bulb; onion, pearl; onion, potato, bulb; shallot, bulb; and cultivars, varieties, and/or hybrids of these.

Ridomil Gold Bravo SC Label

Leek		Shallot	
Target Diseases	Rate (pt/A)	Application Timing	Use Directions
<p>Downy mildew (<i>Peronospora destructor</i>)</p> <p>Botrytis leaf blight (<i>Botrytis aclada</i>, <i>Botrytis squamosa</i>)</p> <p>Purple blotch (<i>Alternaria porri</i>)</p>	2.5	<p><u>For Downy mildew:</u> Begin applications when conditions are favorable for disease, but before infection, and continue at 7 to 14-day intervals until the threat of disease is over.</p> <p><u>For Botrytis leaf blight and Purple blotch:</u> Apply on a 7-day schedule.</p>	<p>Integrated Pest (Disease) Management: Integrate Ridomil Gold Bravo SC into an overall disease management strategy that includes selection of varieties with disease tolerance, optimum plant populations, proper fertilization, plant residue management, crop rotation, and proper timing and placement of irrigation.</p> <p><u>For Botrytis leaf blight and Purple blotch:</u> Apply other effective EPA-registered fungicides between the Ridomil Gold Bravo SC sprays.</p>
<p>Resistance Management:</p> <ul style="list-style-type: none"> • Refer to Section 3.2. 			
USE RESTRICTIONS			
<p>1) Refer to Section 6.1 for additional product use restrictions.</p> <p>2) Maximum Single Application Rate: 2.5 pt/A</p> <p>3) Minimum Application Interval: 7 days</p> <p>4) Maximum Annual Rate: 12.5 pt/A/year Onions (dry bulb) and garlic; 7.5 pt/A/year Onions (green), leeks and shallots</p> <p>Onions (dry bulb) and garlic</p> <ol style="list-style-type: none"> a. DO NOT exceed 15.0 lb ai/A/year of chlorothalonil-containing products. b. DO NOT exceed 1.0 lb ai/A/year of soil-applied and 0.5 lb ai/A/year of foliar-applied mefenoxam- and metalaxyl-containing products. <p>Onions (green), leeks and shallots</p> <ol style="list-style-type: none"> a. DO NOT exceed 6.75 lb ai/A/year of chlorothalonil-containing products. b. DO NOT exceed 1.0 lb ai/A/year of soil-applied and 0.3 lb ai/A/year of foliar-applied mefenoxam- and metalaxyl-containing products. <p>5) Pre-Harvest Interval (PHI):</p> <ol style="list-style-type: none"> a. Onions (dry bulb) and garlic: 7 days b. Onions (green), leeks and shallots: 14 days 			

Early season onion bacterial diseases



Yellow bud of onion
Pseudomonas coronafaciens



Bacterial streak and bulb rot
caused by *Pseudomonas*
***viridiflava* and**
P. alliivorans

Mid- to late-season onion bacterial disease



Center rot of onion: *Pantoea* spp. complex

Late-season onion bacterial diseases



Sour skin of onion: *Burkholderia cepacia*



Onion bulb decay: *Enterobacter cloacae*

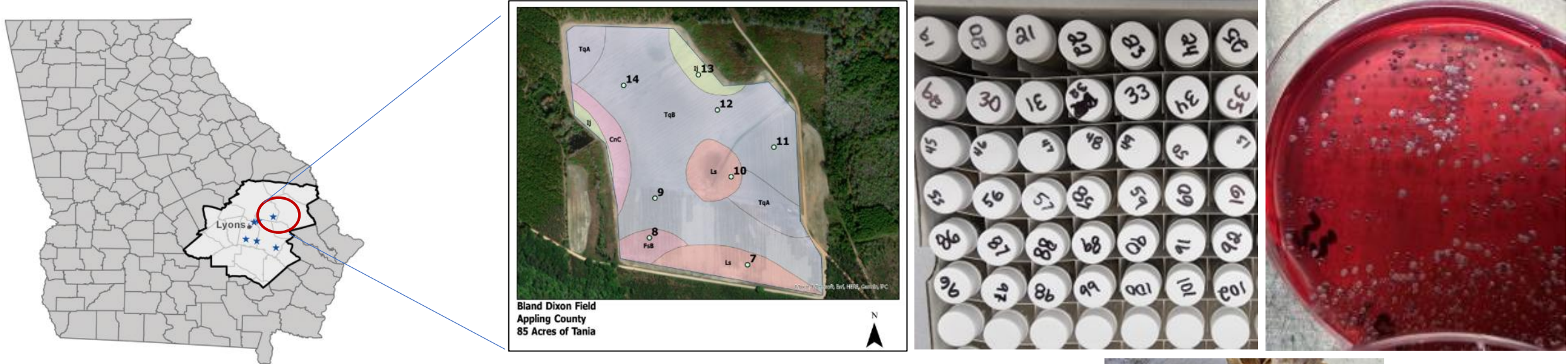


Slippery skin: *Burkholderia gladioli* pv. *alliicola*

Prevalence of *Burkholderia* spp. in soil in the Vidalia onion-growing region

Onion and soil samples

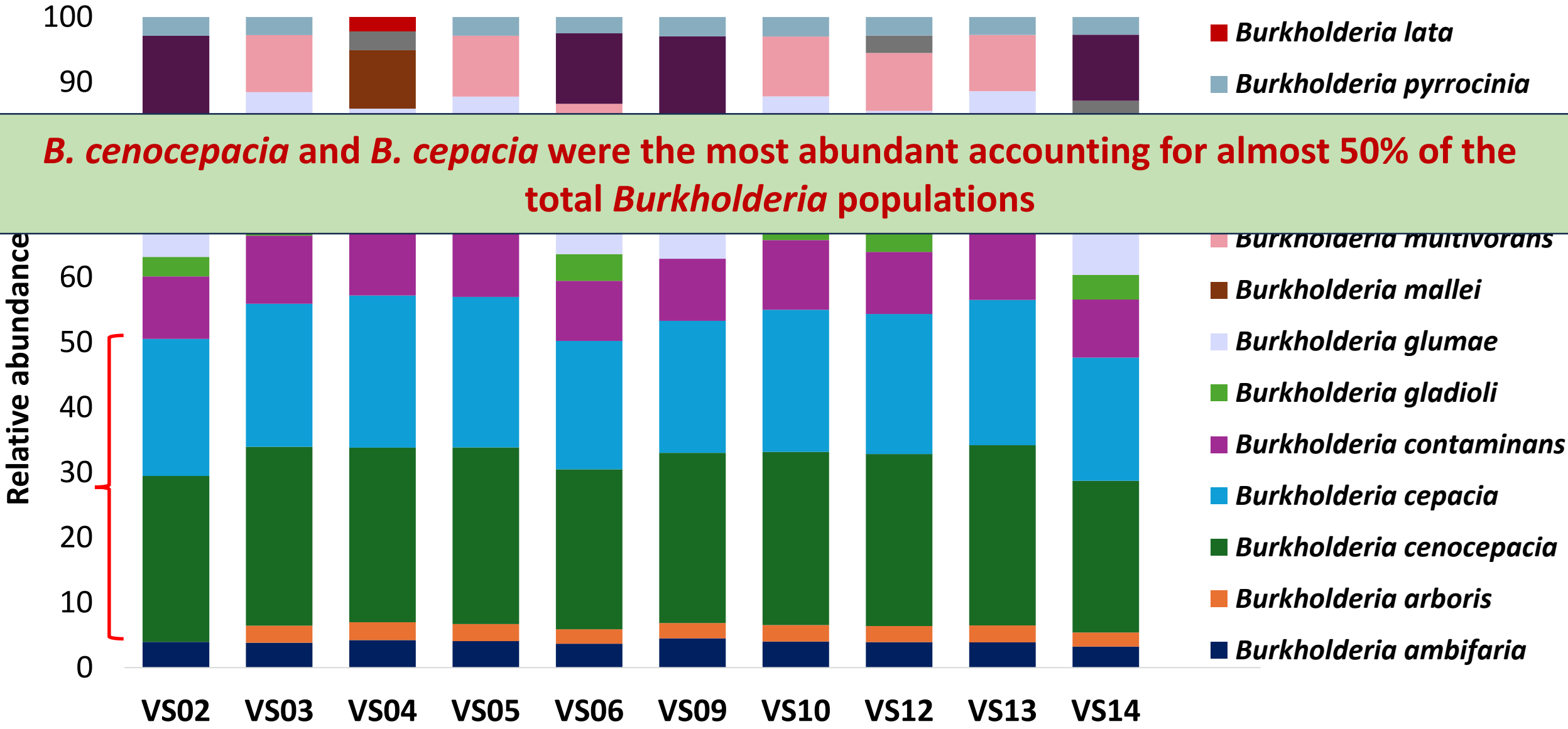
- 120 samples (representing approx. 1,200 acres)



