

# Apple flower development

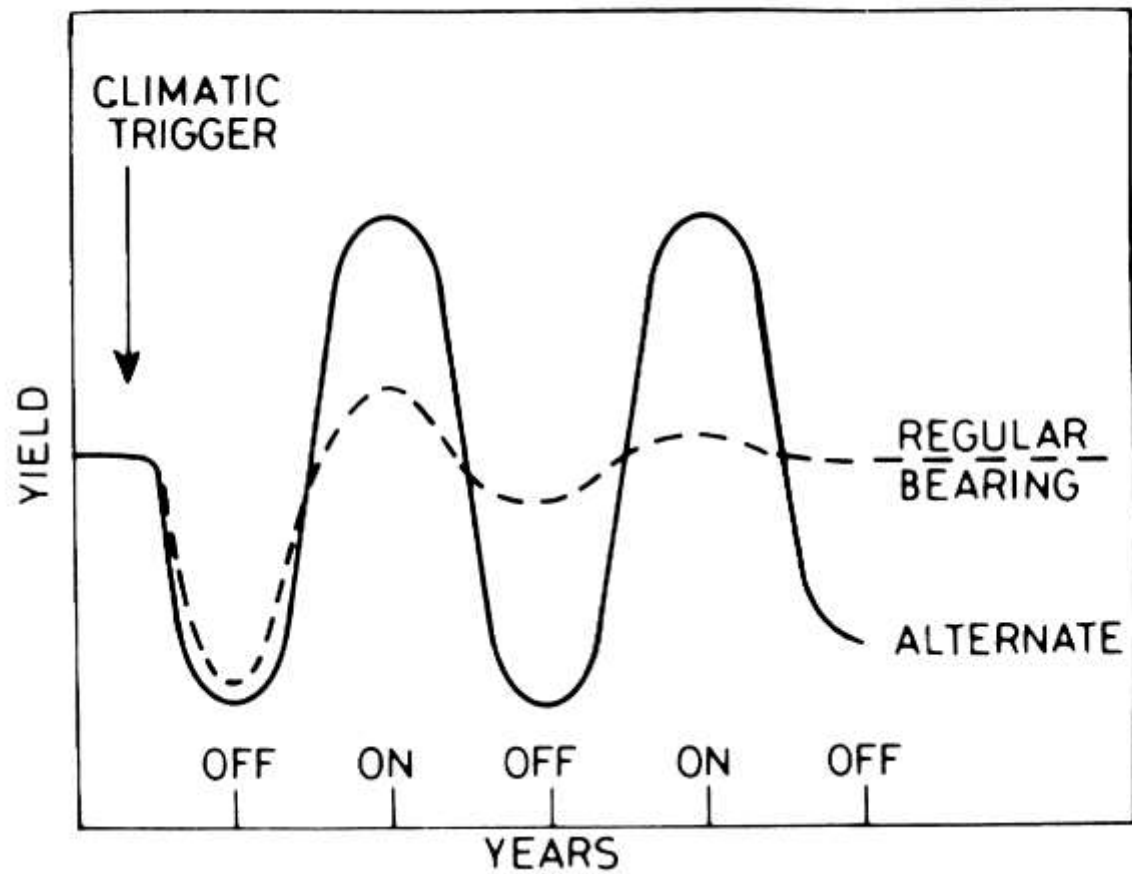
## Busting the myths

**Peter Hirst**

MID-ATLANTIC  
*fruit & vegetable convention*



## Biennial bearing



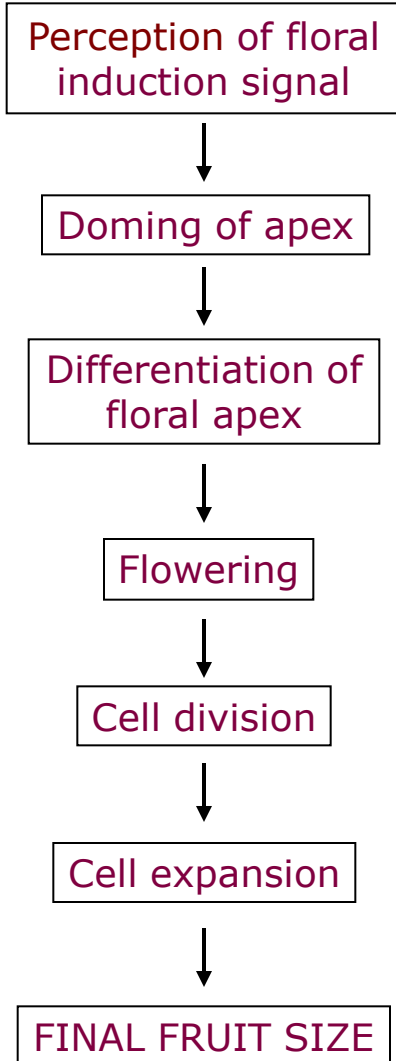




## Biennial Bearing

1. Negative impacts for orchard, warehouse, marketing. Both yield and fruit quality
2. Genotype dependent – many newer cultivars are biennial eg. Honeycrisp, Cameo, Fuji, Braeburn
3. Greater penalty of missing a crop with high cost orchard systems
4. Biennial bearing becoming a bigger challenge





???

June-Aug.

