PNVA Meeting
Kennewick, WA 2023
Onion Session 3:15 PM, 30 Minutes

Stop the Rot

Grower Relevant Results

Lindsey du Toit and Tim Waters
Washington State University

https://alliumnet.com/projects/stop-the-rot/

USDA NIFA SCRI Project No. 2019-51181-30013

USDA United States Department of Agriculture National Institute of Food and Agriculture

Nature's Ninja graphic courtesy of National Onion Association

Help "Stop the Rot"!
Please take our Onion Survey
'Stop the Rot' USDA NIFA SCRI Onion Bacterial Project 2019-51181-30013

Dear Members of the Onion Industry:

During the last four years, researchers, extension educators, and industry stakeholders from across the United States have collaborated on a USDA-funded project to combat onion bacterial diseases using pathogenomic tools and optimized management practices. This project is led by the Project Director, Lindsey du Toit (dutoit@wsu.edu) in the Department of Plant Pathology at Washington State University.
Since this project strives to reduce economic losses for the onion industry, we have been aiming to understand:
(a) severity of the threat of bacterial diseases to economic stability of the onion industry,
(b) what growers are doing to combat bacterial diseases,
(c) what is and what is not working, and
(d) what future research would be most valued by the onion industry.

To help answer these questions, please complete a 10-minute survey.
No identifiable information will be collected to maintain your anonymity.
Thank you very much for your time and support as we continue our efforts to support the onion industry.

Current situation

- Bacterial diseases of onion occur across the USA
- Bacterial diseases are difficult to manage:
  - Lack of effective, rapid detection methods
  - Poor understanding of the genetic basis of pathogenicity, and epidemiology of complex of bacteria associated with onions
  - Few/no resistant onion cultivars
  - No systemic, curative, highly effective bactericides

Stop the Rot

https://alliumnet.com/projects/stop-the-rot/

- $4,044,300 + $4,200,000 matching (universities, stakeholders)
- 4 year-project: September 2019-August 2023 (+ 1-yr no-cost extension)
- 24 collaborators
  - PD = Lindsey du Toit, WSU
  - Co-PI's = Bhabesh Dutta & Brian Kvitko, University of Georgia; Christy Hoepting, Cornell Extension; Brenna Aergerter, University of California; Mark Uchanski, Colorado State University
  - 12 states + Teresa Coutinho, University of Pretoria, South Africa
- 13-member national Stakeholder Advisory Panel
  - Onion growers, seed company breeders & pathologists, consultants

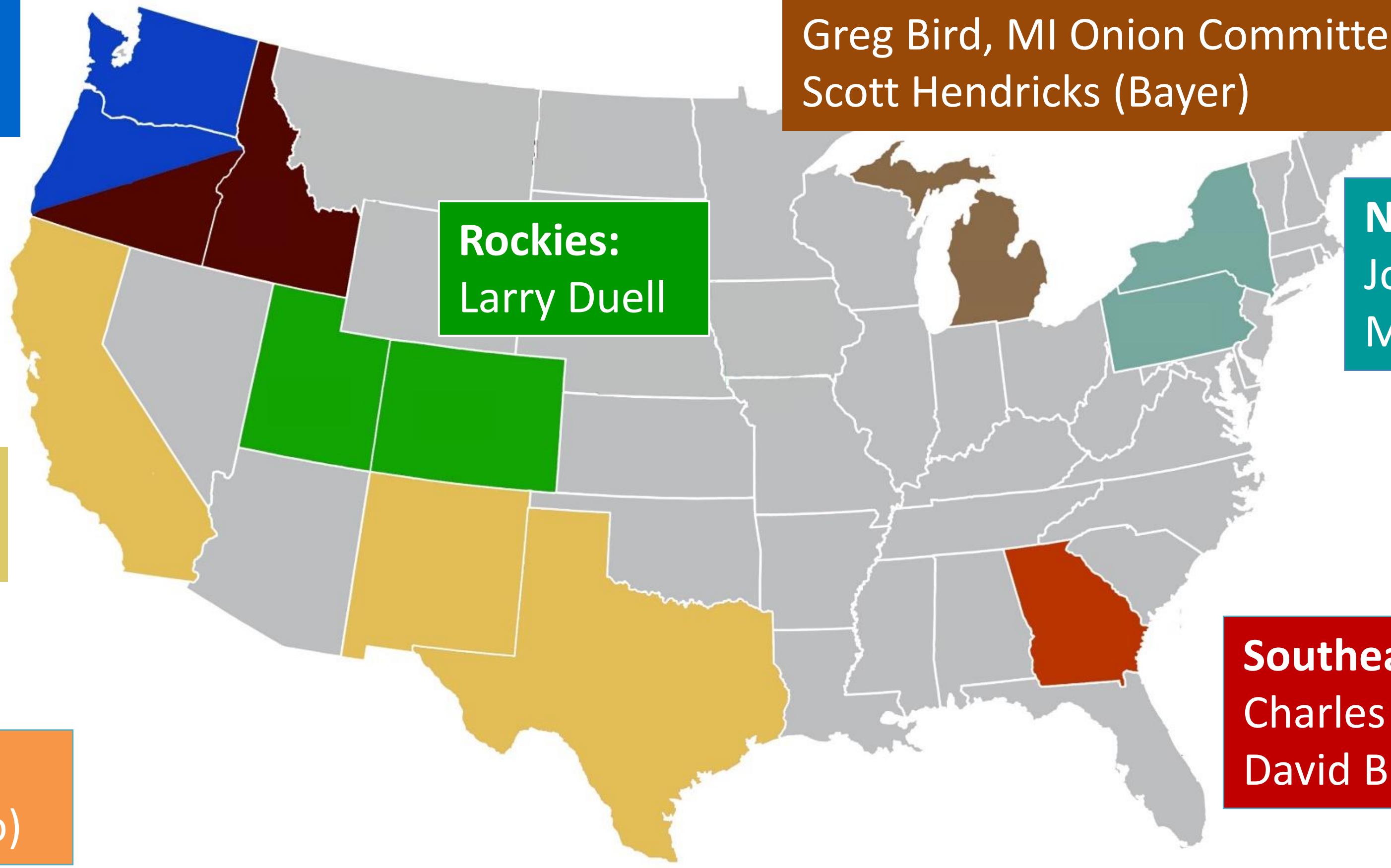
Stop the Rot – Stakeholder Advisory Panel (SMART)

Pacific Northwest:
Michael Locati
Peter Rogers (BASF)
Juan Carlos Brevis (BASF)

Midwest:
Gumz Farms, WI
Greg Bird, MI Onion Committee
Scott Hendricks (Bayer)

Rockies:
Larry Duell

Northeast:
Joe DiSalvo
Maxwell Torrey



Southwest:
Bob Ehn, CGORAB

Southeast:
Charles Hall, GFVGA
David Burrell

International:
Margreet Asma (Bejo)

Stop the Rot

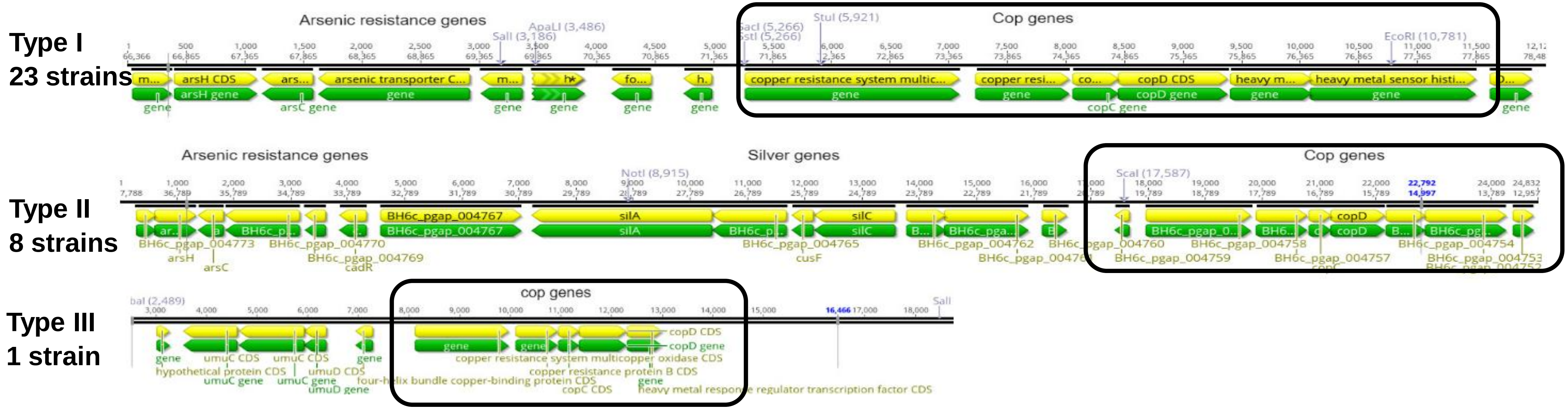
https://alliumnet.com/projects/stop-the-rot/

- Objective A: Onion bacterial disease characterization
  - A1 – Survey onion crops nationally for bacterial pathogens
  - **A2 – Genetic analyses, virulence factors, bacterial communities**
  - A3 – Develop molecular diagnostic tools
  - **A4 – Develop methods to screen for resistance to bacterial diseases**
- Objective B: Onion bacterial disease management
  - **B1 – Irrigation practices**
  - **B2 – Fertility practices**
  - **B3 – Pesticide programs**
  - **B4 – Cultural practices**
  - **B5 – Postharvest practices**
  - **B6 – Bacterial disease modeling/risk prediction**
  - B7 – Extension/outreach
  - B8 – Economic assessments

MacKay, H., du Toit, L., Havey, M., and Rogers, P. 2022. Onion World May/June 2022:14-16.
https://issuu.com/columbiamediagroup/docs/onion_world_may-june_2022/14

A2. Copper resistance genes are common in onion isolates of *Pantoea agglomerans*

- ~50% of *P. agglomerans* strains sequenced to date have **copper resistance (*cop*) genes** on accessory plasmids, similar to those in other bacterial plant pathogens
- *cop* genes and *alt* genes (confer tolerance to onion sulfur compounds) are often on the same plasmids
- *cop* genes have not been found in *P. ananatis* strains sequenced to date
- *cop*+ strains are resistant to at least 100 ppm copper sulfate on CYE agar medium



