2024 Pacific Northwest Vegetable Association
Annual Convention & Trade Show
Kennewick, WA
12-14 November 2024

Stop the Rot

2023-24 Columbia Basin Onion Bacterial Trial Results

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

USDA NIFA SCRI Project No. 2019-51181-30013

United States Department of Agriculture
National Institute of Food and Agriculture

Nature's Ninja graphic courtesy of
U.S. National Onion Association

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 (application of disinfectants to bulbs)
  - B6 – Bacterial disease modeling/risk prediction
  - B7 – Extension/outreach
  - B8 – Economic assessments

MacKay, H., du Toit, L., and Hoepting, C. 2023. Onion World July/August 2023:6-7.
https://issuu.com/columbiamediagroup/docs/ow_july-august_2023?fr=sYmUxNzQ5MDQ1MjQ

2023-24 Washington State Bactericide Trial

Chemigation vs. spray boom application

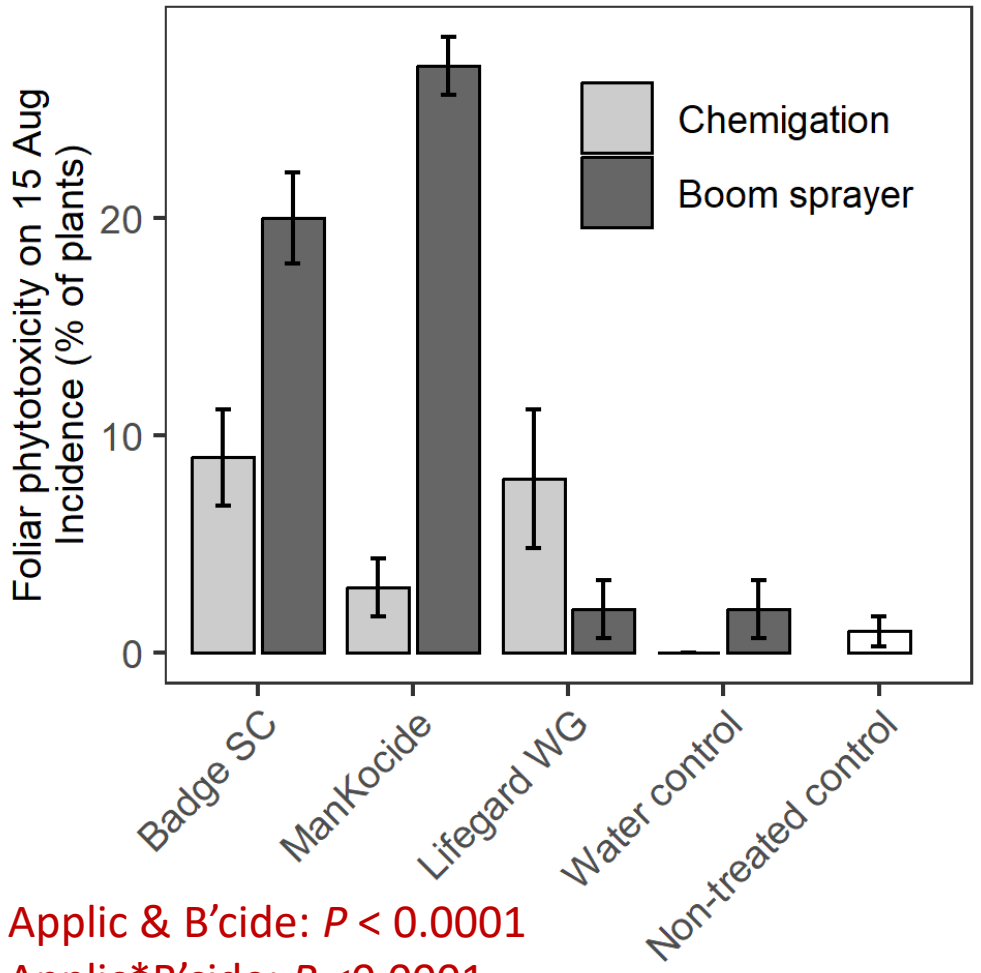
- Pasco, center-pivot irrigated field
- Split-split plot RCBD
  - Main plots: Inoculated (*Burkholderia gladioli* & *Pantoea agglomerans*) (28 Jul = early tops down, & 11 Aug.), or not inoc.
  - Split plots:
    1. Chemigation (2,700 gpa)
    2. Spray boom application (40 gpa, 25 psi)
  - Split-split plots: 5x, weekly intervals, 13 Jul.-10 Aug.
    1. Badge SC
    2. ManKocide
    3. LifeGard WG
    4. Water control treatment
    5. No water control treatment

Tim Waters' chemigator

Inoculation on 11 Aug. 2023 (2nd inoculation)

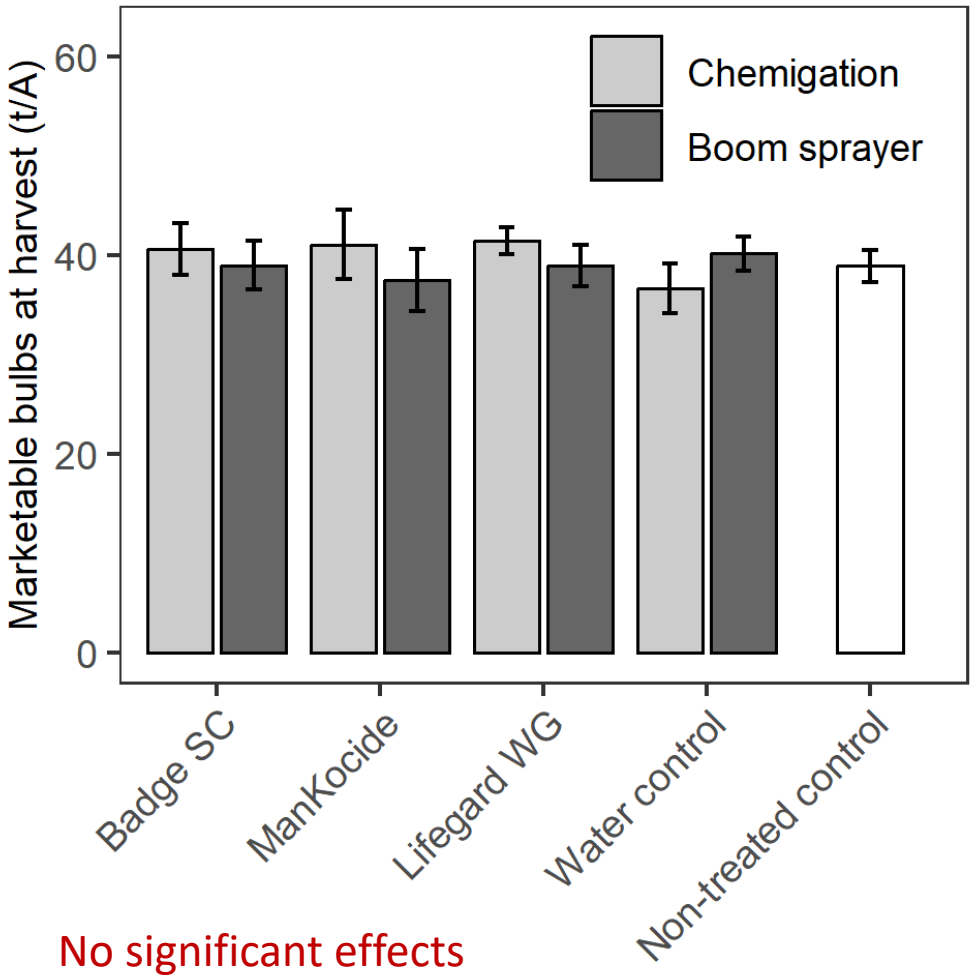
2023-24 Washington State Bactericide Trial