- One hundred percent of the samples had colonies that were identified as *B. cepacia* and *B. cenocepacia* using *recA*-based Sanger sequencing

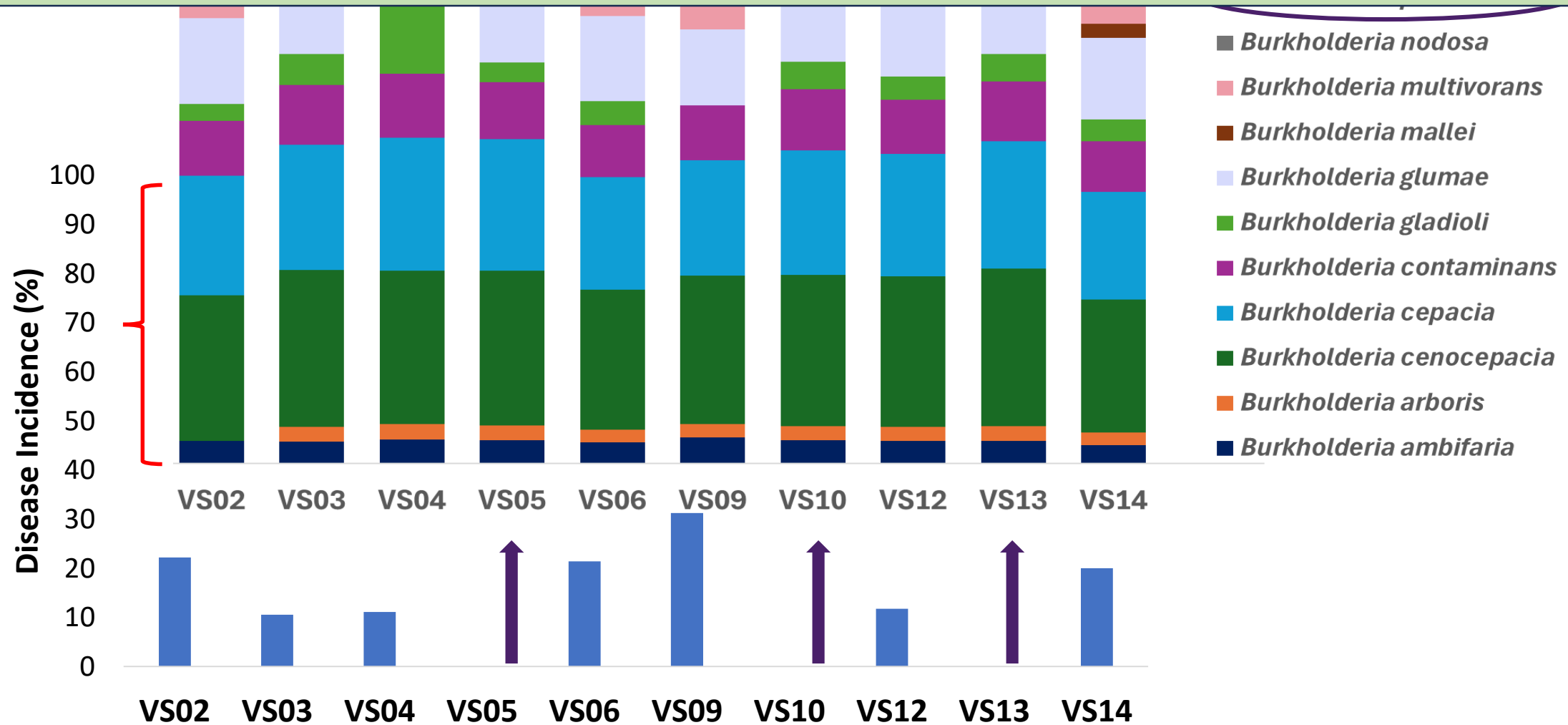


Relative abundance of *Burkholderia* species in Vidalia soils (amplicon-Seq)



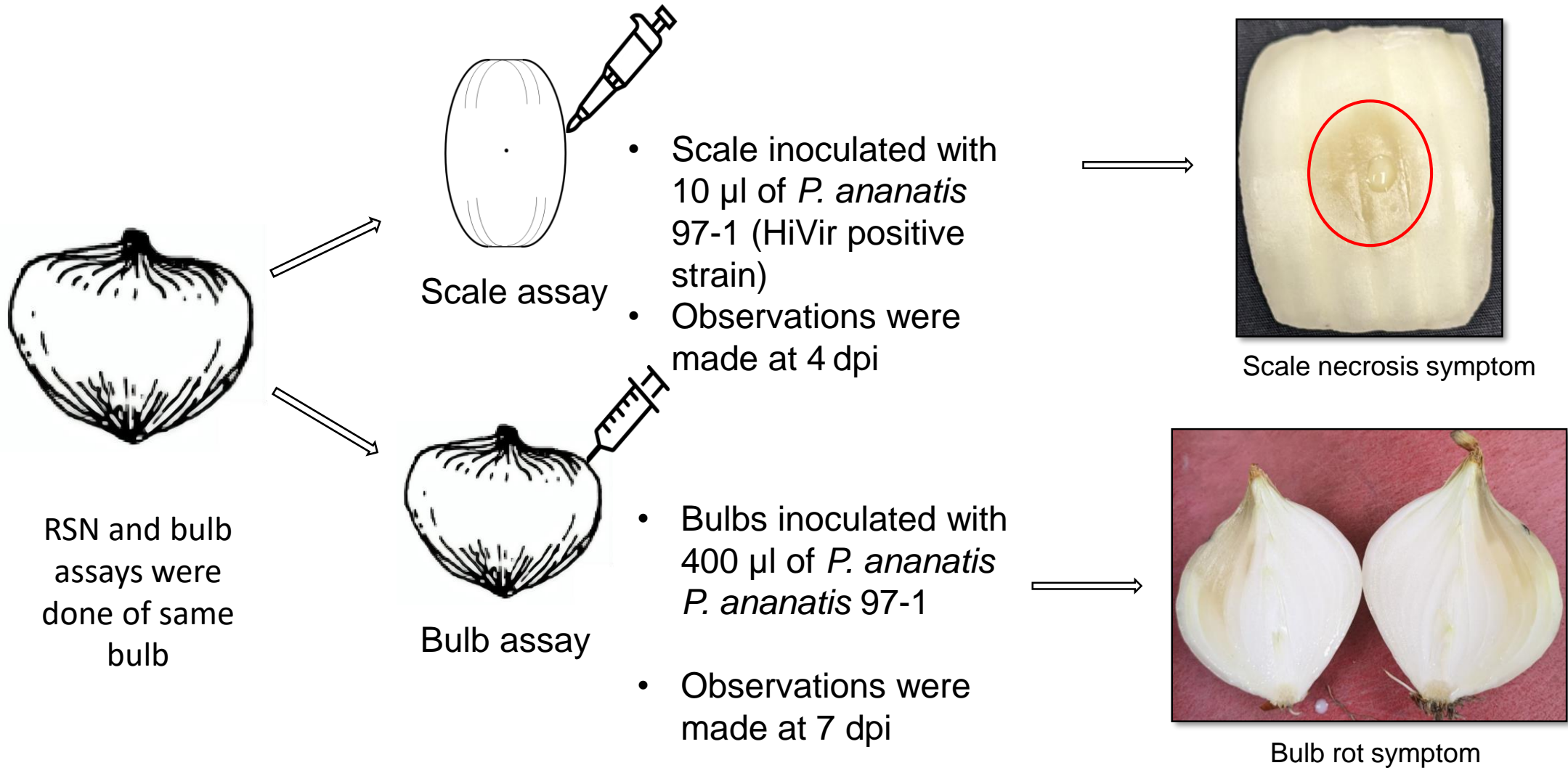
Bulb Rot –Disease Incidence for the first 10 samples

More samples need to be processed for stronger conclusions on associations and correlations between relative abundance and onion disease data.



