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# Cranberry field rot, storage rot, fresh fruit keeping quality and yield in Washington as a function of variety, type of fungicide(s) applied, and the number and timing of applications

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Cranberry field rot, storage rot, fresh fruit keeping quality and yield in Washington as a function of variety, type of fungicide(s) applied, and the number and timing of applications.

Kim Patten & Chase Metzger – WSU



*World Class. Face to Face.*

David Bellamy – OS Cranberries, Inc.

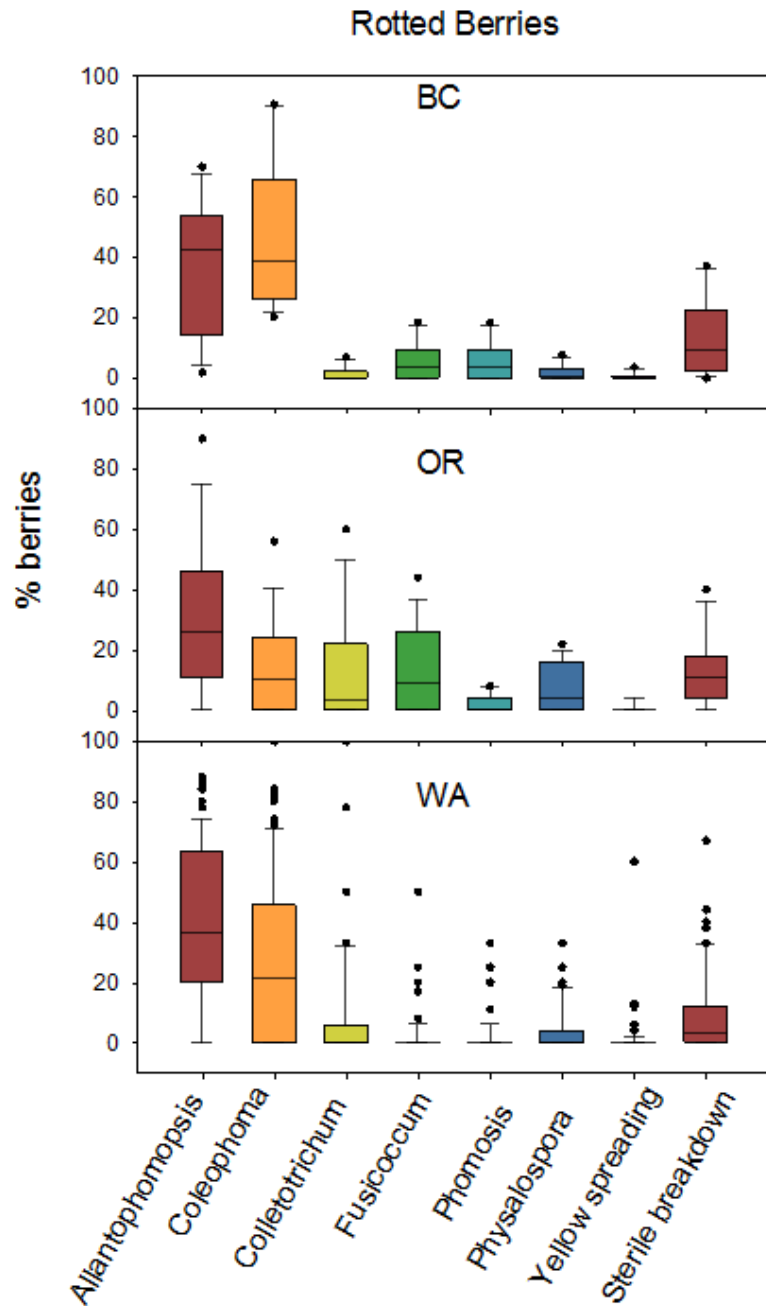


## Background

- Fresh fruit is a major market for Oregon and Washington cranberries.
- Fresh fruit keeping quality has been a consistent problem.
- We have not been able to fill market demand due to quality problems.



# There are several key fruit rotting pathogens in the PNW.



Pathogen in order of importance

- Allantophomopsis
- Coleophoma
- Colletotrichum
- Physalospora
- Cadophora
- Cryptosporiopsis
- Fusicoccum
- Botryosphaeria
- Penicillium
- Pestalotia
- Phomopsis
- Phyllosticta
- Synchronoblastia
- Botrytis