Foliar phytotoxicity



Applic & B'cide: $P < 0.0001$
Applic*B'cide: $P < 0.0001$

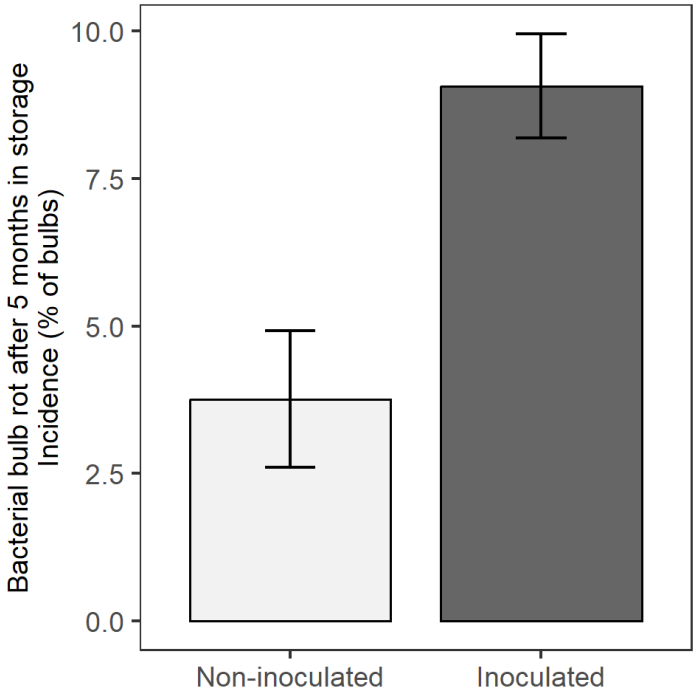
Marketable bulb yield at harvest (t/A)

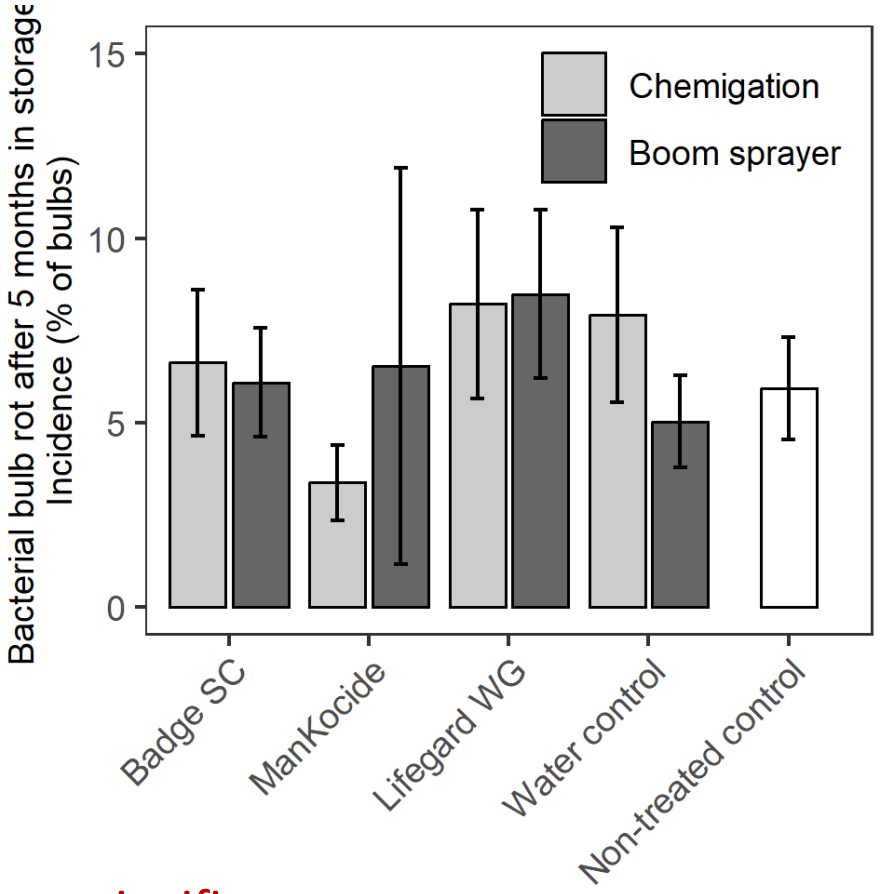


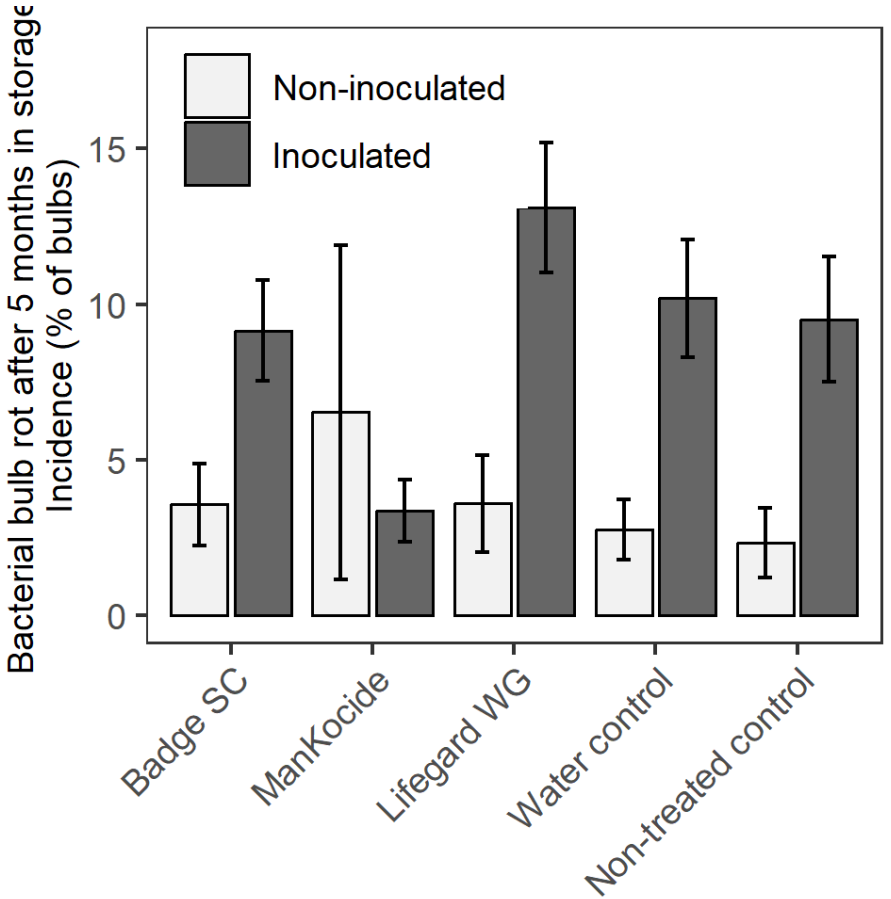
No significant effects

2023-24 Washington State Bactericide Trial

Total bacterial bulb rot (at harvest + after 5 months in storage)





