Understanding Cranberry Bud Development and the Role In Yield Prediction

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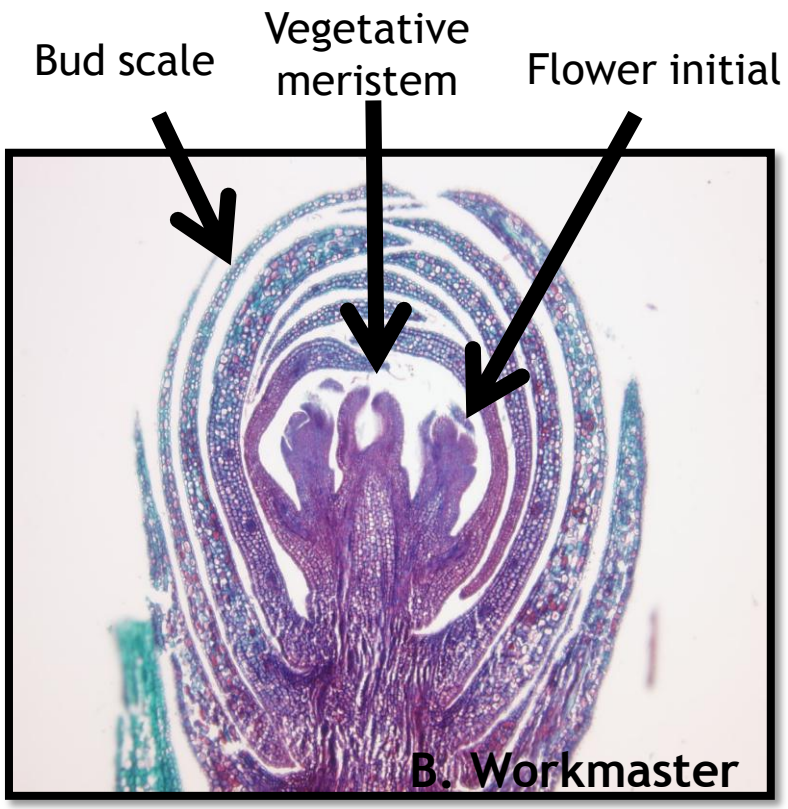
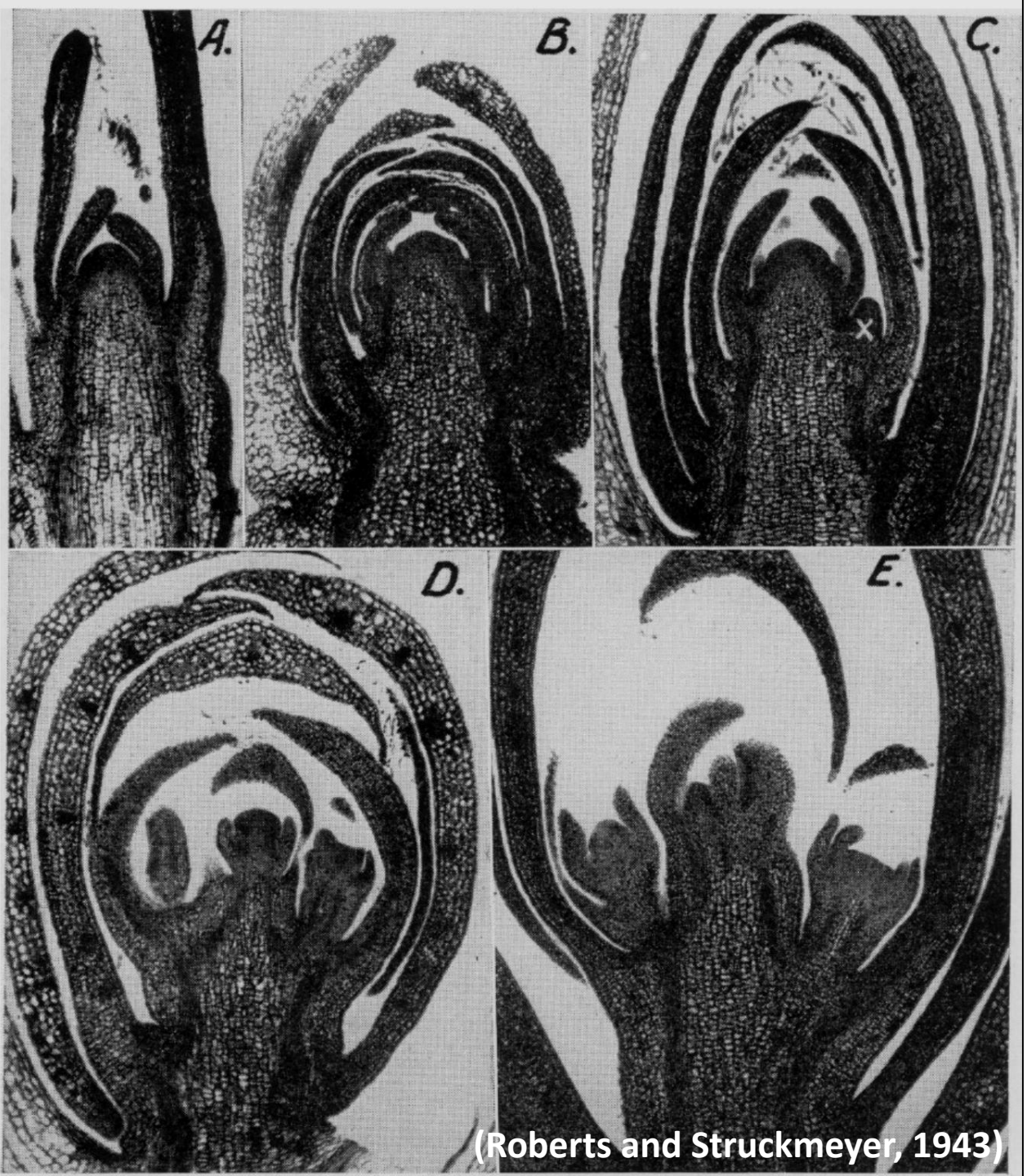
What's in a Bud?

- Terminal buds contain a vegetative meristem and, in some instances, flower initials
  - **Vegetative buds** – contain only a vegetative meristem
  - **Reproductive buds** – contain a vegetative meristem and flower initials
- Biennial bearing tendencies



What Do We Currently Know?