~ Aug. 10



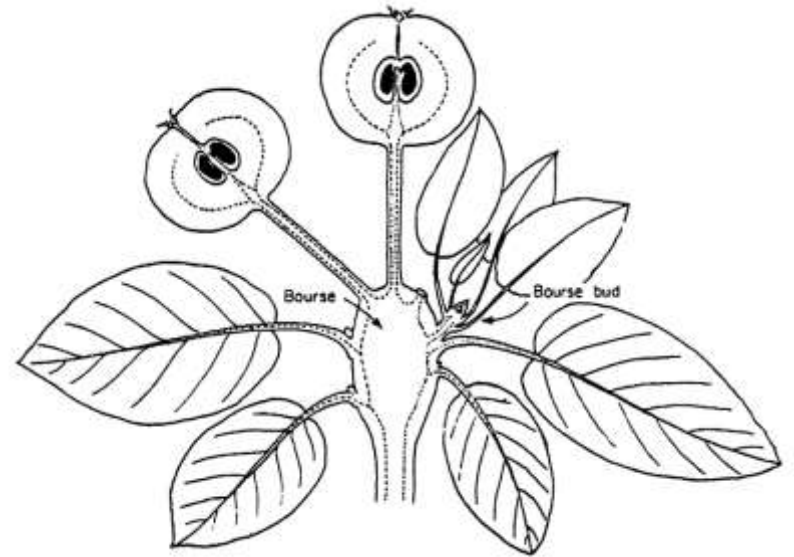
Apr. 20

Apr. 20 - May 8-30

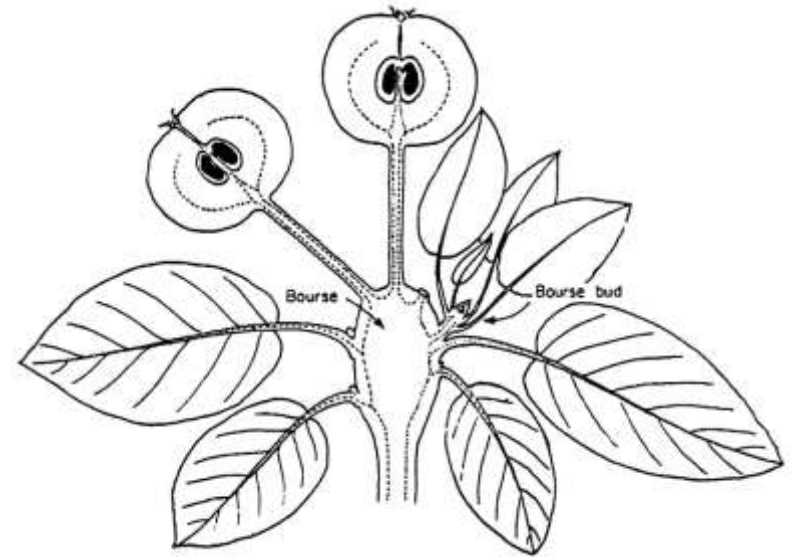
May 8-30 - harvest

Aug-Nov

# Bourse buds

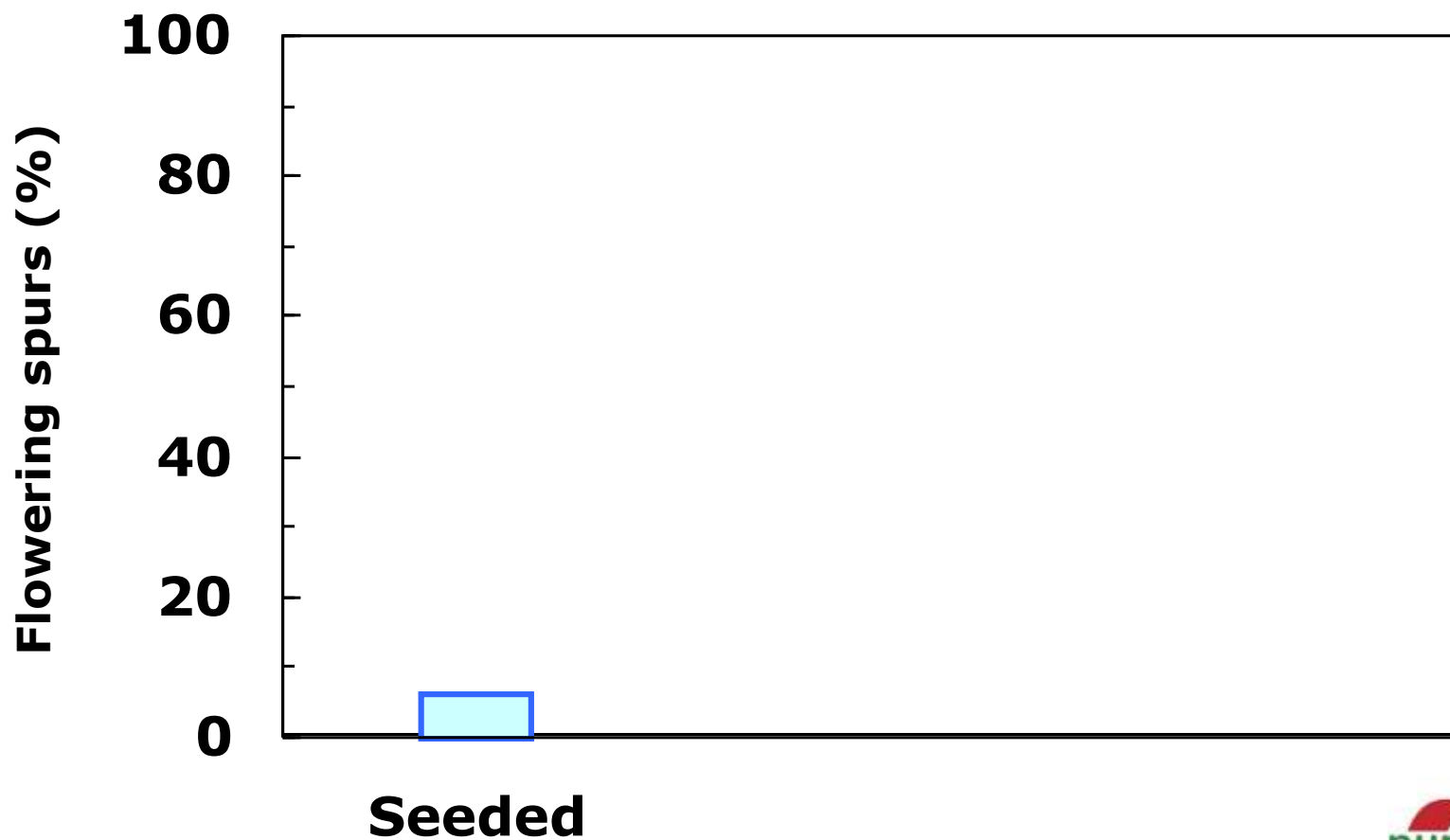


# Bourse buds



# Apple flowering

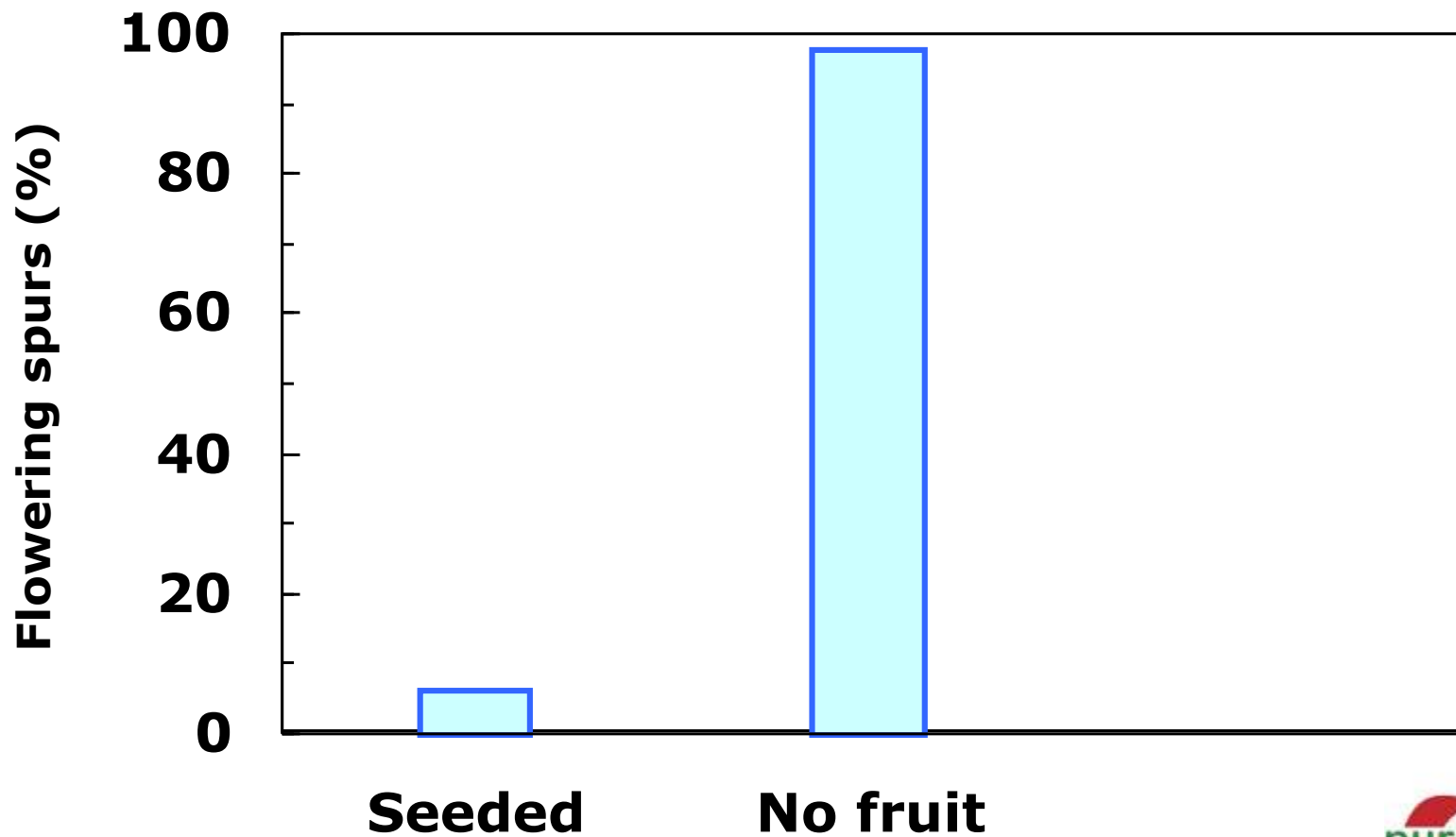
## Spencer Seedless





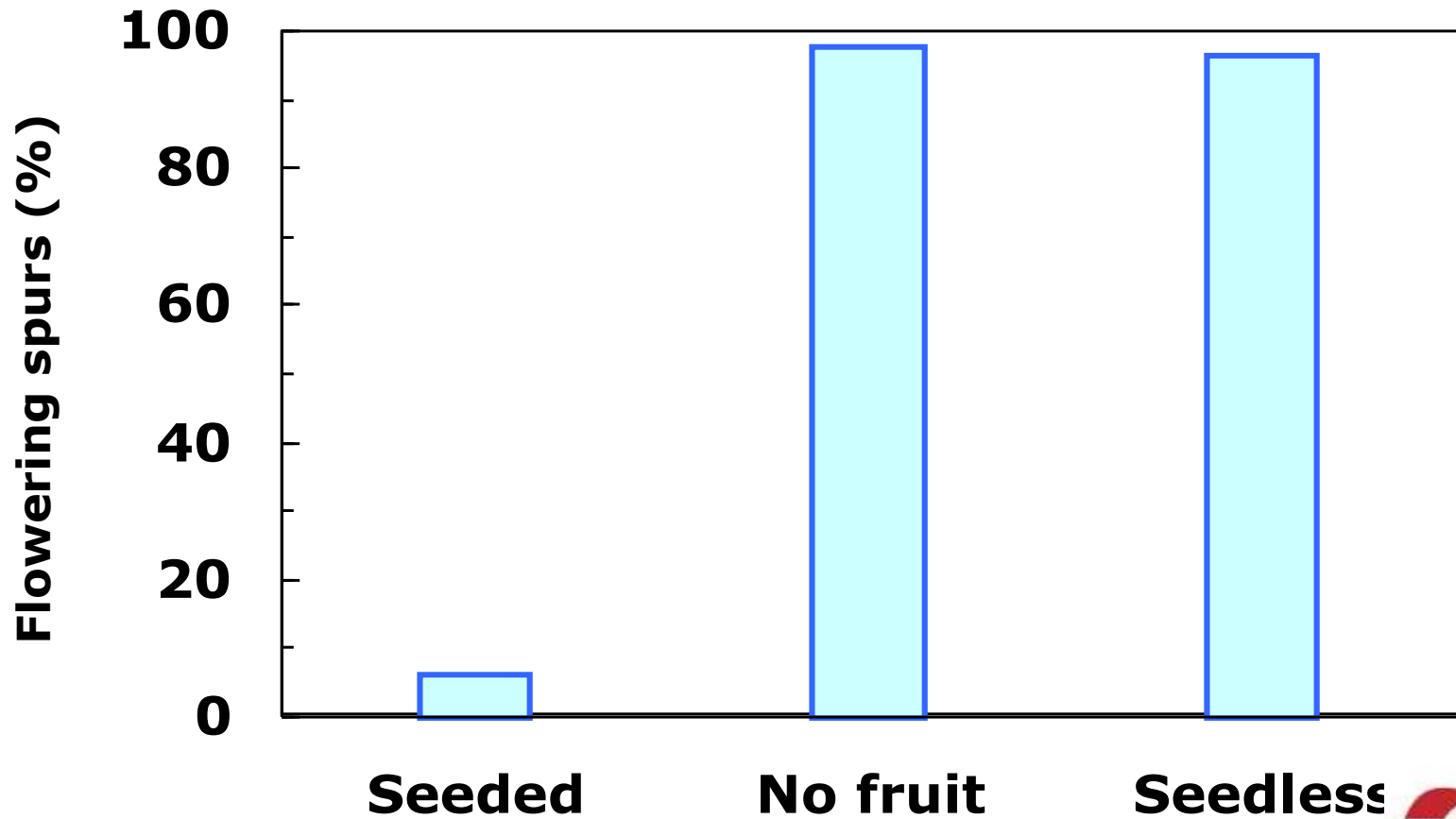
# Apple flowering

## Spencer Seedless



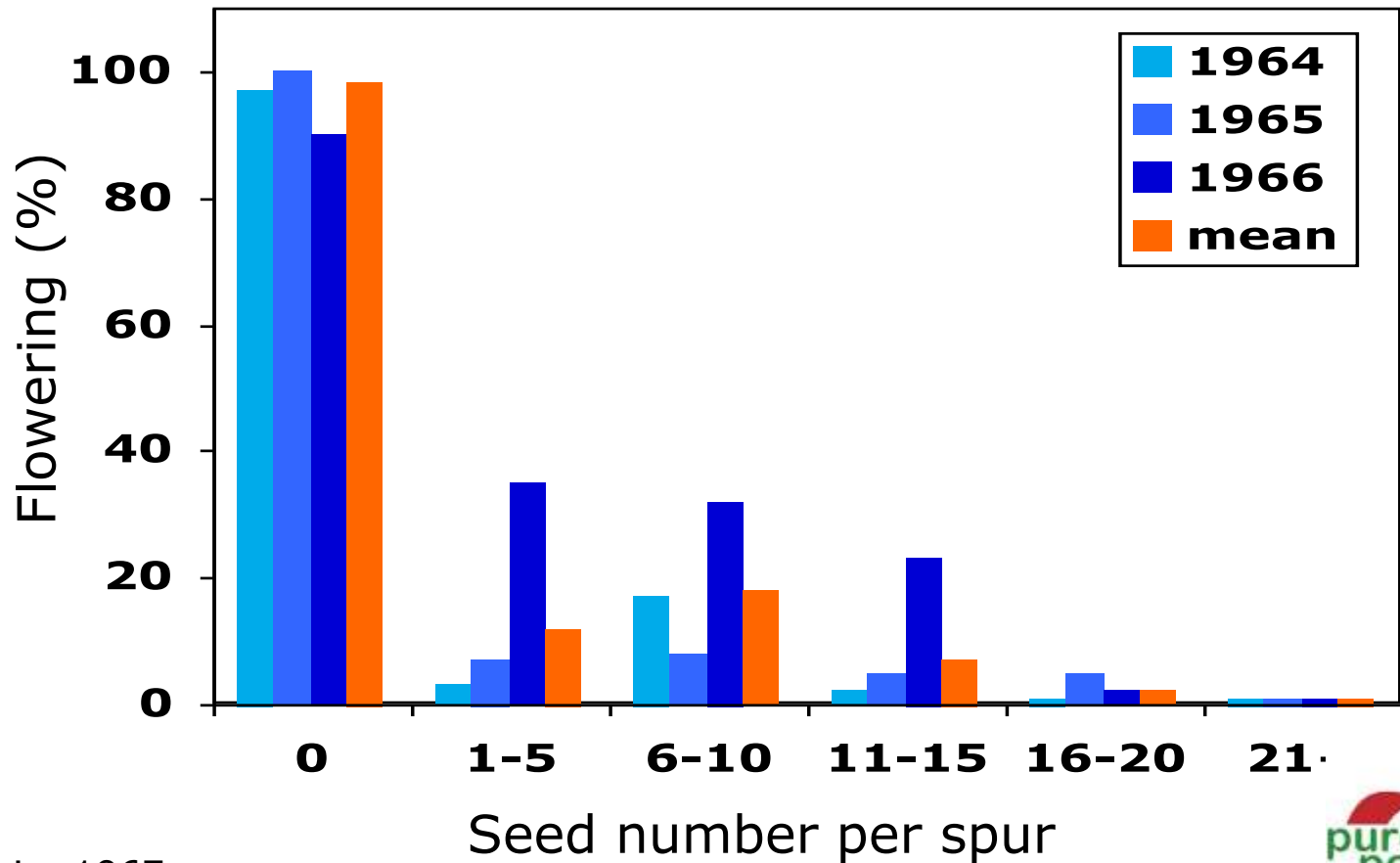
# Apple flowering

## Spencer Seedless



# Effect of seeds on return bloom

## Spencer Seedless





## What the text book says...

1. Presence of a fruit inhibits flower initiation
2. Resting spurs are important for return bloom
3. Thinning results in more resting spurs and increased return bloom
4. Earlier thinning results in increased return bloom