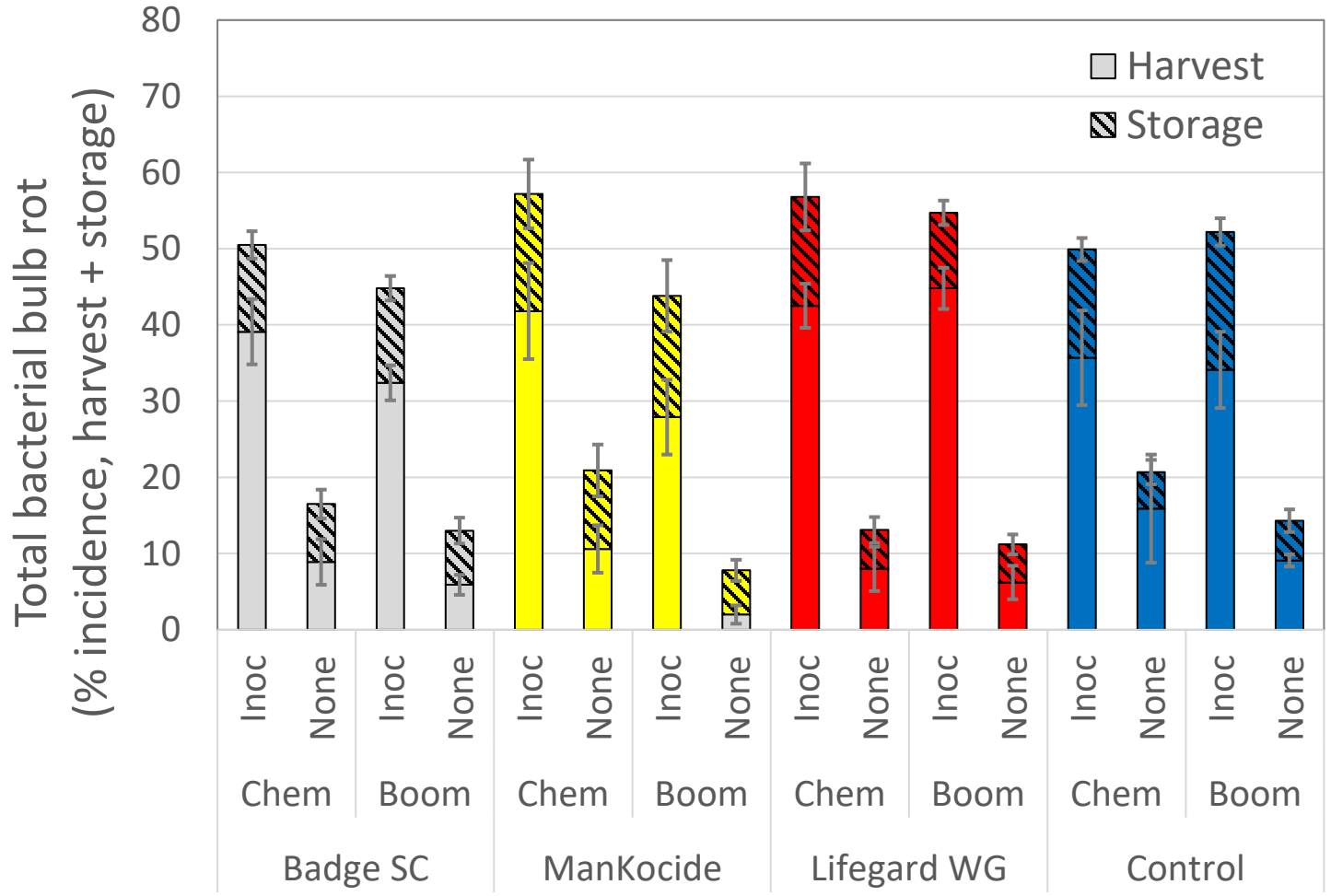


Inoculation: *P* <0.0001

All other ANOVA factors were not significant

2022-23 Washington Bactericide Trial

Total bulb rot (% of bulbs at harvest + storage)



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.

Application of a pesticide to a crop or site that is not on the label is a violation of pesticide law and may subject the applicator to civil penalties

In addition, such an application may result in illegal residues that could subject the crop to seizure or embargo action

It is your responsibility to check the label before using any product to ensure lawful use and to obtain all necessary permits in advance

Effects of cultural practices on management of onion bacterial diseases

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

- Effects of **rolling onion tops** (2020, 2021, 2022)
- Effects of **timing undercutting of bulbs** (2020, 2021, 2022)
- Effects of **timing of topping** (2020, 2021, 2022, 2023)

Georgia: Natural infection

- Manual vs. mechanical **harvest** (2020, 2021, 2022)
- Two **different mechanical harvesters** (2020, 2021, 2022)
- **Length of necks** at 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)

2023-24 WA Timing of Topping Trial

- Trial in center-pivot irrigated field, WSU Vegetable Extension Farm, Pasco
- Split plot RCBD with 5 replications per treatment combination

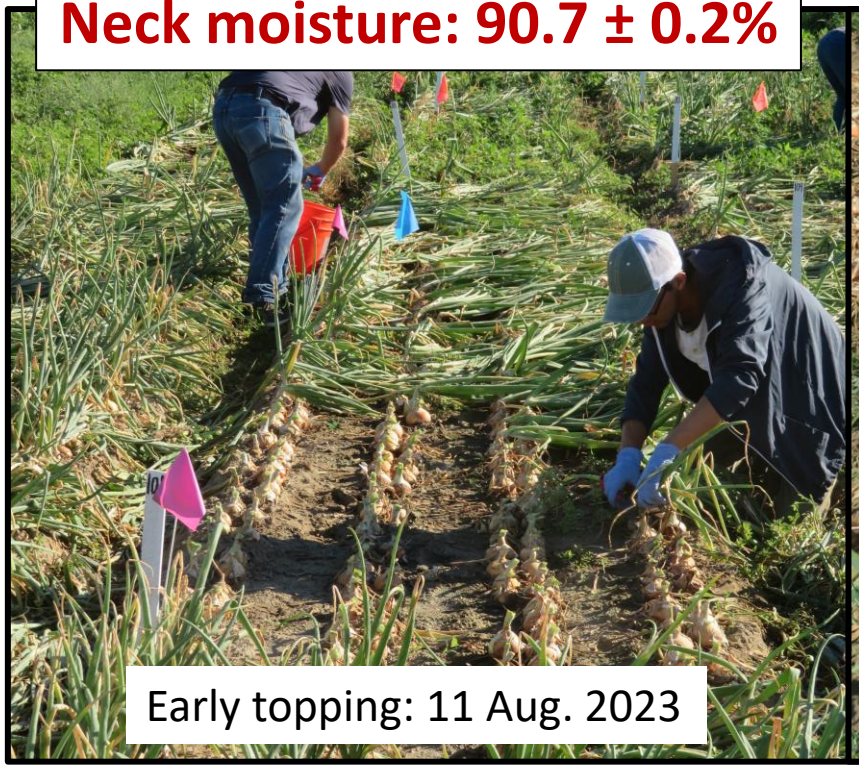
  Main plots: Inoculated (*B. gladioli* & *P. agglomerans*) or not at early tops down (27 July) & 2 weeks later (10 August)