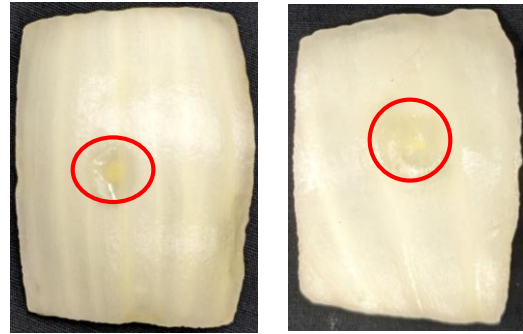
Screen of Commercial Cultivars for *Pantoea* resistance

Phenotypic screen: Onion bulb and scale assays



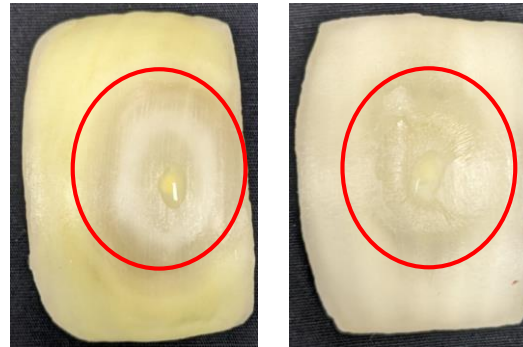
Results

Vidalia onion scale assay (2023)



10256

369



XON-300Y

Early Sweet

Scale rot symptom

No.	Var	Mean lesion area (cm ²)	Group	No.	Var	Mean lesion area (cm ²)	Group
1	Alba_Blanca	0.35	j	1	Candy_Joy	1.53	bcde
2	10256	0.41	ij	2	Miss_Scarlet	1.54	bcde
3	Rio_Del_Sol	0.49	hij	3	EMY_55457	1.70	bcd
4	Chianti	0.55	ghij	4	Sofire	1.71	bcd
5	369	0.61	fghij	5	Mata_Hari	1.72	bcd
6	Red_Marvel	0.62	efghij	6	Sweet_Agent	1.88	bc
7	Maragogi	0.82	defghij	7	EMY_55455	1.93	bc
8	A1926	0.85	defghij	8	Candy_Kim	1.97	bc
9	GA_Boy	1.14	cdefghij	9	Early_Sweet	1.99	bc
10	Macon	1.16	cdefghij	10	XON-300Y	2.04	abc
11	Dulciana	1.17	cdefghij	11	EMY_57357	2.49	ab
12	XON-106Y	1.22	cdefghij	12	EMY_55178	3.08	a

Results

Vidalia onion bulb assay (2023)



10256

Monjablanca



1407

Candy Ann

Bulb rot symptom

Relative weight of rotten tissue (%):

$$\frac{\text{wt. of rotten tissue}}{\text{wt. of entire bulb}} \times 100$$

No.	Var	Rotten tissue wt (%)	Group	No.	Var	Rotten tissue wt (%)	Group
1	Chianti	2.45	d	1	EMY_55455	5.42	abcd
2	Rio_Dulce	2.58	d	2	Vidora	5.70	abcd
3	Red_Marvel	2.65	d	3	Superex	5.90	abcd
4	Monjablanca	2.94	d	4	Candy_Joy	6.04	abcd
5	Dulciana	3.02	cd	5	OSYF12-7091	6.11	abcd
6	10256	3.21	cd	6	Fast_Track	6.39	abcd
7	Sofire	3.22	cd	7	Early_Sweet	6.59	abcd
8	Vulkana	3.34	cd	8	GA_Boy	6.79	abcd
9	A1298	3.44	cd	9	Candy_Kim	7.02	abc
10	Red_Sensation	3.47	cd	10	Candy_Ann	7.72	ab
11	Sweet_Azalea	3.49	cd	11	Quick_Start	7.75	ab
12	A1926	3.50	cd	12	1407	8.60	a

HOST RESISTANCE

Field & Greenhouse Screen of *Allium* Genotypes for Resistance against *P. ananatis*

Source	Number of Lines (N)
University of Warwick, UK	219
USDA PI lines	704
Advanced Breeding Lines, Washington State University	10
Commercial lines, Emerald Seed	27
Commercial lines, Nunhems	15
Commercial lines, DP Seeds	7
Total	982



Dr. Brendon Myers, Ph.D.

Resistance against *P. ananatis* in *A. cepa* is rare (110-days after transplanting)



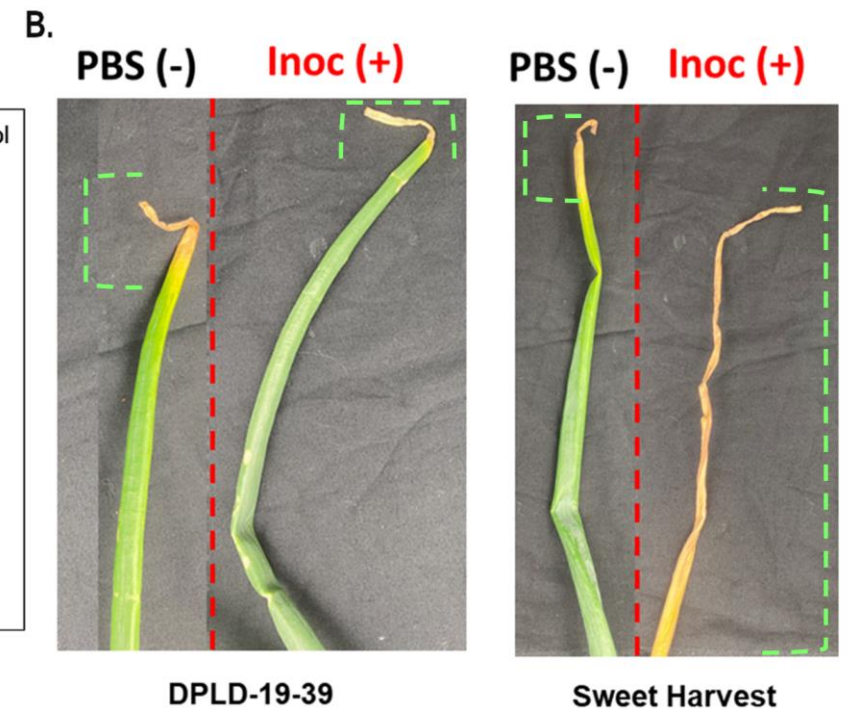
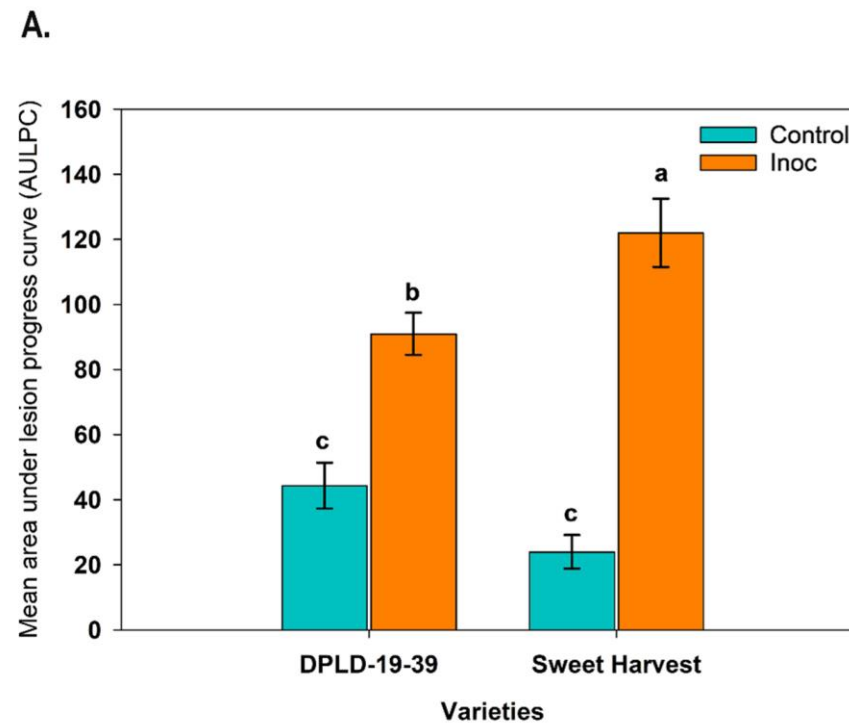
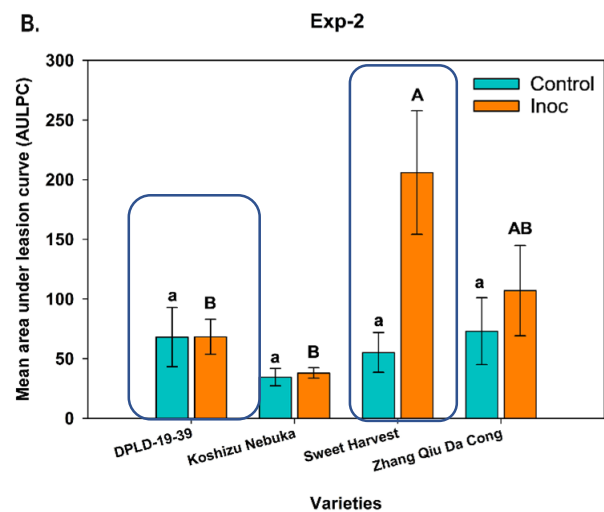
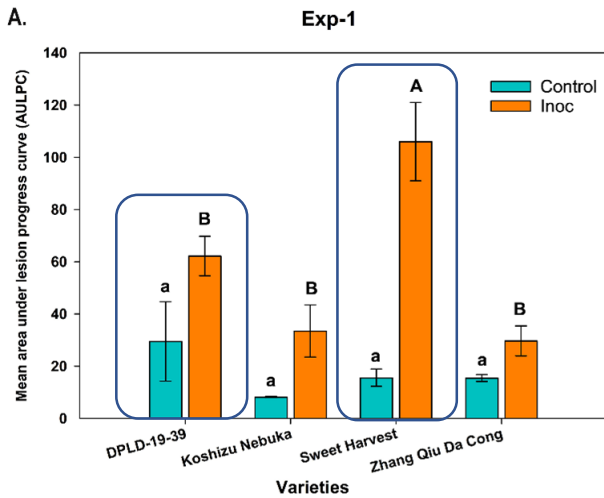
DPLD 19-39

