

**'Stop the Rot' Onion Bacterial Project  
Stakeholder Advisory Panel Meeting  
27 March 2024**



# *Stop the Rot*

*Objective A4:*

*Phenotypic Screening for  
Resistance to Bacterial Bulb Rots*

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& Jennifer Darner, Washington State University;  
Brenna Aegerter & Jas Sidhu, University of California

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

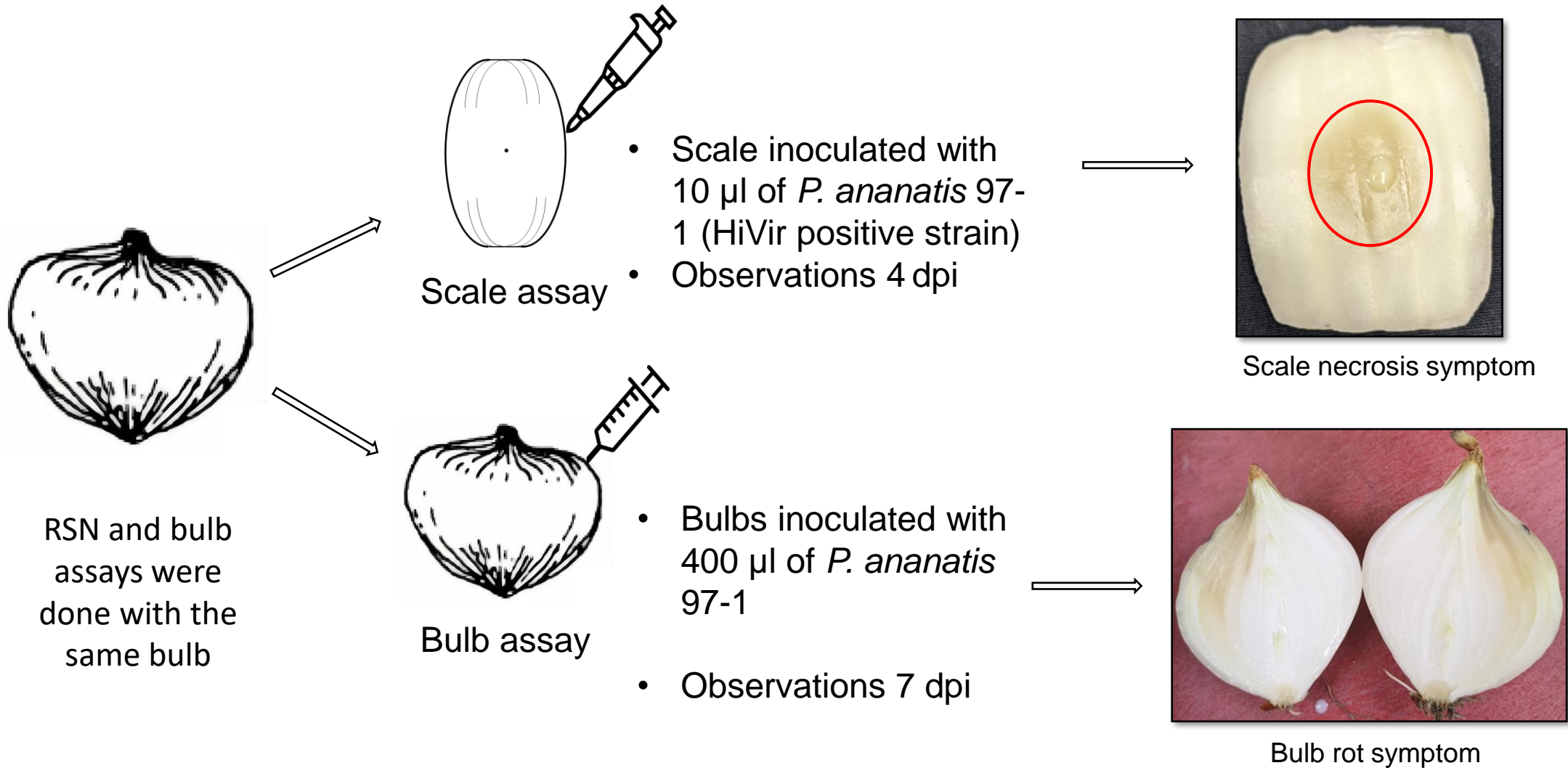
USDA NIFA SCRI Project No. 2019-51181-30013