Data from Caruso & Patten 2014 to 2016



# Can we improve fruit quality with in-bloom fungicides?

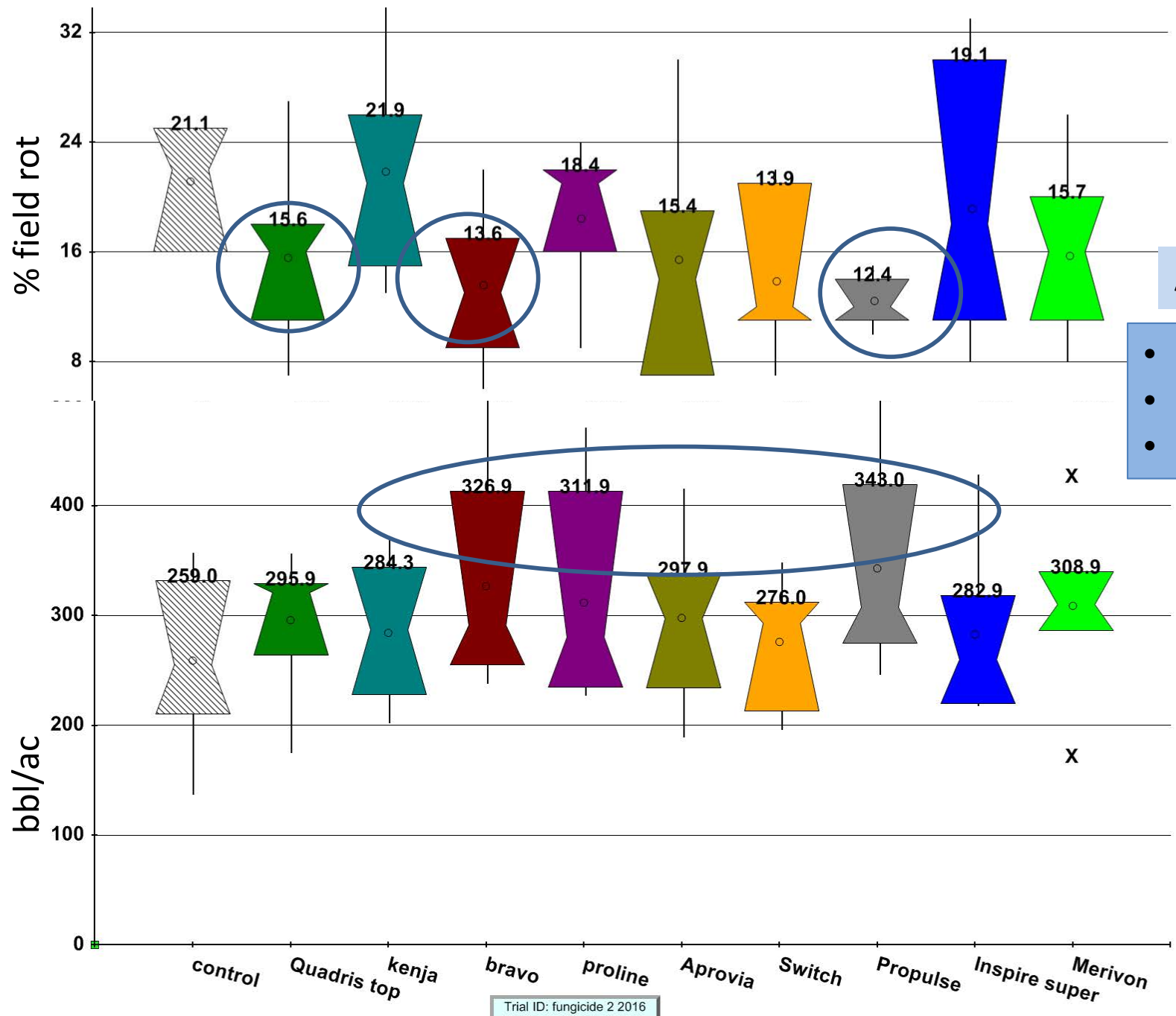
## Experiment

- 33 replicated chemigation and broadcast studies between 2010 and 2016
- Multiple sites over several years, with multiple applications during bloom
- Yield, field rot and 6 weeks storage rot assessed



**Percent of 33 trials where we obtained a significant effect from one or more in-bloom fungicide treatments:**

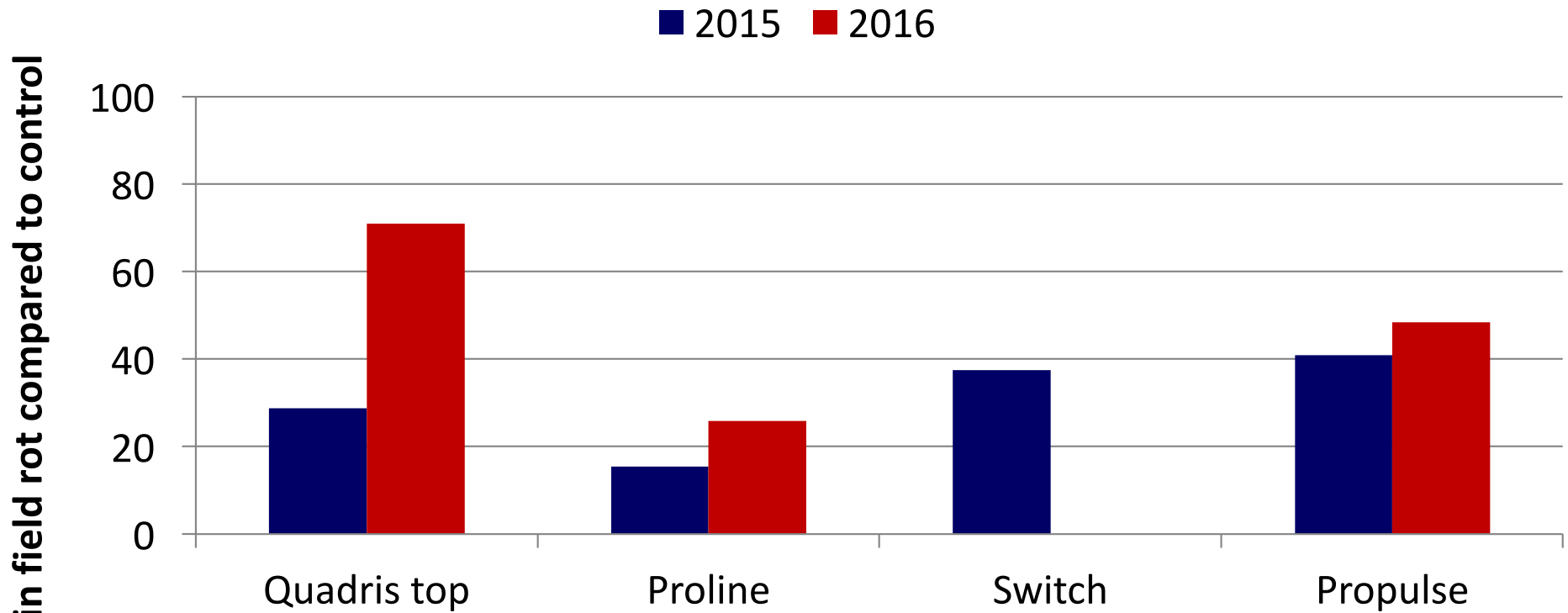
- Reduced field rot: 54%
- Reduced storage rot: 47%
- Positive yield response: 28%