- Goff (1901)
  - Flower initials begin to form in early September in WI
- Lacroix (1926)
  - Flower buds of ‘Howes’ and ‘Early Blacks’ visible by mid-August in MA; no bud growth occurs during winter, but resumes in spring
- Roberts and Struckmeyer (1943)
  - Reproductive bud induction in ‘McFarlin’ occurs around 10 July in WI; flower initials identifiable by 29 July

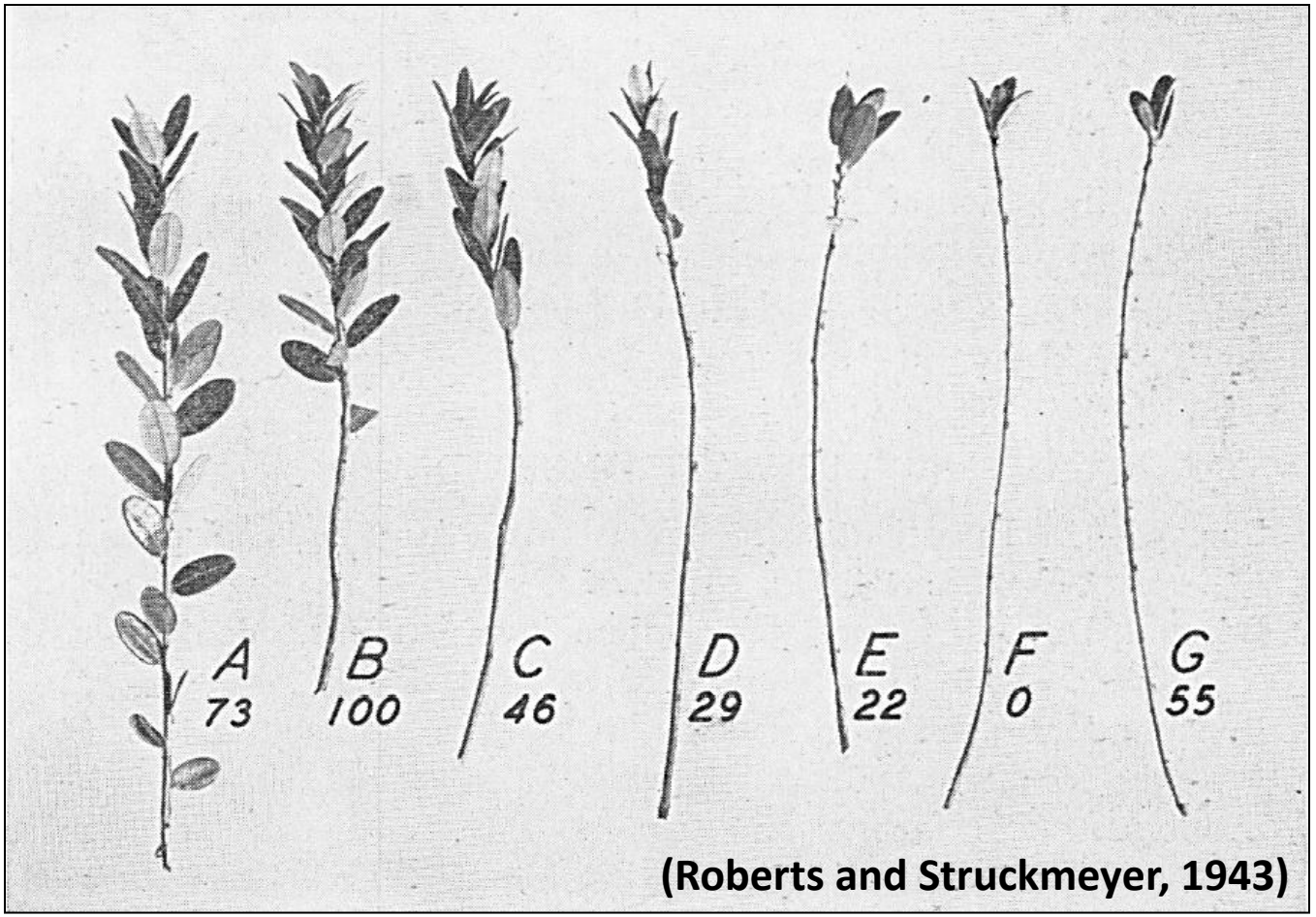


(Roberts and Struckmeyer, 1943)

Reproductive Bud Induction in 'McFarlin'

A. 19 June
B. 21 July
C. 29 July
D. 17 Aug.
E. 8 Sept.

Reproductive Bud Formation on Defoliated Uprights



(Roberts and Struckmeyer, 1943)

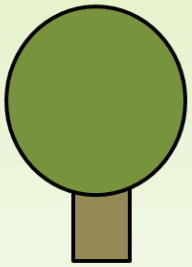
- Numbers show percentage of reproductive buds formed
- Letters denote date of defoliation (below)

A. Untreated	C. 10 June	E. 25 June	G. 21 July
B. 4 June	D. June 18	F. 8 July	

Yield Prediction and the Role of Buds

Current system of yield prediction relies on visual assessment of bud set during the year prior to harvest

Terminal bud shapes, descriptors, and assumed reproductive/fruiting potential.



"Big and Wide"

- Mixed/"reproductive" bud
- Assumed to contain flower initials

"Small and Narrow"

- Vegetative bud
- Assumed to contain **no** flower initials (i.e. nonfruiting)

Challenges & Rationale

- Yield prediction method is qualitative
- What about new cultivars?
- Need for an improved understanding and synthesis of yield metrics

(T. Dittl, WSCGA)

Project Objectives

1. Characterize bud development and floral initiation throughout an entire growing season

2. Compare bud development and floral initiation across several cultivars

3. Determine the relationship of bud external appearance and the presence/absence of floral initials

Methodology

- **2011** → 100 uprights/bed every two weeks from 5 March to 7 Dec.
- **2012** → 70 uprights/bed, twice per week from 5 July to 30 Aug.; then collected 14 Sept. & 26 Oct.
  - Separate samples based on fruiting status of last or current year
  - Bud dissections and analysis
  - Relate development to Growth Degree Days (GDD)
    - Base = 45 °F and Max = 86 °F

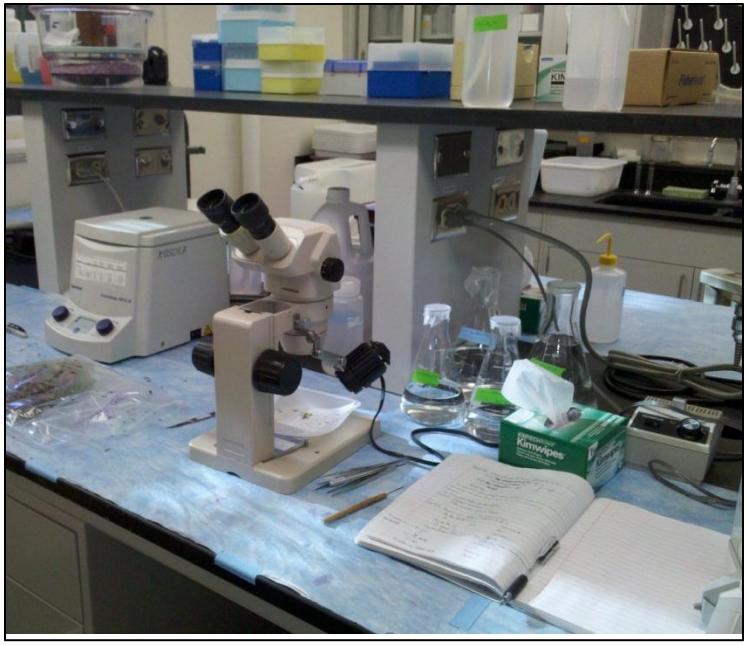
(Perry et al. 1986; DeMoranville et al., 1996)