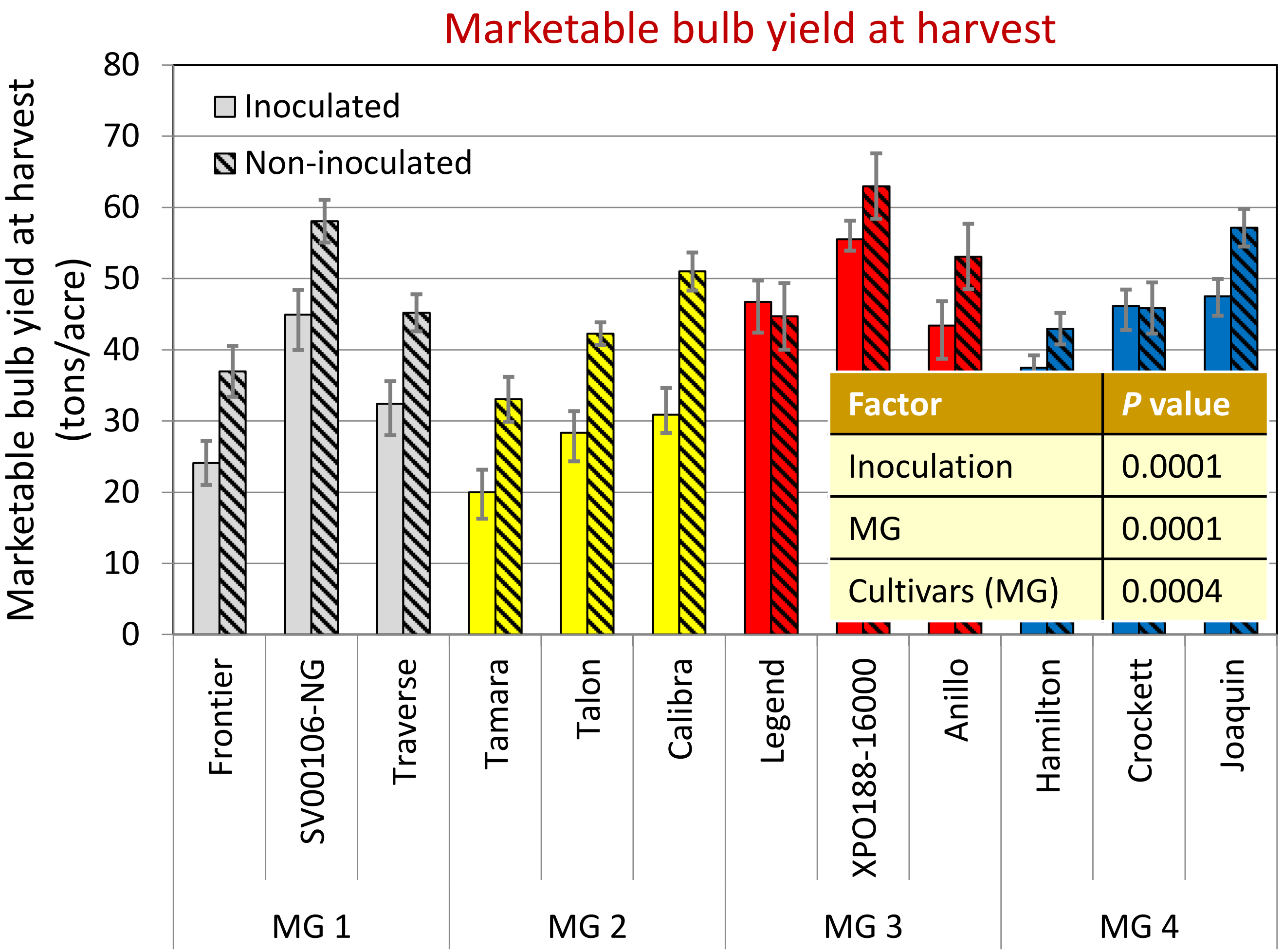
Objective A4: Develop methods to screen onion cultivars for resistance

Lindsey du Toit (WSU), Bhabesh Dutta (UGA), Steve Beer & Christy Hoepting (Cornell), Brenna Aegerter & Jas Sidhu (UC), Claudia Nischwitz (USU)

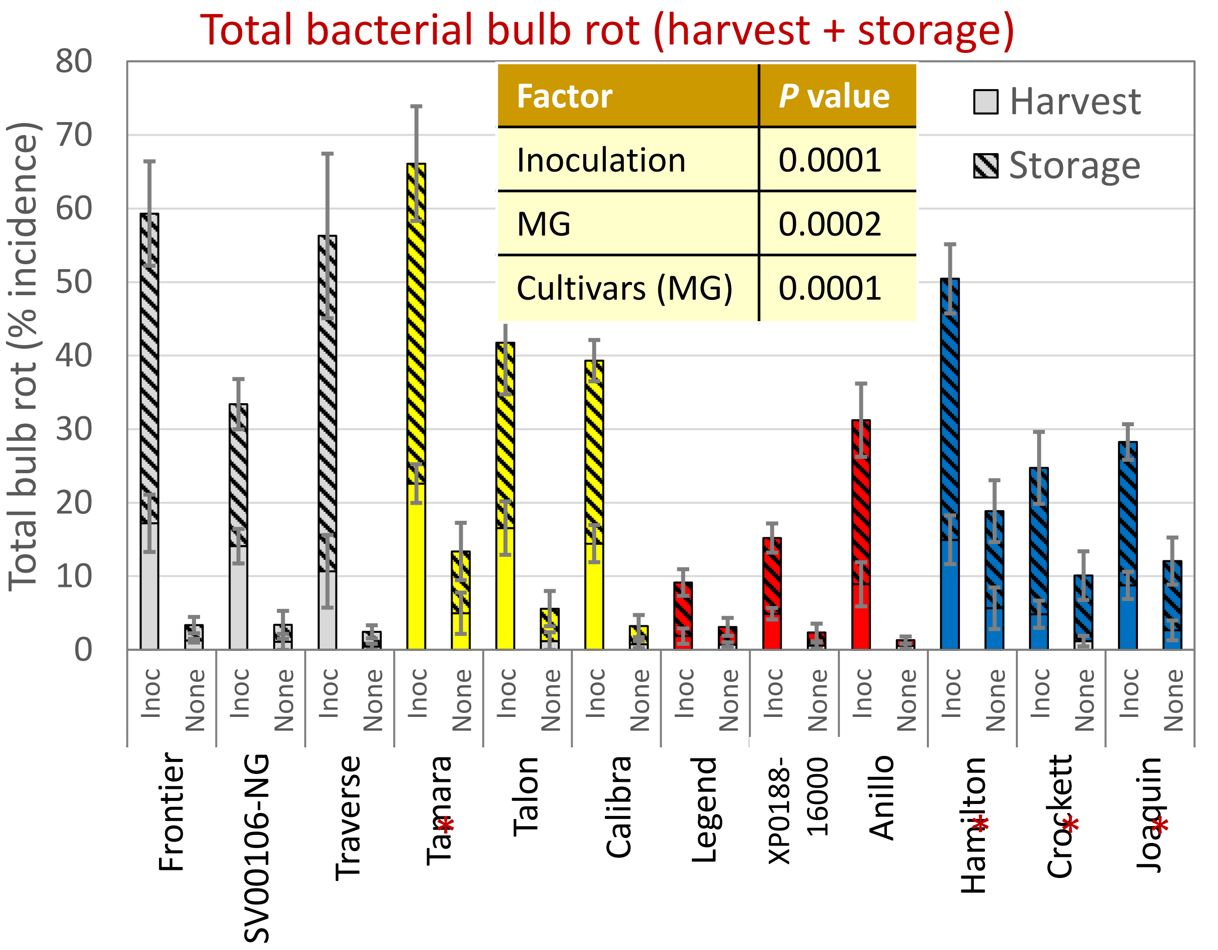
Seasons 1 (2020), 2 (2021), and 3 (2022):

- **Georgia:**
  - Greenhouse test of 2 inoculation methods did not differentiate susceptibility among cultivars
  - Field screening of USDA *Allium* germplasm collection: Differences in susceptibility to *P. ananatis*
- **New York:**
  - Various methods of screening in a growth chamber had inconsistent results (2020)
  - Field trial: 16 cultivars planted on 2 dates (trials), & half plots treated with insecticides (2021, 2022)
- **Washington:**
  - Field trial: 12 cultivars, 3/maturity group, each group inoculated at early tops down & 2 weeks later (2020 pivot irrigation; 2021 & 2022 sprinklers)
  - Comparison of bulb injection vs. scale assay for 54 cultivars (2022)
- **California:**
  - Field trial: 10 cultivars (2022) - bulb rot at harvest vs. bulb injection vs. scale assay
- **Utah:**
  - Field trial: 10 cultivars (2022)

Objective A4, Season 2 (2021-22): Washington Cultivar Trial



Factor	*P* value
Inoculation	0.0001
MG	0.0001
Cultivars (MG)	0.0004



Factor	*P* value
Inoculation	0.0001
MG	0.0002
Cultivars (MG)	0.0001

du Toit et al. 2022. Plant Disease Management Reports 16:V151.