**BUT:**

The textbook is half right and half wrong

**BUT:**

The textbook is half right and half wrong

We don't know which half is which



## What the text book says...

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## Effects of fruiting

Does fruiting affect spur development?  
(are resting spurs necessary?)



vegetative



flowering but  
not fruiting



fruiting



Gala - regular bearing  
- small fruit size

Fuji - biennial bearing  
- larger fruit size



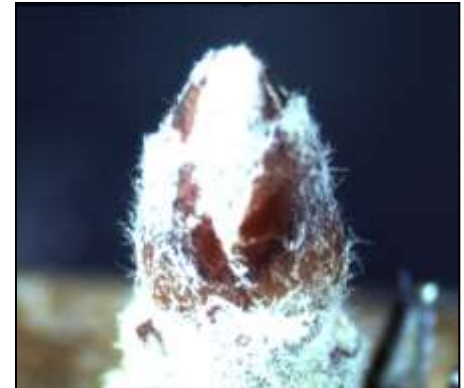


Buds collected throughout each season (2 years)

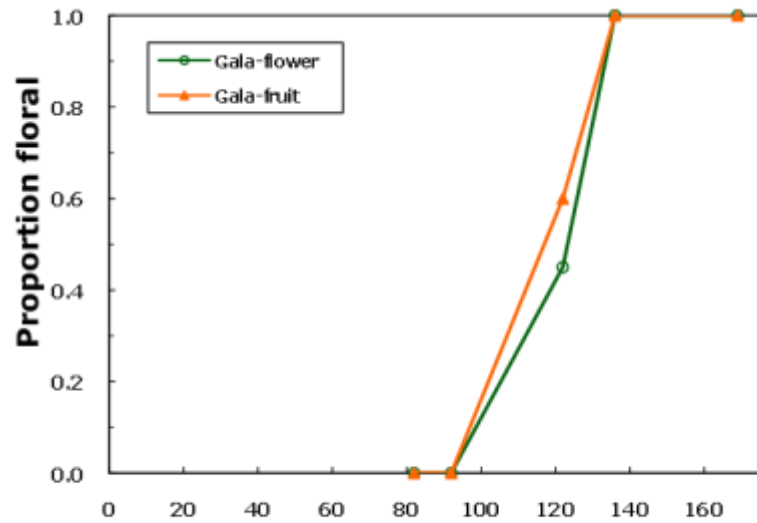
Dissected

Appendages counted

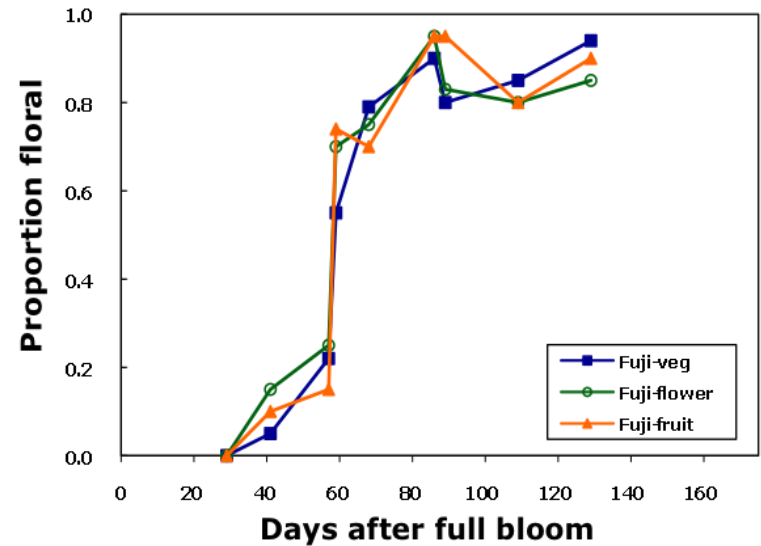
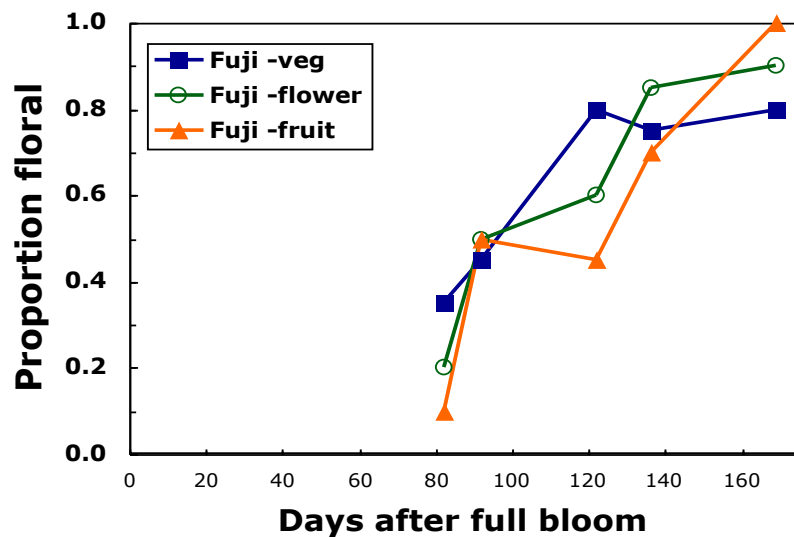
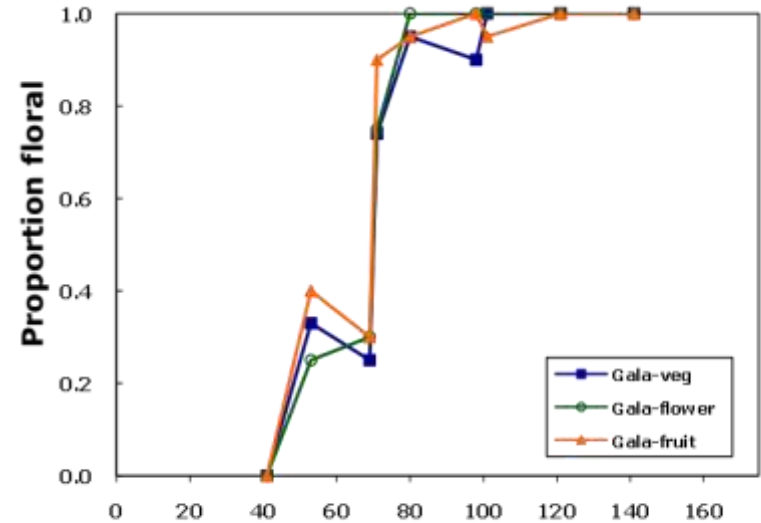
King flower diameter measured



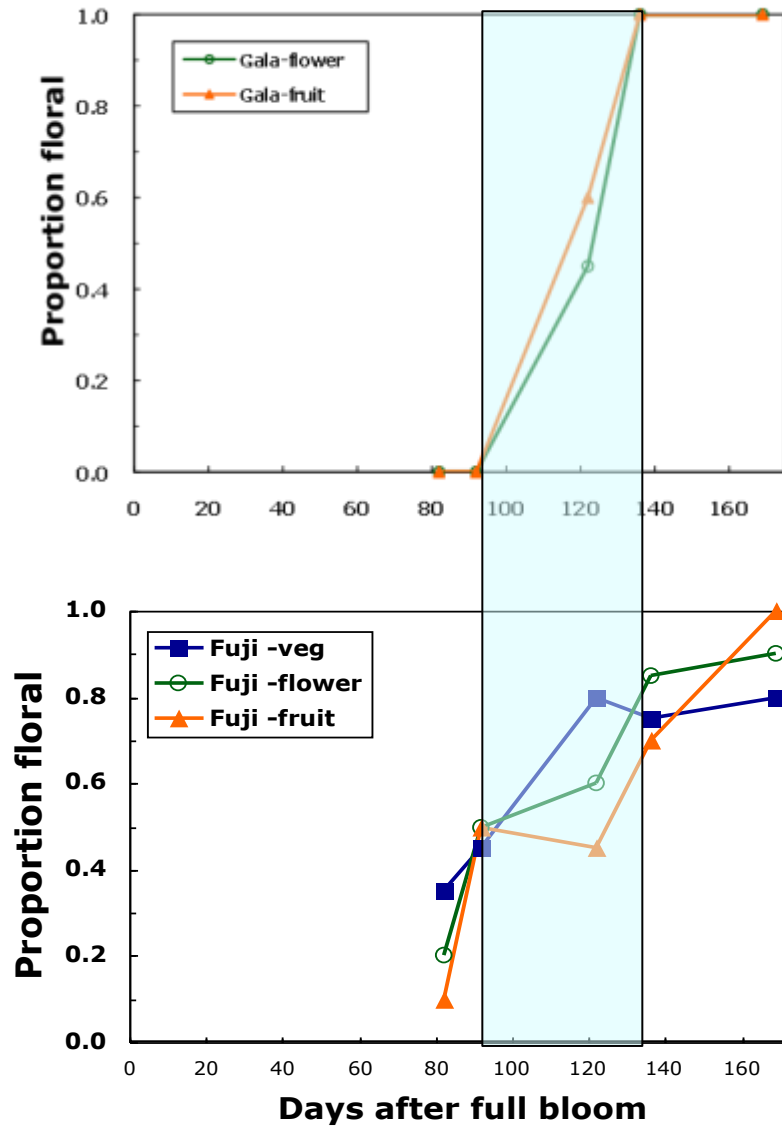
**2006**



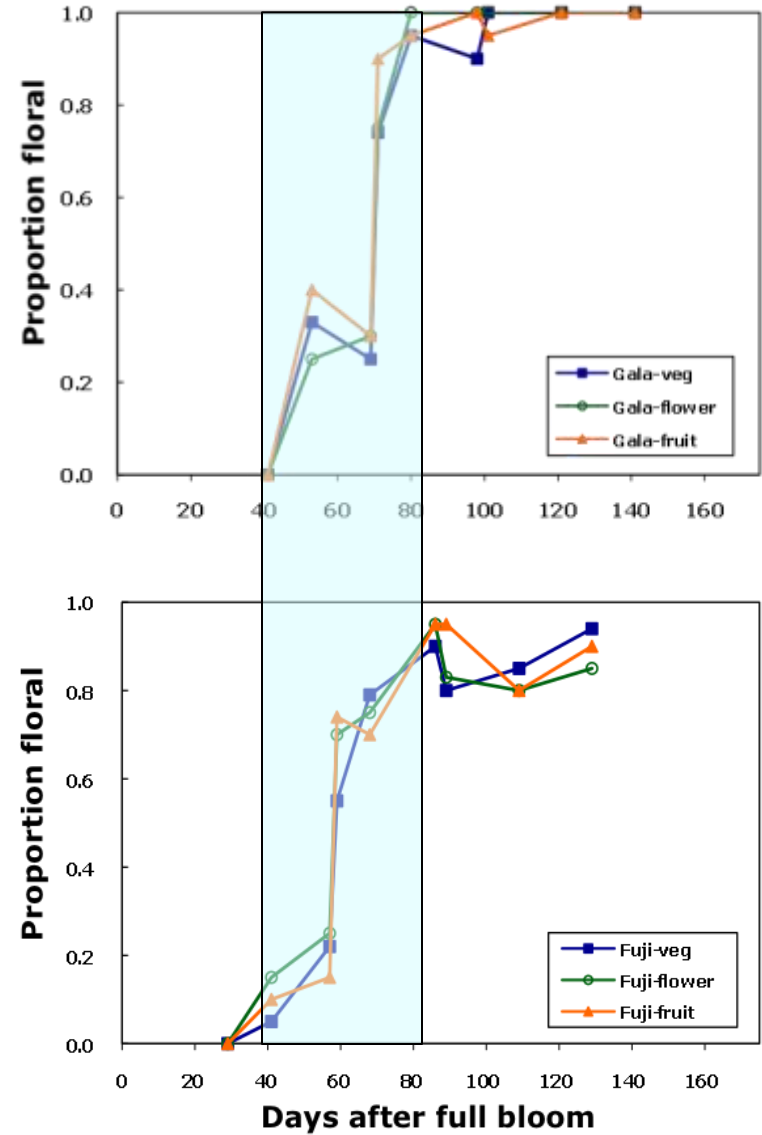
**2007**



**2006**



**2007**





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- 2. Resting spurs are important for return bloom**
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## Resting spurs

On medium-high vigor spurs, the localized presence of fruit:

- Had no effect on return bloom
- Had no effect on subsequent spur quality

Improving overall tree spur quality may reduce biennial bearing.