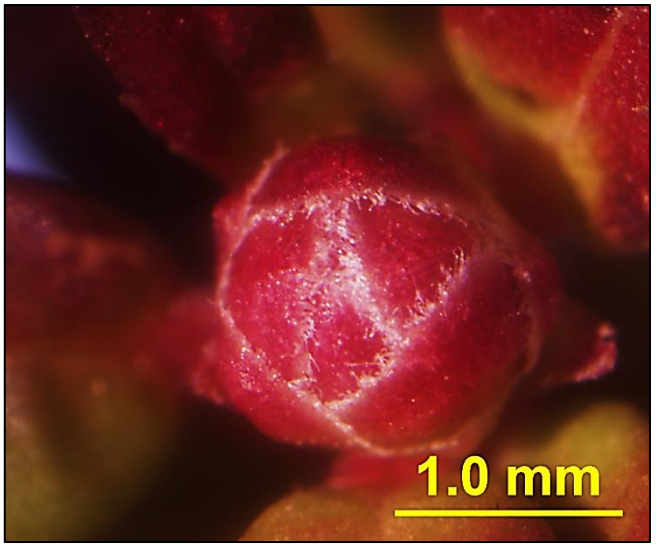
Cultivars Sampled and Dates of Release

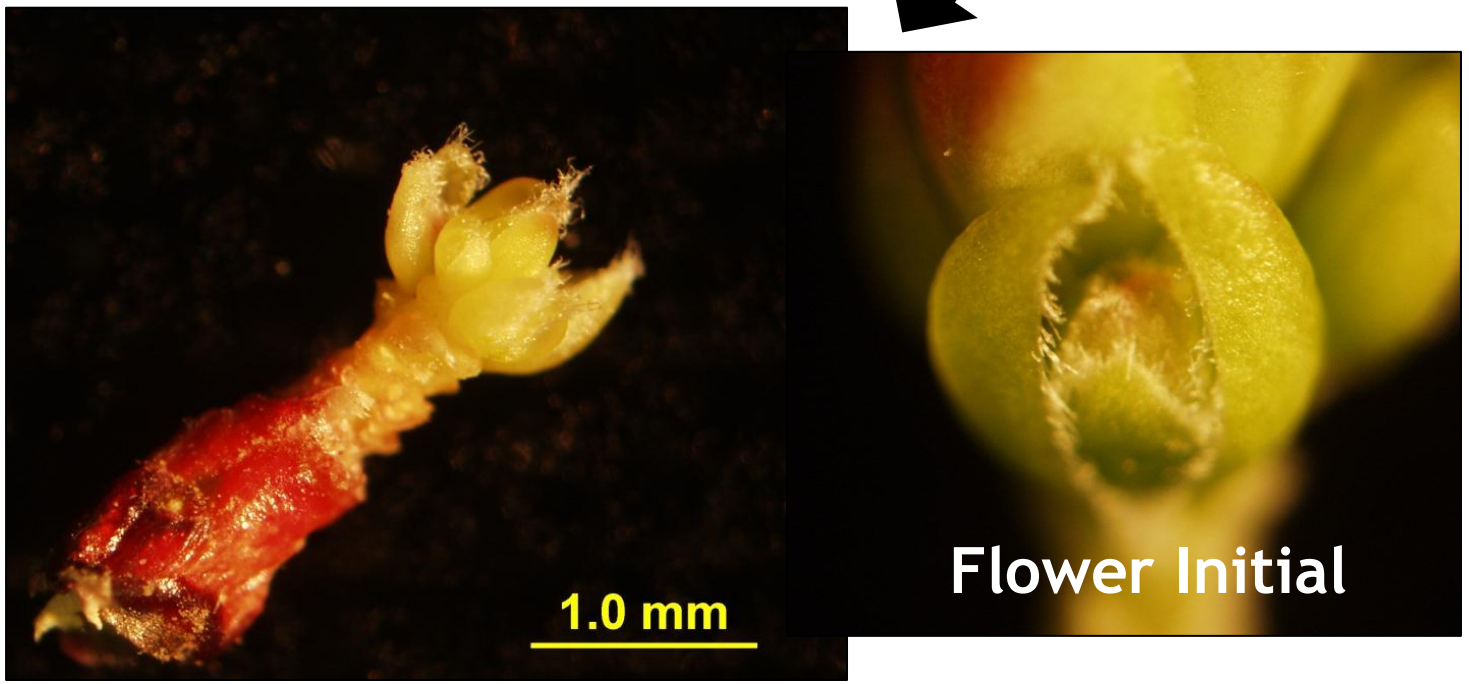
Cultivar	Release Date
Searles[z]	1893
Stevens[y]	1950
HyRed[y]	2003
Crimson Queen[y]	2006

[z]Native selection.

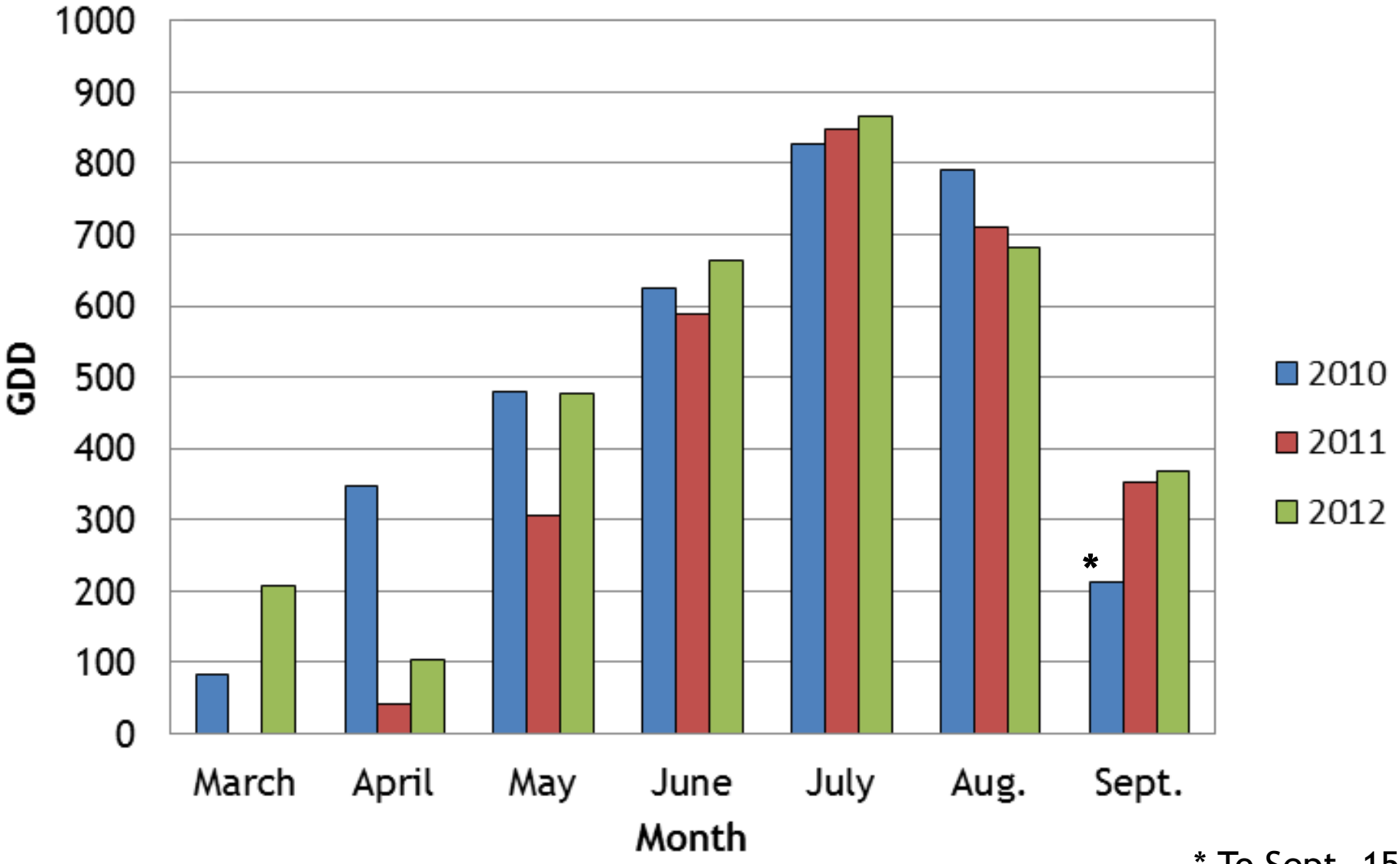
[y]Released from selective breeding programs.