Objective A4, Season 3 (2022): California Cultivar Trial (Brenna Aergerter, Jas Sidhu)

- **Field trial:** Some cultivars (e.g., Derby, Joaquin) had less bacterial bulb rot
- **Postharvest assays:** Significant differences in bulb rot and scale lesion size among cultivars, but results of 2 bulb injection vs. scale inoculation were poorly correlated, and poorly correlated with bulb rot in field trial

			Field trial, 9-Aug		Field trial, at harvest				Postharvest assays			
Cultivar	Type	Days to maturity (listed)	Foliar bacterial disease incidence (%)		Bulb rot incidence (%)		Marketable yield (t/A)		Bulb rot severity (%)		Scale lesion area (mm^2)	
Tannat	LD mid to late, Red	115	12.5	e*	48.4	a	19.6	bcd	53.9	e	79.9	cd
Minister	INT early, Yellow	107	13.8	e	38.1	ab	27.3	abc	65.5	bc	112.9	b
Marenge	LD mid to late, Red	115	16.3	de	34.7	bc	15.5	d	63.2	cd	185.3	a
Vaquero	LD mid to late, Yellow	118-120	35.6	ab	30.2	bcd	22.3	bcd	72.0	ab	91.3	bc
Caliber	LD late, Yellow	122	20.6	bcde	28.5	bcd	22.3	bcd	58.3	de	82.3	cd
Red Angel	INT early, Red	110	29.4	abcd	26.0	cde	28.5	ab	44.8	f	62.7	d
Granero	LD mid to late, Yellow	115-118	38.8	a	24.4	cde	22.3	bcd	70.5	abc	89.2	c
Campero	LD early, Yellow	100	35.0	abc	22.0	def	17.8	cd	66.8	bc	85.9	c
Derby	INT early, Yellow	??	18.8	cde	16.6	ef	34.3	a	65.5	bcd	93.4	bc
Joaquin	LD late, Yellow	135	24.4	bcde	12.1	f	24.4	abcd	75.0	a	94.9	bc
		P value	0.012		<0.0001		0.043		<0.0001		<0.0001	

Objective B1. Effects of irrigation practices

G. LaHue, B. Aegerter, T. Belo, S. Caldwell, T. Coolong, M. Derie, B. Dutta, E. Feibert, H. de Jesus, S. Reitz, A. da Silva, T. Waters, R. Wilson, J. Woodhall, and L. du Toit

Oregon:
- Irrigation frequency and final irrigation timing
- Irrigated with drip
- Yellow storage onion
- Spring planted

Washington:
- Irrigation frequency / final irrigation timing
- Sprinkler irrigation
- Yellow storage onion
- Spring planted

California:
- Drip vs. sprinkler irrigation
- Fresh-market onion
- Spring planted

Georgia:
- Drip vs. sprinkler irrigation
- Vidalia sweet onion
- Fall planted

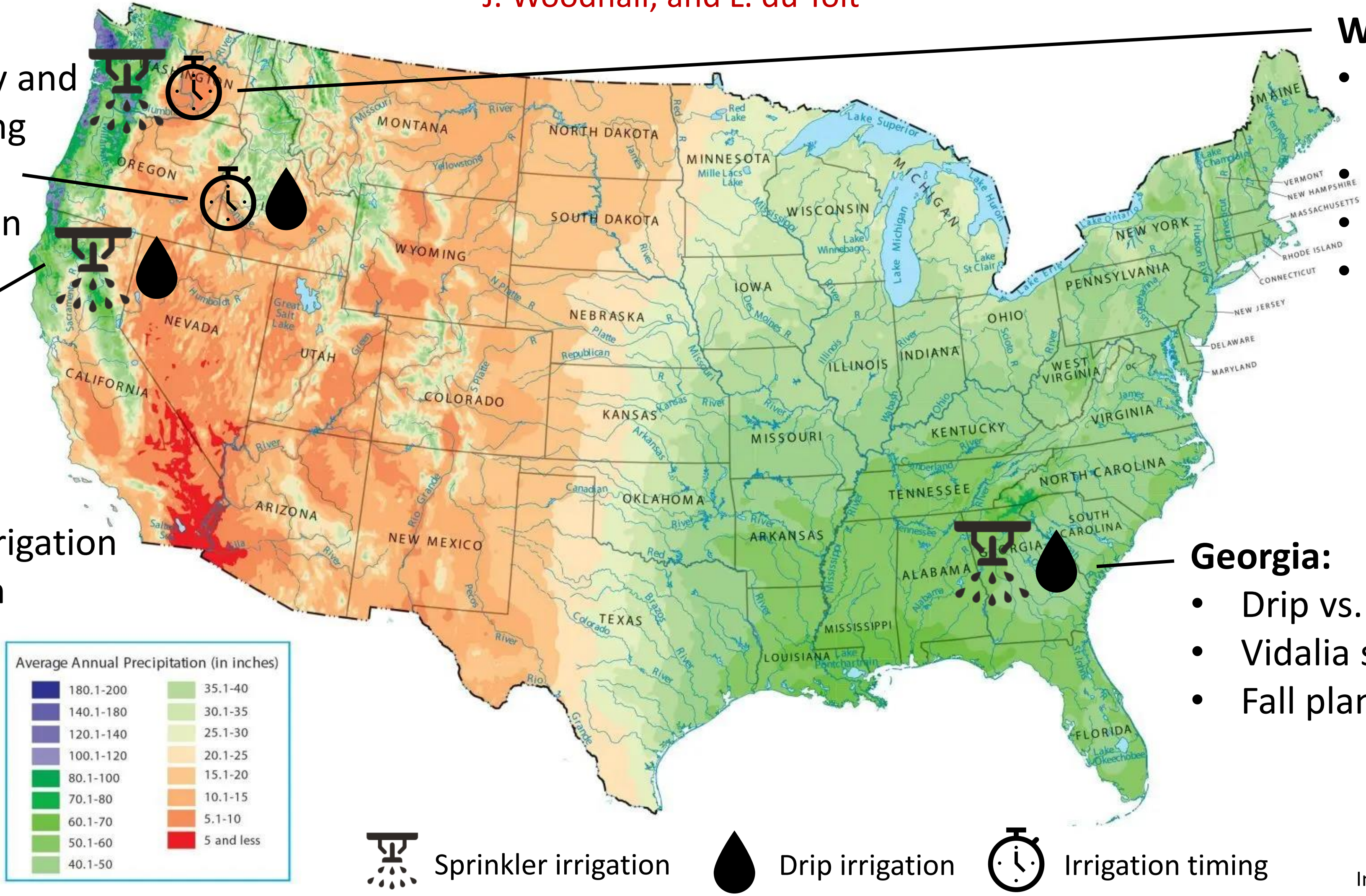


Image credits: GIS Geography, SUBPNG

B1. Summary of results: Irrigation methods

- **GA:** Drip irrigation reduced bulb yield in Season 2 (not in S1), and reduced internal bacterial bulb rot in S1 (not in S2)
- **CA:** Drip irrigation increased bulb yield and decreased bacterial leaf blight and bulb rot in S2 and S3
- **Preliminary conclusion:** Drip irrigation can reduce bacterial bulb rot in drier climates but results are mixed in humid climates

2021 California irrigation trial: Drip vs. solid-set irrigation

Treatment	Foliar bacterial disease incidence AUDPC*	Foliar bacterial disease severity AUDPC	Total bulb yield (t/A)	Average bulb size (oz)	Bacterial bulb rot incidence (% by weight)	Onion stand at harvest (# / bed-ft)
Solid-set irrigation	339 a**	269 a	48.5 b	9.5 b	22.25 a	11.3 a
Drip irrigation	96 b	24 b	59.1 a	11.1 a	0.67 b	11.8 a

Wilson et al. 2022. Plant Disease Management Reports 16:V154.

B1. Summary of results: Irrigation frequency

- **OR:** More frequent irrigation did not impact bulb yield or bacterial bulb rot in S1, but increased Botrytis neck rot and reduced yield in S2
- **WA:** Irrigation frequency did not affect bulb yield or bacterial bulb rot in S1 & S2
- **Preliminary conclusion:** Results differ based on irrigation method and, more importantly, soil moisture threshold for irrigation

B1. Summary of results: Timing of final irrigation

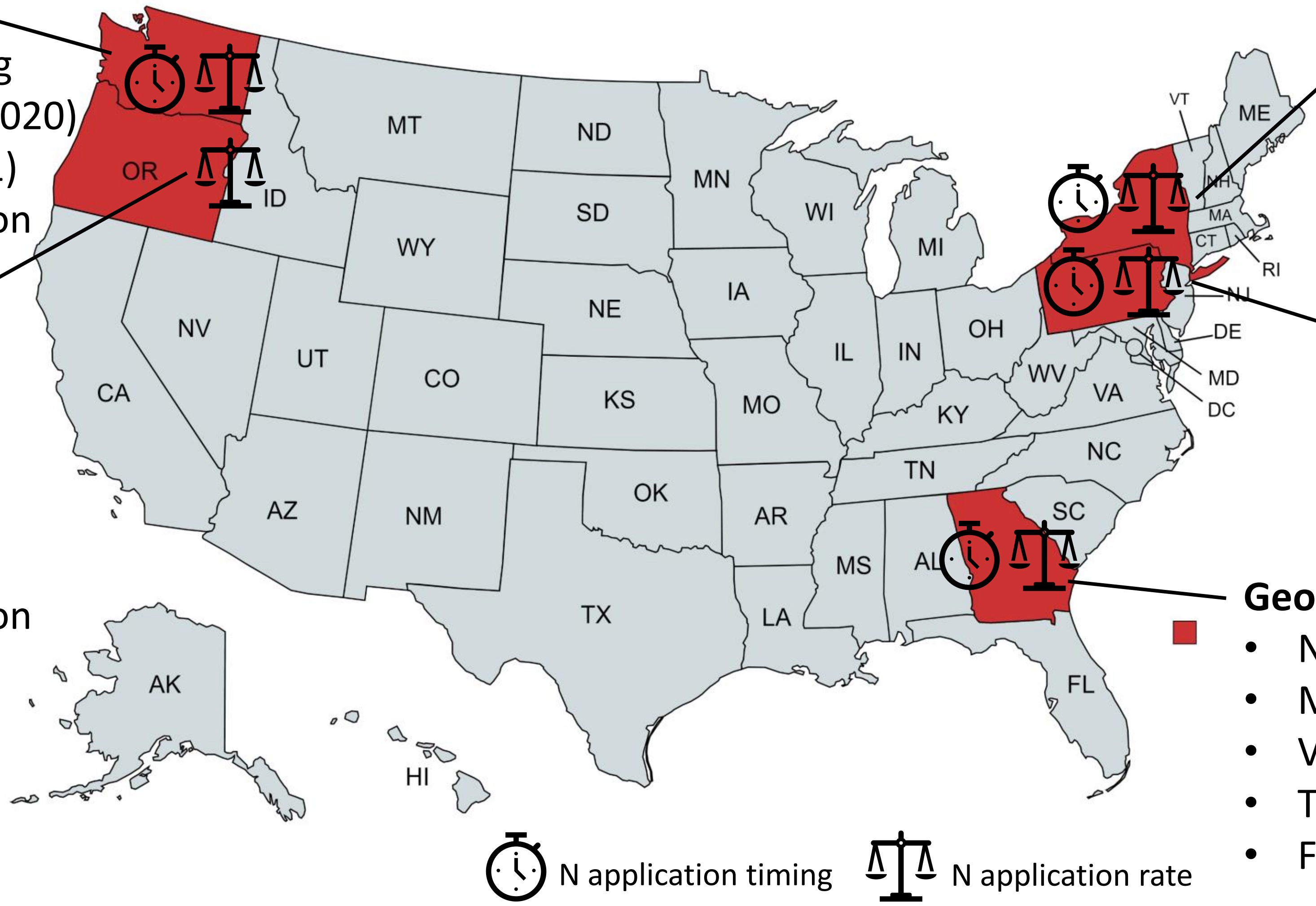
- **OR:** Ending drip irrigation earlier reduced bulb yield in S1. There was not enough bacterial bulb rot to test the effect of final irrigation timing on bacterial rot.
- **WA:** Ending sprinkler irrigation earlier did not affect bulb yield but reduced bacterial bulb rot in inoculated plots (S1 & S2)
- **Preliminary conclusion:** Ending irrigation early more likely reduces bacterial bulb rot under sprinkler vs. drip irrigation, & care should be taken not to end irrigation too early