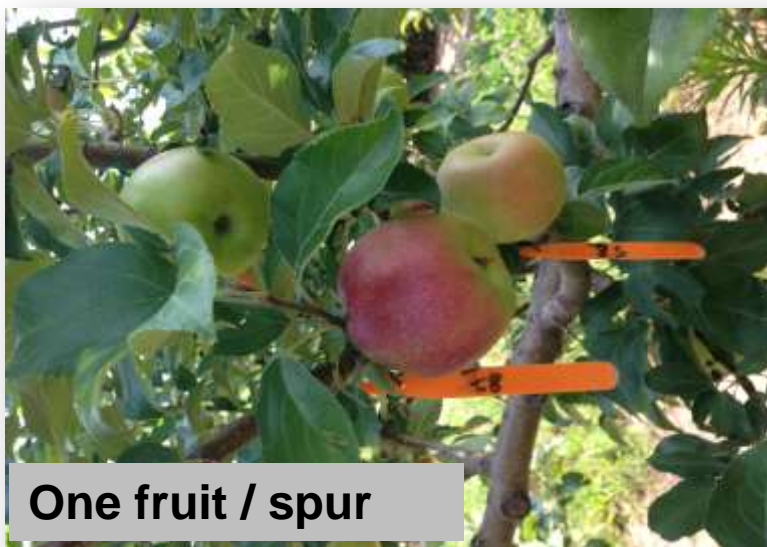
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# Spur or whole tree?

- 42 trees, 7 treatments
- Fruiting spur number from 15 to 120
- One or two fruits per spur
- Fruit number/tree ranged from 30 - 240
- Hand thinning at petal fall



One fruit / spur



Two fruits / spur

# Spur or whole tree?

Treatments	# Fruiting spurs/Tree	# Fruits/Spur	# Fruits / Tree
1	15	2	30
2	30	1	30
3	30	2	60
4	60	1	60
5	60	2	120
6	120	1	120
7	120	2	240



# Spur or whole tree?

## Measurements:

- Fruit weight
- Fruit number
- Seed number
- Bourse length
- Bud diameter
- Flower formation
- CRD; regression and contrast analysis, **R**

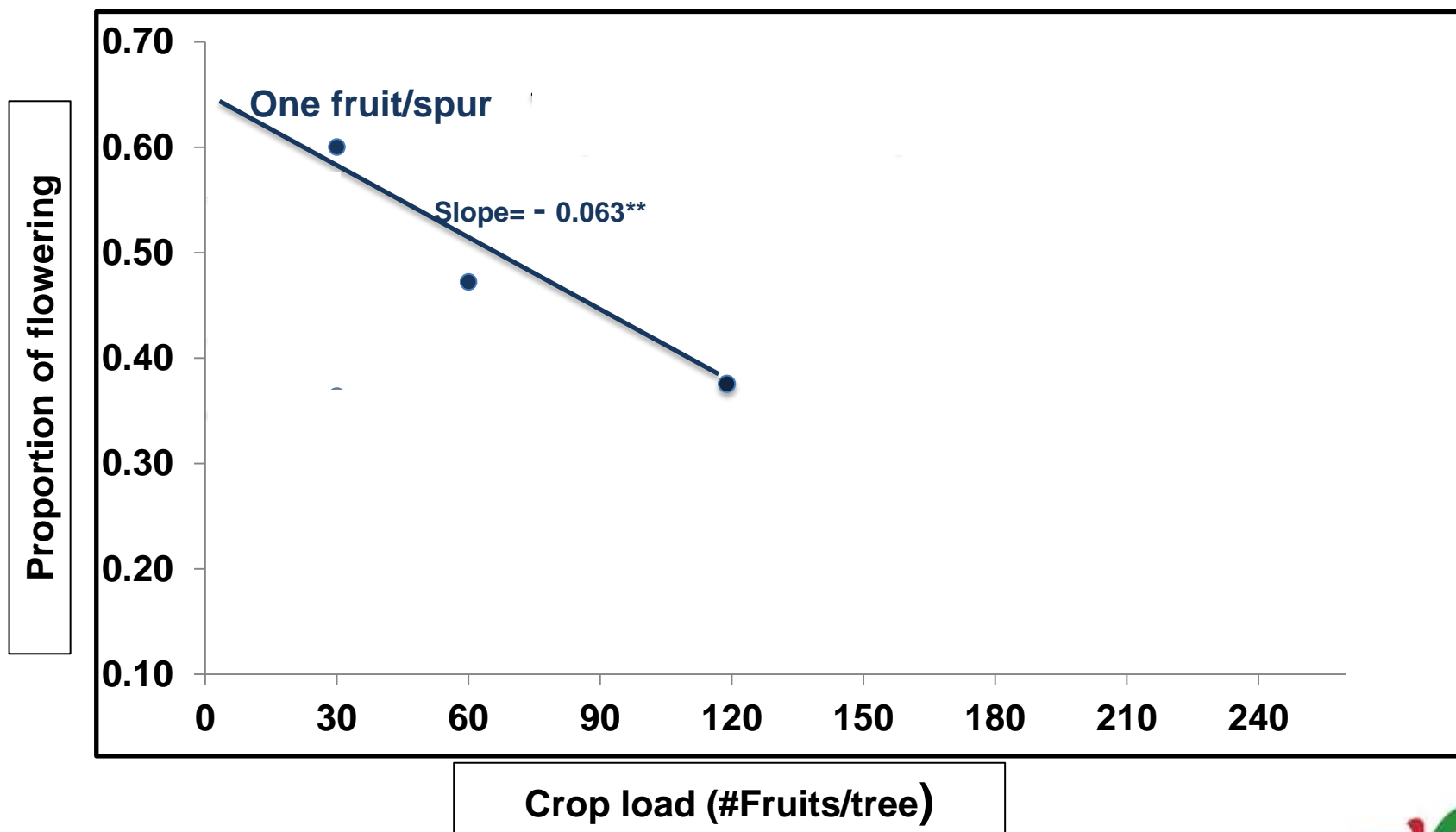


# Results

**Effect of fruit number per spur and total crop load on return bloom**

<b>Treatments</b>	<b># Fruits / Tree</b>	<b># Fruiting Spurs/Tree</b>	<b># Fruits/Spur</b>	<b>Proportion of flowering</b>
1	30	15	2	0.35
2	30	30	1	0.60
3	60	30	2	0.34
4	60	60	1	0.47
5	120	60	2	0.37
6	120	120	1	0.34
7	240	120	2	0.37

# Spur or whole tree?



# Spur or whole tree?

## Regression analysis - effects on return bloom

Coefficients	Estimate	Pr > F
(Intercept)		0.228
Fruit number / spur		0.207
Fruit number / tree		0.53
Total fruit weight / spur		0.337
Total seed number / spur		0.520
Total bourse number		0.774
Average bourse length	-	0.00062***
Average bud diameter	+	0.0332*

# Conclusions

- Local spur effects stronger at low crop loads than at high crop loads
- With two fruits per spur flowering is inhibited by local spur effect even at low crop loads
- High crop load decreases flowering when we have one fruit per spur
- Honeycrisp needs to be thinned to one fruit per spur
- In Honeycrisp, probability of return bloom decreases as bourse length increases



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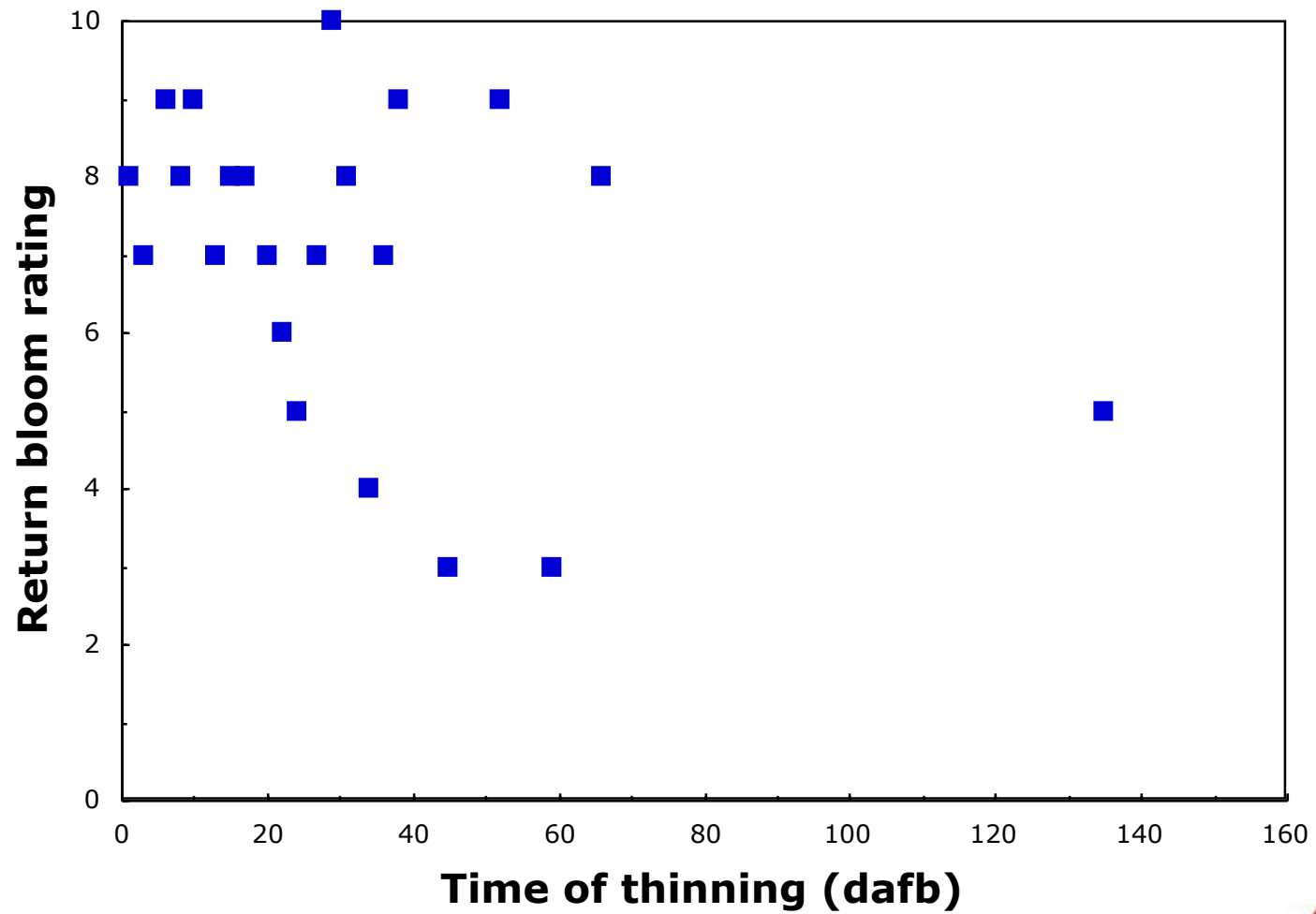
## McIntosh - full bloom