NunSD

Sweet Harvest

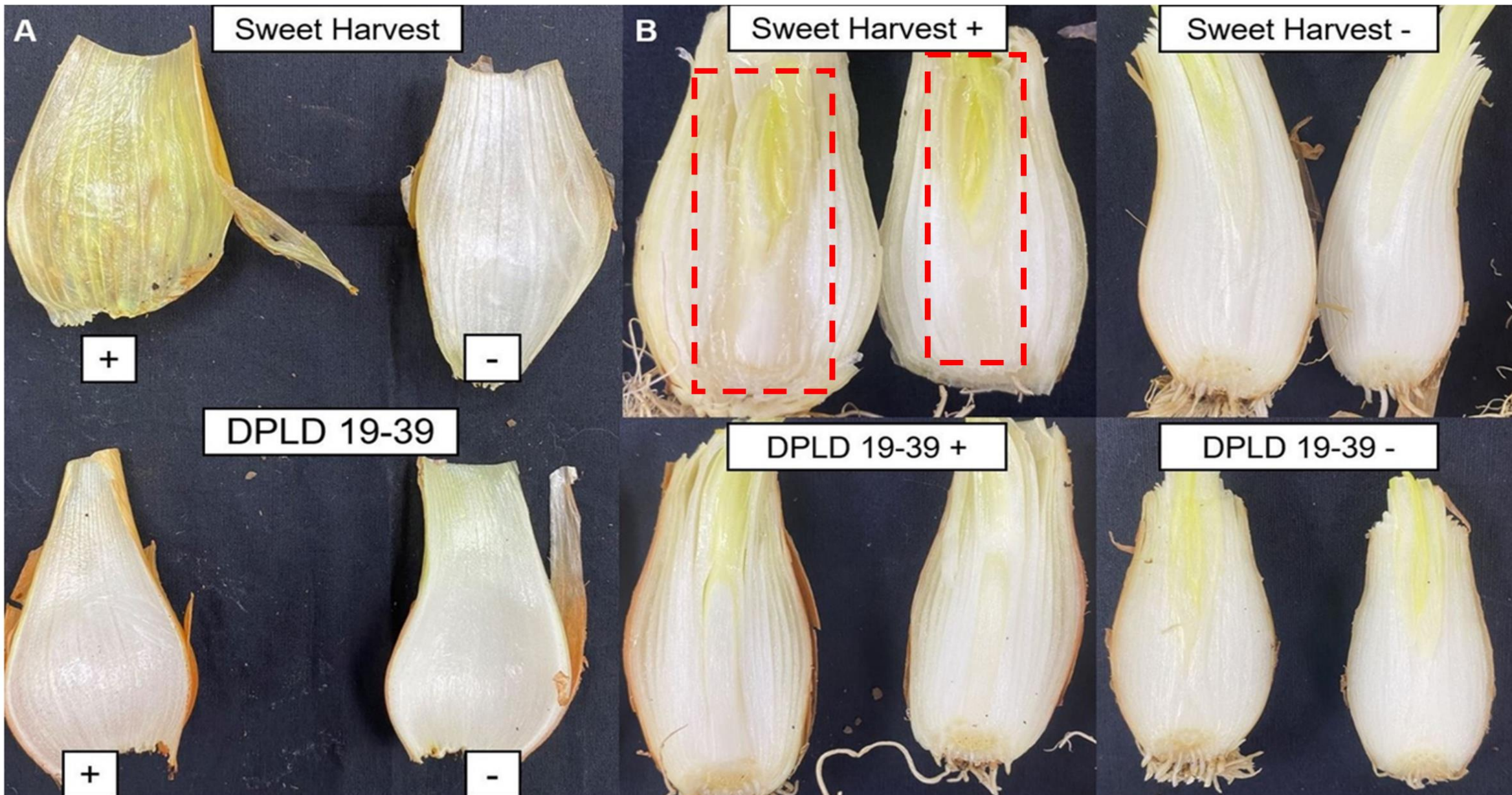
Century

DPLD 19-39 Had Significantly Less Foliar Severity Against PNA 97-1 (consistent across six-greenhouse trials)



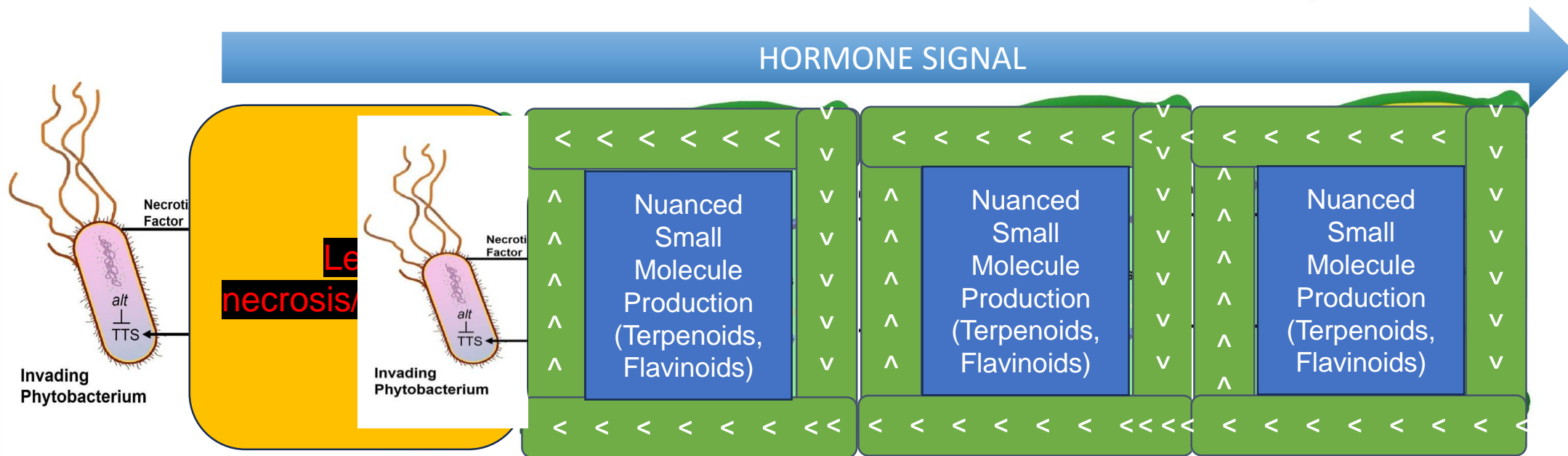
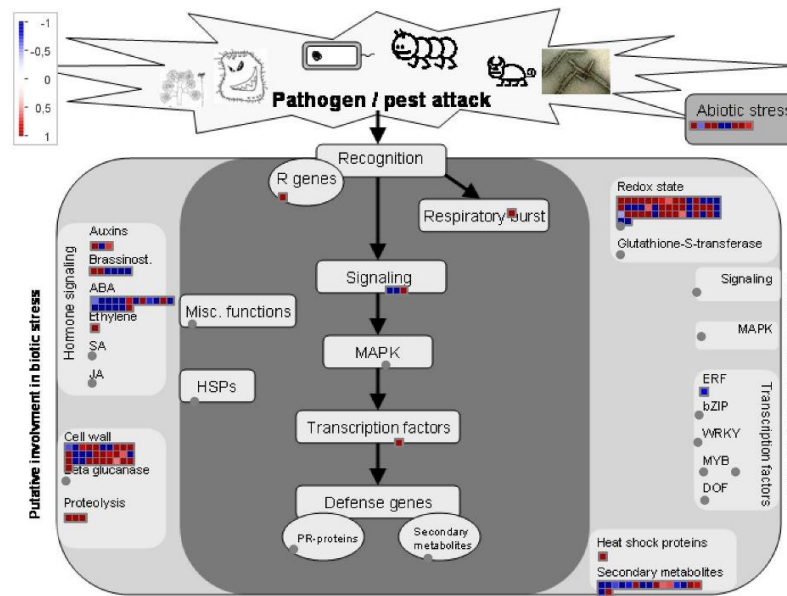
OUTER SCALE