Objective B2. Effects of soil fertility practices

G. LaHue, T. Belo, S. Caldwell, T. Coolong, M. Derie, B. Dutta, B. Gugino, E. van der Heide, C. Hoepting, H. de Jesus, J. Mazzone, M. Murdock, B. Nault, K. Nicholson, K. Regan, S. Reitz, A. Rivera, A. da Silva, I. Trenkel, T. Waters, K. Wieland, R. Wilson, J. Woodhall, and L. du Toit

Washington:
- N rate and N timing
- Loamy fine sand (2020) and silt loam (2021)
- Yellow storage onion
- Spring planted

Oregon:
- N application rate
- Silt loam soil
- Yellow storage onion
- Spring planted



New York:
- N rate and N timing
- **Many field sites**
- Muck soil
- Yellow storage onion
- Spring planted

Pennsylvania:
- N rate and timing
- Mineral soil
- Transplanted onions
- Spring planted

Georgia:
- N rate and N timing
- Mineral soil
- Vidalia sweet onion
- Transplanted
- Fall planted

Image credits: Map Chart

B2. Summary of results: N application rates

- **GA:** A bulb yield response to N was observed in Season 1 & S2, but not S3. N application rates did not impact bacterial bulb rots
- **PA:** Bulb yield and bacterial leaf blight were less in control plots with 0 N applied, but there was no difference for other N rates tested
- No response to N application rates observed for bulb yield or bacterial bulb rot in **NY** (S1 & S2), **OR** (S1), or **WA** (S1 & S2), though the percentage of the bulb yield that was marketable decreased with increasing N in **OR**

B2. Summary of results: N application timing

- **GA:** Earlier final N application increased bulb yield in S2, & reduced bacterial bulb rot in S1
- There was no effect of N application timing on bulb yield or bacterial bulb rot in **NY** (S1 & S2), **PA** (S2 & S3), or **WA** (S1 & S2)

Preliminary conclusions: Due to indirect mechanisms by which N rate or application timing impacts onion bacterial diseases, effects of N treatments were not consistent across trials. Residual available N in soil likely affected N rate treatments in some trials.

Objective B3: Effects of pesticide programs

- 7 trials in 2020 & 2021, 3 in 2022: CA, CO (3), GA (3), NY, OR, TX, UT (2), WA (3)
- Various onion cultivars: Avalon, Calibra, Century, Granero, Salute, Vaquero
- Many products evaluated alone or in combinations:
  Actigard 50WG, Agrititan, Aliette, Badge SC, BlightBan A506, Champ, Cueva, Cuprofix Ultra 40 Disperss dry flowable, Harbour, Kocide 3000, Leap, Lifegard WG, ManKocide, Mastercop, Nano-MgO, Nordox, NuCop, Oxidate 2.0, Oxidate 5.0, Serenade, Water control, Zerotol 2.0
- Applications: 4 to 6 applications at 7- to 10-day application intervals, maximum label rate
- Inoculation: CO, OR, WA, & UT trials inoculated twice late in the season
- Inoculum: *Burkholderia gladioli* pv. *alliicola, Pantoea agglomerans*, & *Pantoea ananatis*
- **Results:**
  CA, CO, NY, OR, TX, & UT: Insufficient bacterial disease to see if treatments worked
  WA: No treatment reduced bacterial bulb rot (2 seasons), coppers caused phytotoxicity in 2020 (Season 1)
  GA: Most treatments reduced bacterial bulb rot to some degree in all 3 seasons

2020 Bactericide trial for management of onion center rot in Georgia

Dutta, B., and Foster, M. J. 2021. Plant Disease Management Reports 15:V027.

Treatment and rate of product per acre	Application No. [z]	Initial disease severity (%) on 25 Mar	Final disease severity (%) on 28 Apr[y]	AUDPC[x]	Center rot incidence in bulb (%)[w]
Mankocide 2.5 lb	1-6	10.7 b[x]	43.8 c	358.8 c	9.1 c[v]
Kocide 3000 1.5 lb	1-6	28.9 ab	50.0 bc	540.7 bc	29.8 bc
Champ 1.5 lb	1-6	15.1 ab	51.3 b	464.8 bc	18.0 c
Oxidate 5.0 32 fl oz per 100 gal	1-6	40.0 a	71.3 a	791.2 ab	55.2 a
Agrititan 800 ppm	1-6	29.4 ab	58.8 b	602.8 bc	19.5 c
LifeGuard 2 fl oz	1-6	22.7 ab	48.8 bc	469.2 bc	26.8 bc
Nordox 1 lb	1-6	18.0 ab	53.8 b	502.4 bc	17.2 c
Mastercop 1 pt	1-6	23.7 ab	48.9 bc	489.6 bc	12.2 c
Leap 1 qt	1-6	32.4 ab	70.0 a	703.8 ab	52.5 ab
Actigard 0.5 fl oz	1-6	34.9 ab	70.0 a	699.5 ab	57.5 ab
NUCop 1.5 lb	1-6	15.2 ab	55.0 b	485.4 bc	18.8 c
Non-treated check	**-**	**44.9 a**	**87.5 a**	**1012.2 a**	**74.8 a**

Stop the Rot: Washington State Season 3 Field Trials

Objective B3: Bactericide trials for management of onion bacterial diseases

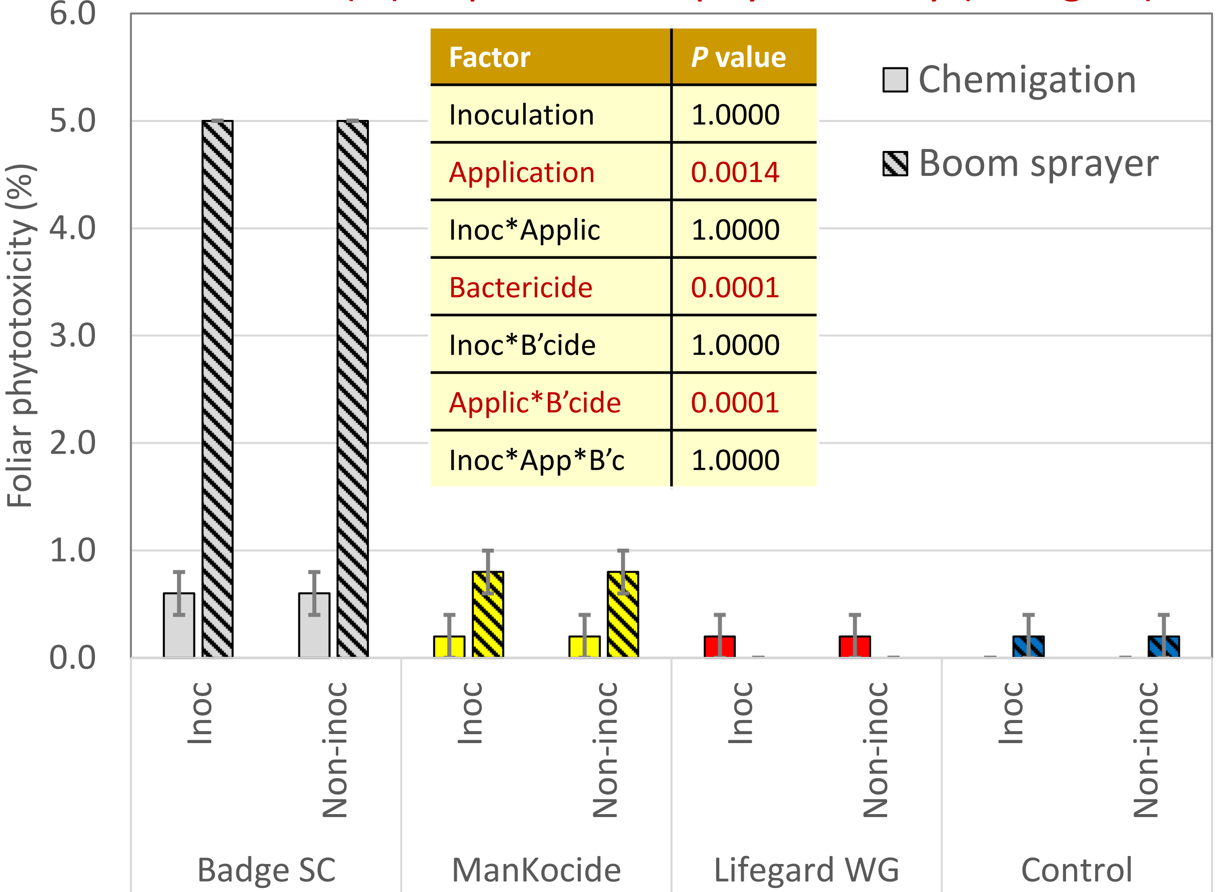
Bactericide Chemigation vs. Spray Boom Trial:

- Location: Pasco, WA (Columbia Basin)
- Split-split plot RCBD
  - Main plots: Inoculated (*Burkholderia gladioli* & *Pantoea agglomerans*) or not inoculated (tops down & 2 weeks later)
  - Split plots:
    1. Chemigation (2,700 gpa)
    2. Spray boom application (40 gpa, 25 psi)
  - Split-split plots: Bactericides (5x, 7-day intervals)
    1. Badge SC
    2. ManKocide
    3. LifeGard WG
    4. Control (no treatment)
- Center-pivot irrigation for the trial

du Toit et al. 2023. Plant Disease Management Reports 17:V123.