A typical data set

- Lots of variability
- Field rot response
- Yield response

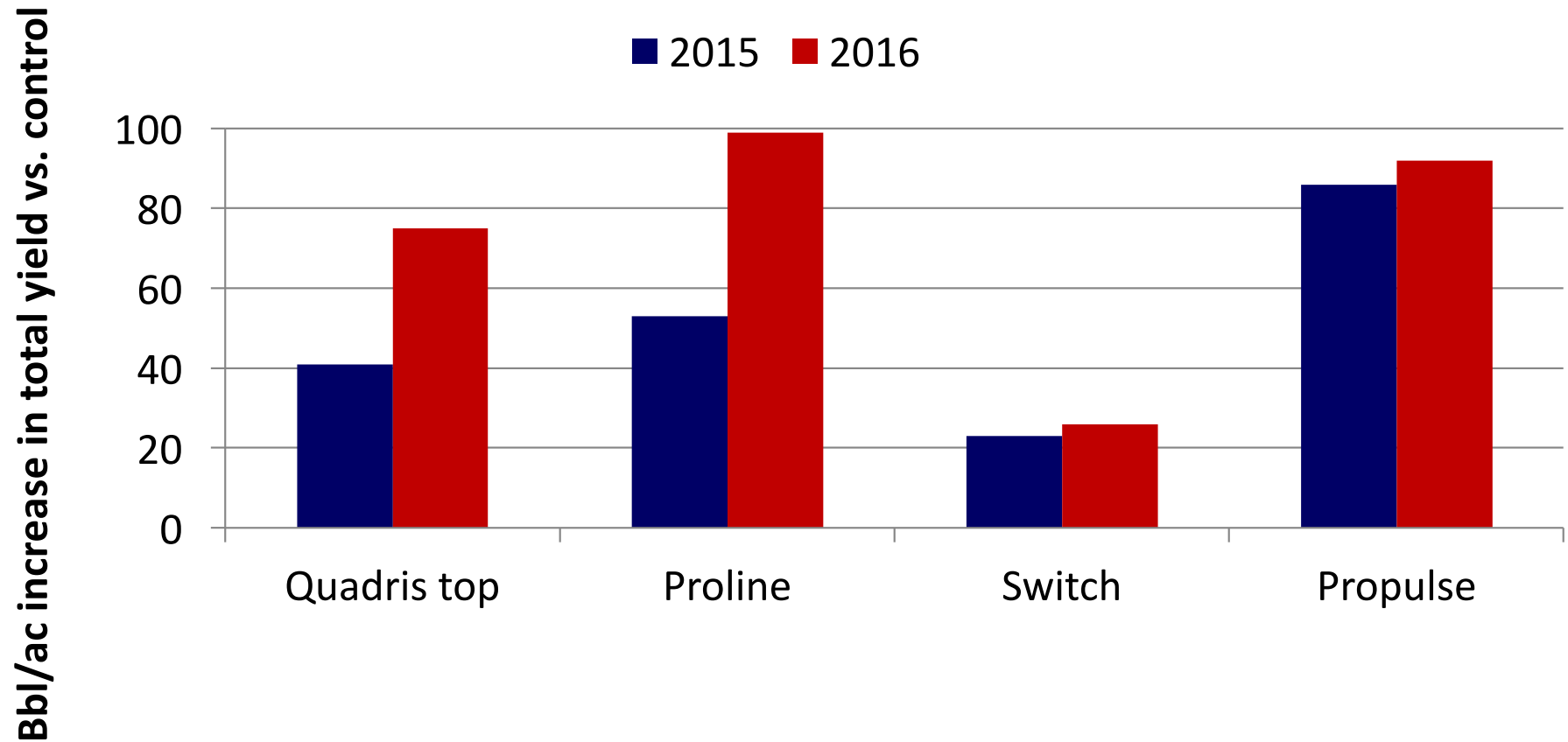
# % field rot decrease of Stevens with in-bloom fungicides



Field rot of the untreated control was 21 and 31 % in 2015 and 2016 respectively

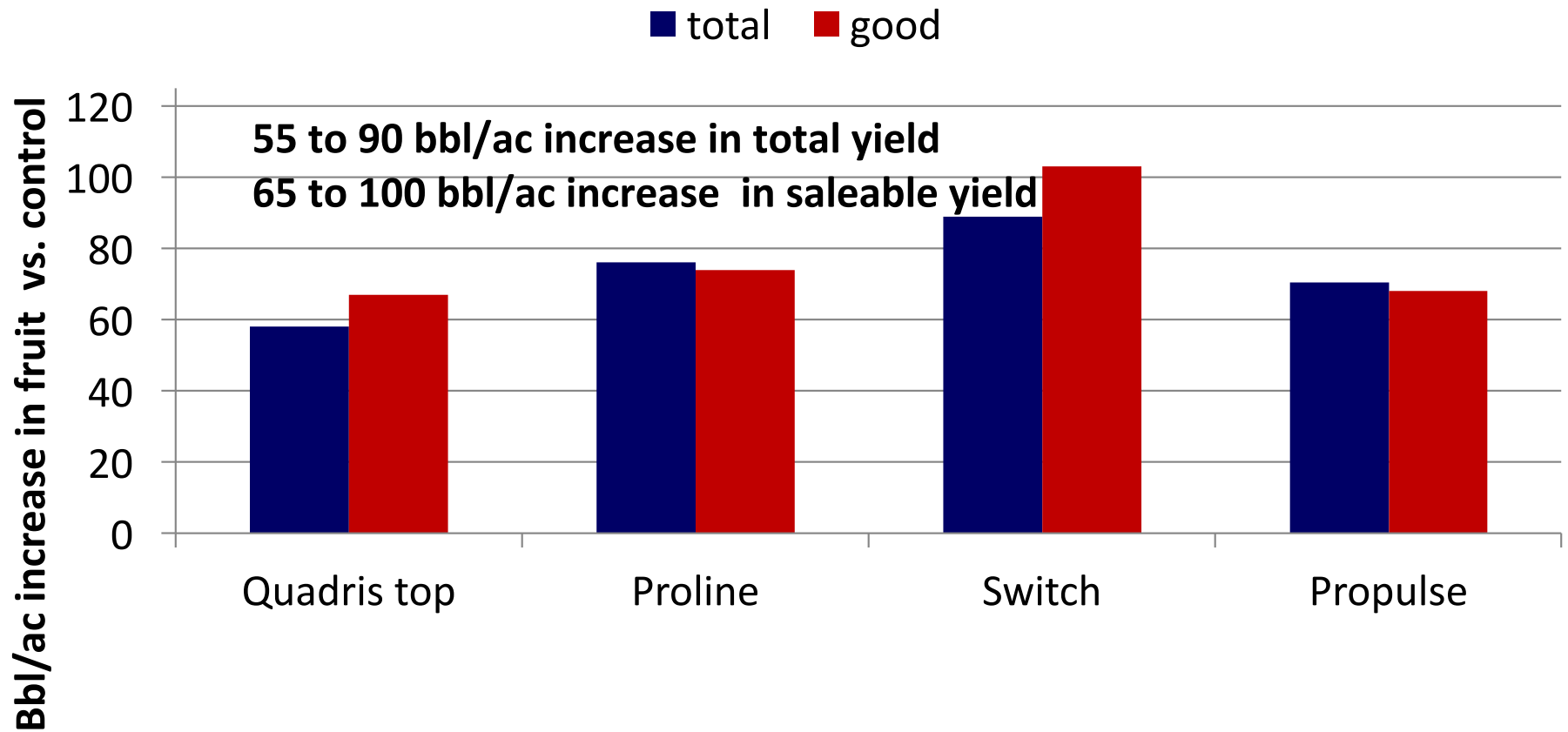


# Increase in total yield of Stevens



Yield of the control was 248 and 207 bbl/ac in 2015 and 2016 respectively

# In beds with good populations of pathogens – a mean increase in yield with fungicides



## **Conclusion**

- ~  $\frac{1}{4}$  of the time we obtained a positive yield response to fungicides.
- ~  $\frac{1}{2}$  of the time we obtained a reduction in field and storage rot in response to fungicides, especially on beds with heavy pathogen loads.
- No consistent pattern of effect between fungicides.