  Split plots: Bulbs topped early (11 Aug.), standard (25 Aug.), or late (12 Sep.)
- Measured moisture content in 2-cm cross-section of neck of ~50 bulbs/plot at topping
- Bulbs harvested, sized, weighed on 12 Sep., bacterial culls & marketable bulb yield
- Marketable bulbs stored for 5 months, rated incidence/severity of bulb rot

Neck moisture: 90.7 ± 0.2%

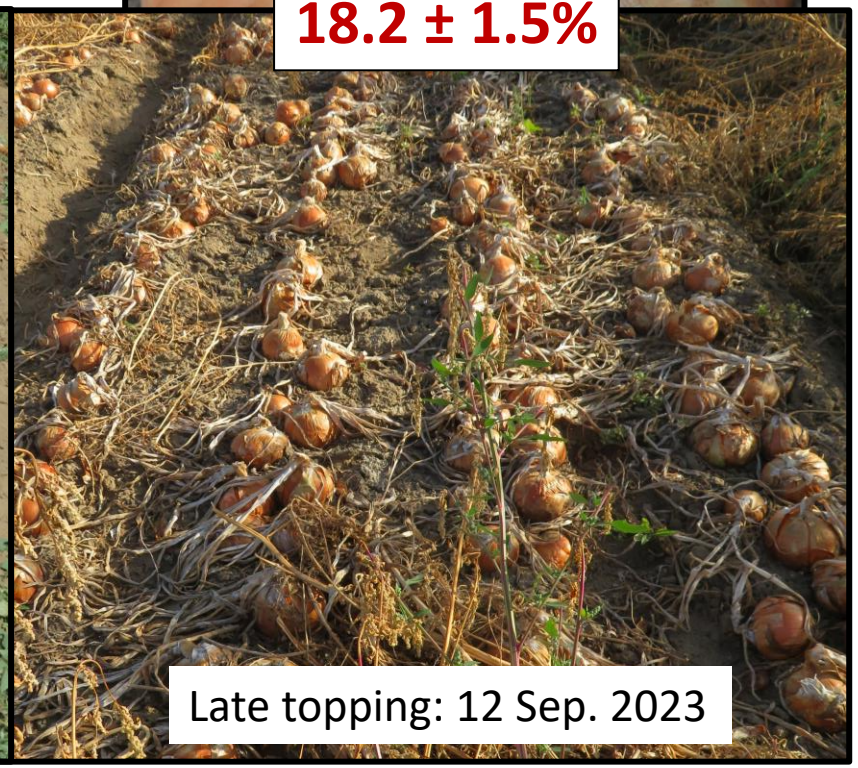
59.5 ± 2.0%

18.2 ± 1.5%



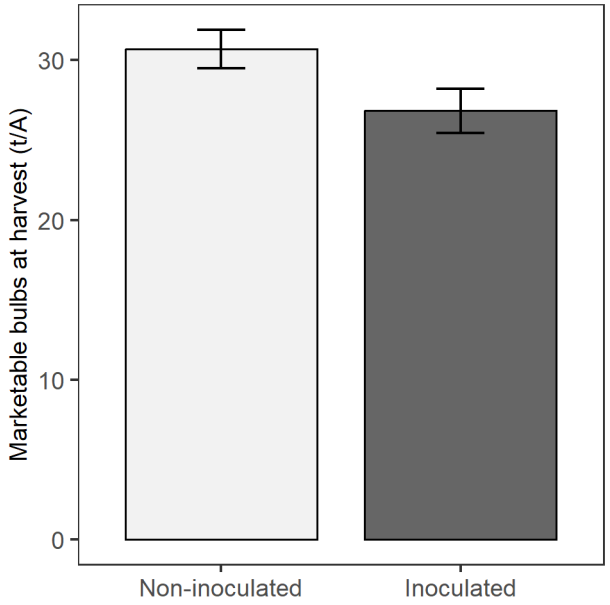
Early topping: 11 Aug. 2023

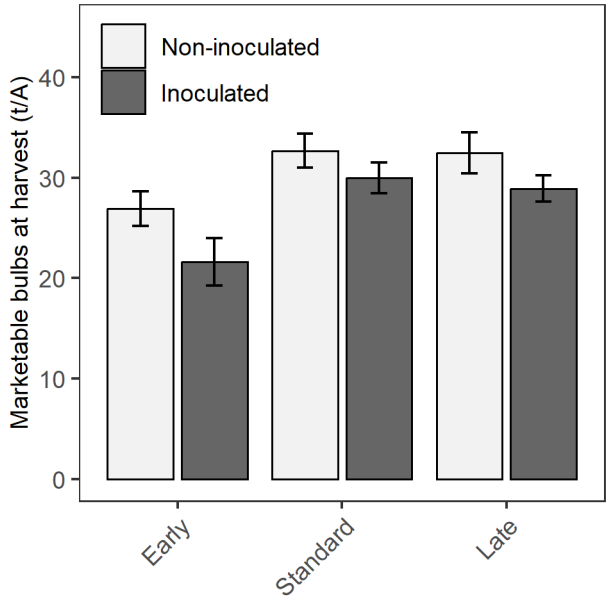
Standard topping: 25 Aug. 2023



Late topping: 12 Sep. 2023

2023-24 WA Timing of Topping Trial



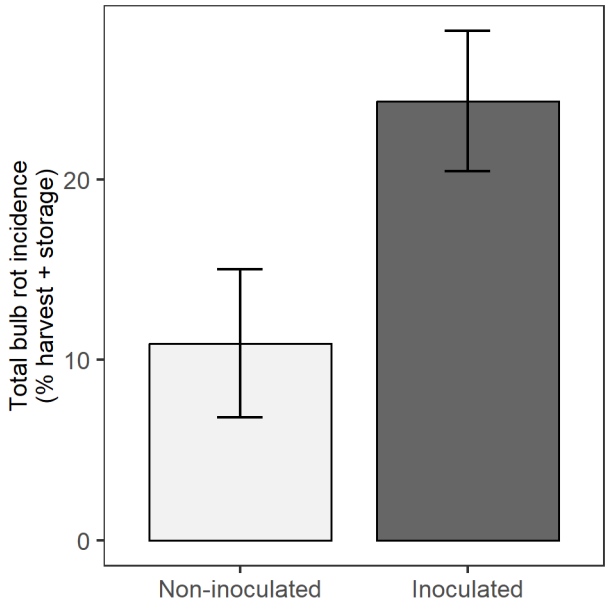


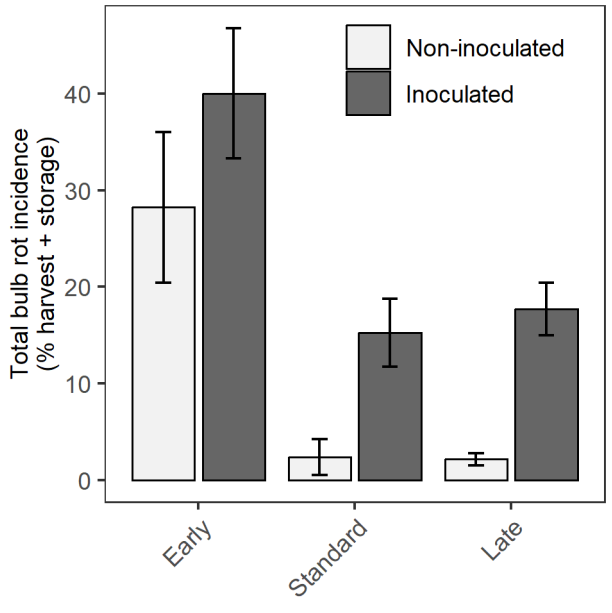
Marketable yield

Inoculation: *P* = 0.0054

Topping: *P* = 0.0002

Inoc*Topping: *P* = 0.6822



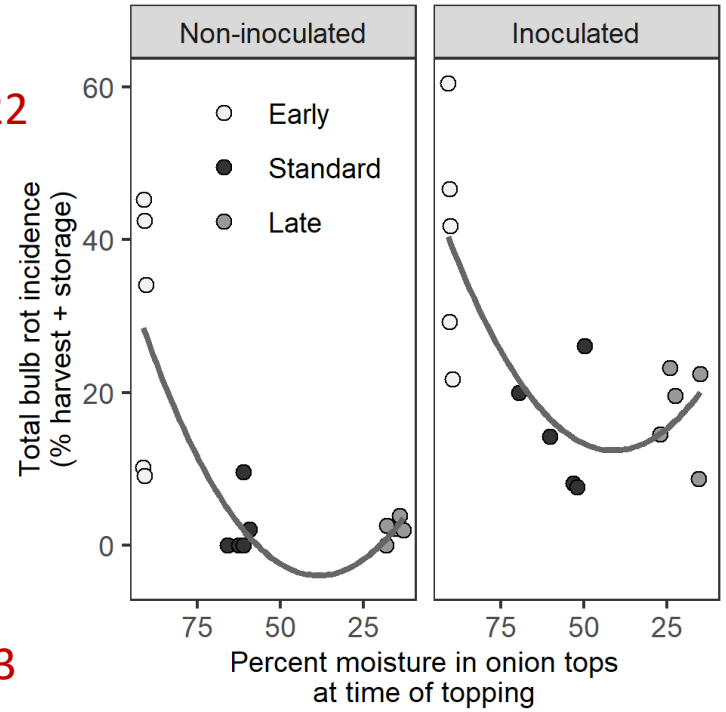


Total bulb rot

Inoculation: *P* = 0.0003

Topping: *P* < 0.0001

Inoc*Topping: *P* = 0.8433



2021 & 2022 GA trials evaluating the length of topping bulbs (Vidalia sweet onion cultivar harvested with green tops)

2021 trial on length of neck after topping	Internal bacterial bulb rot incidence (%)
12.5 cm	4.5 y
7.5 cm	4.0 y
2.5 cm	19.0 z

Dutta et al. 2022. Plant Disease Management Reports 16:V107.

2022 trial	Internal bacterial rot incidence (%)7.5