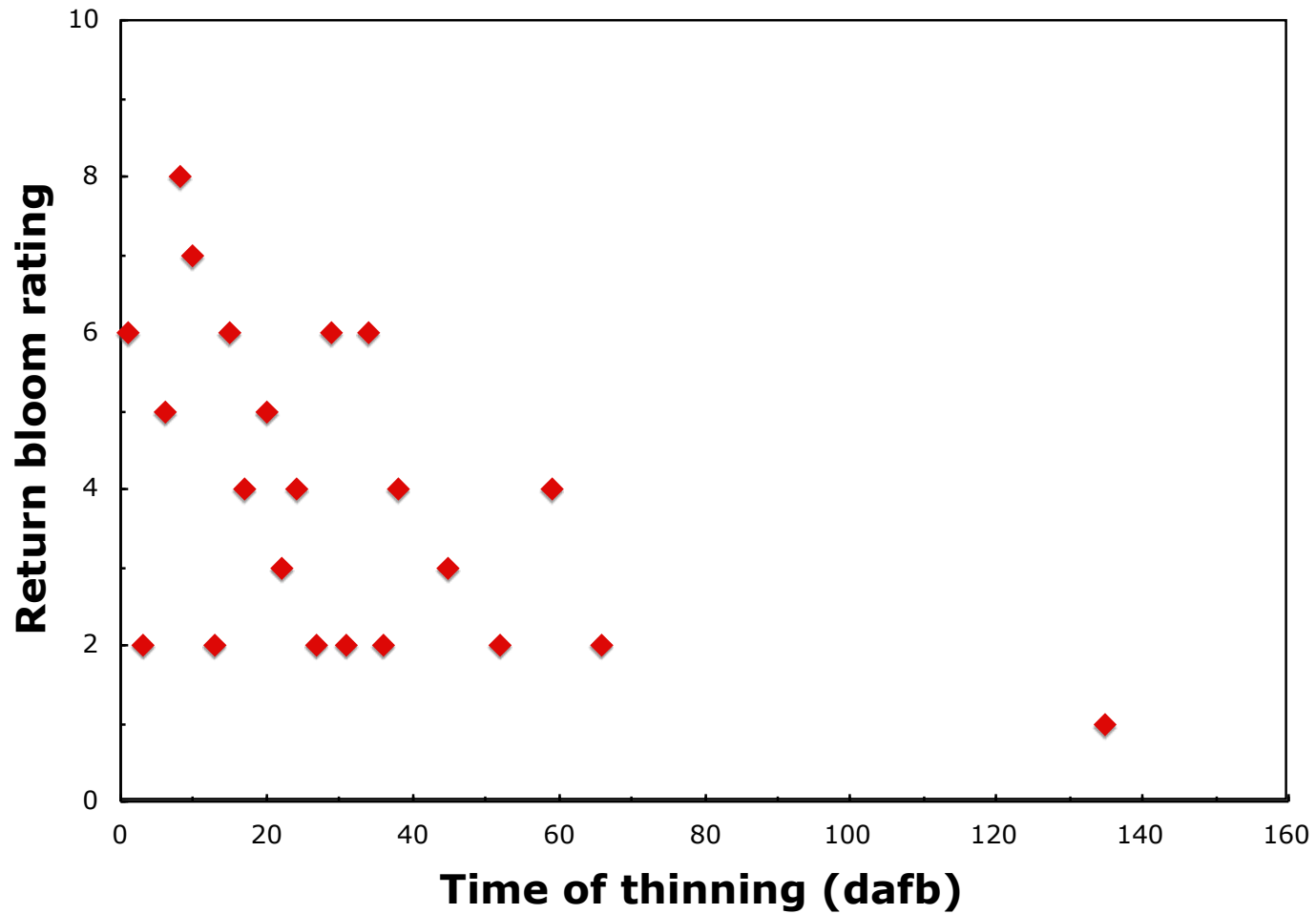
## McIntosh - full bloom



# Gala



# Fuji





## **Time of thinning summary**

Unthinned trees had poor return bloom

Better return bloom with early thinning

**BUT**

wide variation

(more to this story than just thinning)

# Busting the myths

## True or false?

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# Busting the myths

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# Busting the myths

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# Busting the myths

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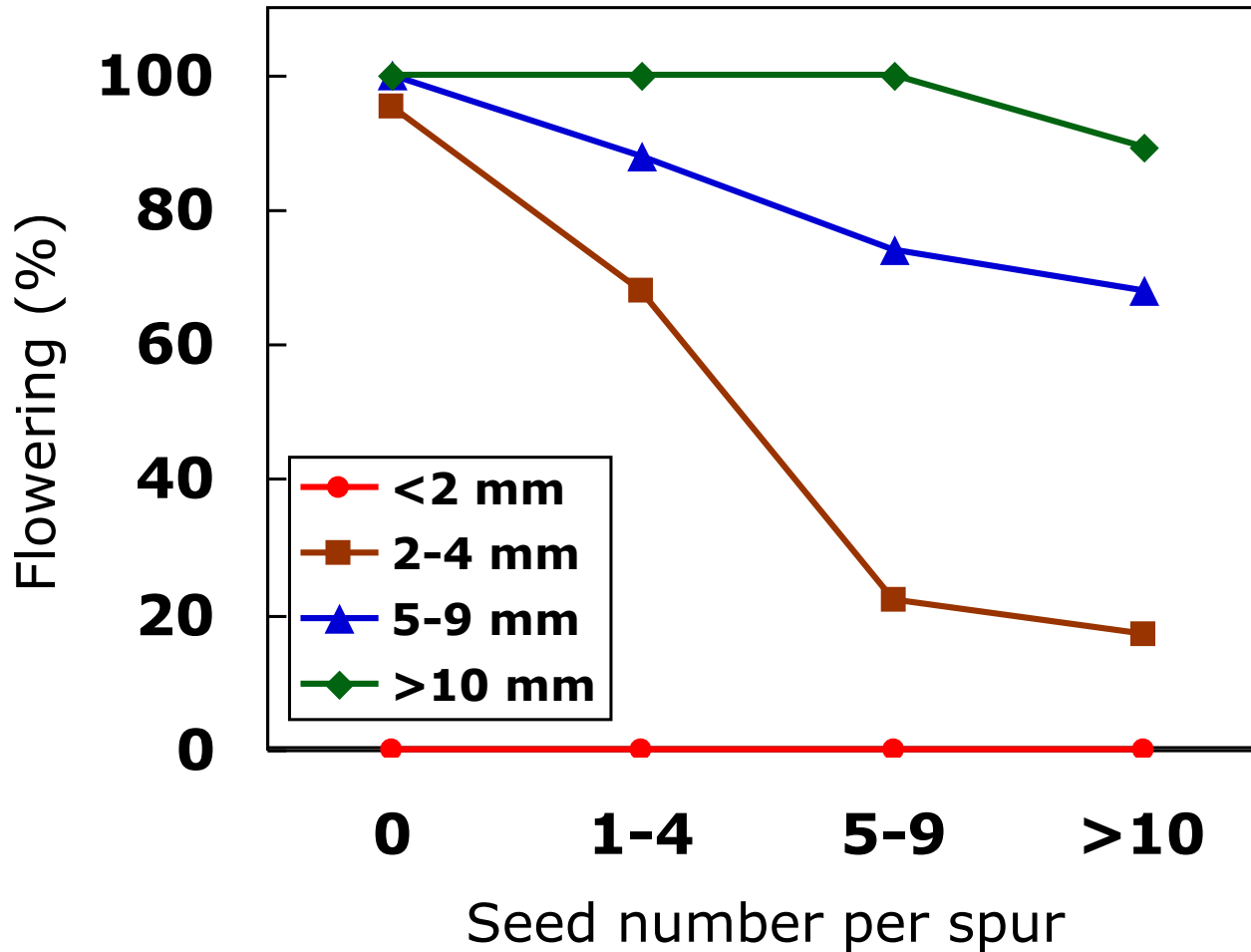


## So where do we go from here?

1. Flowering is complicated - simplistic explanations don't cut it
2. No doubt that thinning is still important, just not the whole story
3. So what IS the rest of the story – what do we do NOW?



## Effect of bourse length on return bloom Spencer Seedless, 1996



# Bourse shoots Gala and Honeycrisp:

- 500 spurs tagged on Gala and HC
- Half de-fruited
- The remainder thinned to a single flower, allowed to set a single fruit



# Bourse shoots Gala and Honeycrisp:

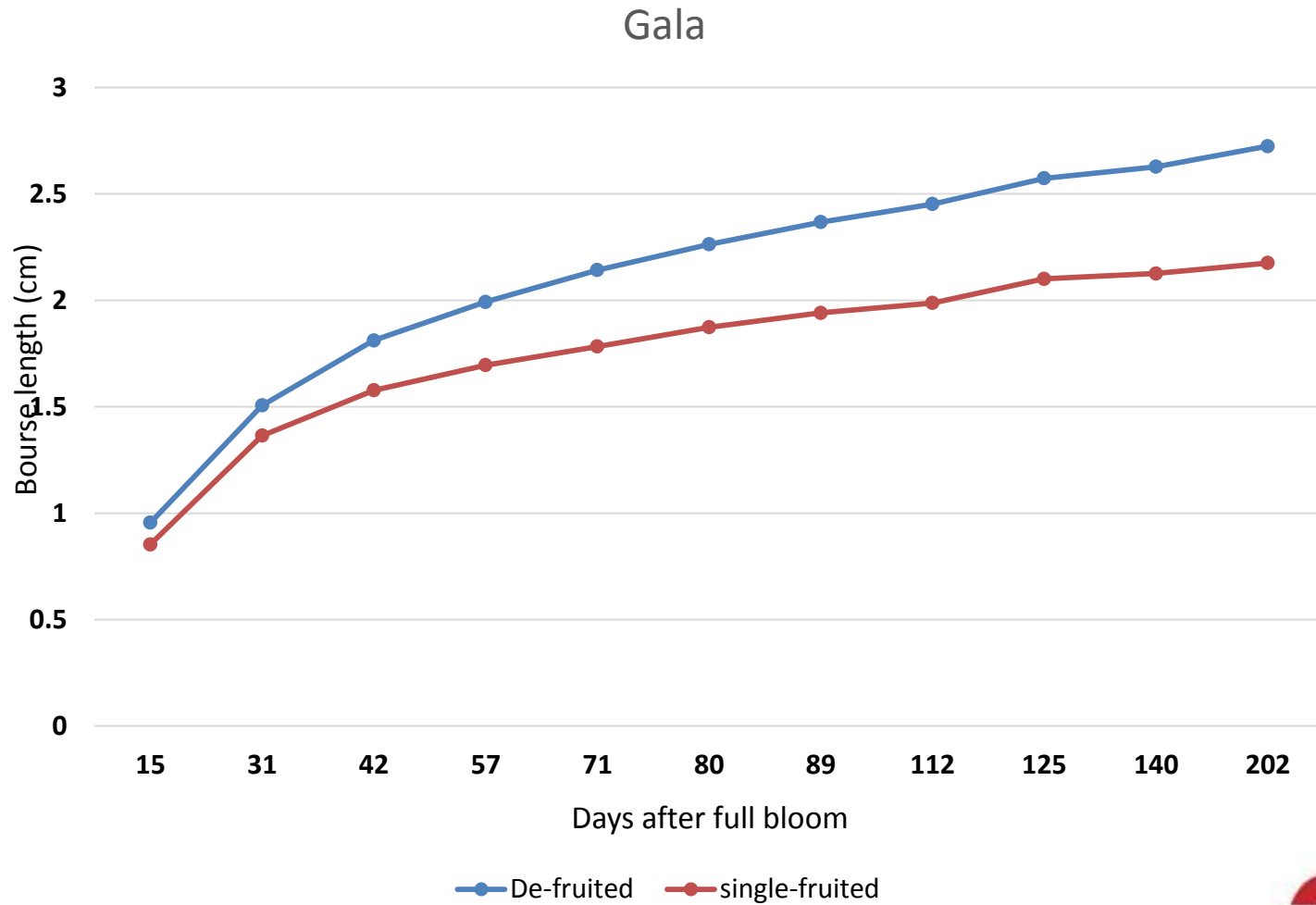
- 1 or 2 bourses
- Bourse shoots  
measured every 2  
weeks
- Time of terminal bud  
set
- Fruit characteristics