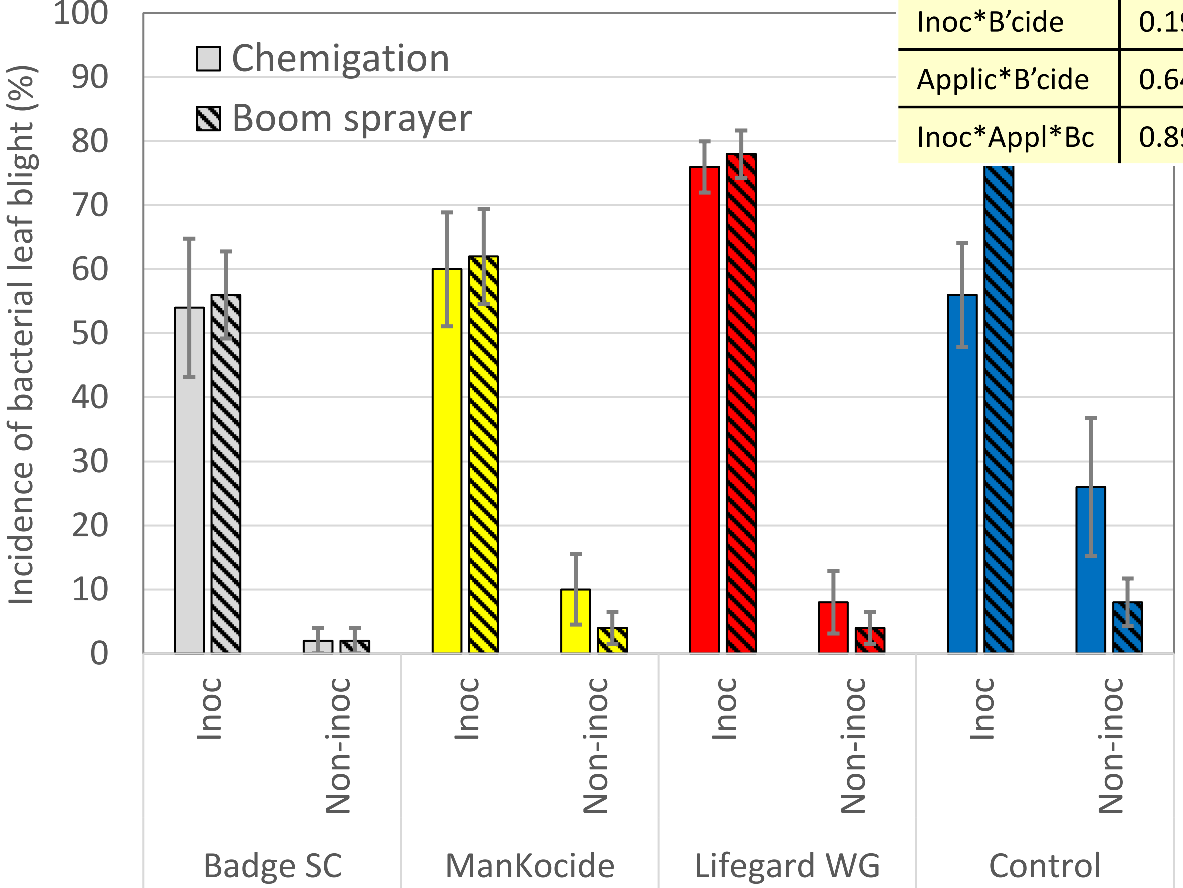
Objective B3, Season 3 (2022): Washington Bactericide Trial

Incidence (%) of plants with phytotoxicity (2 August)



Factor	*P* value
Inoculation	1.0000
Application	0.0014
Inoc*Applic	1.0000
Bactericide	0.0001
Inoc*B'cide	1.0000
Applic*B'cide	0.0001
Inoc*App*B'c	1.0000

Incidence (%) of bacterial leaf blight

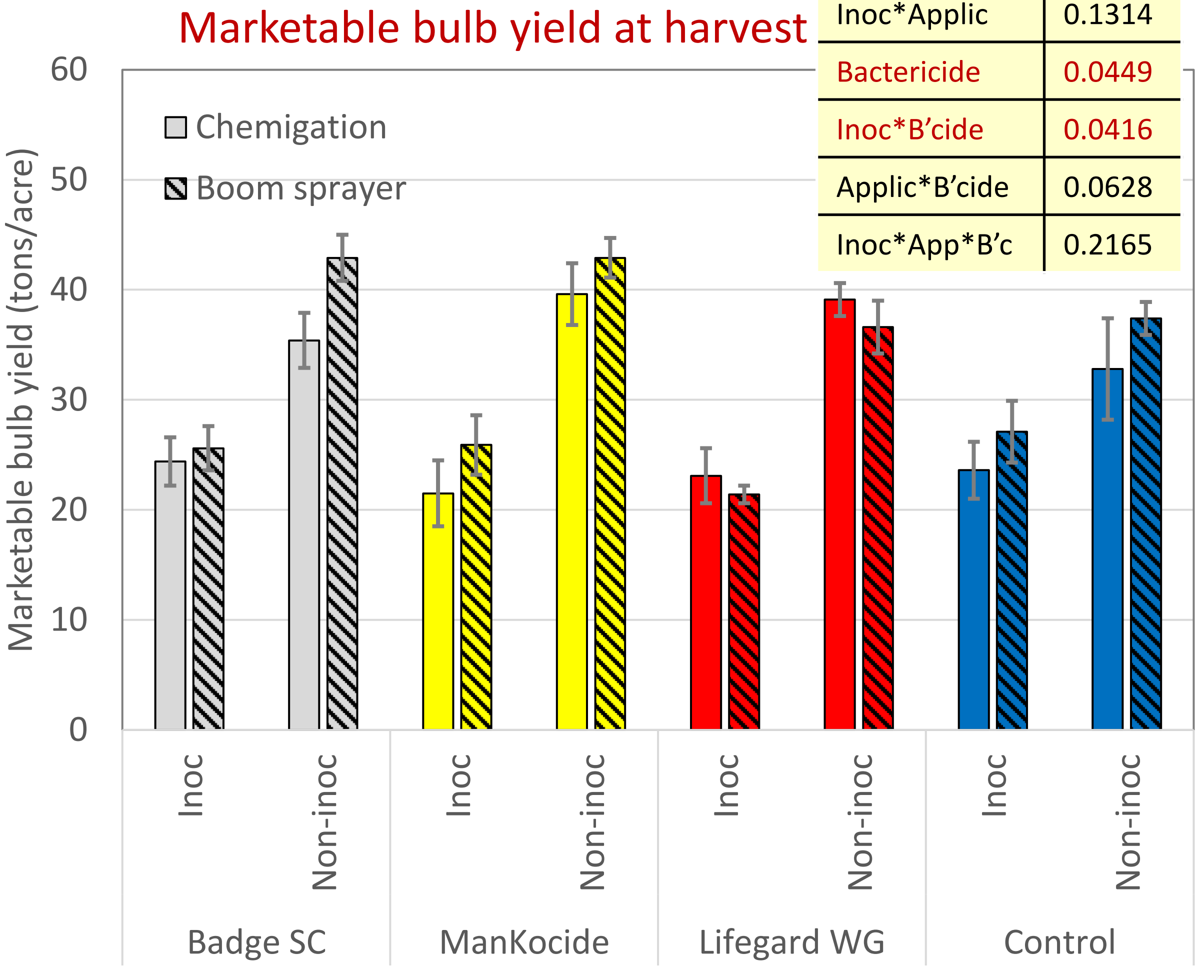


Factor	*P* value
Inoculation	0.0001
Application	0.6722
Inoc*Applic	0.0364
Bactericide	0.0007
Inoc*B'cide	0.1948
Applic*B'cide	0.6485
Inoc*Appl*Bc	0.8979