United States  
Department of  
Agriculture

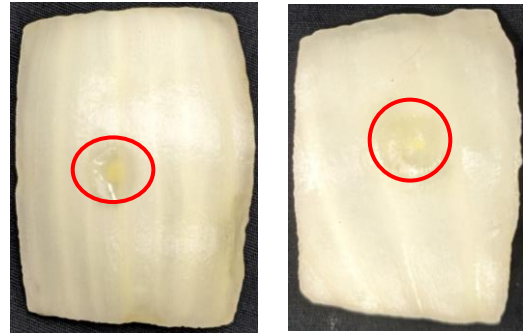
National Institute  
of Food and  
Agriculture

# A4. GA Phenotypic screening: Onion bulb and scale assays



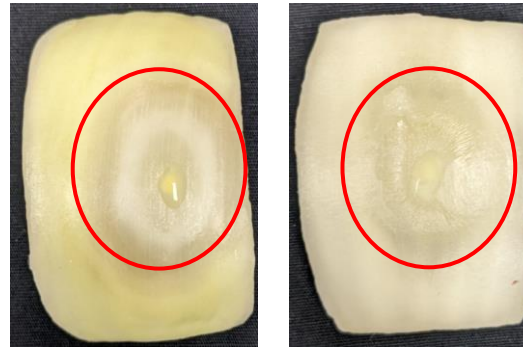
# UGA Results

## Vidalia onion scale assay (2023)



10256

369



XON-300Y

Early Sweet

Scale rot symptom

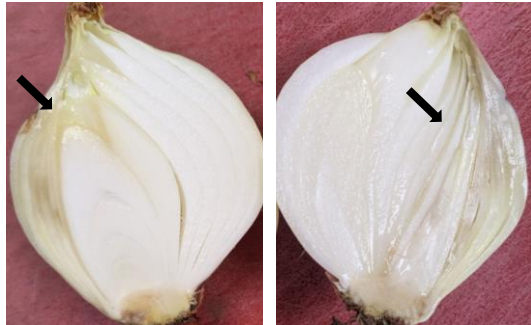
No.	Var	Mean lesion area (cm <sup>2</sup> )	Group	No.	Var	Mean lesion area (cm <sup>2</sup> )	Group
1	Alba_Blanca	0.35	j	1	Candy_Joy	1.53	bcde
2	10256	0.41	ij	2	Miss_Scarlet	1.54	bcde
3	Rio_Del_Sol	0.49	hij	3	EMY_55457	1.70	bcd
4	Chianti	0.55	ghij	4	Sofire	1.71	bcd
5	369	0.61	fghij	5	Mata_Hari	1.72	bcd
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

# UGA 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

## Objective A4, Season 3 (2022): California Cultivar Trial (Brenna Aegerter, Jaspreet Sidhu)

		Field trial, 9-Aug		Field trial, at harvest				Postharvest assays			
Cultivar	Type	Foliar bacterial disease incidence (%)		Bulb rot incidence (%)		Marketable yield (t/A)		Bulb rot severity (%)		Scale lesion area (mm <sup>2</sup> )	
Tannat	LD mid to late, Red	12.5	e	48.4	a	19.6	bcd	53.9	e	79.9	cd
Minister	INT early, Yellow	13.8	e	38.1	ab	27.3	abc	65.5	bc	112.9	b
Marengo	LD mid to late, Red	16.3	de	34.7	bc	15.5	d	63.2	cd	185.3	a
Vaquero	LD mid to late, Yellow	35.6	ab	30.2	bcd	22.3	bcd	72.0	ab	91.3	bc
Caliber	LD late, Yellow	20.6	bcde	28.5	bcd	22.3	bcd	58.3	de	82.3	cd
Red Angel	INT early, Red	29.4	abcd	26.0	cde	28.5	ab	44.8	f	62.7	d
Granero	LD mid to late, Yellow	38.8	a	24.4	cde	22.3	bcd	70.5	abc	89.2	c
Campero	LD early, Yellow	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	24.4	bcde	12.1	f	24.4	abcd	75.0	a	94.9	bc
	<i>P</i> value	0.012		<0.0001		0.043		<0.0001		<0.0001	

**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.
- Bulb injection and scale inoculation results negatively correlated ( $r = -0.30911$ ,  $n = 30$ ,  $P = 0.0965$ )
- Neither lab assay correlated with field results ( $P = 0.0965$  and  $P = 0.7447$  for bulb assay and scale assay, respectively).

