

THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES



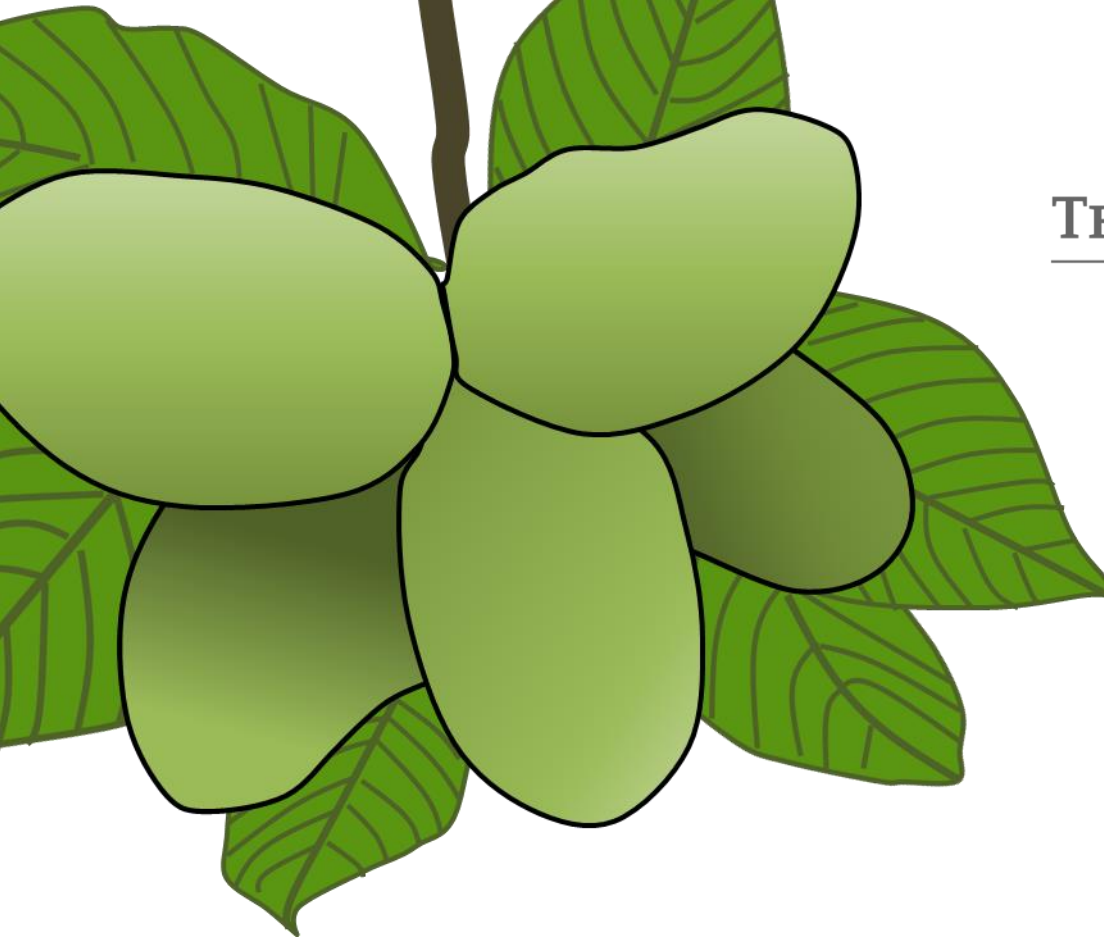
Ohio Department
of Agriculture



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Perfecting pawpaw production in Ohio