1.0 mm

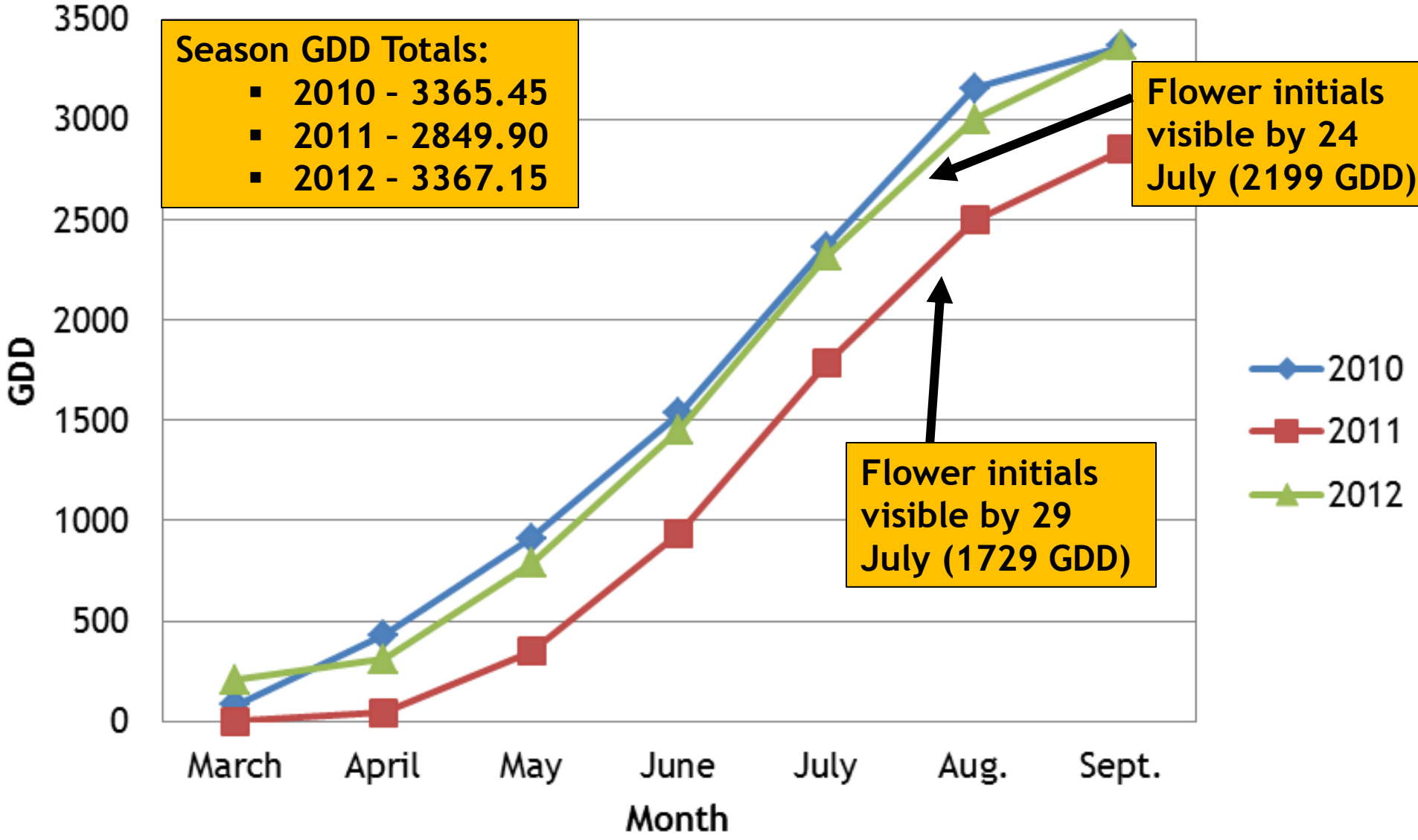

1.0 mm
Flower Initial

Growth Degree Days (GDD) by Month 2010 - 2012

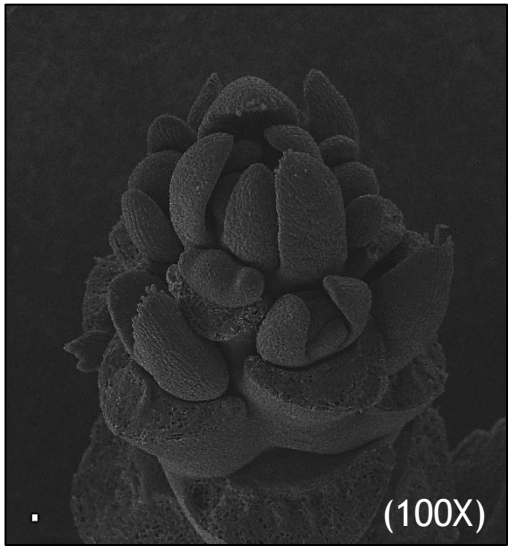


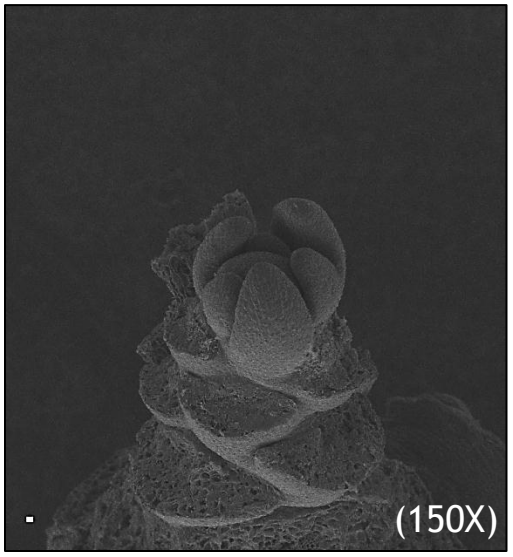
* To Sept. 15

Cumulative Growth Degree Days (GDD) 2010-2012

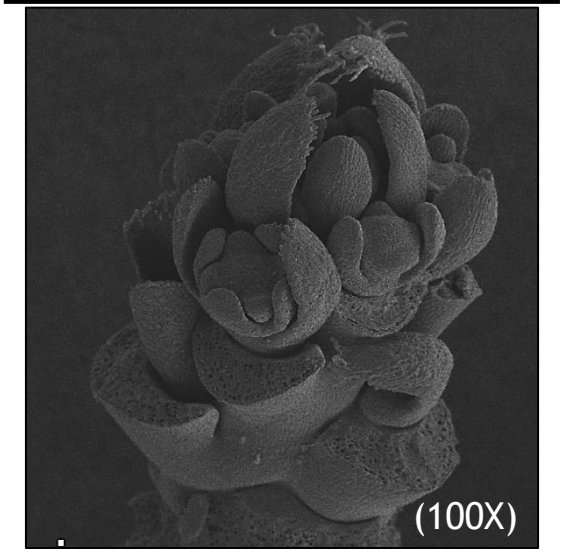