## Objective A4, Season 4 (2023): California Cultivar Trial (Brenna Aegerter)

Variety	Description	Bulb rot (%)		Scale necrosis lesion size (mm <sup>2</sup> )	
Dehy #2	dehy type, small bulbs	51.8	a	75	c
Dehy #5	dehy type, small bulbs	51.6	a	68	de
Dehy #6	dehy type, small bulbs	50.7	a	43	ef
Dehy #8	dehy type, small bulbs	50.0	ab	71	de
Dehy #7	dehy type, small bulbs	49.9	ab	34	f
Dehy #3	dehy type, small bulbs	49.8	abc	91	b
Dehy #4	dehy type, small bulbs	48.1	abc	64	cd
Dehy #1	dehy type, small bulbs	45.8	bcd	79	c
S70W	Sakata, white	44.5	cde	217	a
Harlan	Bayer, intermediate, yellow, late	43.4	de	212	a
Vaquero	Nunhems, long day, yellow	41.8	de	252	a
Yosemite	Sakata, intermediate, yellow, mid-late	39.4	e	242	a
	Mean	47.2		109.5	
	<i>P</i> value	< 0.0001		< 0.0001	

### Postharvest assays:

- Results of 2 laboratory-based assays significantly negatively correlated ( $r = -0.49741$ ,  $n = 47$ ,  $P = 0.0004$ ).
- Varieties with larger lesions in scale assay (4 fresh market types) had less severe rot in bulb injection assay. Dehydration types had smaller bulbs, resulting in higher % of bulb rotted (didn't control for bulb size).

# Washington State Season 3 Cultivar Trial: 2022-23

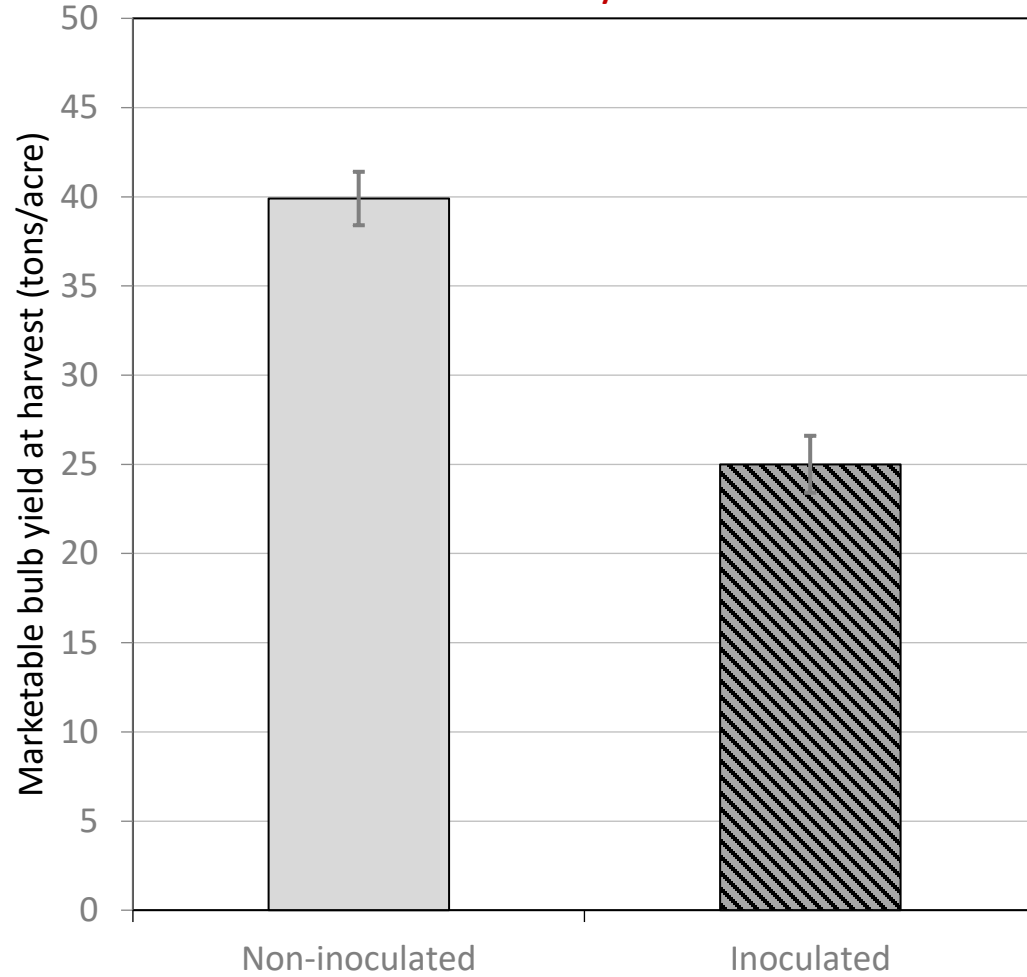
## Objective A4: Develop methods to screen for resistance to bacterial diseases