Quantity and quality



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Acknowledgements

Funding, helpers (Thom, etc. + UGs



Overview

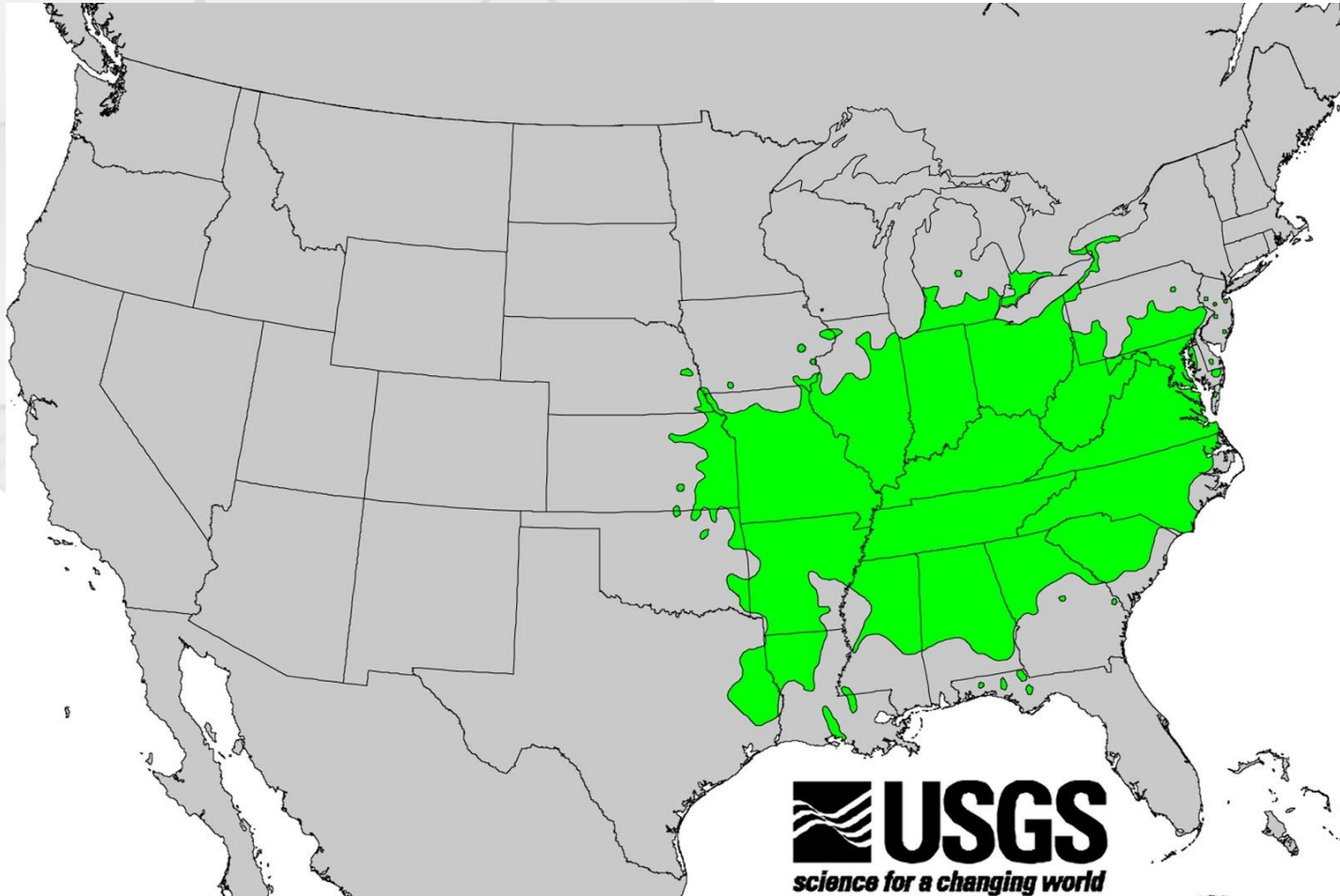