# Is the yield response to fungicides due to effects on fruit set?

## Experiment:

A range of fungicide trials applied over bloom across multiple varieties and sites

## Data collected included:

- % fruit set
- # fruit/upright
- # undeveloped fruit/upright
- # unpollinated flowers/upright
- Yield (pending)
- Field rot (pending)
- Fruit size (pending)







## Study 1.

**Experiment:** 4 varieties, 3 fungicide treatments applied at 10, 50 and 75% bloom.

**Results:** No treatment effects on fruit sets of Pilgrim, Willapa Red, Mullica Queen or Crimson Queen. Only 2 variables were significant.

Treatment	Willapa Red (Fruit/upright)	Pilgrim (% undeveloped fruit)
Control	1.2 a	18 a
Proline + Abound, Indar + Abound , Proline + Abound	1.3 ab	16 ab
Propulse, Quadris Top, Propulse	1.4 b	13 b

## Study 2.

**Experiment:** 2 varieties, 4 fungicide treatments applied at 10, 50 and 75% bloom.

**Results:** No difference between varieties; one fungicide treatment reduced set and fruit/upright compared to control.

<b>Treatment</b>	<b>% fruit set</b>	<b># fruit/upright</b>
<b>Control</b>	65 a	2.4 a
<b>Proline, Proline, Bravo</b>	55 b	1.9 b
<b>Proline + Abound, Indar + Abound , Proline + Abound</b>	70 a	2.2 a
<b>Propulse, Quadris Top, Propulse</b>	64 a	2.3 a

### Study 3.

**Experiment:** 2 varieties, 1 fungicide treatment applied at 10 & 50% bloom.

**Results:** No treatment effect.

Treatment	% set - Stevens	% set - Willapa Red
Control	49 a	73 a
Proline+ Abound -twice	44 a	71 a

## Study 4.

**Experiment:** 1 variety (Stevens), 2 fungicide treatments applied at 10 & 50% bloom.

**Results:** No treatment effect.

Treatment	% set	Fruit /upright
Control	34 a	1.2 a
Proline+ Abound -three	30 a	1.2 a
Bravo - twice	35 a	1.2 a

## **Conclusion**

- Any effects of fungicides (positive or negative) on fruit set under Washington conditions are minimal, and inconsistent.



# How much difference is there between varieties in Oregon and Washington in field and storage rot (6 to 8 weeks)?

## Experiment:

- Three variety trials (2003 planting in WA, 2009 planting in OR, and 2009 and 2010 plantings in WA).
- Sites received minimal fungicide applications.

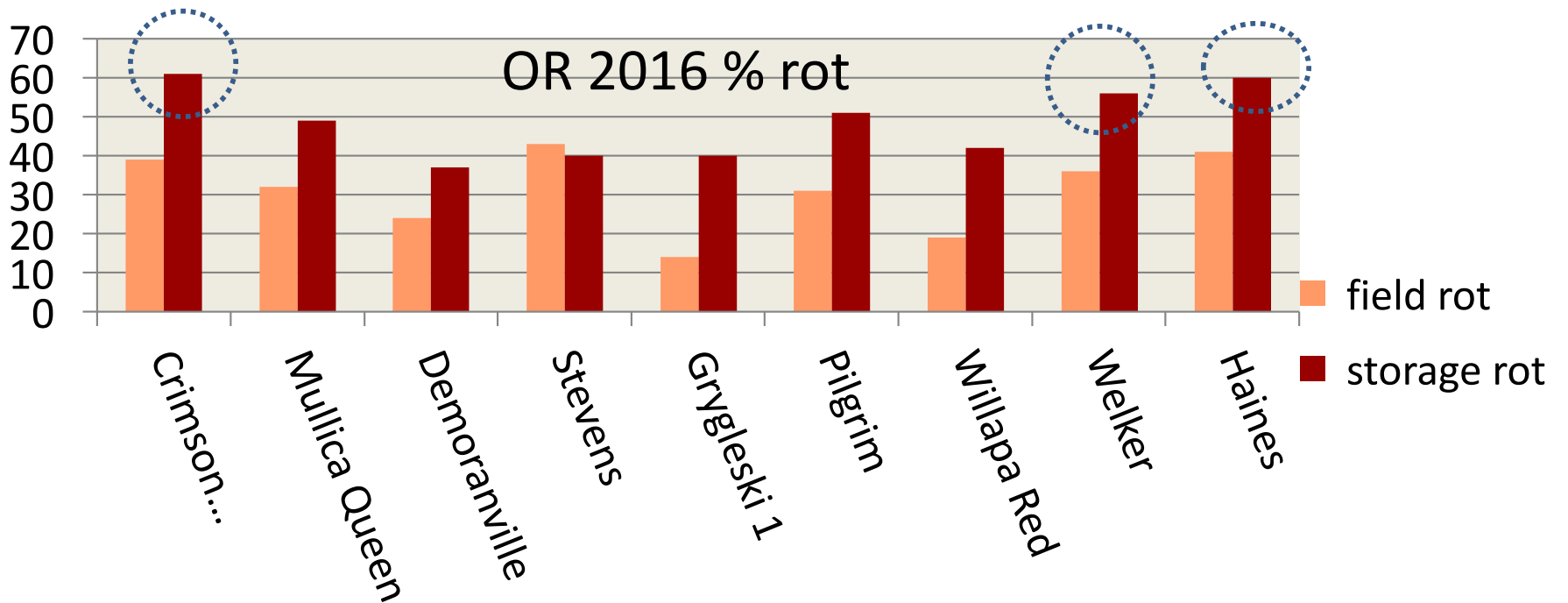
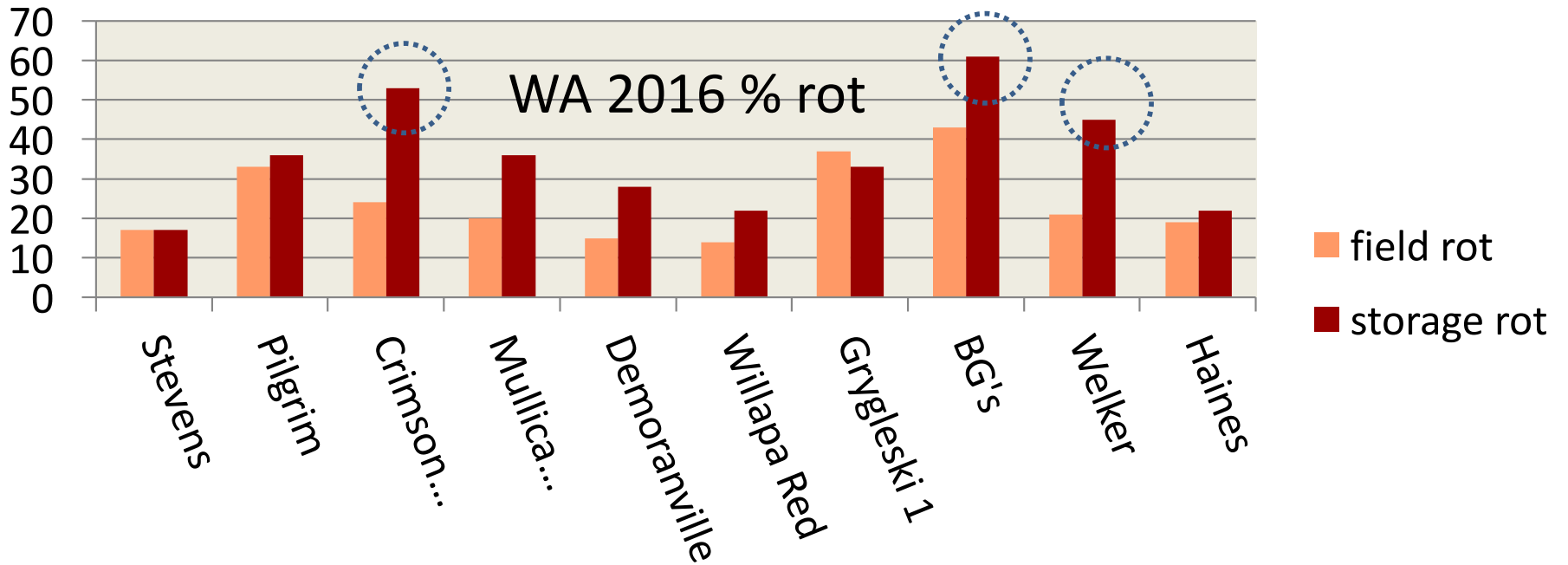
## Data