BULB



Potential Coordinated Defense Strategy

- Multi-layered defense system involving
 - ROS Regulation
 - Alternative Hormone Signaling
 - Cell Wall Fortification
 - Small Molecule Production



Management of center rot and sour skin

Copper Products are Equally Effective in Reducing Center Rot but not Sour Skin

Copper Products	Center rot	Sour skin
Badge 1 pt	20.3 b	9.5 a
Badge 1.5 pt	15.8 b	5.5 a
Kocide 3000 1.5 lb	11.7 b	6.5 a
Mankocide 2.5 lb	9.2 b	2.5 a
Nordox 1 lb	20.6 b	4.0 a
Mastercop 1pt	6.2 b	4.5 a
Non-treated check	56.6 a	12.5 a

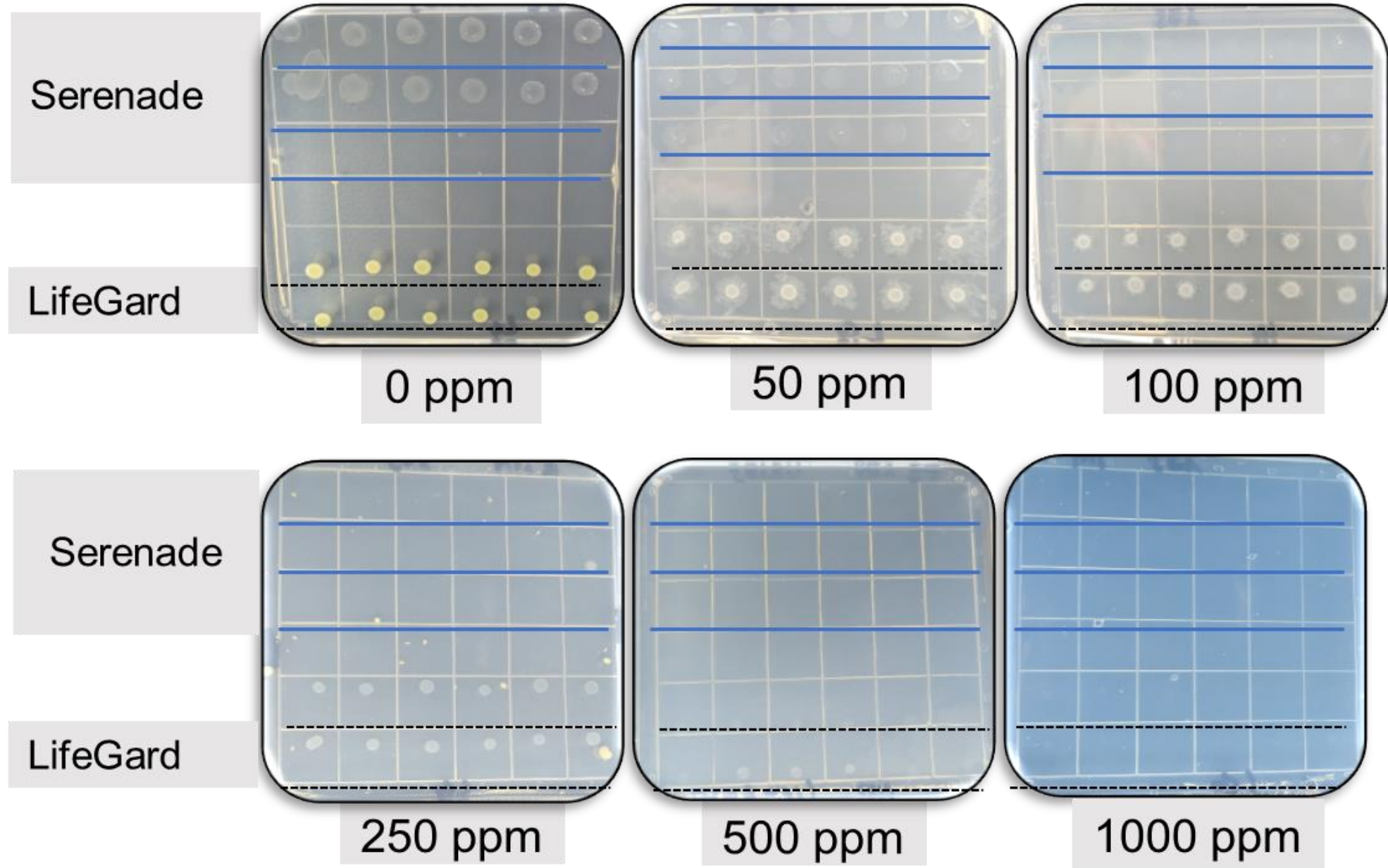
LifeGard can be rotated with copper products to reduce Center rot severity

Products	Frequency of app	Center Rot Bulb Incidence (%)
LifeGard 4.5 fl oz Kocide 3000 1.5 lb	3 3	12.5 b
LifeGard 4.5 fl oz Nordox 1 lb	3 3	14.2 b
LifeGard 4.5 fl oz Serenade ASO 4 fl oz	3 3	26.2 ab
LifeGard 4.5 fl oz Nordox 1 lb	3 3	13.5 b
LifeGard 4.5 fl oz Mastercop 1 pt	3 3	10.5 b
Non-treated check		32.4 a