Woodland production

- Yield
- Economic returns
- Stand management

Orchard production

- Establishment
- Yield
- Fruit quality
- Economic returns

Introduction







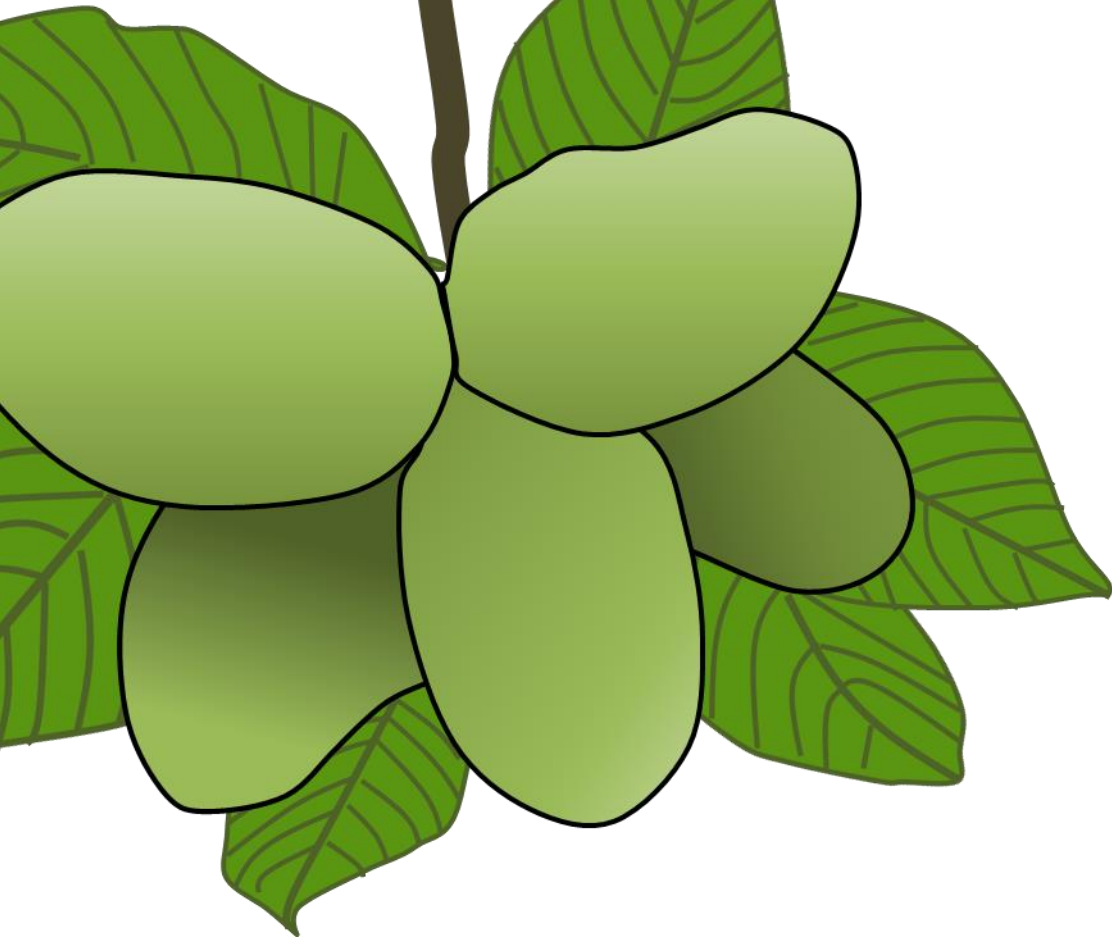