- Field and storage rot assessed.



## **Results**

- A lot of noise and variation between locations and years.
- In low rot years minimal variety effect on fruit rot.
- In years of high rot, some of the new selections were particularly prone to higher field and storage rot.



Some selections not well adapted to fresh fruit due to patterns of high storage rot

## Conclusion

- BG, Crimson Queen and Welker tend to consistently have higher levels of field and storage rot than other varieties, and will require more rigorous fungicide programs.

# What does commercial fresh data tell us about fungicide?

## Experiment:

Assessed WA fresh fruit data for 2015 and 2016

78 different fungicide application patterns used by 58 growers on 213-249 beds

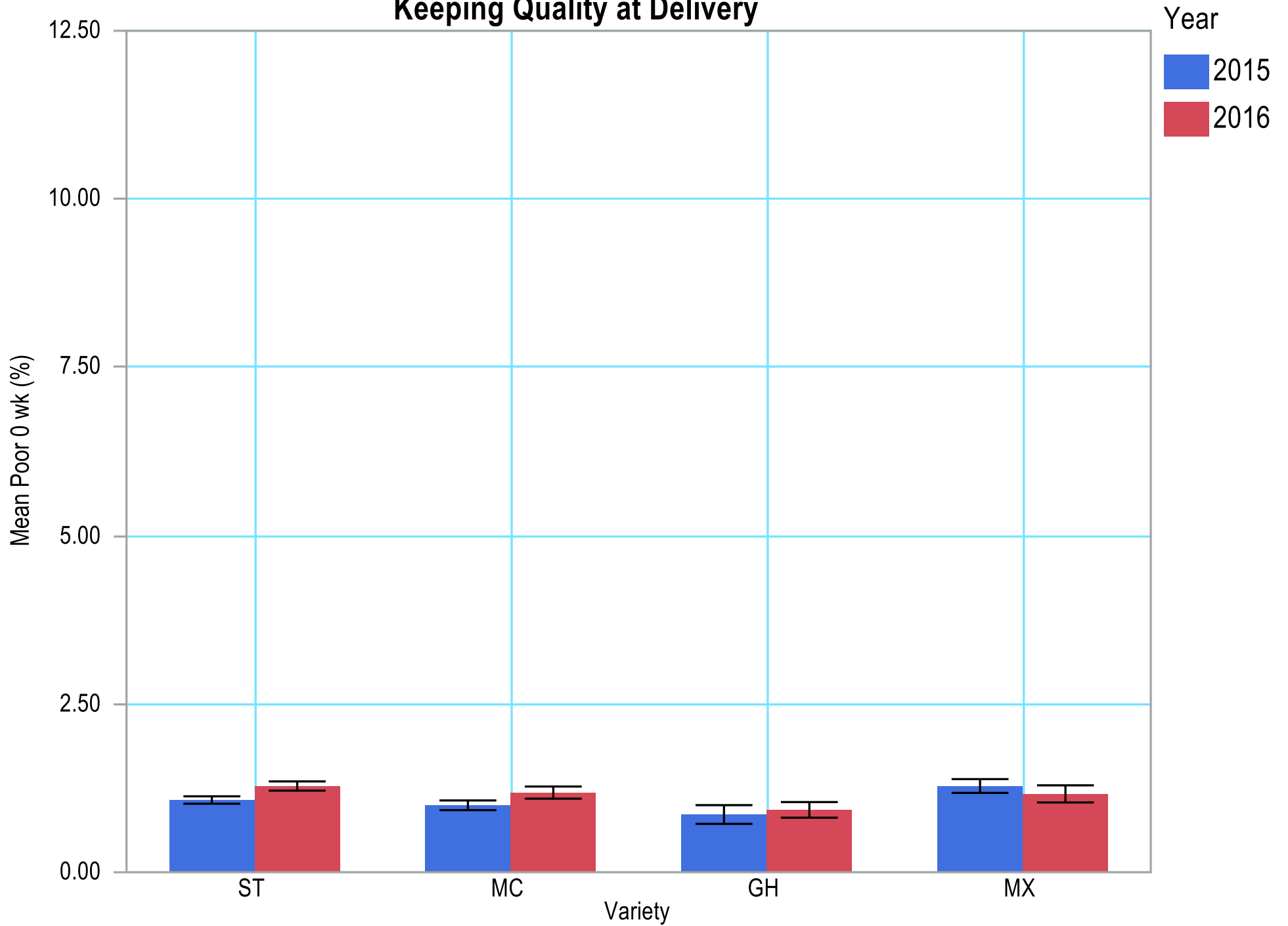
## Data:

- Keeping quality over time by variety
- % poor at delivery and 3 weeks by fungicide practice