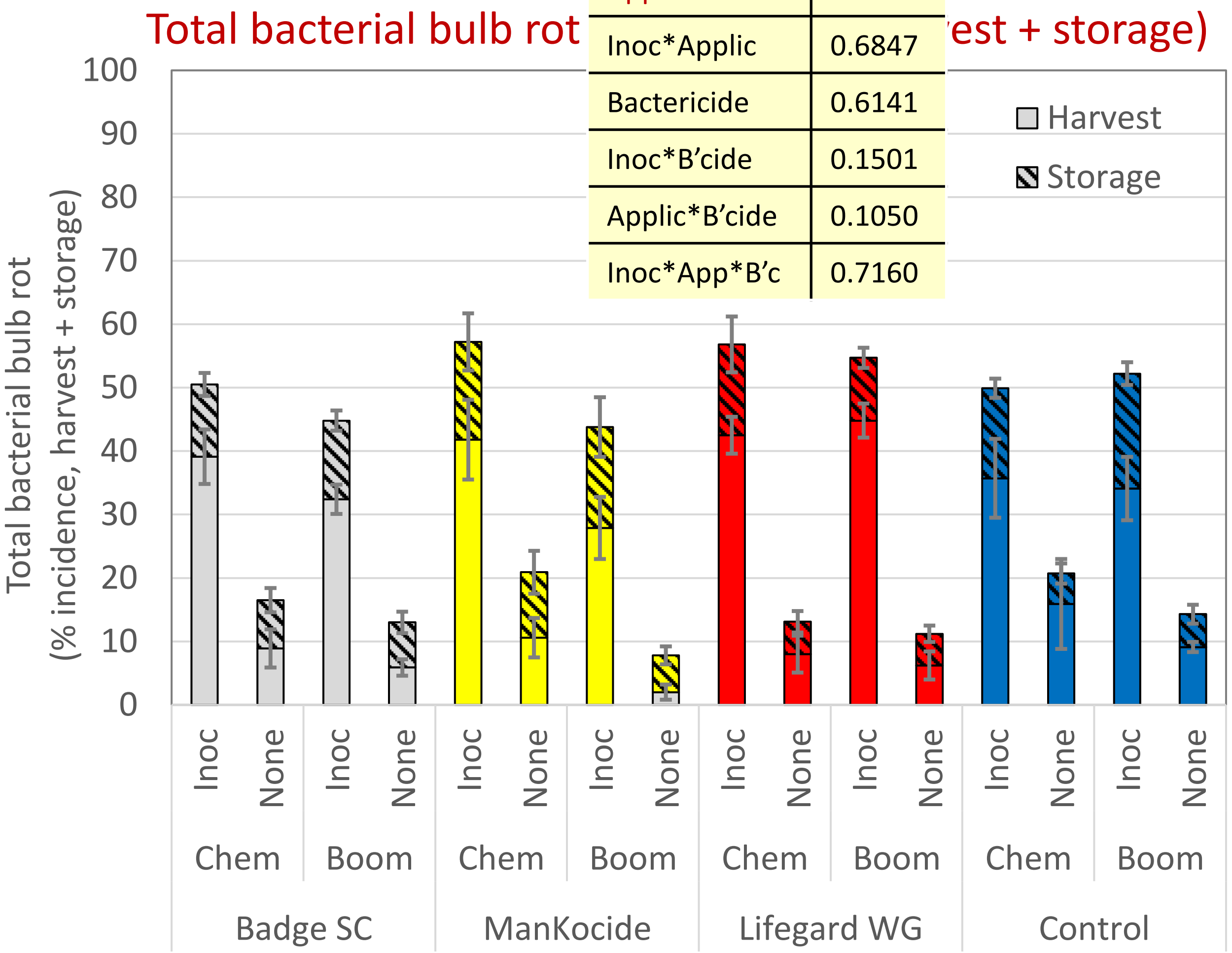
du Toit et al. 2023. Plant Disease Management Reports 17:V123.

Objective B3, Season 3 (2022): Washington State Bactericide Trial

Factor	*P* value
Inoculation	0.0001
Application	0.0157
Inoc*Applic	0.1314
Bactericide	0.0449
Inoc*B'cide	0.0416
Applic*B'cide	0.0628
Inoc*App*B'c	0.2165



Factor	*P* value
Inoculation	0.0001
Application	0.0321
Inoc*Applic	0.6847
Bactericide	0.6141
Inoc*B'cide	0.1501
Applic*B'cide	0.1050
Inoc*App*B'c	0.7160



du Toit et al. 2023. Plant Disease Management Reports 17:V123.

Objective B4: Effects of cultural practices on onion bacterial diseases

Lindsey du Toit (WSU), Bhabesh Dutta, UGA), Christy Hoepting (Cornell)

Washington: Trials inoculated with *B. gladioli* & *P. agglomerans*

- Effects of rolling onion tops or not (2020, 2021, 2022)
- Effects of (timing of) undercutting bulbs or not (2020, 2021, 2022)
- Effects of timing of topping onion bulbs (2020, 2021, 2022)
- 2021 & 2022: Earlier initiation of treatments than 2020

Georgia: Natural infection

- Manual vs. mechanical harvest (2020, 2021, 2022)
- Two different mechanical harvesters (2020, 2021, 2022)
- Length of necks with manual topping (2021, 2022)

New York: Natural infection

- Rolling tops that died 'standing up' (2020, 2021, 2022)
- Outdoor curing vs. forced air indoor curing (2020, 2021, 2022)

Season 2 (2021-22): Washington Cultural Practice Trials

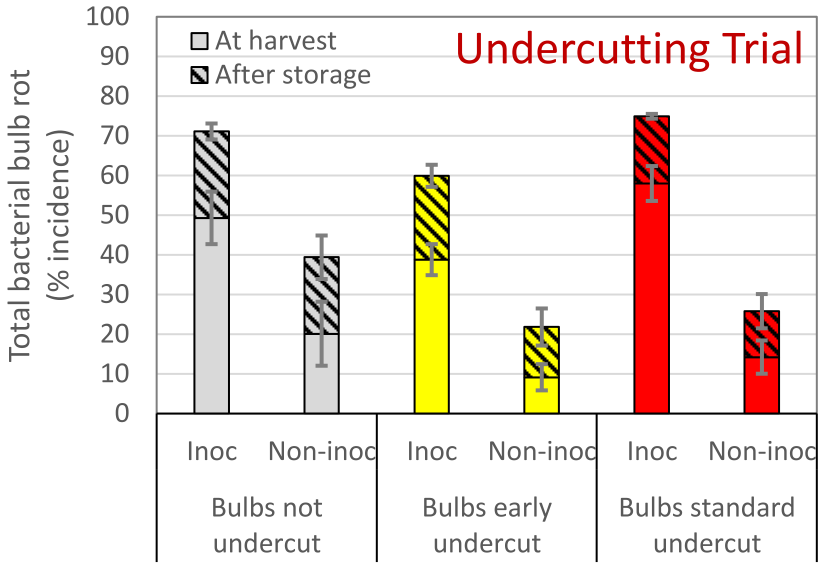
- In all three trials, inoculation:
  - Increased bacterial leaf blight
  - Decreased marketable bulb yield at harvest (by 7 to 10 tons/acre)
  - Increased bacterial bulb rot at harvest & in storage (by 27 to 35%)
- Rolling tops trial (Aug. 11):
  - Increased bacterial leaf blight in inoculated plots from 41.6 to 70.4%
  - Bulb yield and bacterial bulb rot in storage not affected
- Undercutting trial (Aug. 11, Aug. 25, or not undercut):
  - No effect of early, normal, or no undercutting on BLB, bulb yield, or bacterial bulb rot
- Timing of topping trial (Aug. 11, Aug. 25, or Sep. 8):
  - Early topping increased bacterial bulb rot (harvest + storage)

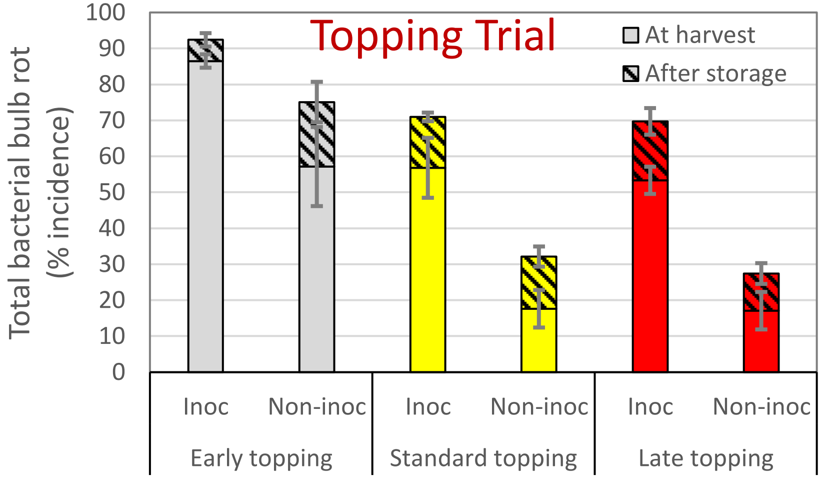
    - 69% of bulbs vs. 42% for standard and late topping in inoculated plots
  - Timing of topping did not affect bacterial leaf blight or bulb yield at harvest

du Toit et al. 2022. Plant Disease Management Reports 16:V149.

Objective B4, Season 3 (2022): Washington Cultural Practice Trials

- Undercutting bulbs:
  - Early undercutting (50% tops down) increased marketable bulb yield and reduced bacterial bulb rot at harvest & in storage compared to undercutting at 100% tops down or not undercutting
- Timing of topping bulbs:
  - Early topping (~50% tops down) reduced marketable bulb yield by 54%, and increased bacterial bulb rot (harvest + storage) to 84% vs. 49-52% of bulbs topped late in inoculated plots
- Rolling tops:
  - Rolling tops at the onset of tops down did not affect bacterial leaf blight, marketable bulb yield, or bulb rot at harvest & in storage





du Toit et al. 2023. Plant Disease Management Reports 17:V125, V128, V129.

2020, 2021, & 2022 Georgia trials on onion harvest methods

Incidence (%) of bulbs with internal bacterial rot

Method of digging onion bulbs	2020	2021	2022
Chain digger (TopAir)	3.5 b	9.0 b	1.3 b
Straight-blade undercutter (TopAir)	10.2 a	20.5 a	10.7 a
P value	<0.001	<0.001	<0.0001

Dutta, B., and Tyson, C. 2020. Plant Disease Management Reports 15:V025.

Mechanical vs. manual harvest	2020	2021	2022
Mechanical harvest (TopAir)	2.2 b	4.5 b	3.0 b
Manual harvest	10.5 a	14.5 a	12.5 a
P-value	0.024	0.031	<0.0001

Dutta, B., and Tyson, C. 2020. Plant Disease Management Reports 15:V026.