Patch of pawpaw trees



Pawpaw fruit

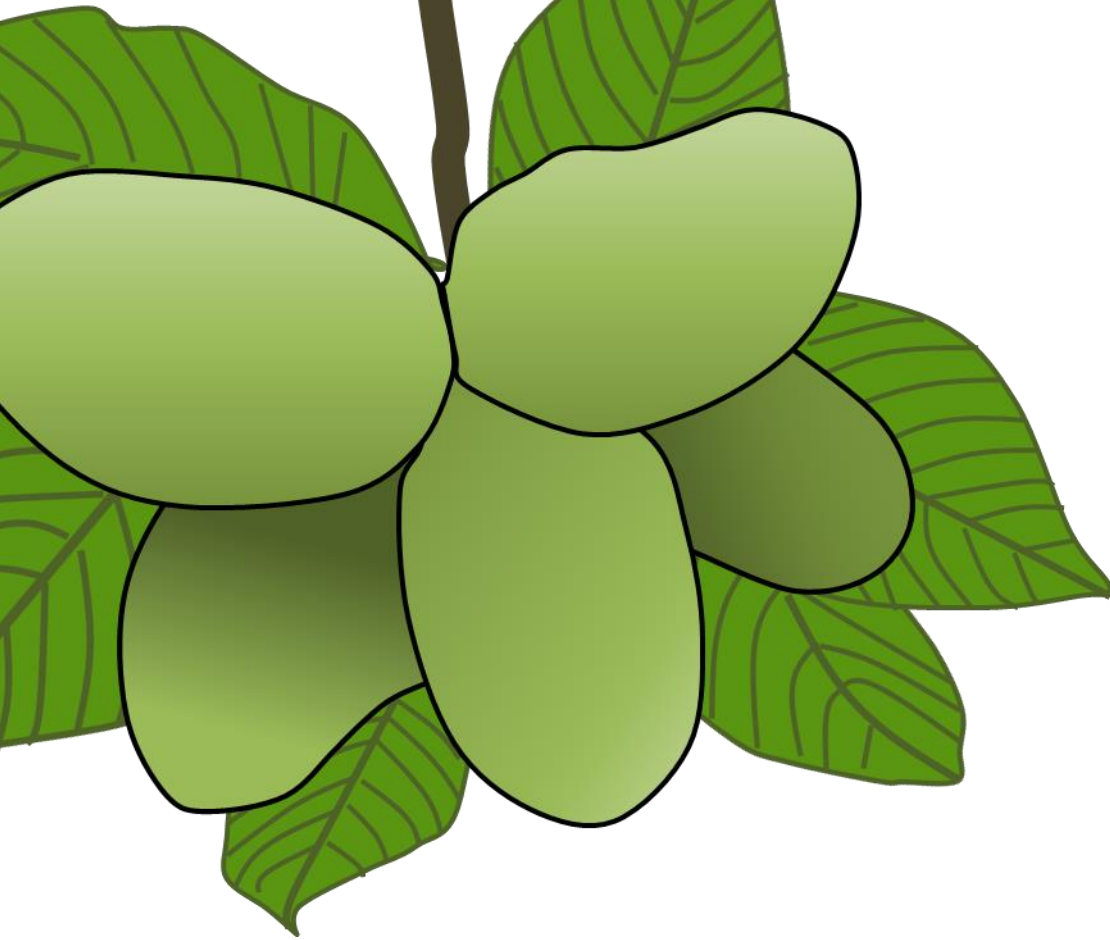
- Pawpaw Beer – Jackie O's Brewery (Athens, OH)
- Pawpaw Pulp – Integration Acres (Athens, OH)





Part I.