- Location: Pasco, WA (Columbia Basin)
- Split-split plot RCBD
  - Main plots: Inoculated (*Burkholderia gladioli* & *Pantoea agglomerans*) or not inoculated
  - Split plots: Cultivar maturity group (MGs 1 to 4)
  - Split-split plots: 3 cultivars nested in each maturity group (12 total)
- Inoculation at early tops down & 2 weeks later
- Sprinkler irrigation, terminated at ~50% tops down individually for each MG
- Very warm mid-summer and fall



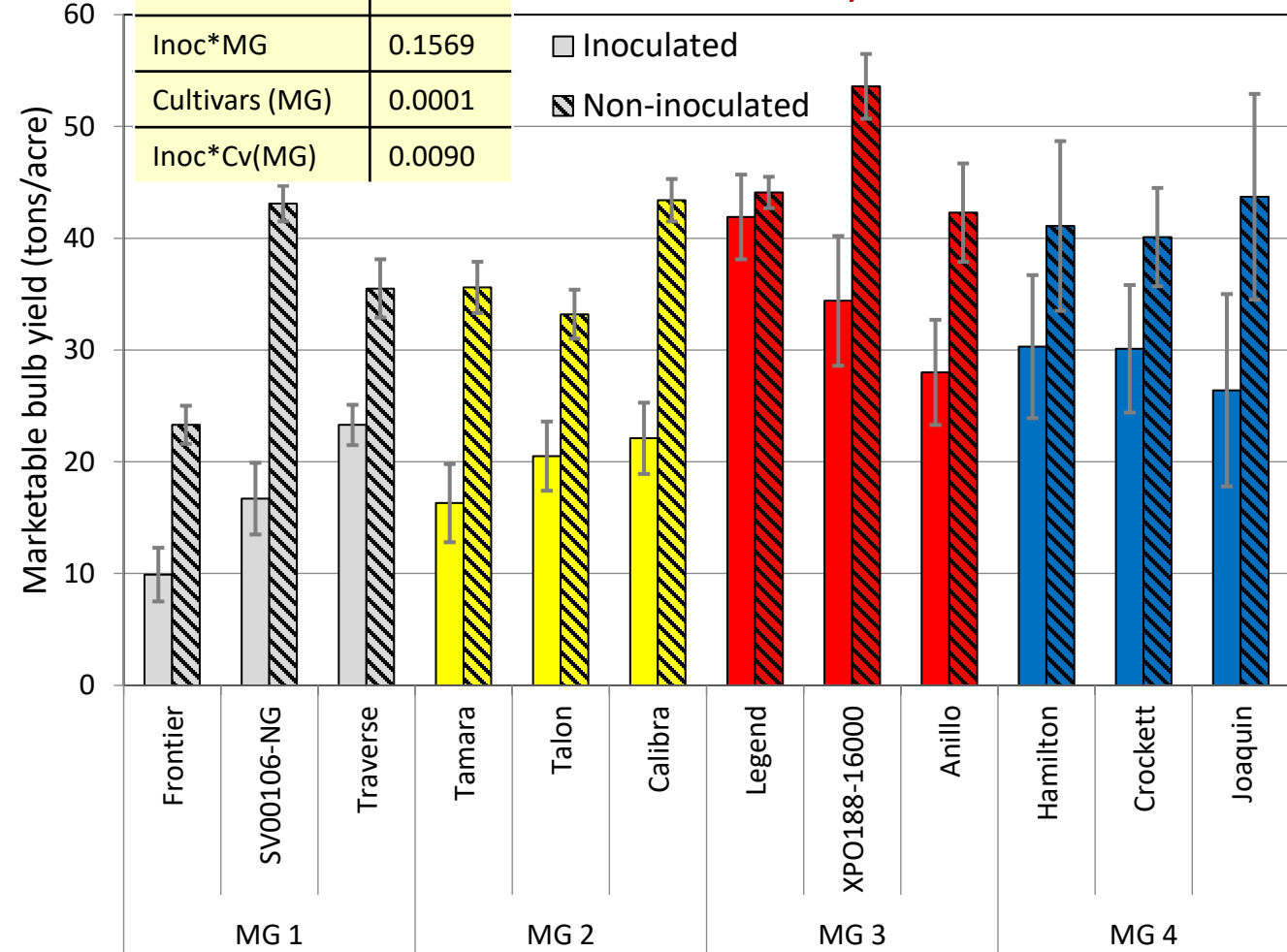
# Objective A4, Season 3 (2022): Washington State Cultivar Field Trial