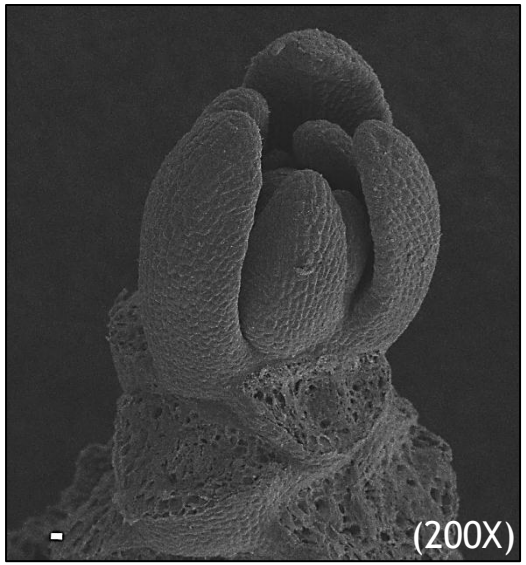
Vegetative Uprights





Reproductive Uprights



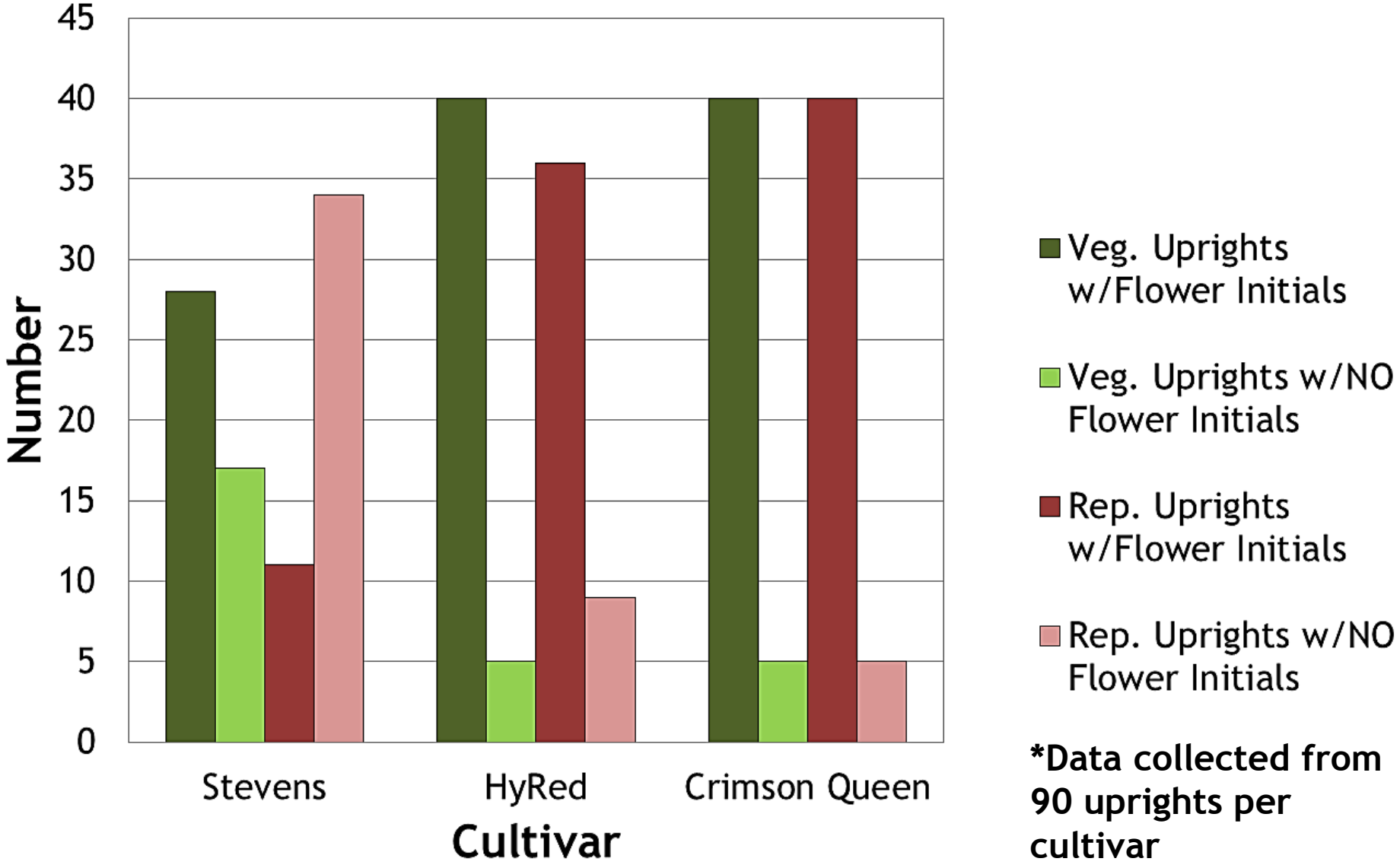


‘HyRed’ 2011

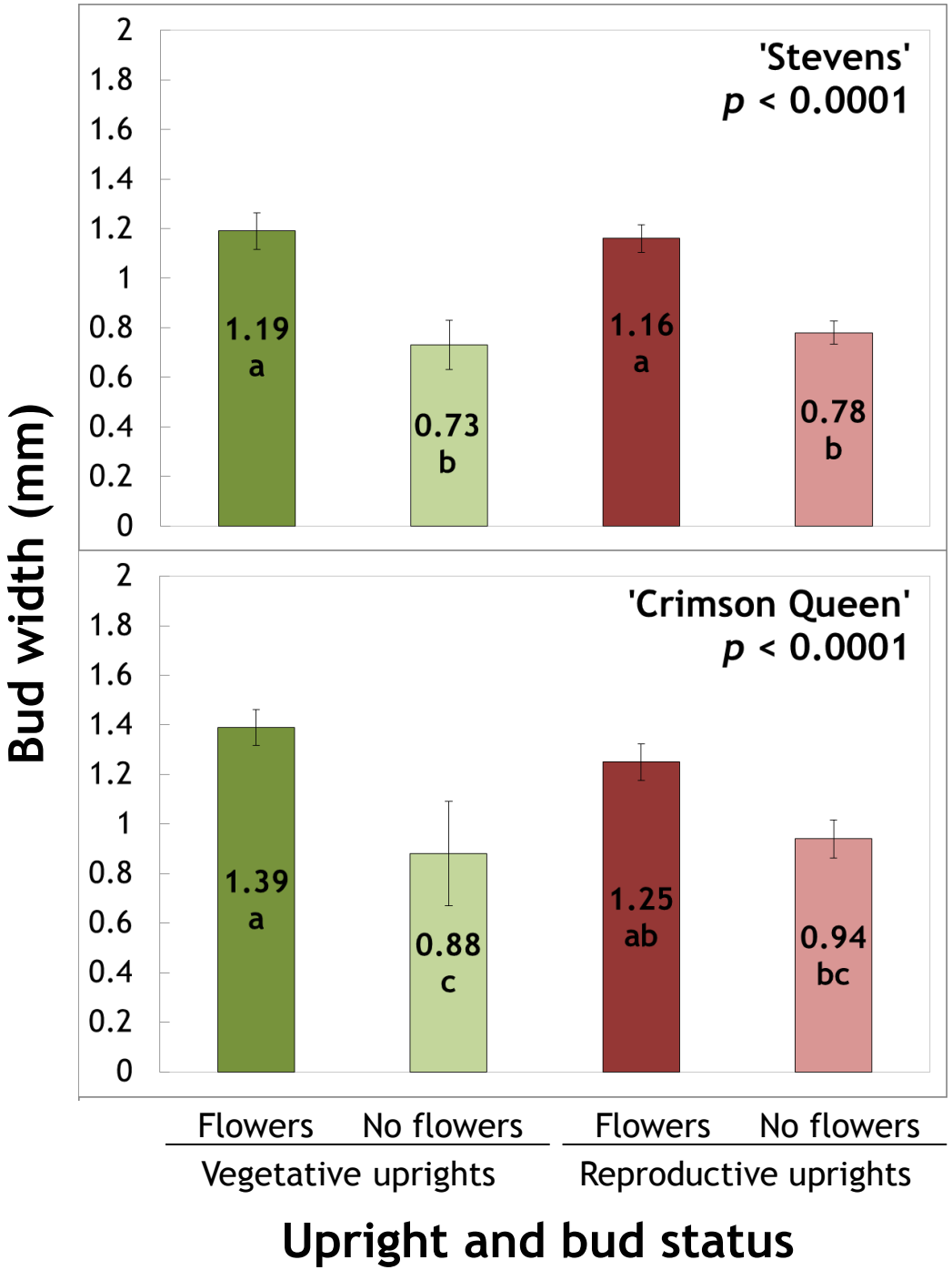
- Many assumed vegetative buds actually contained flower initials (excludes ‘Searles’)

(Bar = 10 microns)

Comparison of Floral Intiation Patterns Across Three Cultivars of Cranberry - 2012