Woodland pawpaw production

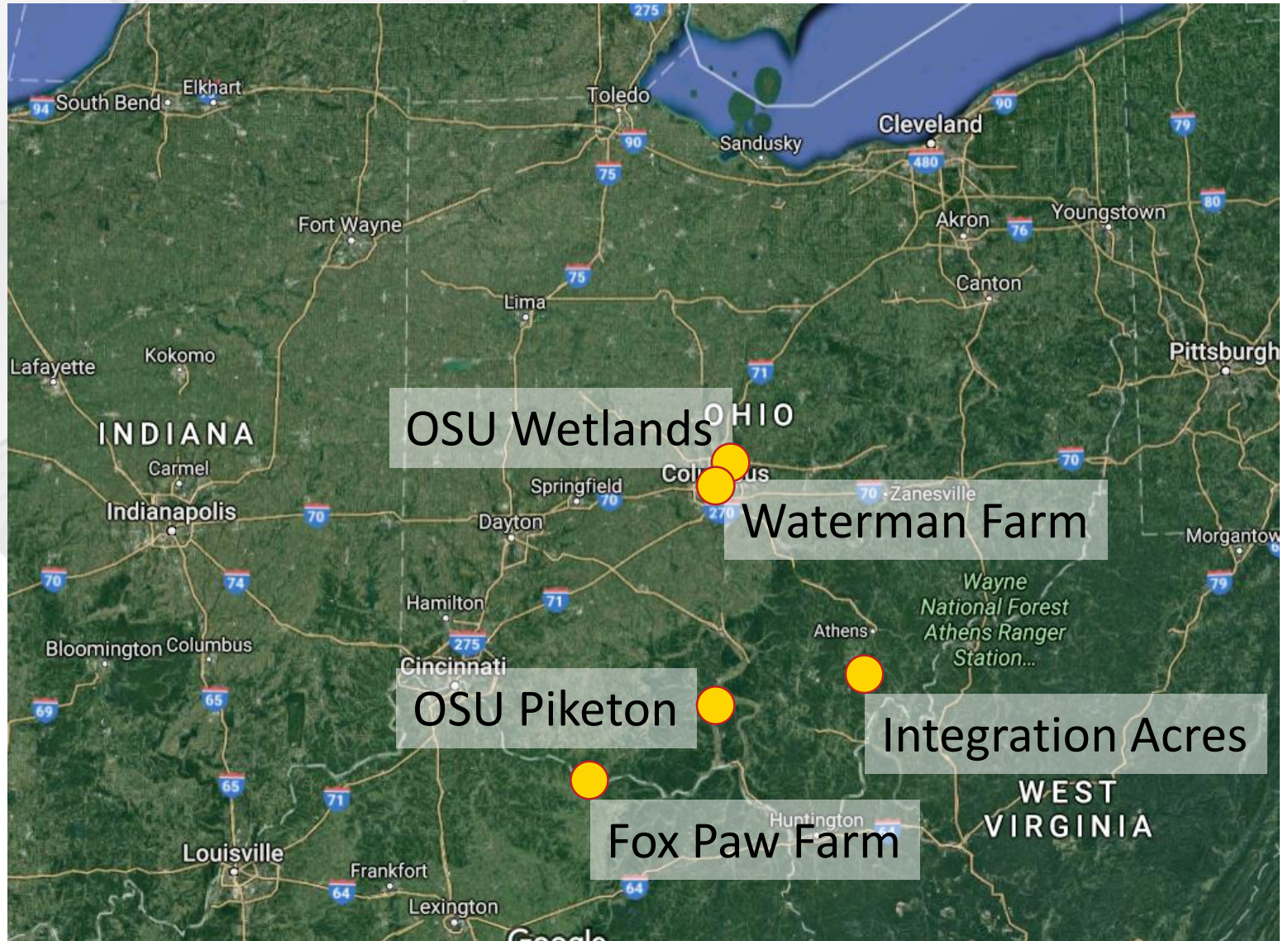


- Yield