7.5 cm	10.0 b
5.0 cm	11.5 b
2.5 cm	18.0 a
0 cm	19.5 a

Dutta et al. 2023. Plant Disease Management Reports 17:V008.

The Bacterial 'Rot Race'

- Once tops start to fall, neck tissue is dying and losing resistance to infection
- While necks are still green (moist) and fallen over, bacteria (and fungi) become active and move down the neck toward the bulb
- **Race to dry the necks before infections get to the bulbs**
- Topping = wounding = entry for bacteria (and fungi) into the neck
- If necks are fully dry when topped, neck length is not critical
- If necks are moist (green) when topped, top long so necks dry before bacteria can get to the bulbs
- Other cultural practices to speed field curing: undercutting, terminating irrigation by ~50% tops down, avoid excessive and late N applications

Evaluation of postharvest application of disinfectants to onion bulbs for control of bulb rots in storage

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

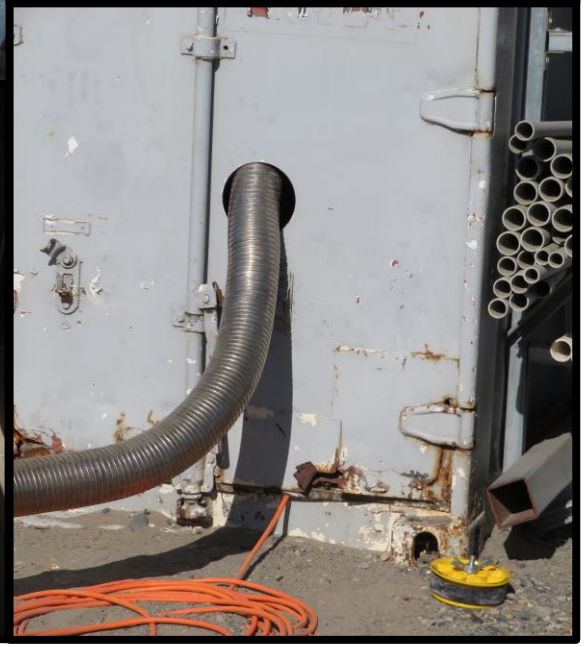
2020-21, 2021-22, 2023-24 WA trials

- 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 (24 fl oz) thermofogged for 1 h, container sealed for 8 h
  2. Sanidate 5.0 (24 fl oz) thermofogged for 1 h, container sealed for 8 h
  3. StorOx 2.0 (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