Marketable bulb yield at harvest



Factor	P value
Inoculation	0.0001
MG	0.0391
Inoc*MG	0.1569
Cultivars (MG)	0.0001
Inoc*Cv(MG)	0.0090

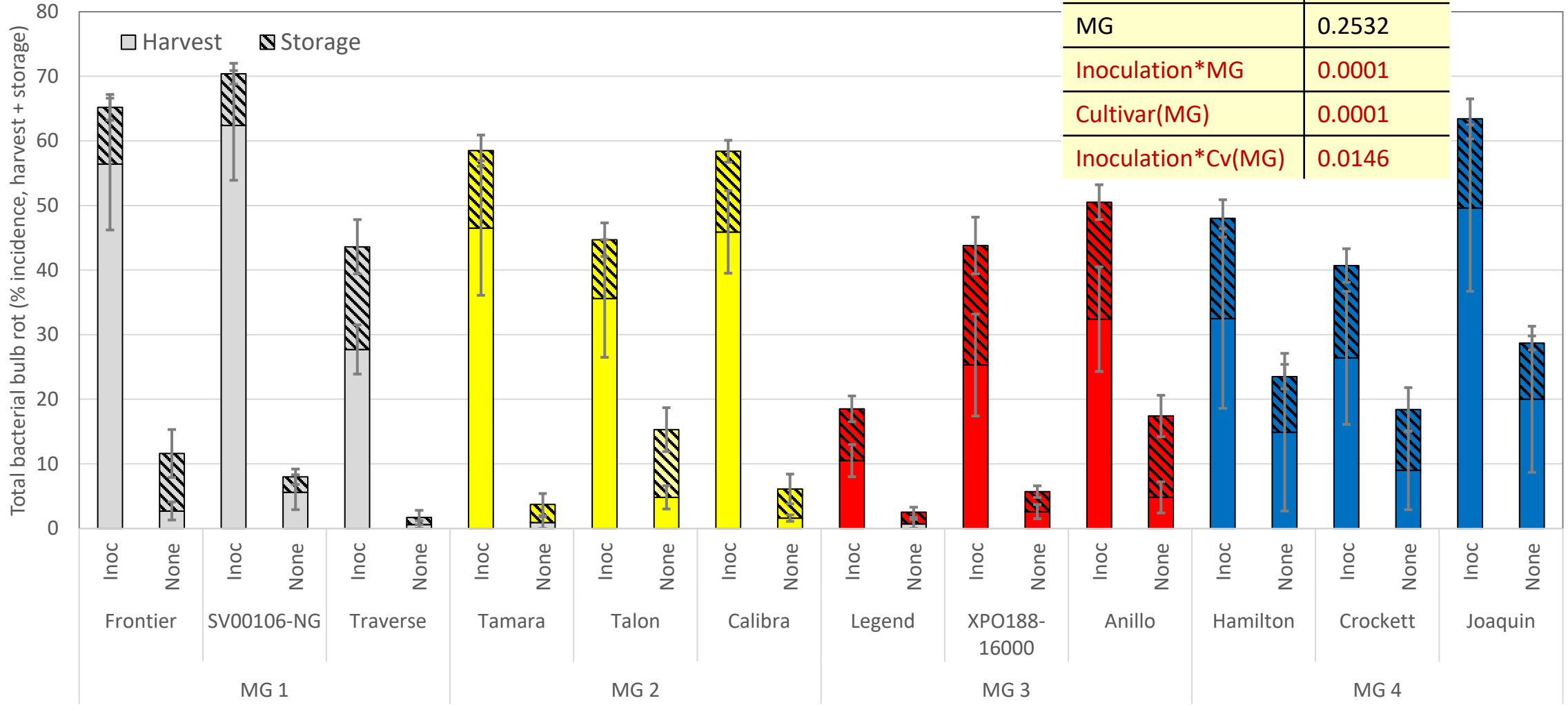
Marketable bulb yield at harvest



# Objective A4, Season 3 (2022): Washington State Cultivar Trial



Total bacterial bulb rot (harvest + storage)