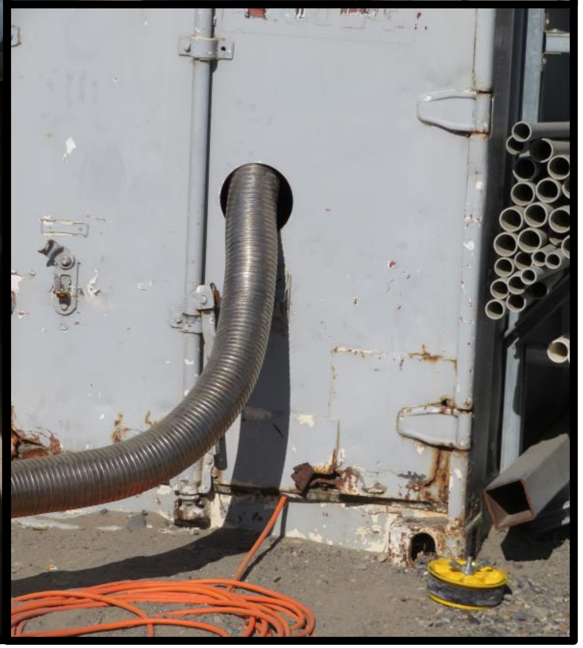
2021 & 2022 GA trials evaluating the length of topping bulbs

2021 trial on length of neck after topping manually	Internal bacterial bulb rot incidence (%)
5 inches	4.5 y
3 inches	4.0 y
1 inch	19.0 z

2022 trial	Internal bacterial rot incidence (%)
3 inches	10.0 b
2 inches	11.5 b
1 inch	18.0 a
0 inches	19.5 a

Objective B5: Postharvest application of disinfectants to onion bulbs

Tim Waters & Lindsey du Toit (WSU), Mark Uchanski & Jane Davey (CSU)



2020-21 WA trial

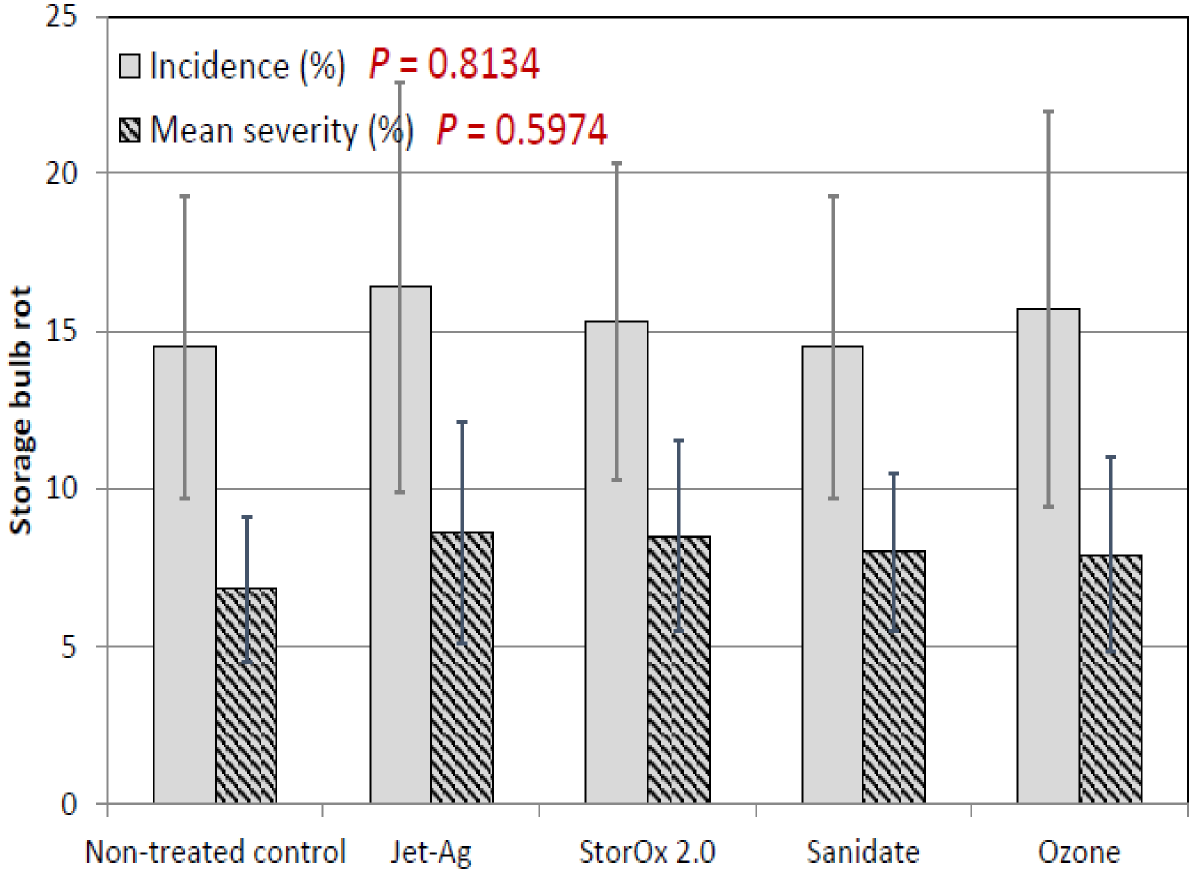
- Bulbs harvested from:
  1. Plots inoculated with bacteria (*B. gladioli* & *P. agglomerans*)
  2. Non-inoculated plots
- Disinfectants applied postharvest by IVI with commercial equipment:
  1. Jet-Ag at 24 fl oz thermofogged for 1 h, container sealed for 8 h
  2. Sanidate 5.0 at 24 fl oz thermofogged for 1 h, container sealed for 8 h
  3. StorOx 2.0 at 24 fl oz thermofogged for 1 h, container sealed for 8 h
  4. Ozone applied at 8,500 mg ozone/hour for 8 h
  5. Non-treated control bulbs thermofogged with water
  6. Non-treated control bulbs not thermofogged
- Bulbs in commercial storage, evaluated for bacterial rot in February 2021

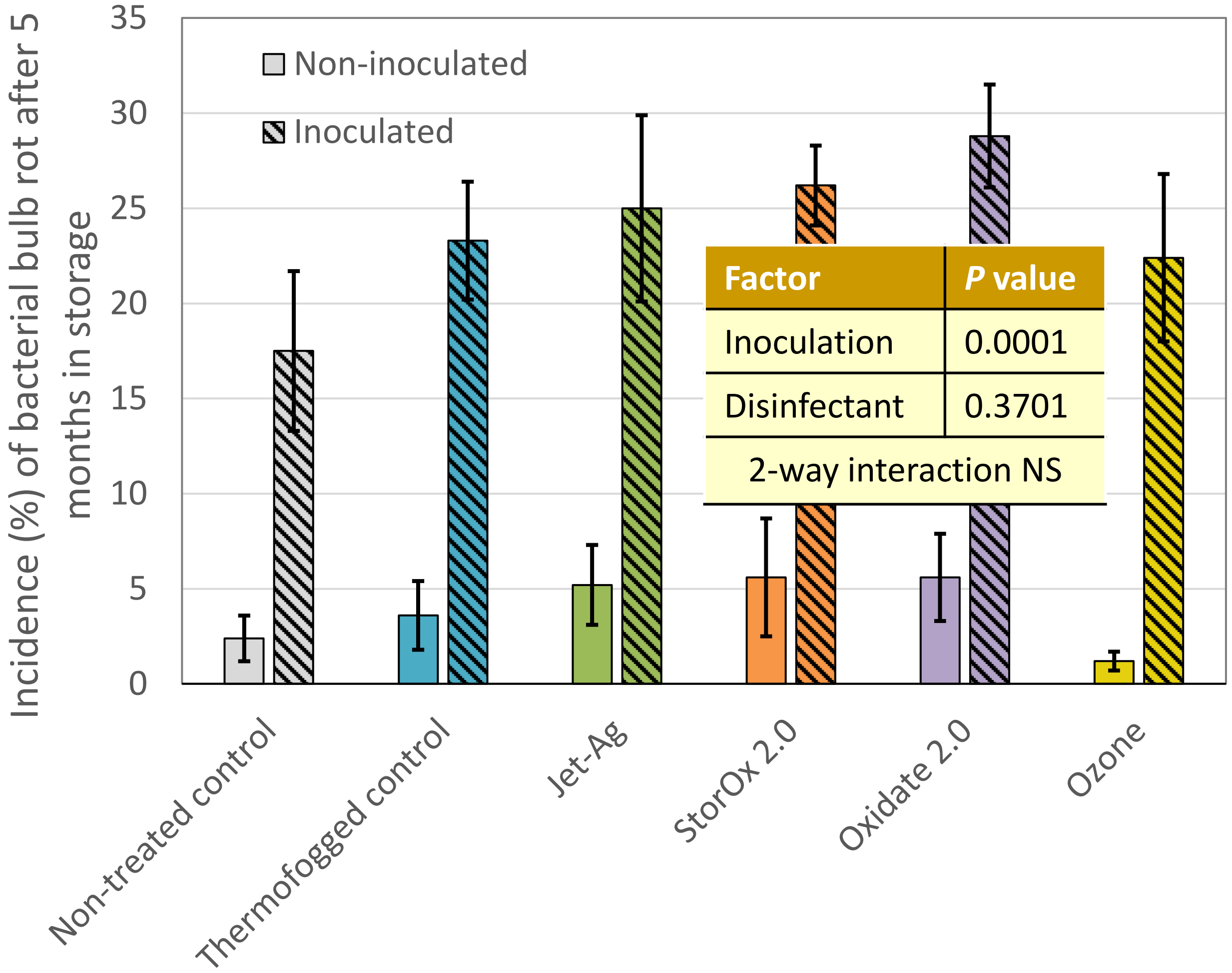
2021-22 and 2022-23 WA trials

- Repeat treatments
- **Commercial storage evaluations:** Growers remove sample of bulbs during treatment, replace non-treated bulbs, evaluate for storage rots