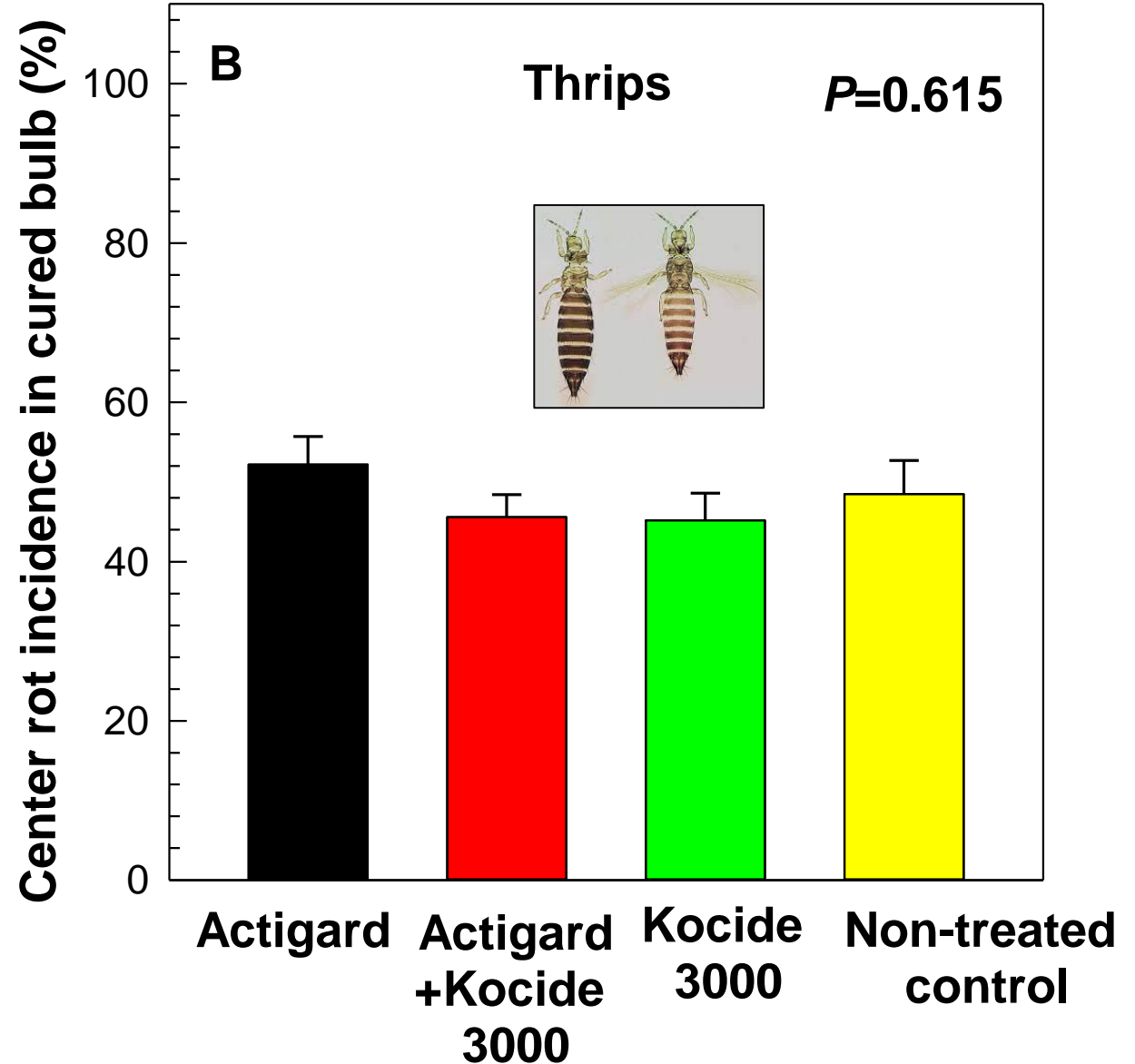
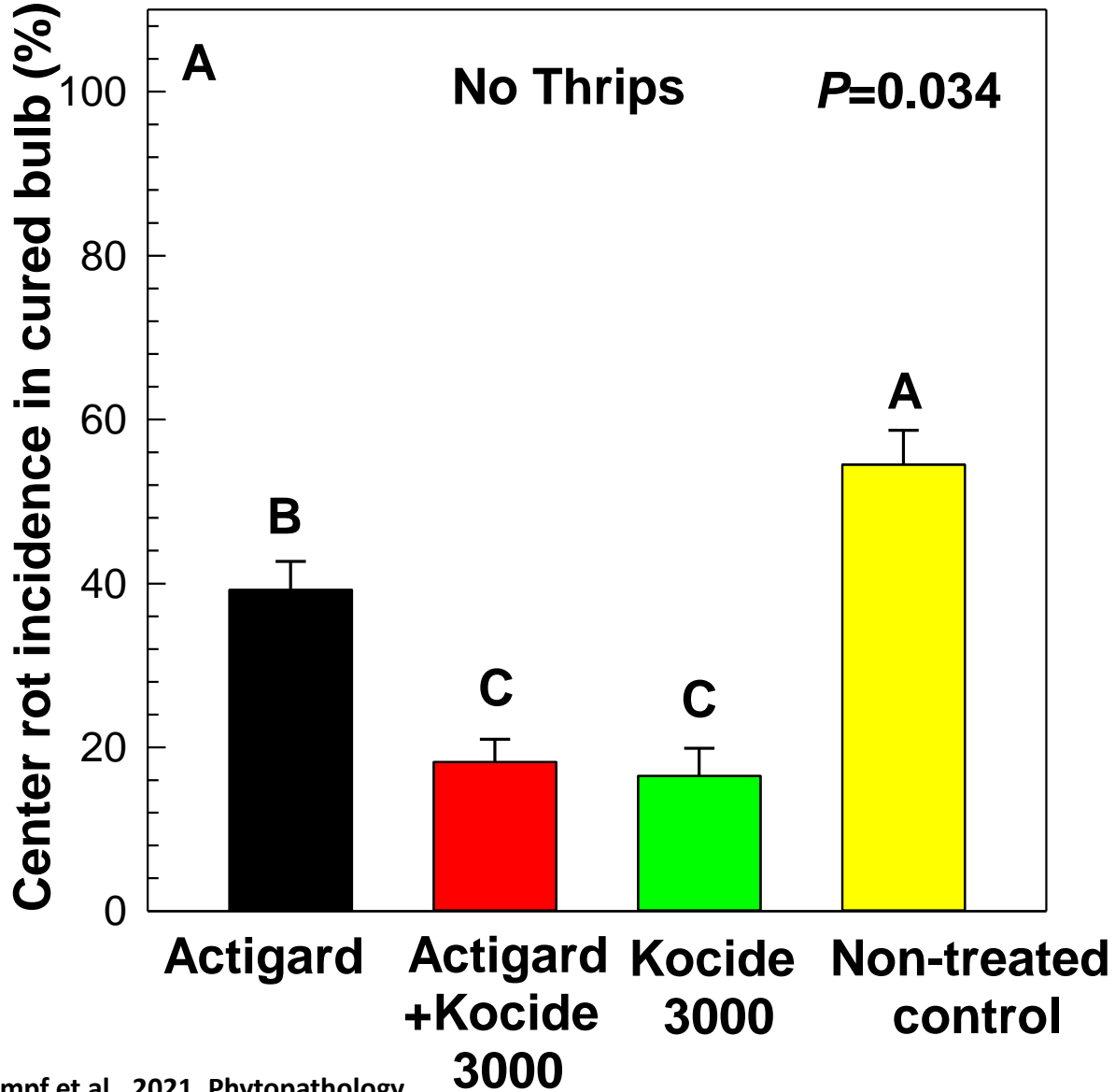
Evaluate if tank-mix application of BCA and copper differs from solo application of BCA or copper in their efficacy for center rot management

Trt No.	Treatments	Sequence of Application	Type of Application	Interval of Application (days)
1	Serenade + Nordox	1 – 8	Tank mixing	7
2	LifeGard + Nordox	1 – 8	Tank mixing	7
3	Serenade Nordox	1, 3, 5, 7 2, 4, 6, 8	Alternate	7
4	LifeGard Nordox	1, 3, 5, 7 2, 4, 6, 8	Alternate	7
5	Serenade	1 – 8	Solo	7
6	LifeGard	1 – 8	Solo	7
7	Nordox	1 – 8	Solo	7
8	Non-treated	1 – 8	-	7

Tank-mixing Serenade with Copper is not a good option; LifeGard's activity was not affected; rotation is much preferred!



Thrips infestation can reduce the efficacy of protective chemical treatments against *P. ananatis*



Thrips program over-lapped with a bactericide program (bulb-initiation and bulb-swelling) can significantly reduce center rot bulb incidence

Percent bulb-rot incidence (field and storage)

Bactericide treatments	Bulb rot % (No-Thrips control)	Bulb rot % (Thrips control)
Kocide 3000 1.5 lb (Cu product)	48.4	34.2*
Agrititan 1%	46.2	31.2*
Kocide 3000+Agrititan 1%	37.5	18.4**
Nordox (Cu product)	44.6	31.5*
Control (water)	72.5	59.2*

* $P < 0.05$; ** $P < 0.001$

Dutta et al., 2020-22



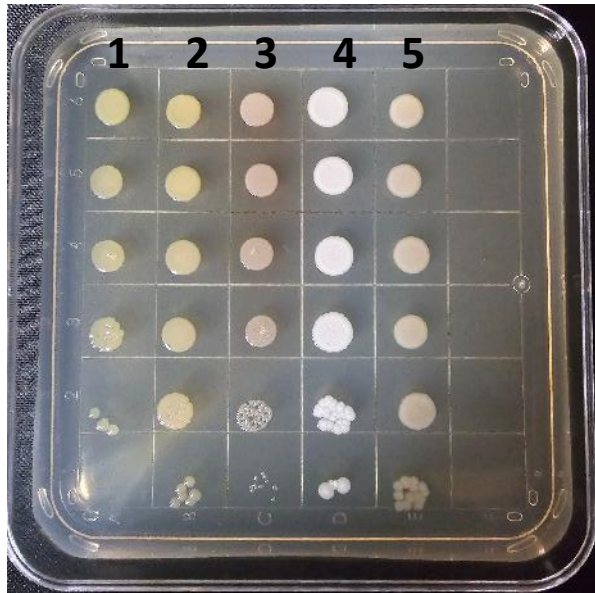
Do these findings made any difference in growers' practices and behavior?