- Economic returns
- Stand management

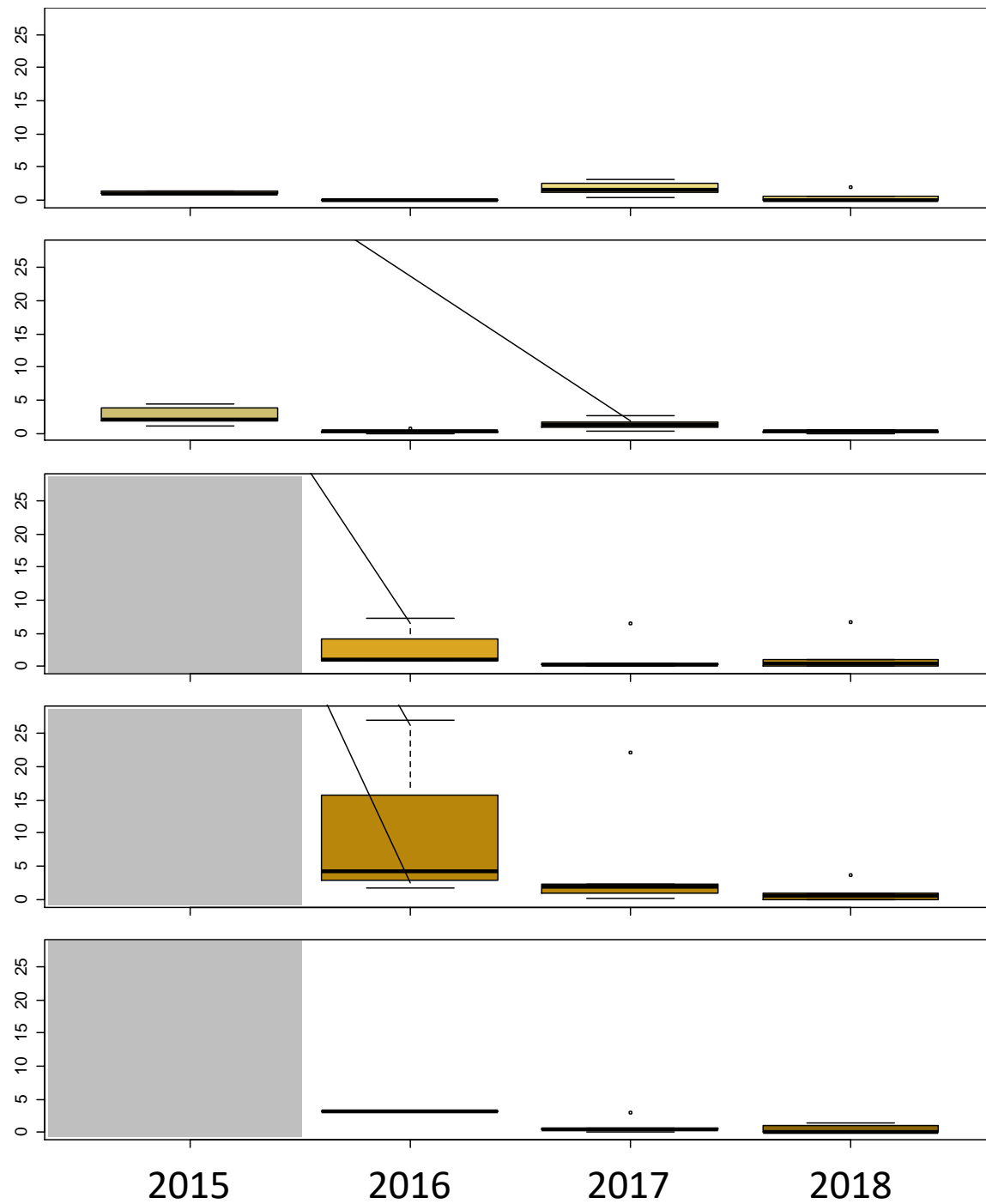
Part I.