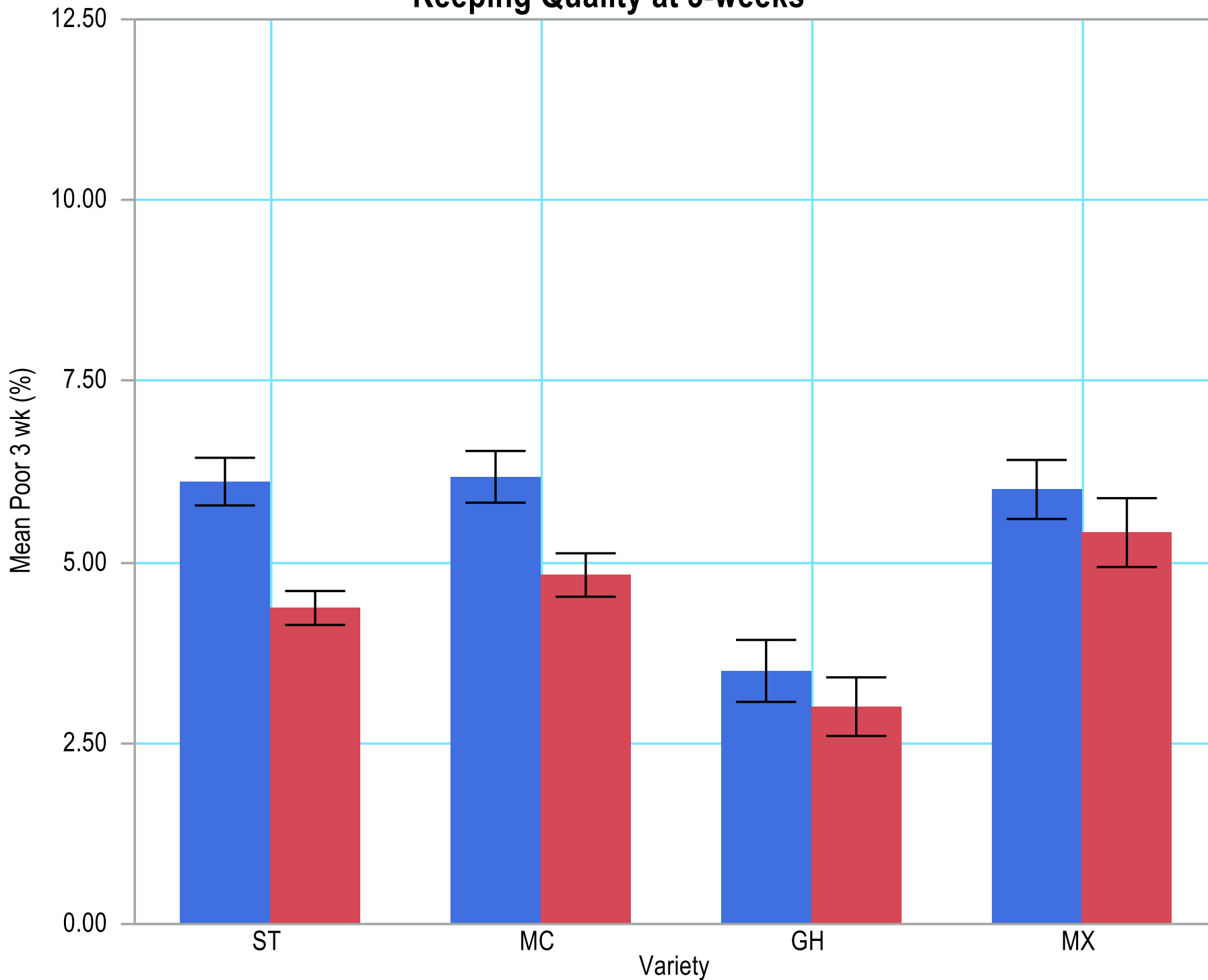
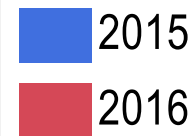