- After growth had stopped, all bourses were collected from the field
- Last bourse measurement was done in the lab
- All buds were dissected and their return bloom recorded

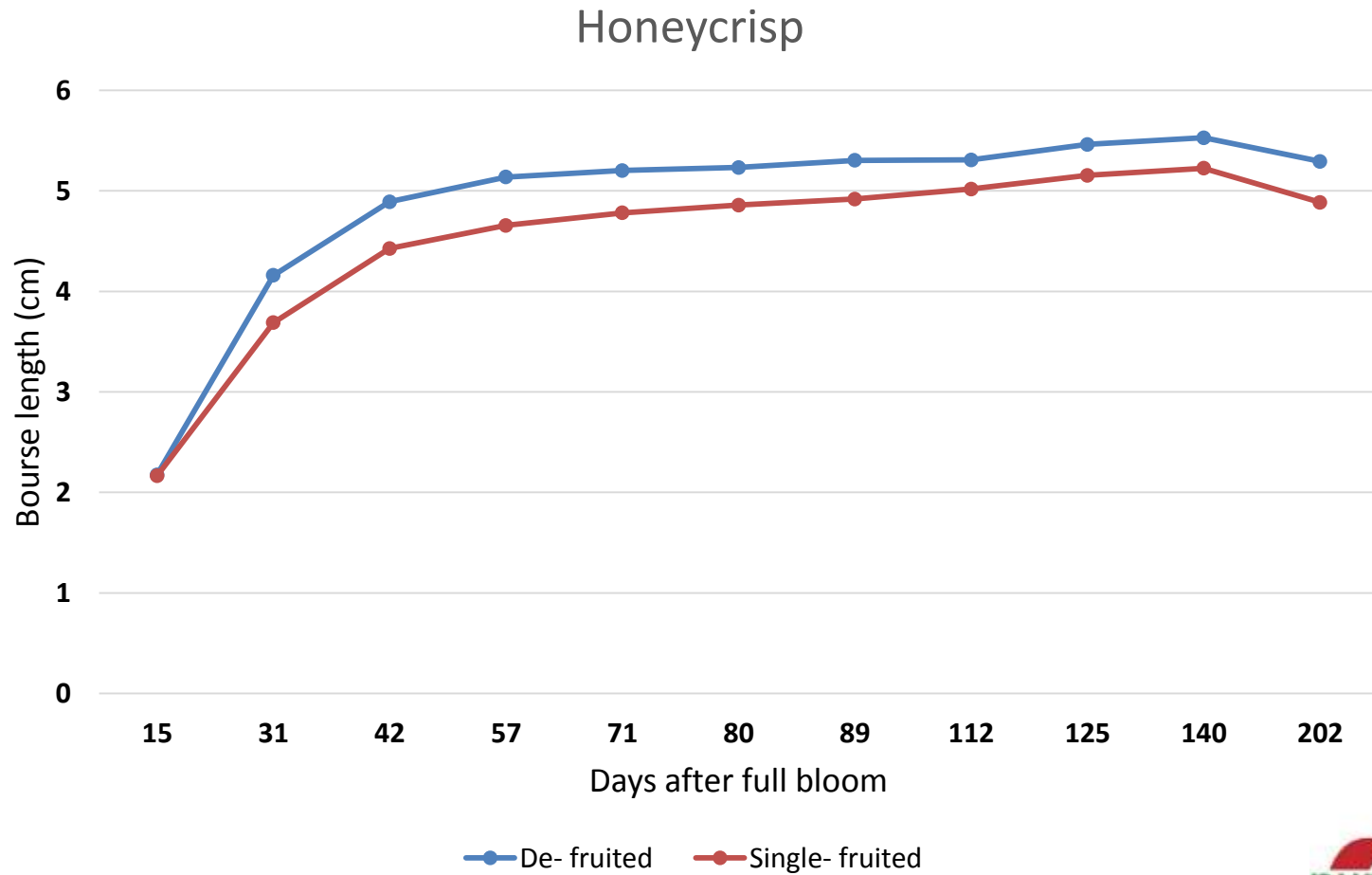


# Bourse growth



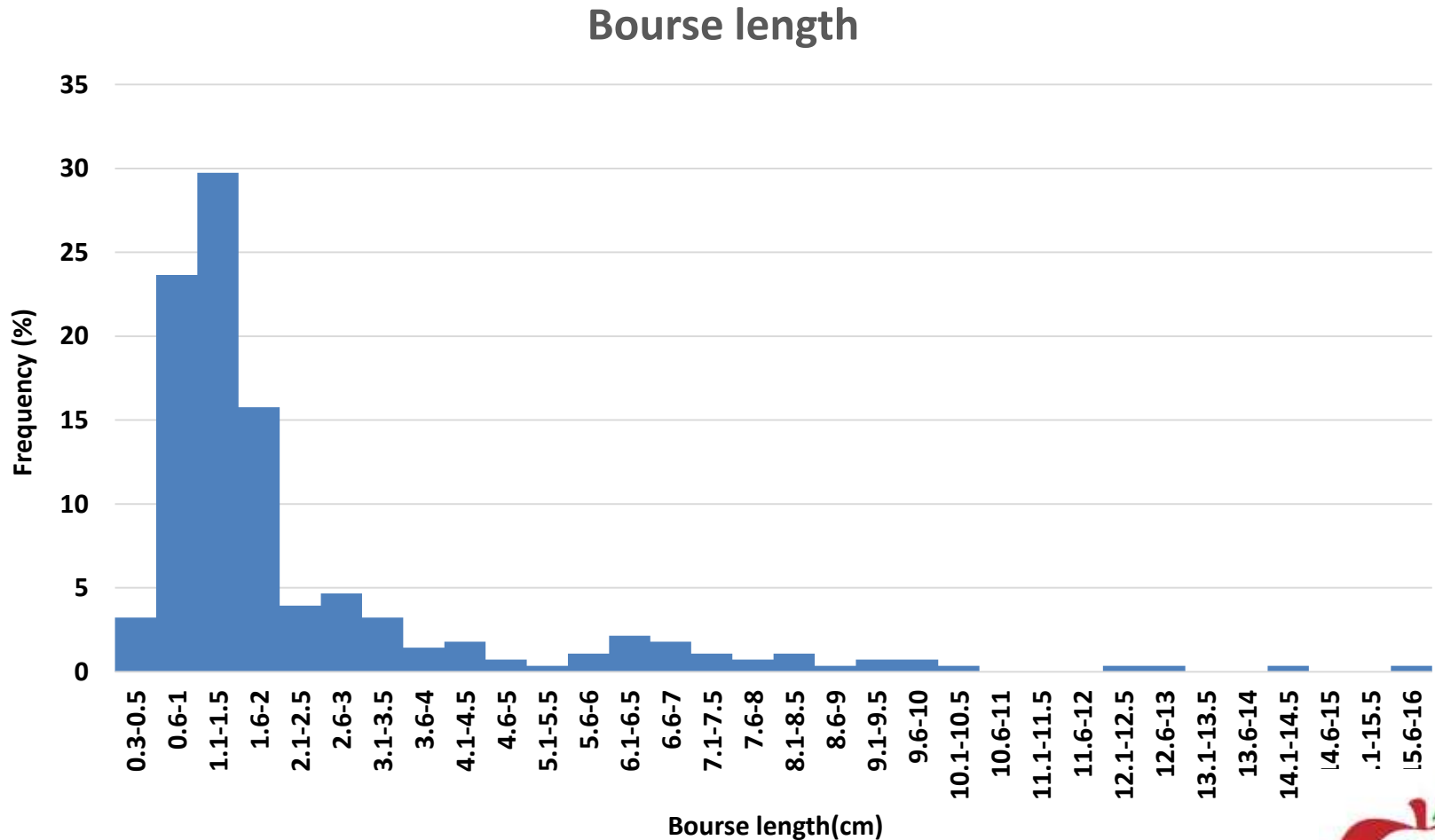


# Bourse growth



# Gala

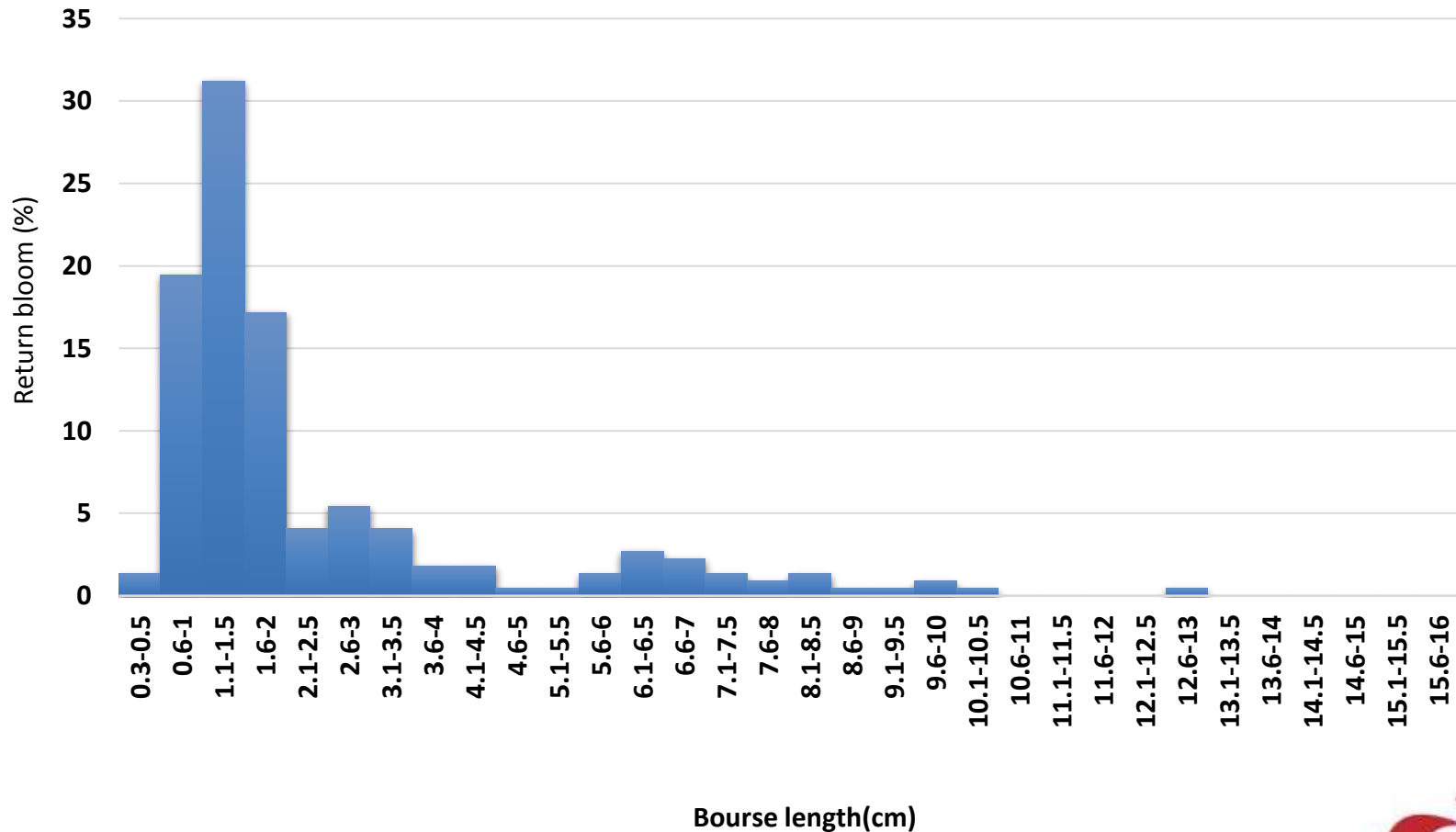
## (All bourses, both treatments)