Woodland pawpaw production

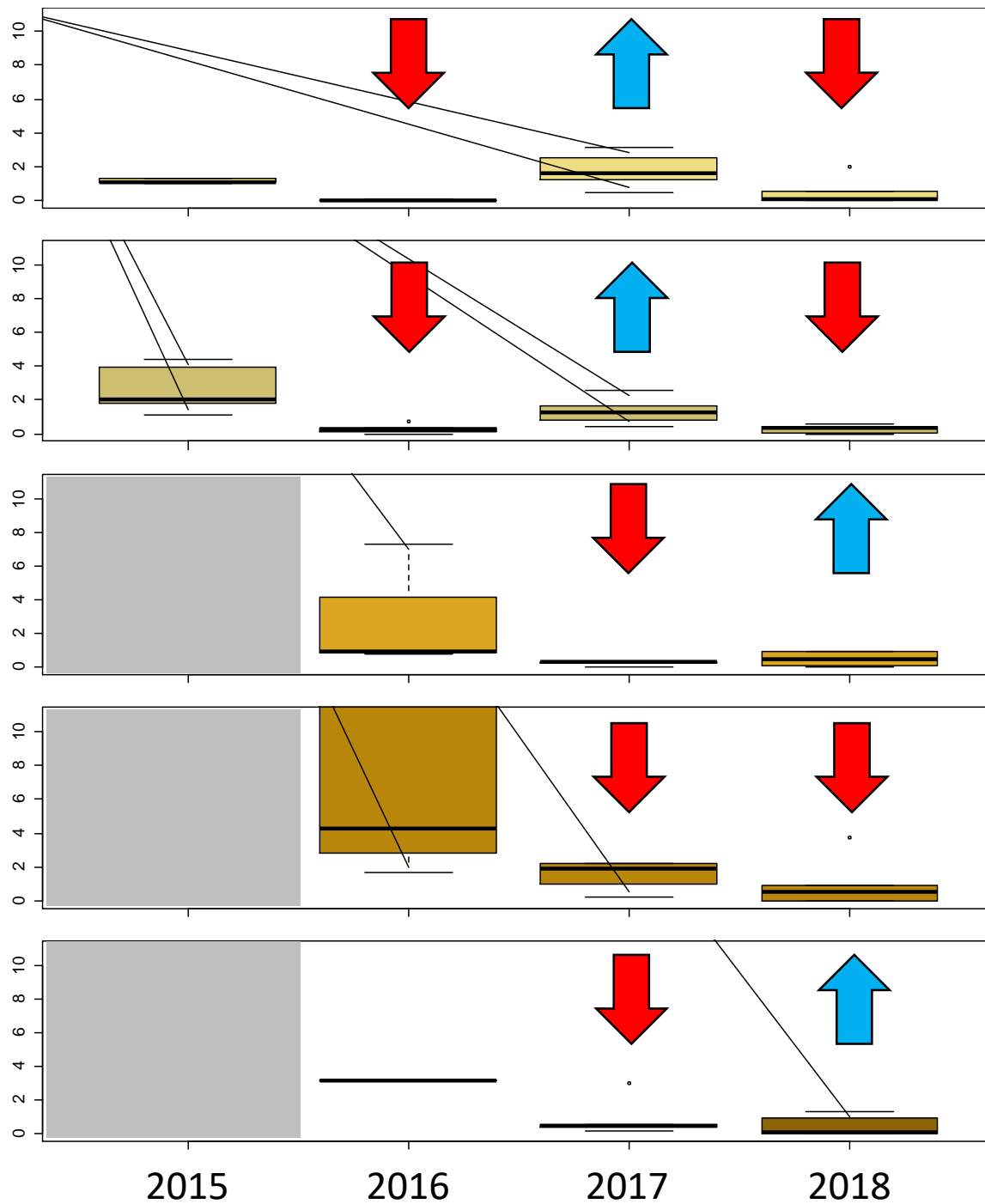
Wild patch monitoring



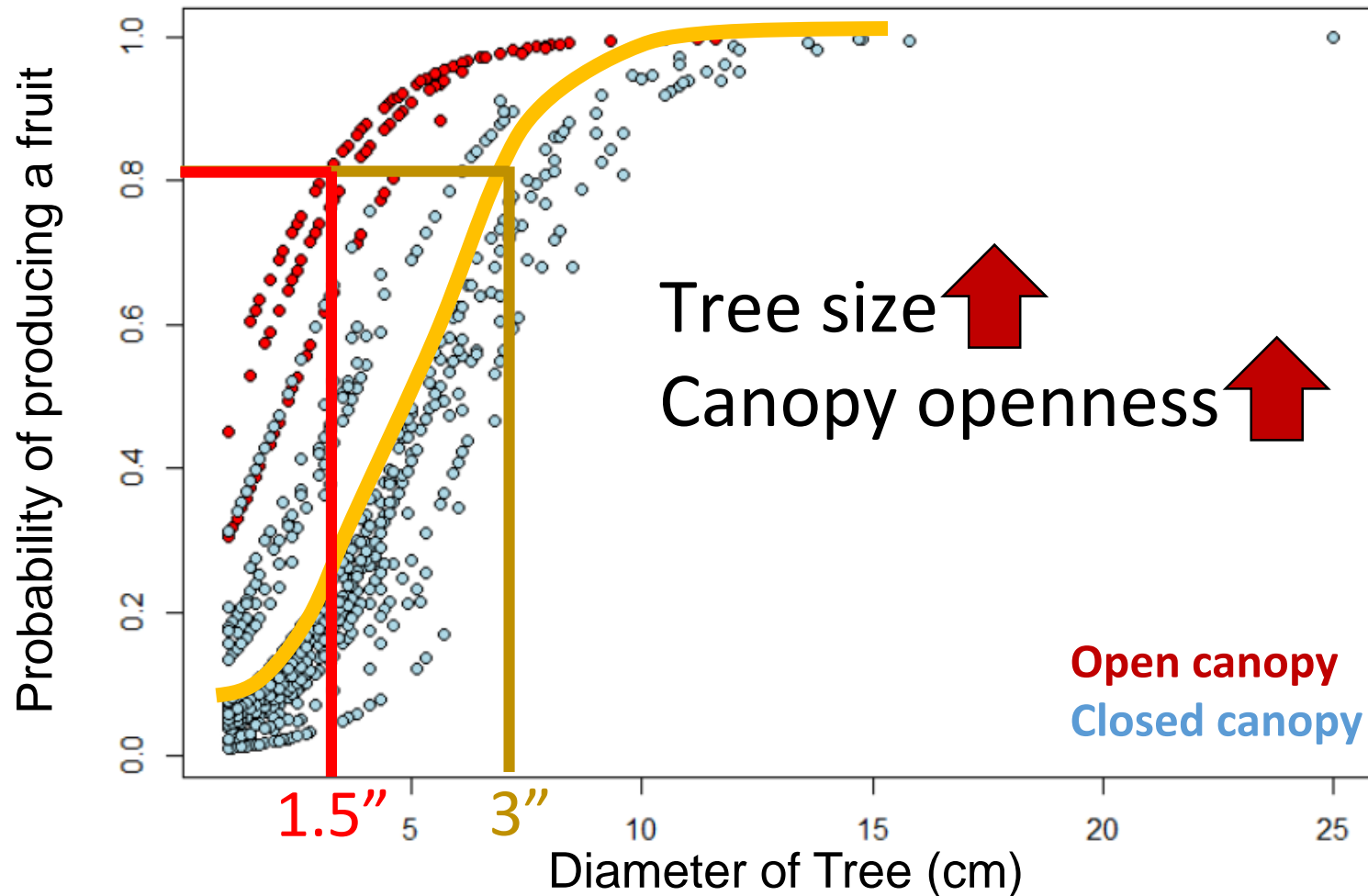
Mean number of pawpaw per tree



Mean number of pawpaw per tree



What controls yield?



Potential Economic Return

- Woodland stand yields: ca. 900 fruit/acre trees*
- Wild fruit weight: ca. 0.2 lb
- Wild fruit pulp yield: ca. 0.1 lb/fruit
- Approx. crop value:
Wholesale: \$1/lb – Market: \$3/lb – Pulp (processed) \$8/lb

**Not necessarily an acre in area – an acre of trees would consist of ca. 530 trees at spacings we observed*

Potential Economic Return