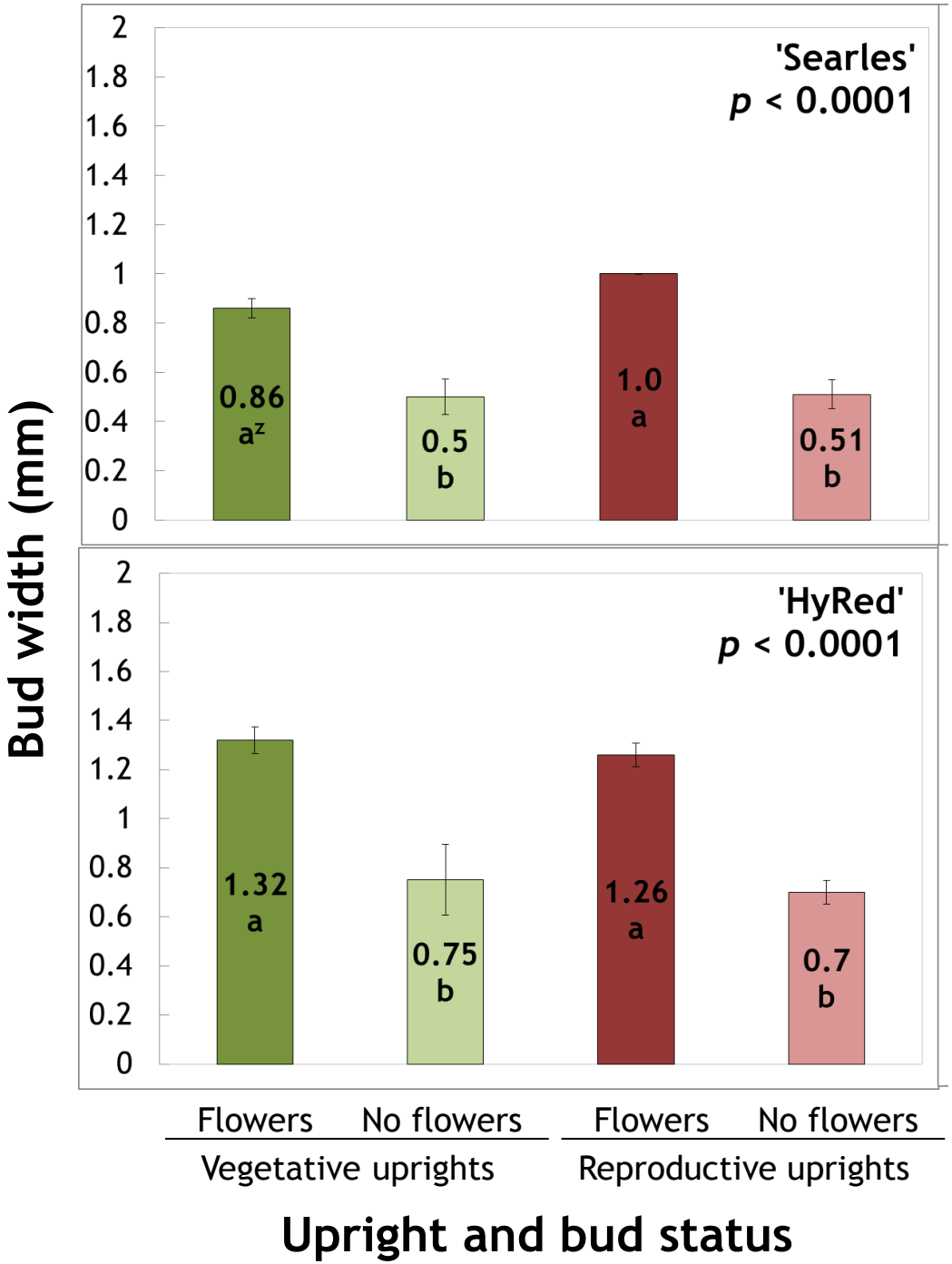


***Data collected from 90 uprights per cultivar**



Relationship between bud width and fruiting potential of cranberry uprights

- Collected 7 Dec. 2011
- 93 uprights/cultivar
- [z]Means with the same letter are not different at $P < 0.05$