2022-23

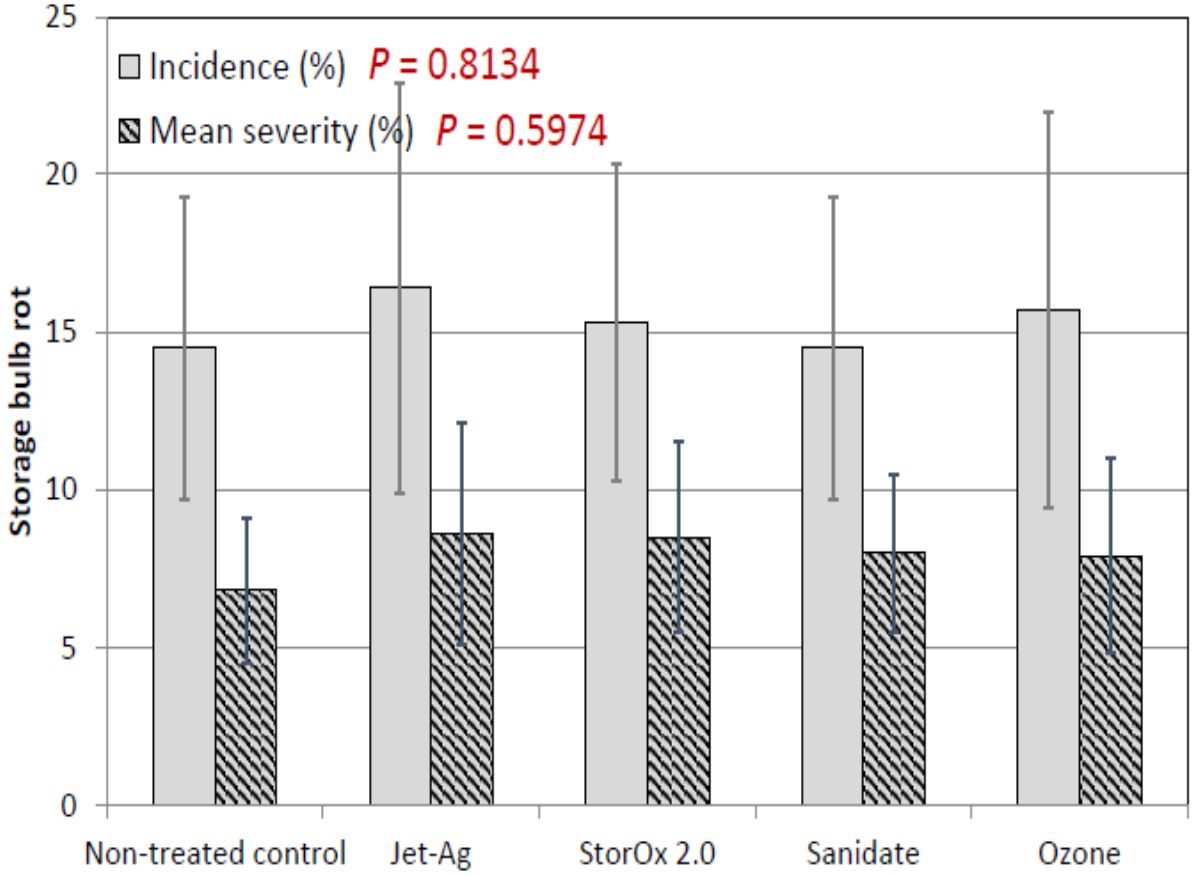
- **Commercial storage evaluations:** Growers remove sample of bulbs during treatment, replace non-treated bulbs, evaluate for storage rots

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

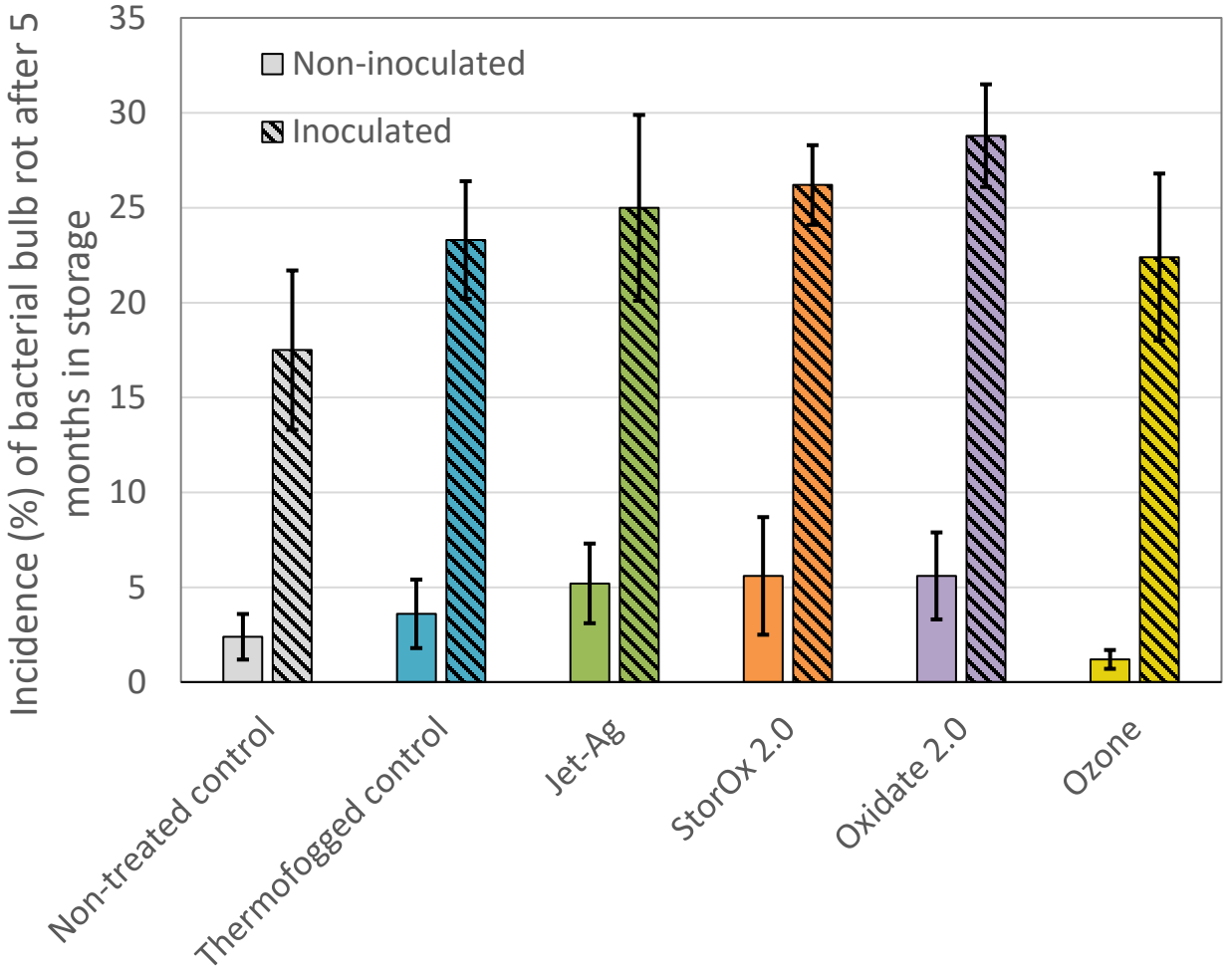


WA trials evaluating postharvest applications of disinfectants

2020-21 trial: Incidence (%) of bacterial rot



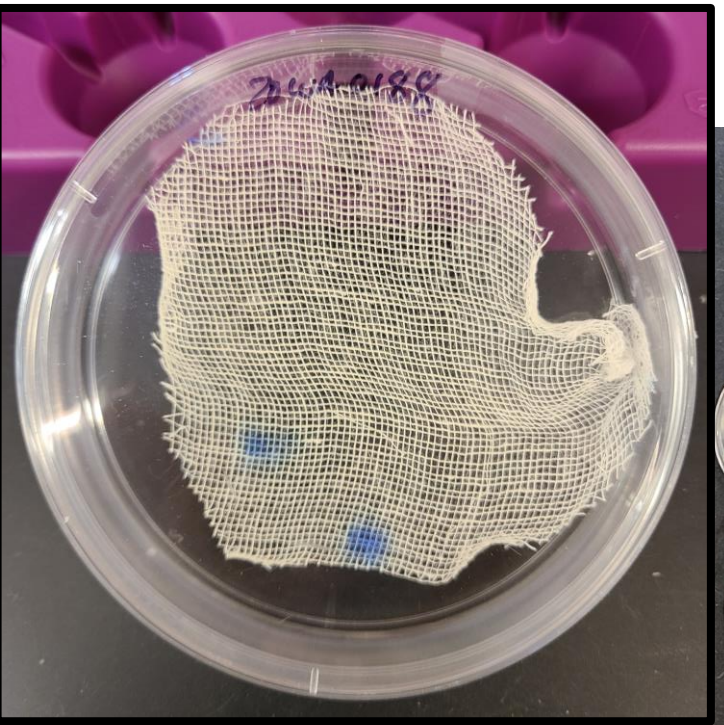
2021-22 trial: Incidence (%) of bacterial rot