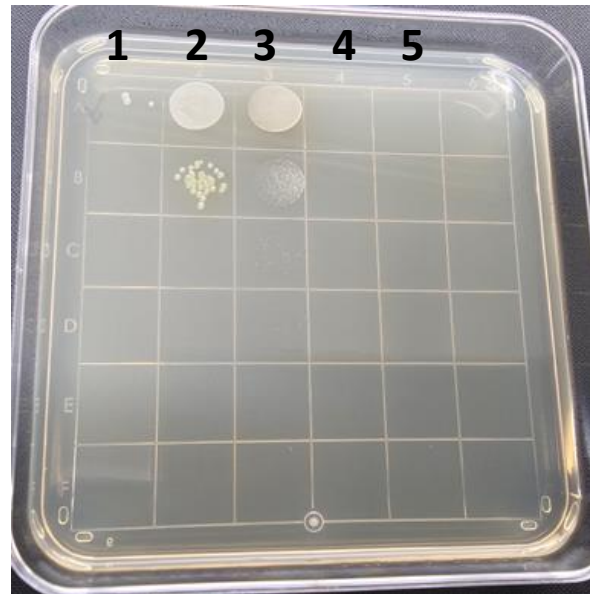
- LifeGuard is used in rotation with Copper products
- Thrips management program is now a cornerstone for the center rot management used by both organic and conventional onion growers

Novel soil bio-fumigant (Proprietary; plant-origin) against onion associated *Burkholderia* species

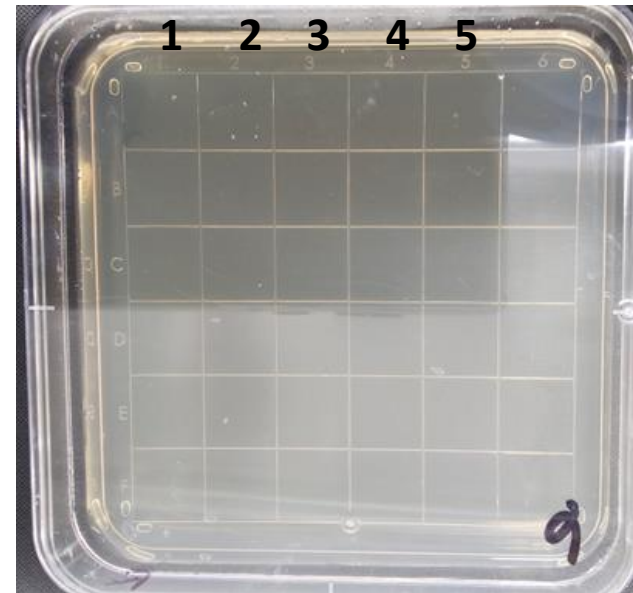
In-vitro screen of Aster against diverse *Burkholderia* species



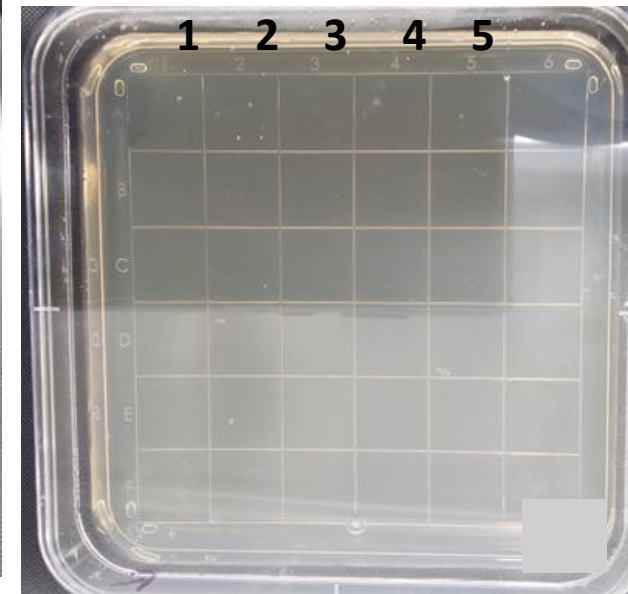
Control



0.125%



0.25%



0.5%

Evaluation of Aster on reducing disease incidence/severity in *B. cepacia*-inoculated soil (Greenhouse)

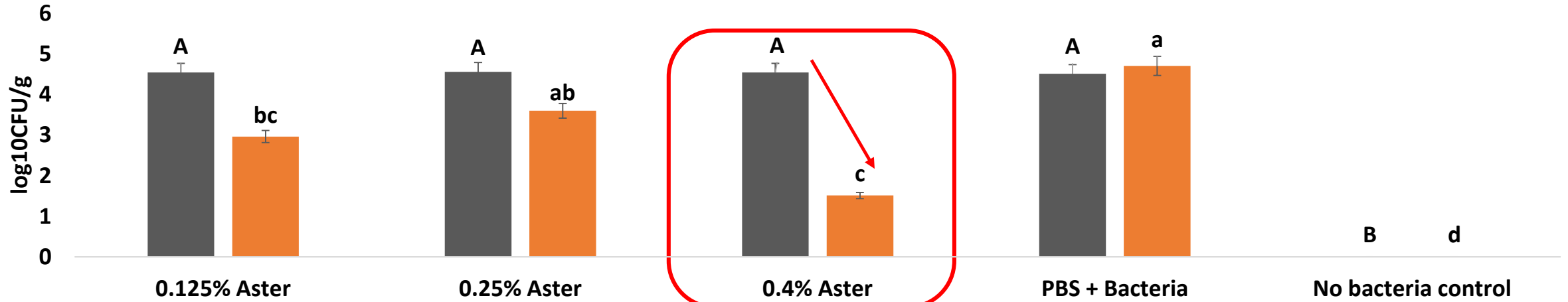
Five treatments: Autoclaved soils+

- i. 0.125% Aster (V/V) (15 gallons/Acre) + *B. cepacia*
- ii. 0.25% Aster (31 gallons/Acre) + *B. cepacia*
- iii. 0.4% Aster (50 gallons/Acre) + *B. cepacia*
- iv. PBS control + *B. cepacia*
- v. PBS control + No bacteria

***Note:** 12, 300 gallons of water is needed to penetrate 9 inches into the sandy loam soils of GA

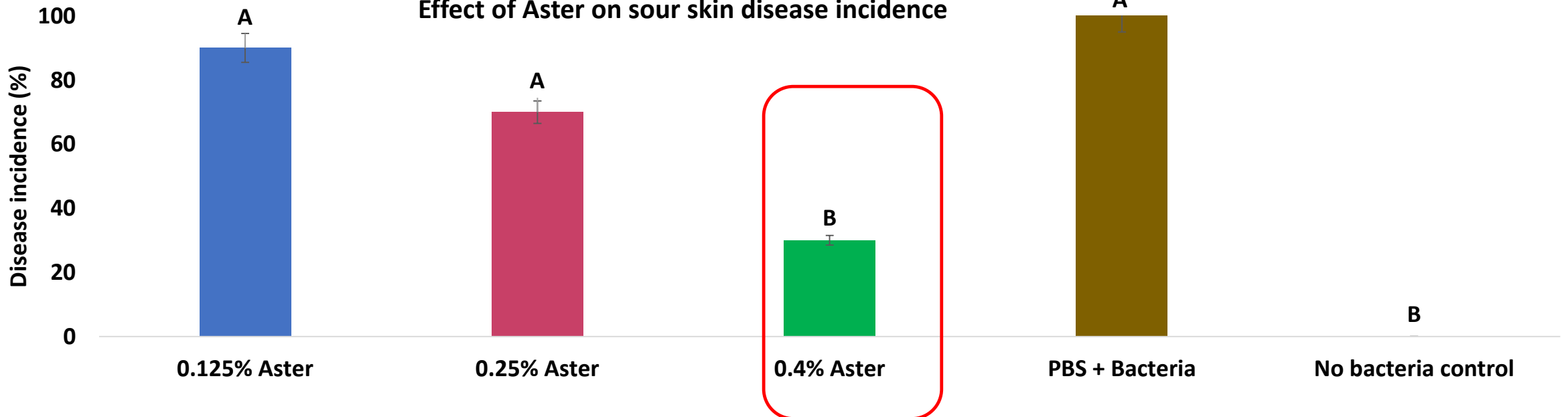


Effect of Aster on *B. cepacia* populations in the soil



Aster significantly reduced sour skin rot incidence on onion bulbs at 0.4% application rate