Factor	P value
Inoculation	0.0001
MG	0.2532
Inoculation*MG	0.0001
Cultivar(MG)	0.0001
Inoculation*Cv(MG)	0.0146

# Washington State Season 3 (2022-23)

## 2022-23 WSU Onion Cv. Trial: Bulb vs. Scale Assays

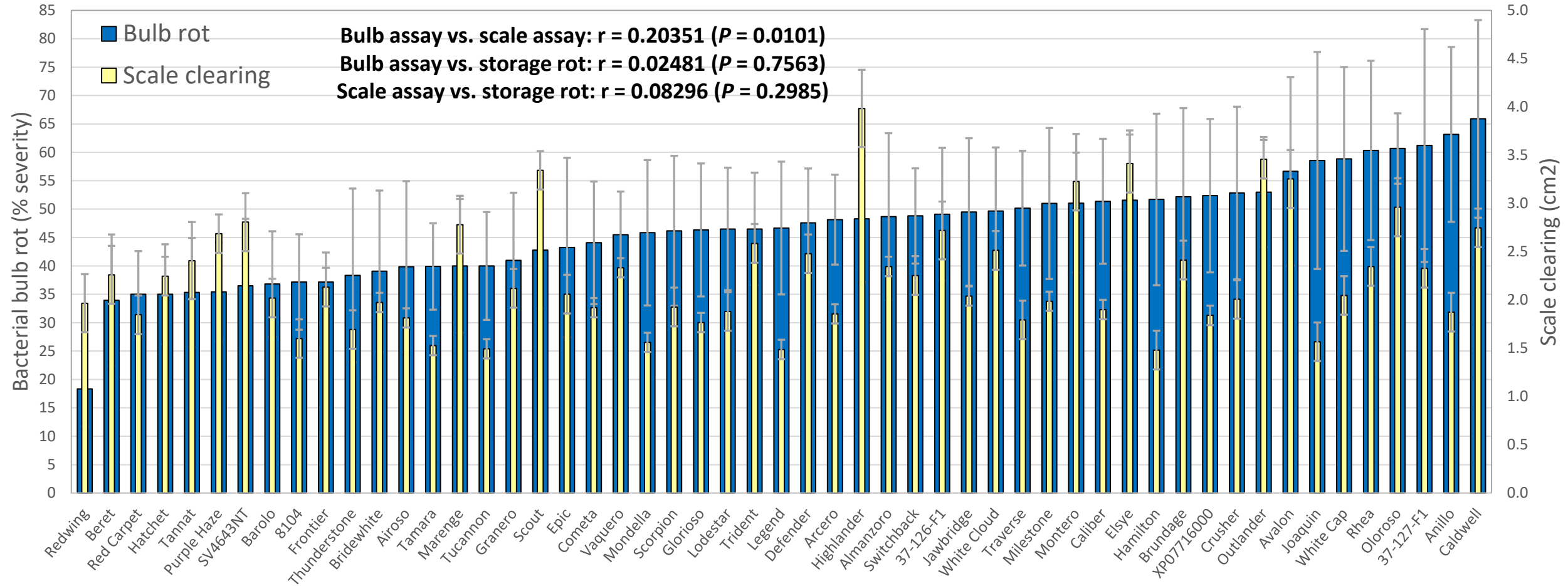
Comparison of bulb injection vs. scale assay for screening

- 25 bulbs from 3 replicate plots of 53 cultivars from 2022 WSU Onion Cultivar Trial (Tim Waters, Carrie Wohleb)
- 20 bulbs/rep/cultivar injected with *B. gladioli*
- 4 scales from each of 5 bulbs (20 scales) inoculated
- 'Arcero' for positive control (inoculated with *B. gladioli*)
- 'Arcero' for 2 negative control treatments (*E. coli* & saline only)
- Correlation of bulb assay vs. scale assay vs. bacterial bulb rot in storage