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



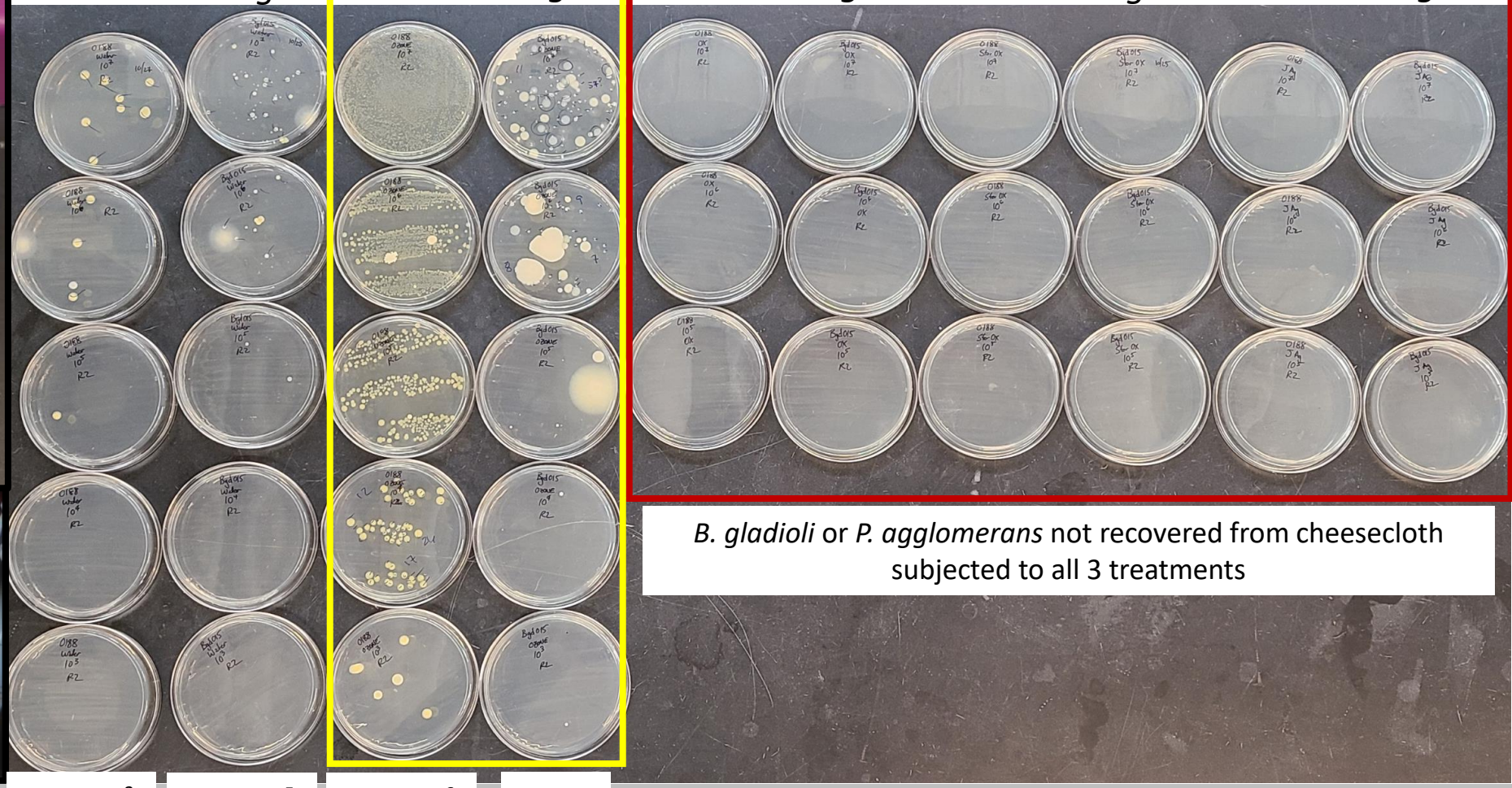
Water thermofog — *Pa* *Bg*

Ozone — *Pa* *Bg*

Oxidate 2.0 — *Pa* *Bg*

Storox 2.0 — *Pa* *Bg*

Jet-Ag — *Pa* *Bg*

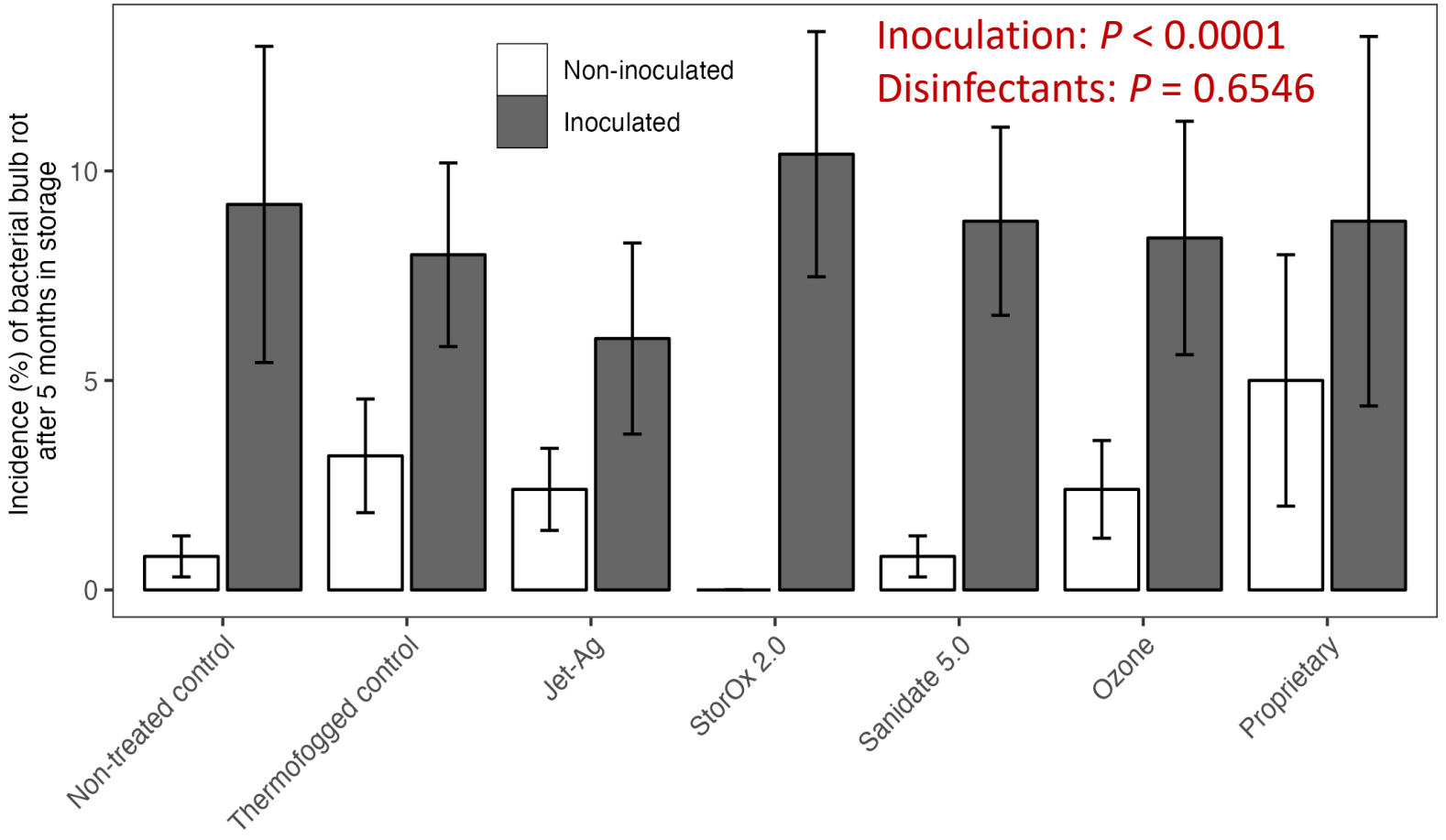


B. gladioli or *P. agglomerans* not recovered from cheesecloth subjected to all 3 treatments

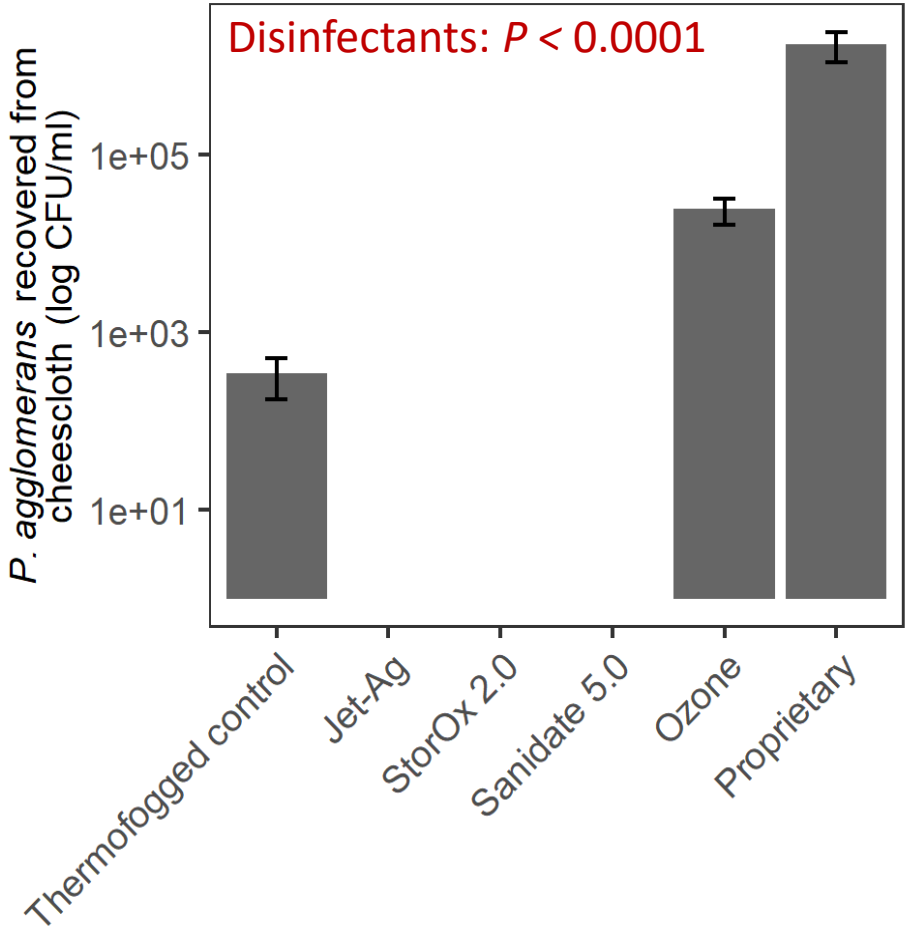
1.7 x 10^3	3.1 x 10^5	1.6 x 10^6	0

2023-24 WA evaluation of postharvest disinfectant applications

Incidence (%) of bacterial bulb rot after 5 months in storage



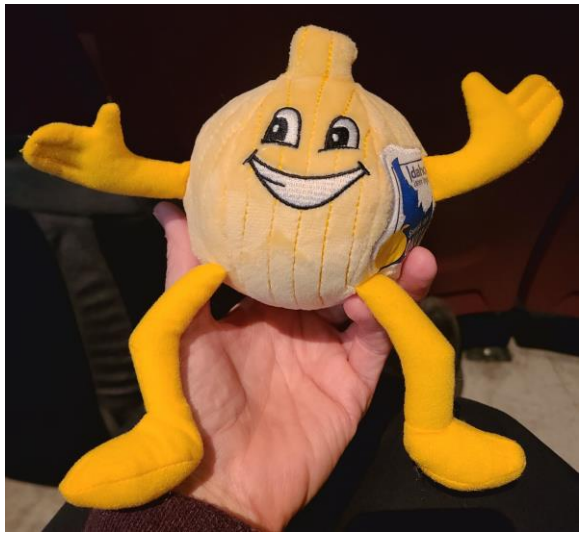
Recovery of *Pantoea agglomerans* from cheesecloth exposed to disinfectants



Evaluation of postharvest disinfectant applications for managing bacterial bulb rots in storage

- Application of disinfectants to onion bulbs after harvest provided no control of bacterial bulb rot in storage (3 years of WA trials & 2 years of CO trials)
- Hydrogen peroxide + peroxyacetic acid products were highly effective at killing *P. agglomerans* on cheesecloth
- Ozone had no effect on bulb rots and limited efficacy against *P. agglomerans* on cheesecloth
- Disinfectants do not penetrate outer, wrapper scales of onion bulbs so they do not make direct contact with bacterial (and fungal) infections inside bulbs
- Potential value for surface infections of other commodities?

Summary



- You cannot spray your way out of bacterial bulb rots
- Focus on **cultural management practices**:
  - Irrigation
    - Final irrigation at ~50% tops down
    - Frequency of irrigation, starting mid-June
  - Nitrogen
    - Avoid excessive rates of application
    - Avoid late-season applications
  - Field curing
    - Avoid topping when necks are still green/moist
    - Top long necks if you must top before necks are fully dry
    - Undercut to speed drying of necks
- Disinfectants applied to bulbs in storage will not prevent bacterial rot

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

Acknowledgements

- **WSU Stop the Rot teams** – Tim Waters', Gabriel LaHue's, and Lindsey du Toit's teams
- **Other Stop the Rot team members**
- **Grower-cooperators & CBORC**
- **IVI**
- USDA NIFA SCRI Project No. 2019-51181-30013