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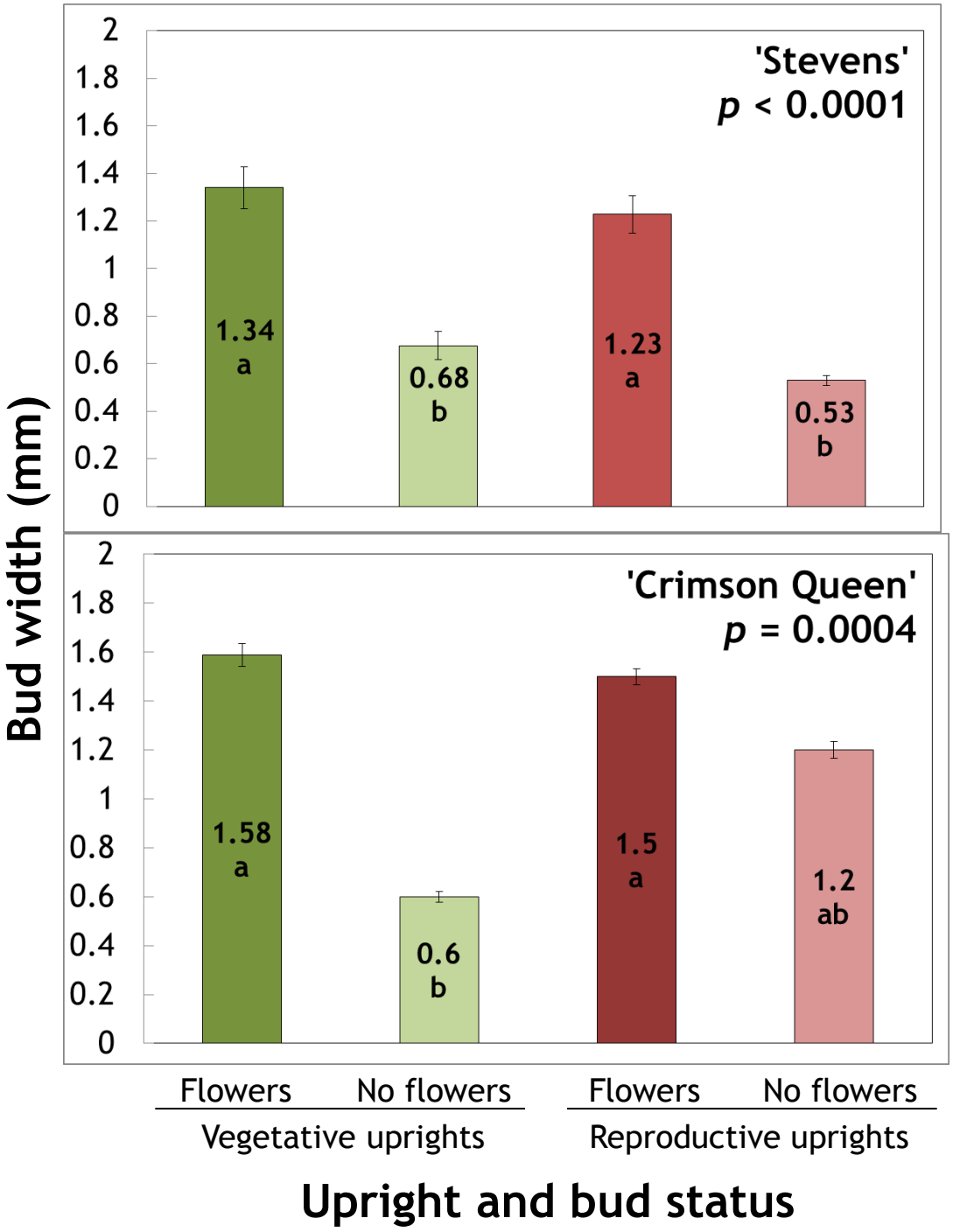

Relationship between bud width and fruiting potential of cranberry uprights

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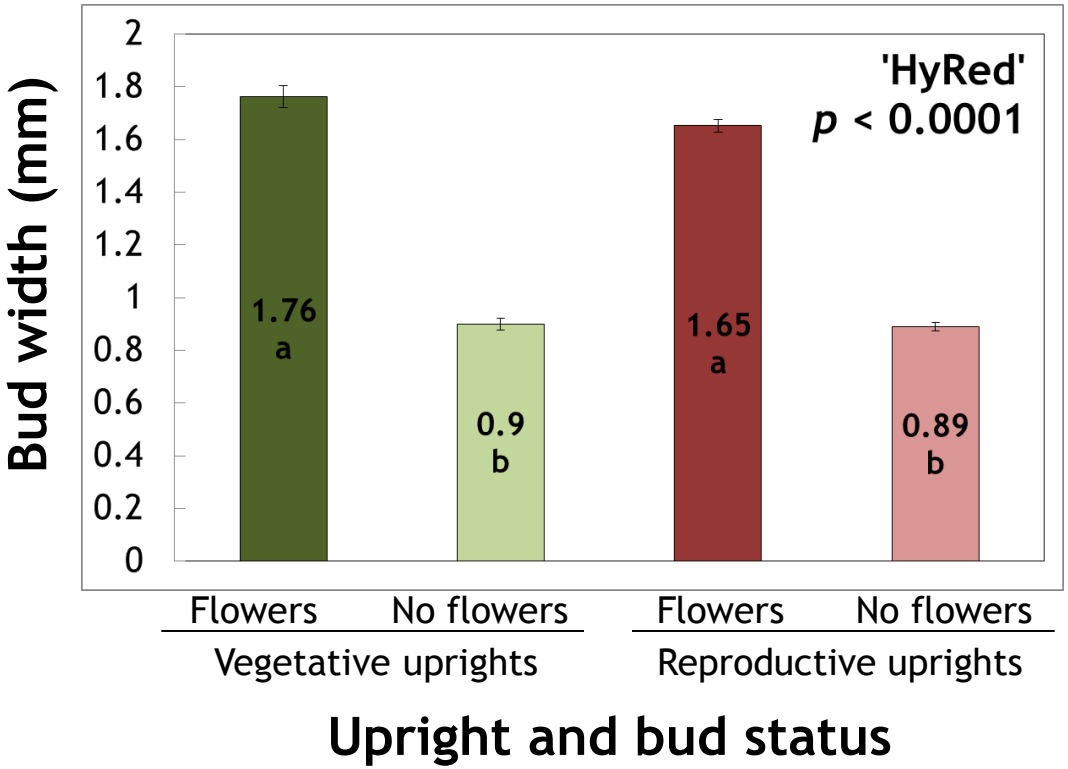