# Keeping Quality at Delivery



# Keeping Quality at 3-weeks

Year

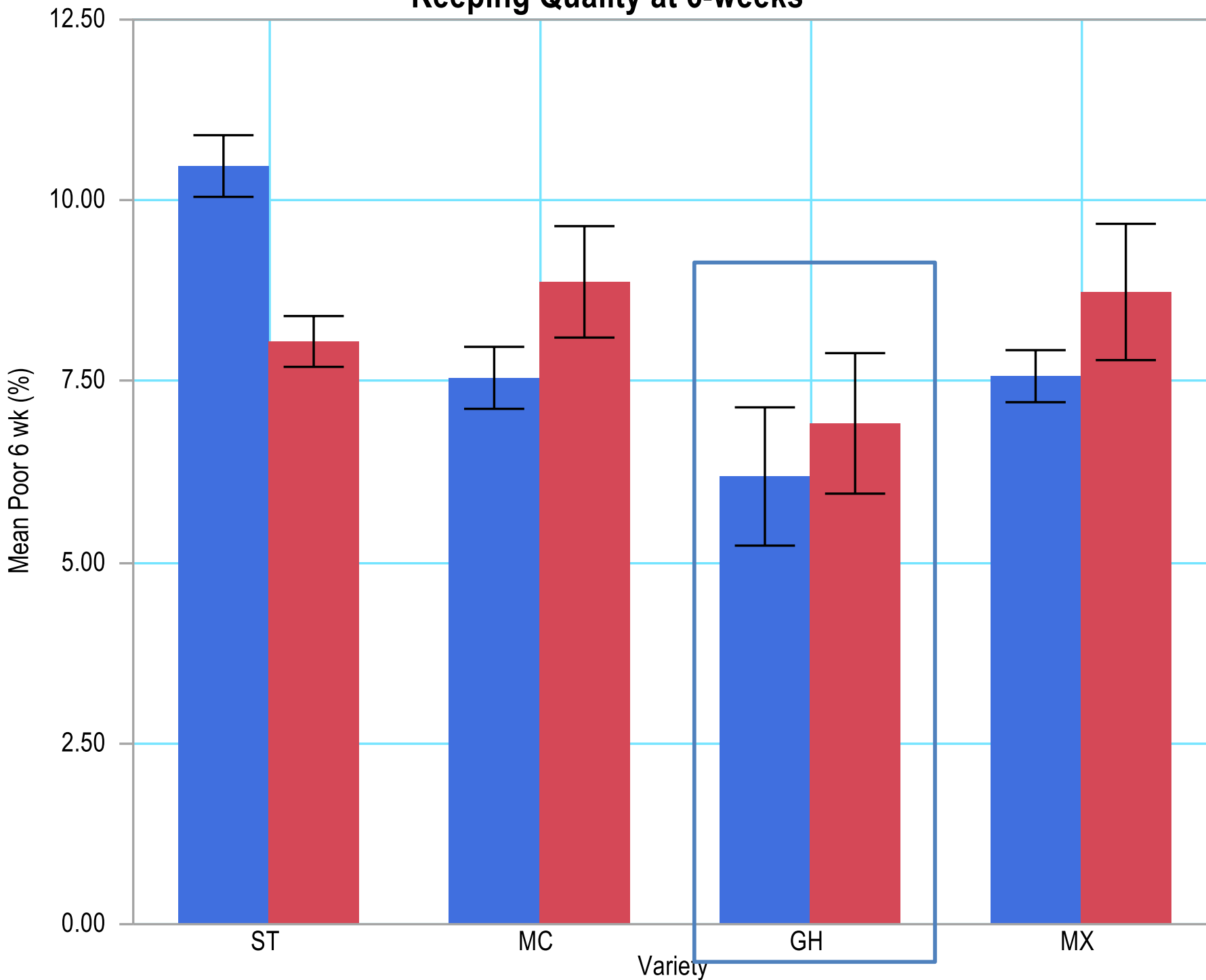


# Keeping Quality at 6-weeks

Year

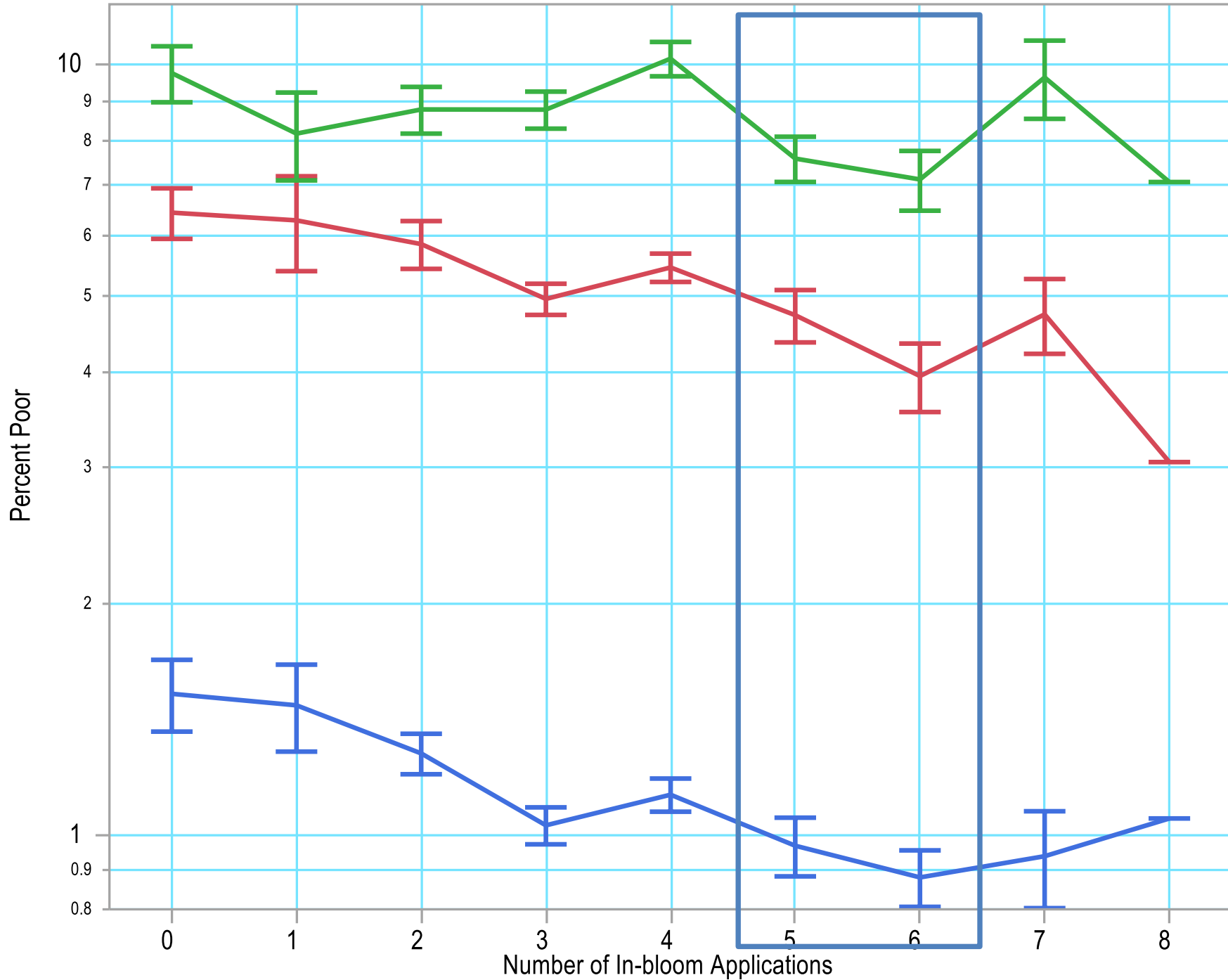
2015

2016

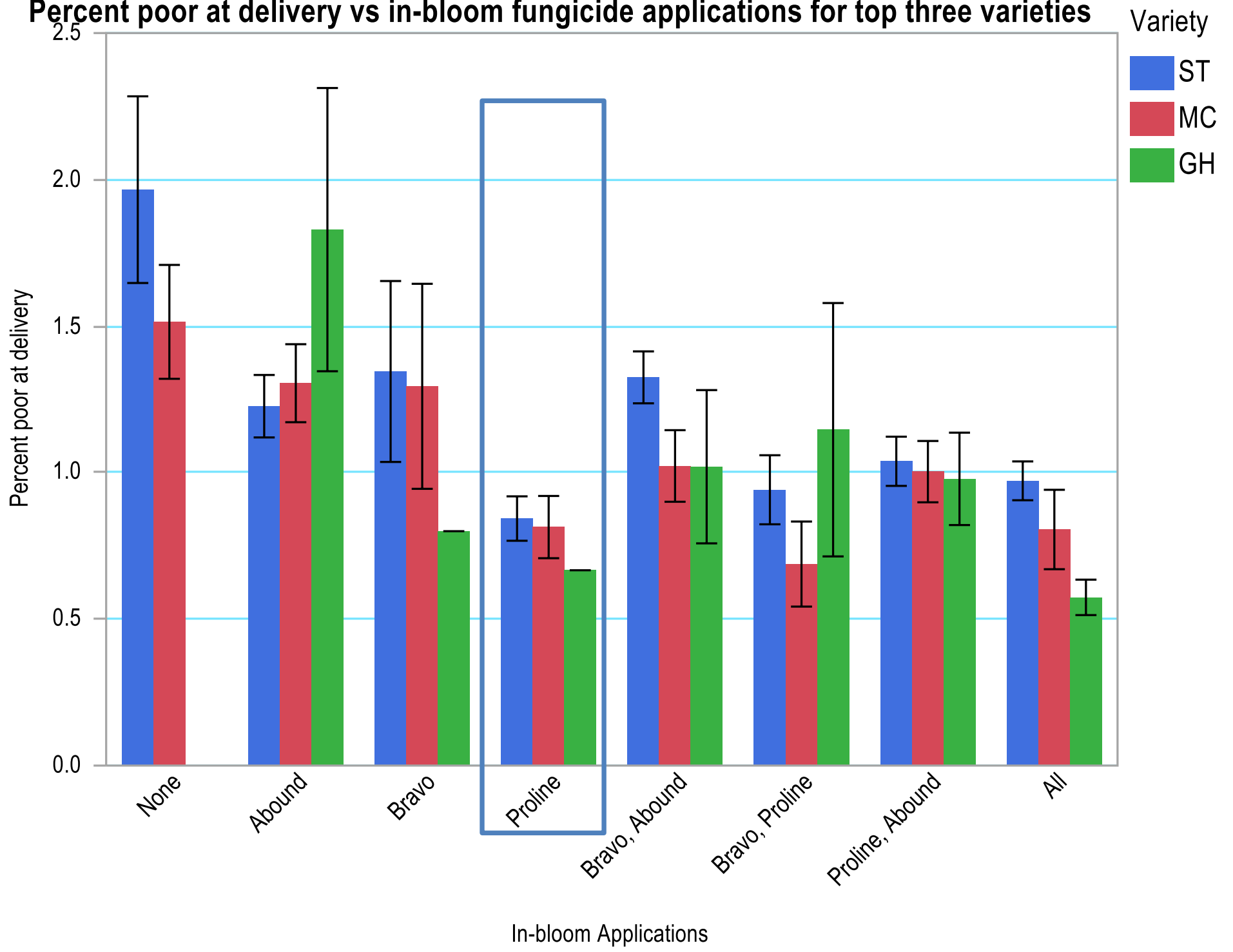


# Percent poor at delivery and number of in-bloom fungicide applications

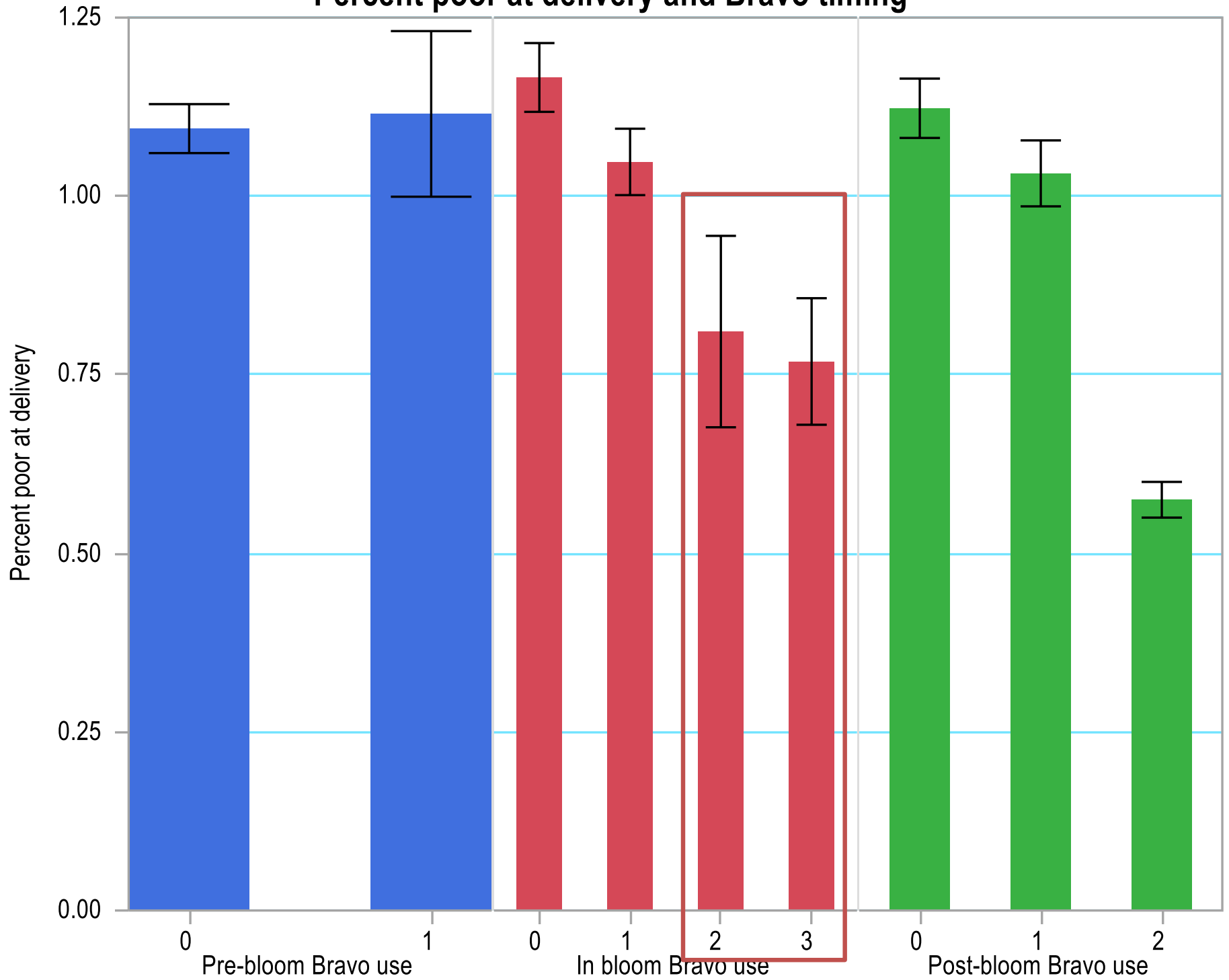
- Delivery
- 3 weeks
- 6 weeks



# Percent poor at delivery vs in-bloom fungicide applications for top three varieties



# Percent poor at delivery and Bravo timing





# Conclusion

- Grygleski keeping quality > Stevens & McFarlin.
- Multiple fungicides applied during bloom reduced % poor at delivery and after 3 and 6 weeks storage.
- Proline > Bravo, Abound, or fungicide combinations in reducing % poor at delivery.
- Bravo timing has important effect of delivery quality.

## **Summary:**

- WA experiment fruit rot data and grower data is highly variable.
- Significant variety effect, especially in high rot years.
  - Grygleski particularly good for fresh fruit.
  - CQ, Welker, and BGs prone to higher rot.

## Summary:

- Fungicide effect.
  - Multiple in-bloom fungicides reduced field and storage rot
    - Experimental data: ~ 50% of the time positive effect
    - Grower data: 5-6 in-bloom fungicides best (~2% decrease)
  - Some fungicides are more effective than others in reducing fruit rot.
    - In-bloom Proline and Bravo appears particularly efficacious
    - 2 Post-bloom Bravo applications reduced % poor at delivery
  - Multiple in-bloom fungicides increased yield ~ 25% of the time.
    - Yield response likely not due to increased fruit set or decreased field rot.