2021-22, 2022-23 CO trials - Mark Uchanski, CSU

WA trials evaluating postharvest applications of disinfectants



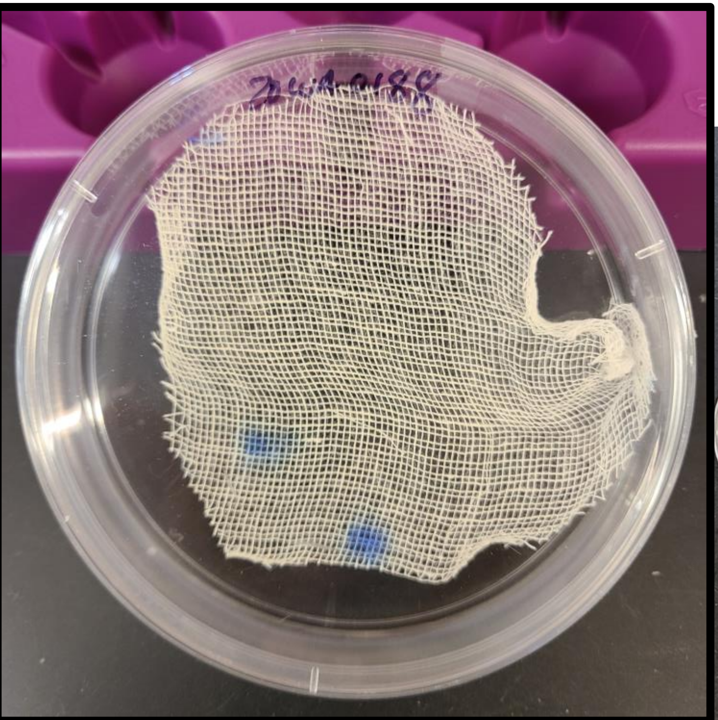


Factor	*P* value
Inoculation	0.0001
Disinfectant	0.3701
2-way interaction NS	

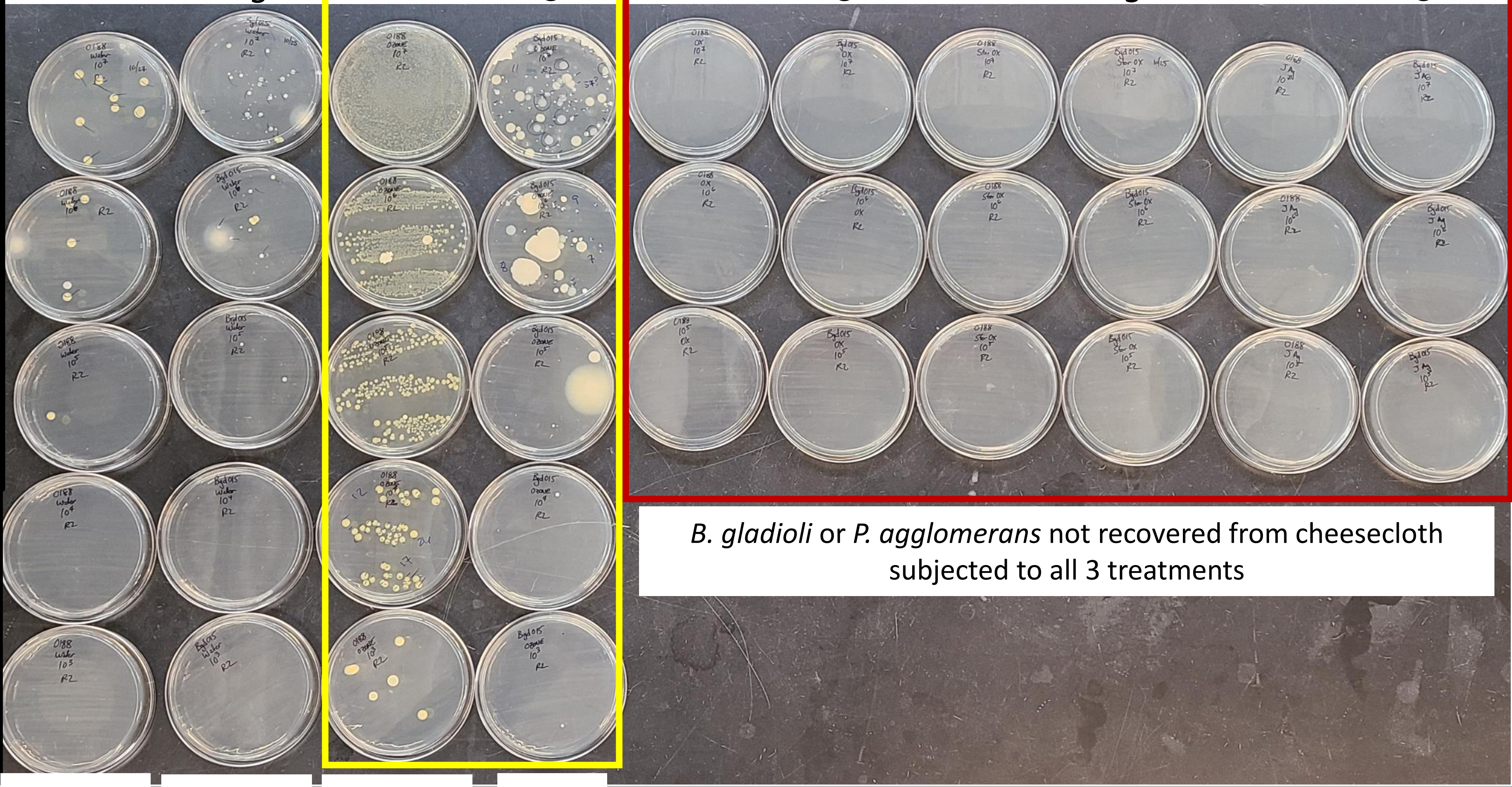
du Toit et al. 2021. Plant Dis. Management Reports 15:V102.
du Toit and Waters. 2021. Onion World, July/August 2021:6-9.

du Toit et al. 2022. Plant Disease Management Reports 16:V148.

2021-22 WA trial evaluating postharvest application of disinfectants



Water thermofog		Ozone		Oxidate 2.0		Storox 2.0		Jet-Ag	
Pa	*Bg*	*Pa*	*Bg*	*Pa*	*Bg*	*Pa*	*Bg*	*Pa*	*Bg*



B. gladioli or *P. agglomerans* not recovered from cheesecloth subjected to all 3 treatments

1.7×10^3	3.1×10^5	1.6×10^6	0

Objective B6: Modeling the risk of onion bacterial diseases

Heather MacKay, Lindsey du Toit, Kirti Rajagopalan, Supriya Savalkar, & Tim Waters (WSU), Stuart Reitz (OSU)

Aim: Generate predictive bacterial disease models across diverse regions of onion production in the USA

Purpose: Inform risk management decisions by growers

- Management decisions in the field
- Tradeoffs - bulb storage vs. sale, based on risk of rot

Initial approach (Years 1 and 2)

1. Mine large amounts of field data for key environment- and management-related drivers of bacterial diseases
2. Identify key drivers and interactions, develop testable hypotheses
3. Develop empirical predictive models for bacterial diseases of onion

Adapted approach (Years 3 and 4)

1. Develop a simple, field-scale, risk scoring model based on prior Onion ipmPIPE project
2. Calibrate the model using expert knowledge, stakeholder input, and results of Stop the Rot field trials
3. Map key regional-scale environmental drivers of risk of bacterial diseases

Onion bacterial risk assessment score has 4 main components

1. Current/Cumulative risk
- Previous week's risk score
- Confirmed disease symptoms
- Crop stage

2. Field variables
- Soil type (light/heavy/muck)
- Irrigation type & strategy
- Rotation
- Variety
- Plant density

3. Environmental variables
- Max daily air temperatures
- Windspeed
- Relative humidity
- Precipitation
- Hail damage

4. Production variables
- Fertility (cumulative N)
- Fertility (N timing)
- Bactericide program
- Weed pressure

Week	Crop growth stage	Assessment date	Total risk score	Current/cumul risk	Field variables	Environmental variables	Production variables
1	(1) Seedling -1 leaf	4/10/2021	28.0	3	12	9	4
2	(2) 1-4 leaves	5/1/2021	30.0	4	11.5	10.5	4
3	(3) 4-8 leaves	5/23/2021	30.0	4	11.5	10.5	4
4	(4) Bulbing, 8-14 leaves	6/16/2021	41.8	6	11.5	20.25	4
5	(4) Bulbing, 8-14 leaves	7/6/2021	43.5	7	11.5	21	4
6	(5) 'Soft necks' stage: leaf	7/28/2021	57.5	12	11.5	30	4
7	(6) 5-50% tops down	8/19/2021	48.5	12	11.5	21	4
8	(7) 50-100% tops down	8/28/2021					
9	(8) At harvest, prior to sto	10/1/2021					
10	(9) In storage, post-harve	10/16/2021					

Objective B7. Extension and Outreach

Christy Hoepting (Cornell), Joe LaForest (UGA), Lindsey du Toit and Heather MacKay (WSU), and Stop the Rot team

https://alliumnet.com/stop-the-rot/

https://alliumnet.com/stop-the-rot-publications-and-resources/

- Technical reports
- Presentations
- Plant Disease Management Reports
- Extension Bulletins & Educational Materials
- Videos
- Peer-reviewed journal articles
- Popular articles (Onion World, …)
- Other resources (National Onion Association newsletter)

Developed, maintained, and hosted by the Southern IPM Center and Center for Invasive Species and Ecosystem Health, University of Georgia (Joe LaForest)

Allium net

Objective B8 : Economics Component

Greg Colson, UGA

Baseline Survey of Onion growers, Stakeholder Advisory Panel, & Project Team

- Prevalence and severity of bacterial rots of onion
- Effectiveness of existing management strategies for bacterial diseases

Economic analysis of bactericide trials

- Profit/loss comparison of commercial products compared to non-treated control

Preliminary economic analysis of harvest equipment trials in GA

- Comparison of straight-blade undercutter vs. chain differ for harvesting onions

Economic analysis of nitrogen trials

- Assessed the impact of nitrogen price spikes on optimal input usage

Economic analysis of cultural practice, irrigation, and postharvest treatment trials

- Assessed the economic impacts of various practices

Endline survey to complement Year 1 baseline survey and assess impacts of this project

Help “Stop the Rot”!

Please take our Onion Survey

‘Stop the Rot’ USDA NIFA SCRI Onion Bacterial Project 2019-51181-30013

Dear Members of the Onion Industry:

During the last four years, researchers, extension educators, and industry stakeholders from across the United States have collaborated on a USDA-funded project to combat onion bacterial diseases using pathogenomic tools and optimized management practices. This project is led by the Project Director, Lindsey du Toit (dutoit@wsu.edu) in the Department of Plant Pathology at Washington State University.

Since this project strives to reduce economic losses for the onion industry, we have been aiming to understand:

(a) severity of the threat of bacterial diseases to economic stability of the onion industry,

(b) what growers are doing to combat bacterial diseases,

(c) what is and what is not working, and

(d) what future research would be most valued by the onion industry.

To help answer these questions, please complete a 10-minute survey.

No identifiable information will be collected to maintain your anonymity.

Thank you very much for your time and support as we continue our efforts to support the onion industry.

Thanks to the 2023 Washington State University Stop the Rot Team

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