Relationship between bud width and fruiting potential of cranberry uprights

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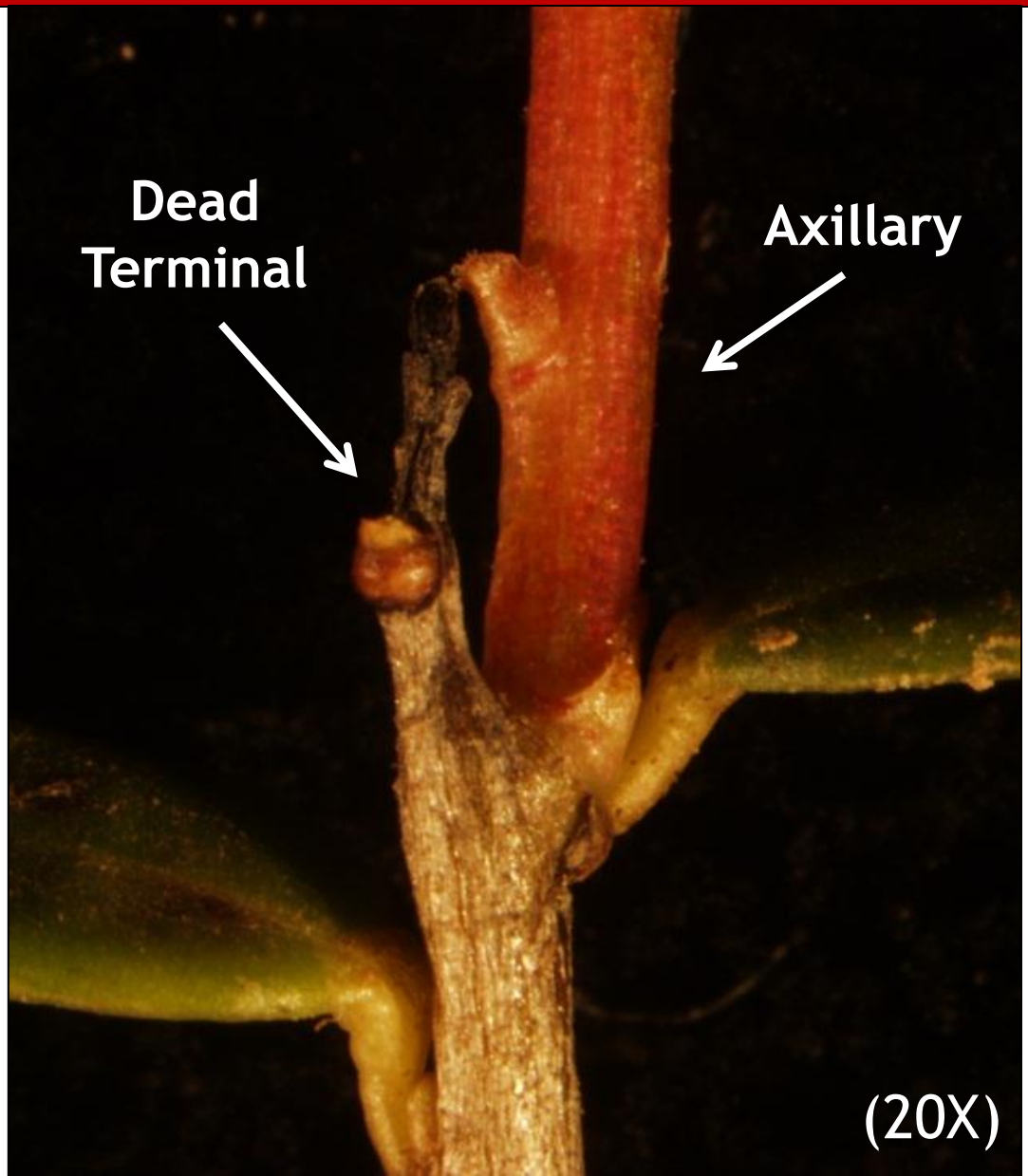
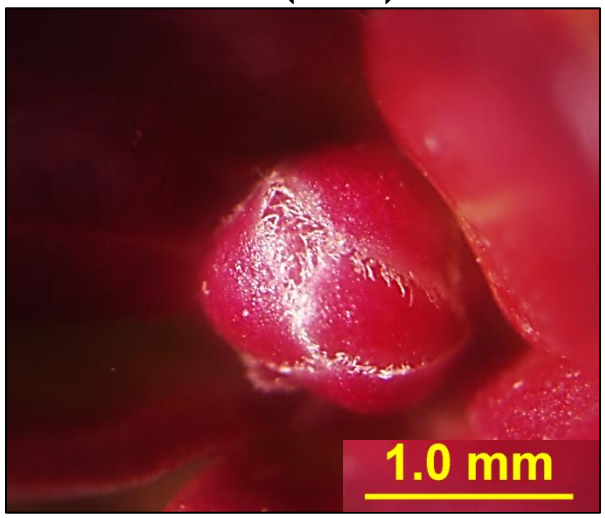
‘Searles’



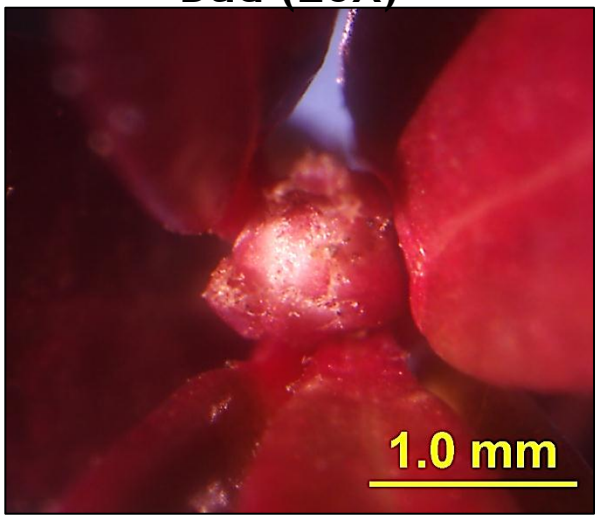
Summary of Results…

- Wider buds are more likely to contain flower initials
- Cultivars differ in bud development
  - Recently released cultivars have **wider** buds that are more likely to contain flower initials, regardless of last year's fruiting status

'Stevens' Vegetative Bud (20X)



'Stevens' Reproductive Bud (20X)



Conclusions to Date:

- New hybrids have greater tendency for ‘rebud’

The Future…

- Continue monitoring bud development
- Yield prediction and carbohydrate analysis

Acknowledgements

- Wisconsin cranberry growers
- Wisconsin State Cranberry Growers Association
- Biological & Biomaterials Preparation, Imaging, and Characterization Laboratory at the University of Wisconsin – Madison
- The Harbut Lab

Questions & Discussion