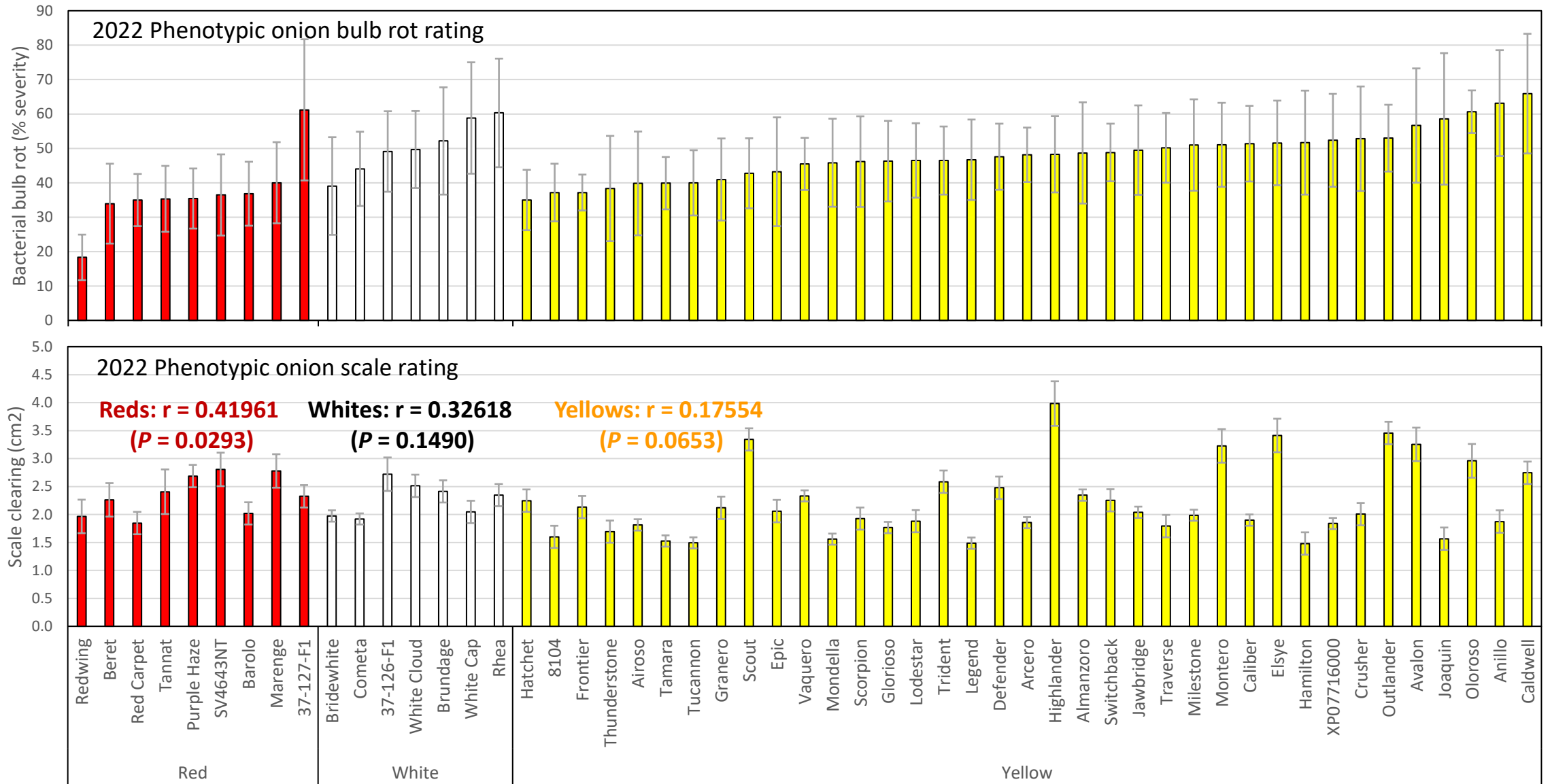


# Stop the Rot: Washington State Season 3

## 2022 WSU Onion Cultivar Trial: Bulb vs. Scale Assay



# 2022 WSU Onion Cultivar Trial: Bulb vs. scale assays sorted by bulb color



# Recommendations & questions from Stakeholder Advisory Panel on phenotypic screening for resistance to onion bacterial bulb rot