# Gala

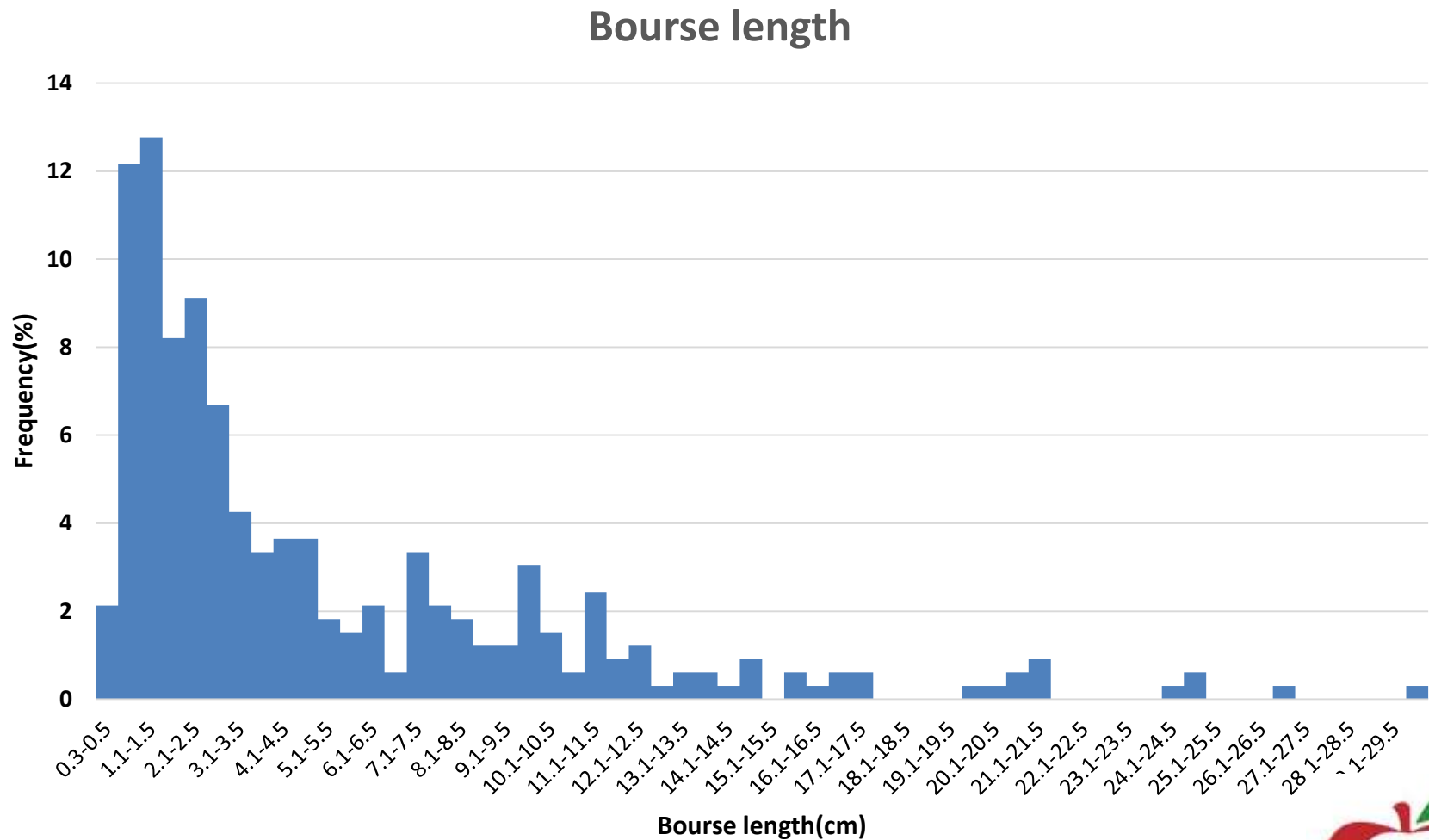
## (All bourses, both treatments)

Return bloom



# Honeycrisp

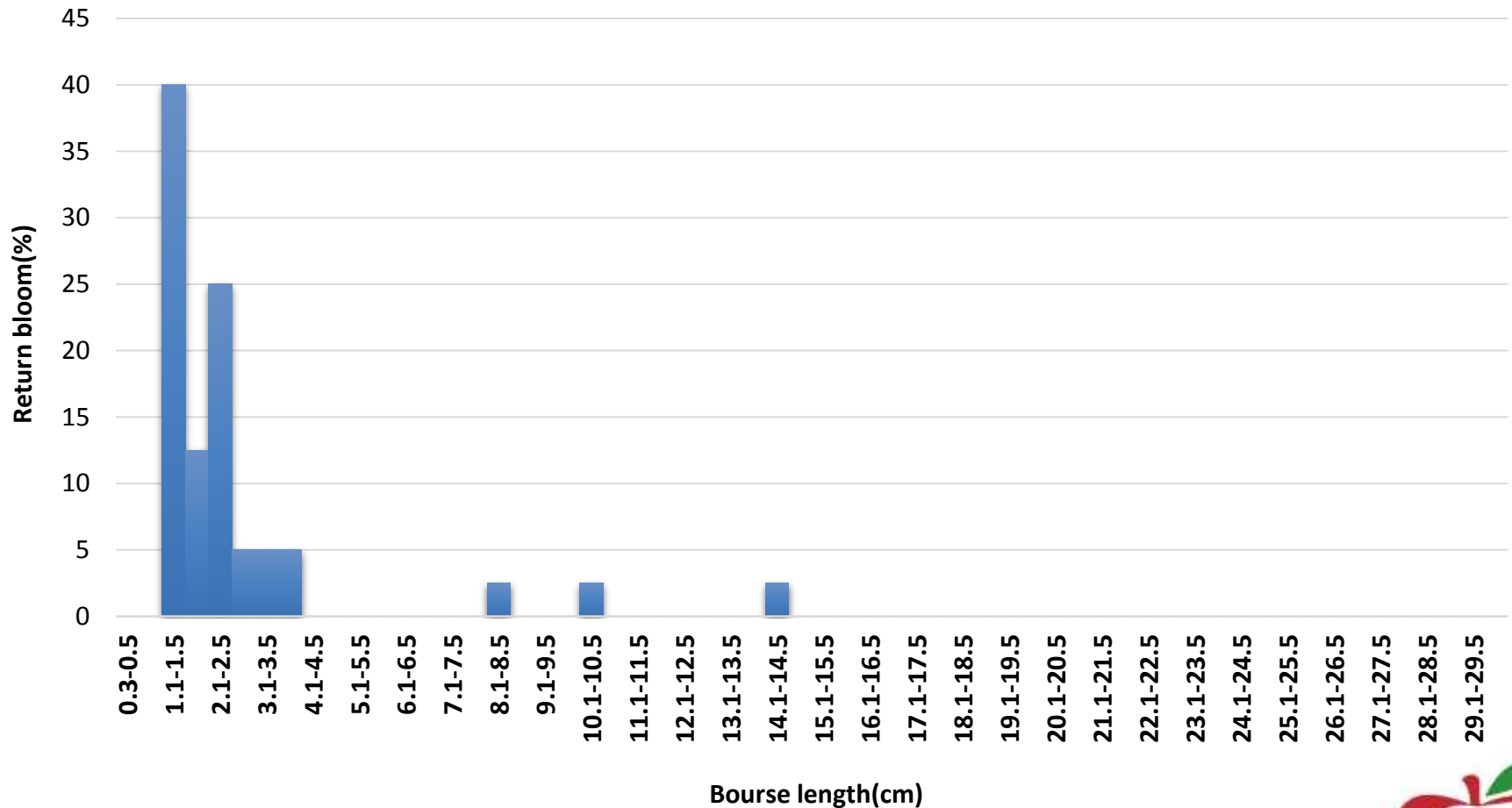
## (All bourses, both treatment)