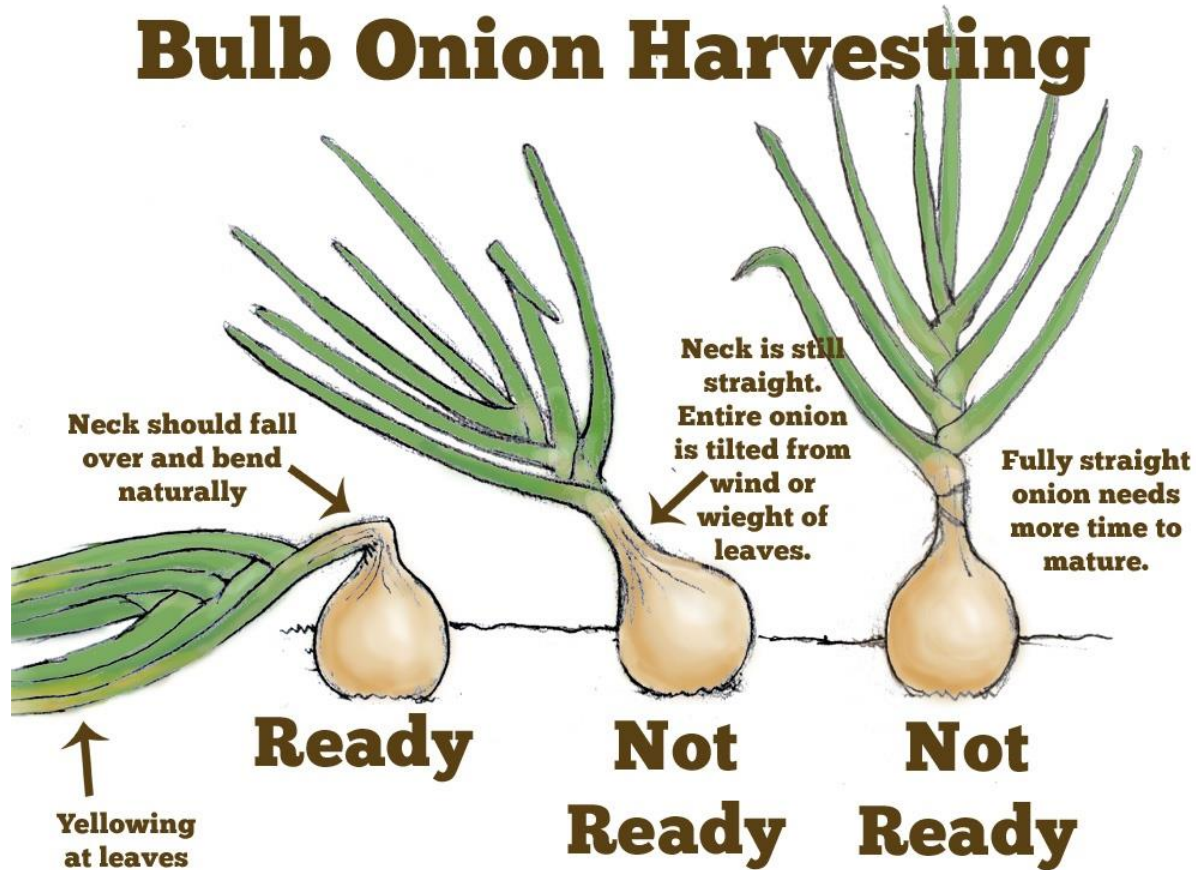
Effect of Aster on sour skin disease incidence



Do Cultural Practices Affect Internal Bacterial Bulb Rot?

©The Seasonal Homestead

Bulb Onion Harvesting



Harvest Maturity Stage



Not yet matured



Field Curing for at least 48 hours is recommended to aid in drying of neck



Harvesting can be done manually (95%) or mechanically (5%)



TopAir Onion Harvester



Nicholson Onion Harvester



Variations in onion neck length after manual or mechanical harvest

Bulb after manual harvest

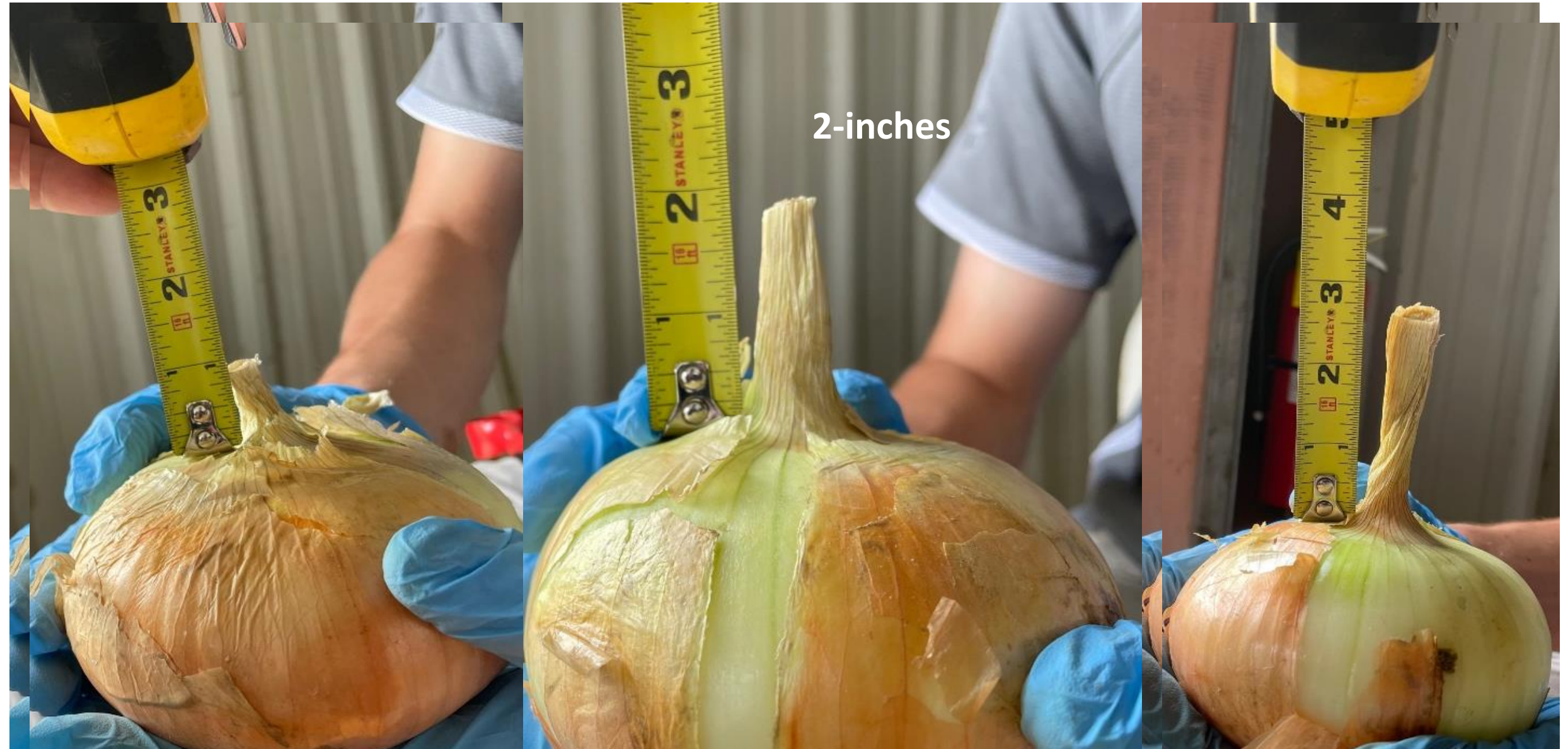


Bulb after mechanical harvest



**NECKS CLIPPED CLOSER TO THE SHOULDER DECREASE STORABILITY
(INTERNAL BACTERIAL ROT)**

Optimized neck length that improves storability of onions (2022 and 2023) (Ross Greene)



Optimized neck length that improves storability of onions (2022 and 2023) (Ross Greene)

Neck length clipped	Bacterial rot (internal) (%) (2022)	Bacterial rot (internal) (%) (2023)
Clipped at the shoulder	18.5 A	14.5 a
Neck clipped after field curing (1")	18.0 A	12.0 a
Neck clipped after field curing (2")	13.0 B	5.5 b
Neck clipped after field curing (3")	13.0 B	6.5 b





Impact

**Vidalia Onion Sold
with
2-inches of dried neck
in Publix (Tifton, GA)
in 2023**



Dutta Lab (University of Georgia)



Acknowledgements

Current members

Dr. Anoop Malik (Post Doc)
Dr. Vishal Negi (Post Doc)
Dr. Mei Zhao (Post Doc)
Dr. Michelle Pena Maclellan (Post Doc)
Dr. Shatrupa Ray (Post Doc)
Dr. Kephass Mphande (Post Doc)
Dr. Gaurav Agarwal (Post Doc)
Dr. Shaun Stice (past co-advised PhD student)
Brendon Myers (PhD student)
Santosh Koirala (PhD student)
Bamidele Sangiyomi (MS student)
Trey Doss (Research Professional I)
Michael Foster (Research Professional II)
Michael Donahoo (Research Professional I)

Collaborators:

Onion team: Brian Kvitko, Lindsey duToit, Tim Coolong,

Team of enthusiastic Vidalia onion growers and county extension agents



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