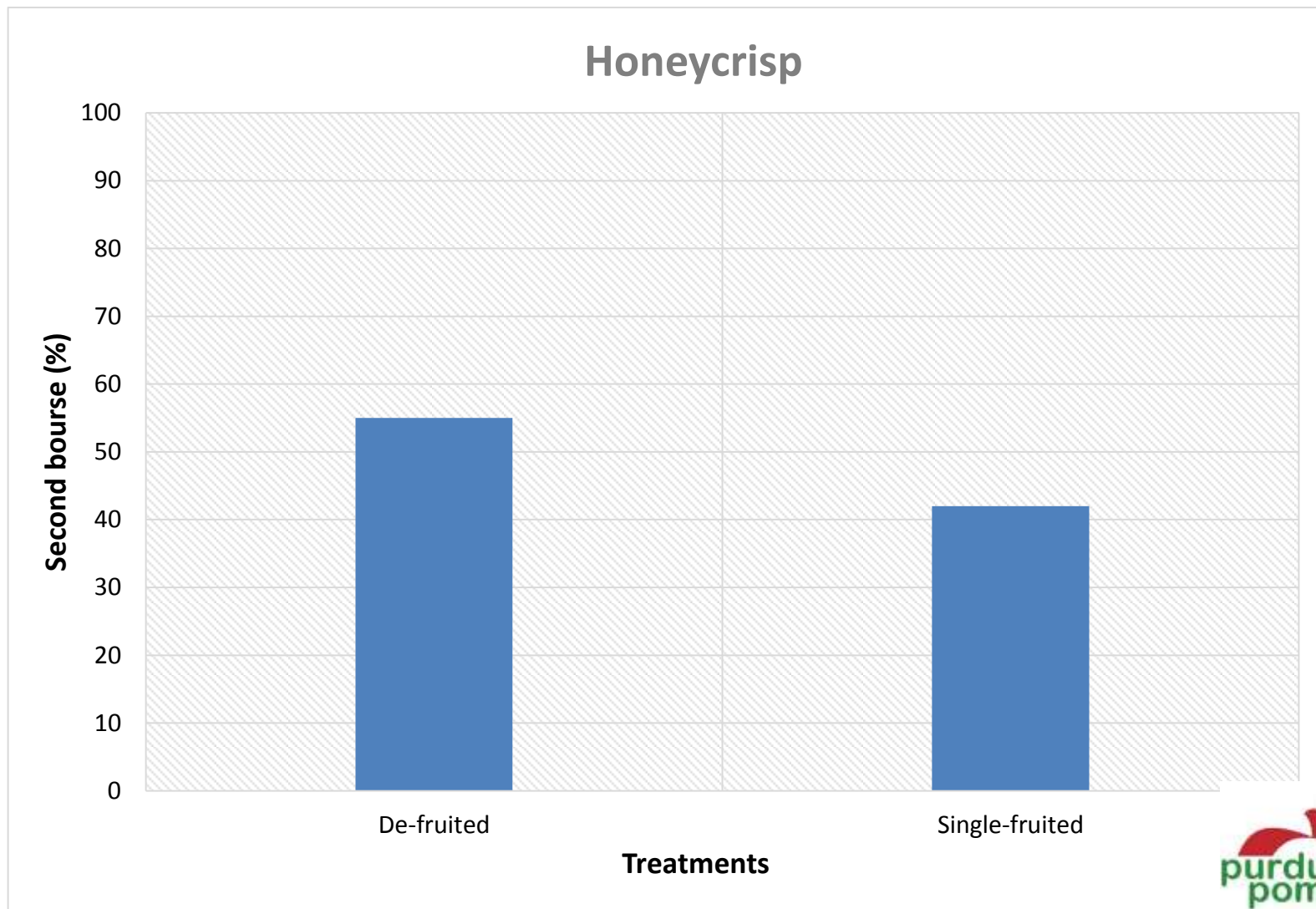
# Honeycrisp

## (All bourses, both treatment)

Return bloom

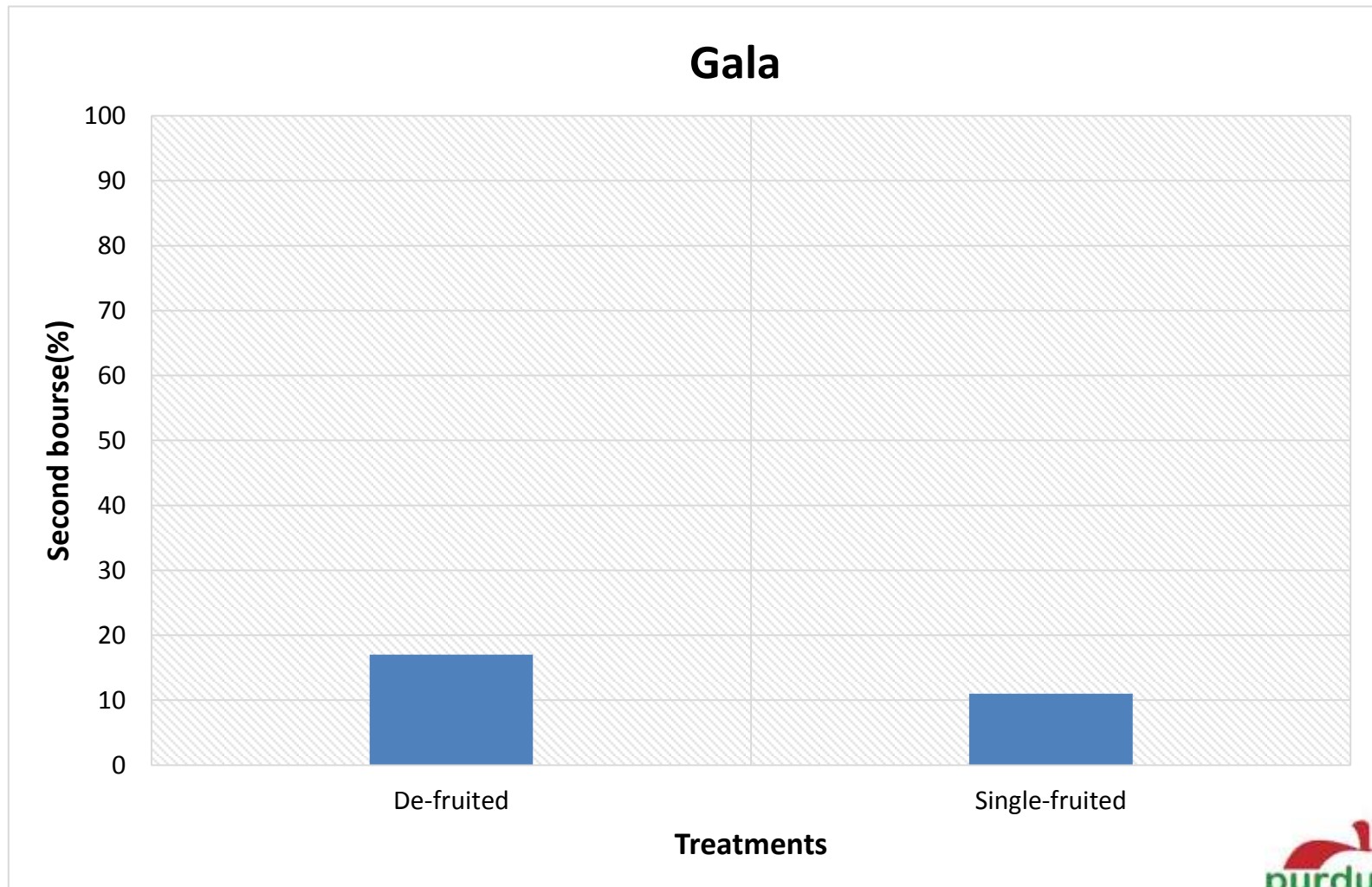


# Chance of second bourse

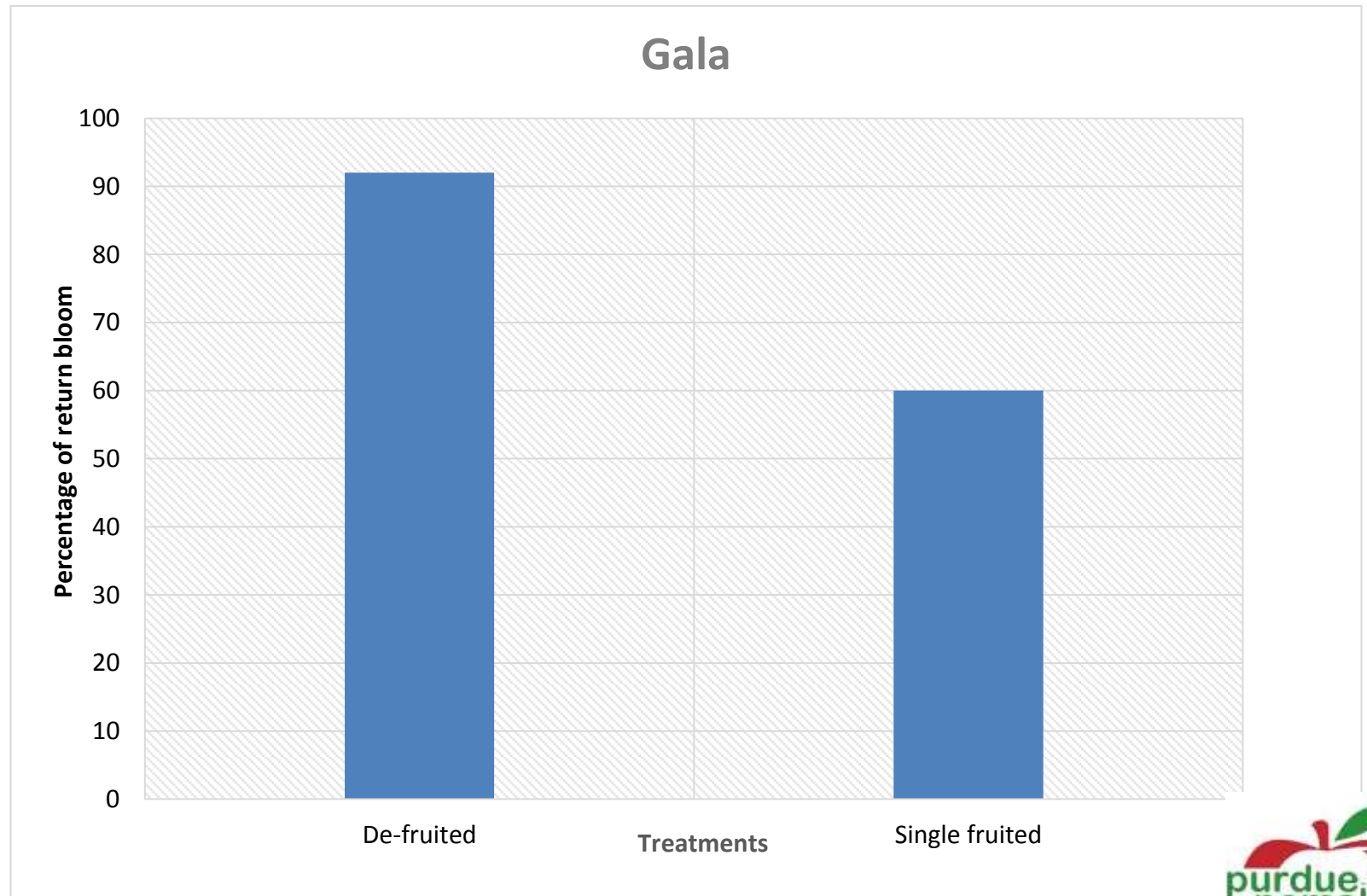




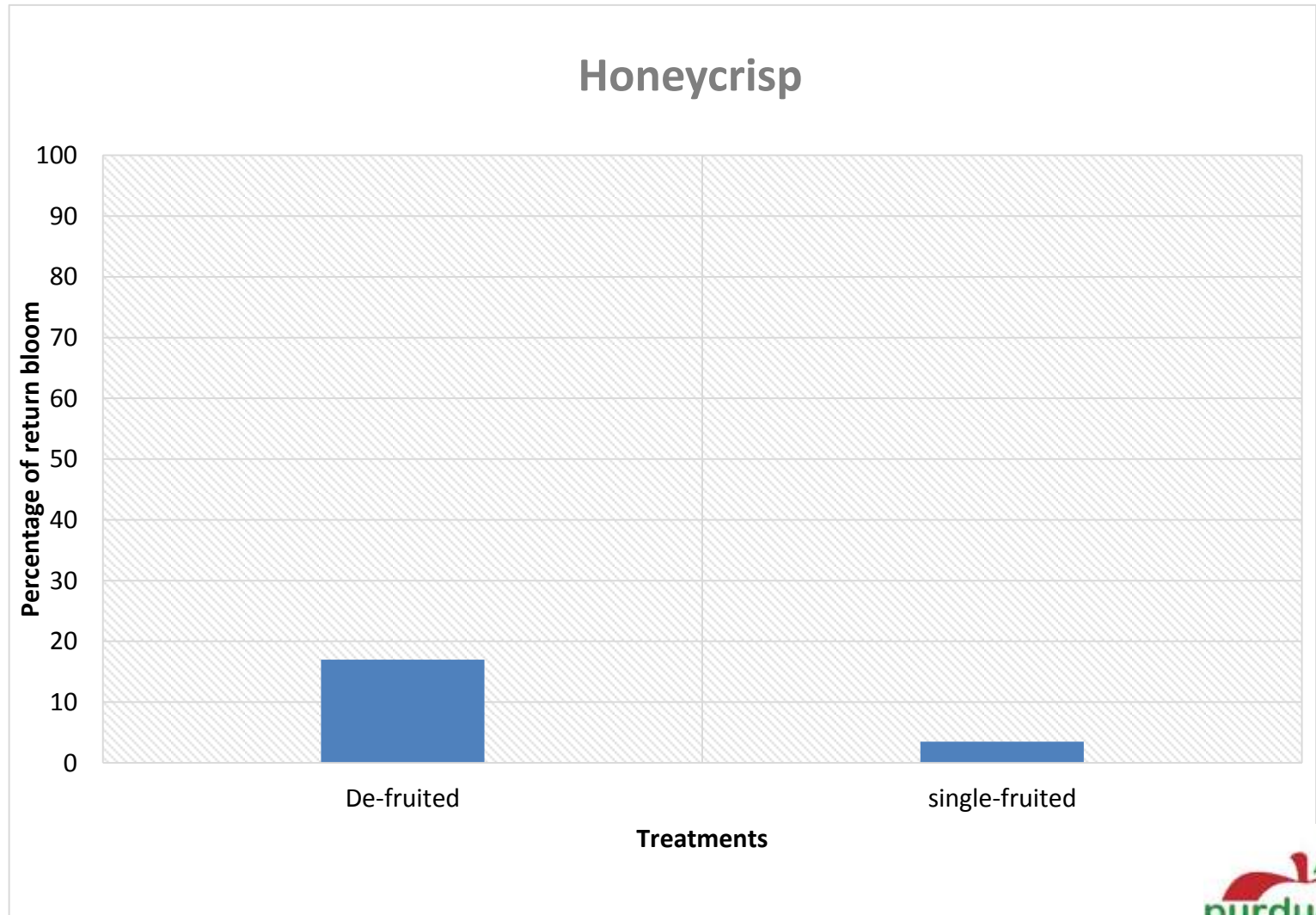
# Chance of second bourse



# Fruit vs. Return bloom



# Fruit vs. Return bloom



# Single fruited vs. de-fruited

Fruit does not have any effect on:

- Bourse length
- Time of terminal bud set

While it has affected:

- Return bloom



# Honeycrisp vs. Gala

Honeycrisp (biennial) and Gala (annual) are different in many aspects including:

- Bourse length
- Return bloom
- Time of terminal bud set
- Chance of having second bourse

Much more for us to learn about flowering on bourses

# What can a grower do NOW?

- Manage growth – avoid excessive vigor
- Attention to thinning – moderate crop load
- Try to thin to singles
- Open canopy, strong spurs





## Thanks to:

Jacob Franzen  
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