Scenario	Market Value	Net Return
Wholesale to processor	\$183	- \$294
Farmers Market	\$549	\$72
Processed pulp*	\$732	- \$111

Values and returns per acre of pawpaw patch

**Excludes infrastructure and equipment*

Enhancing patch productivity



Pollination experiment

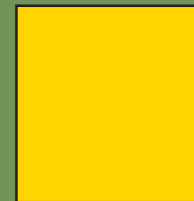
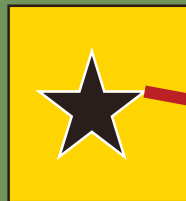
Objective – do pollination limitation and self-unfruitfulness control fruit-set?



Waterman Farm

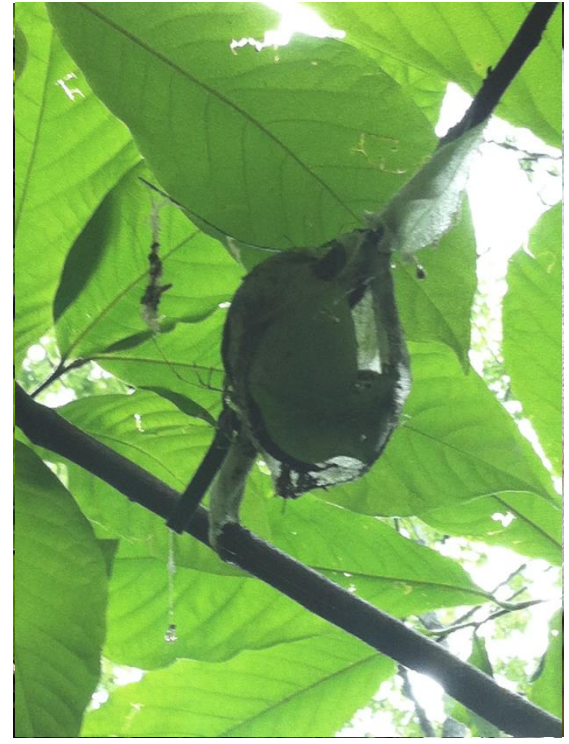


Olentangy Wetlands



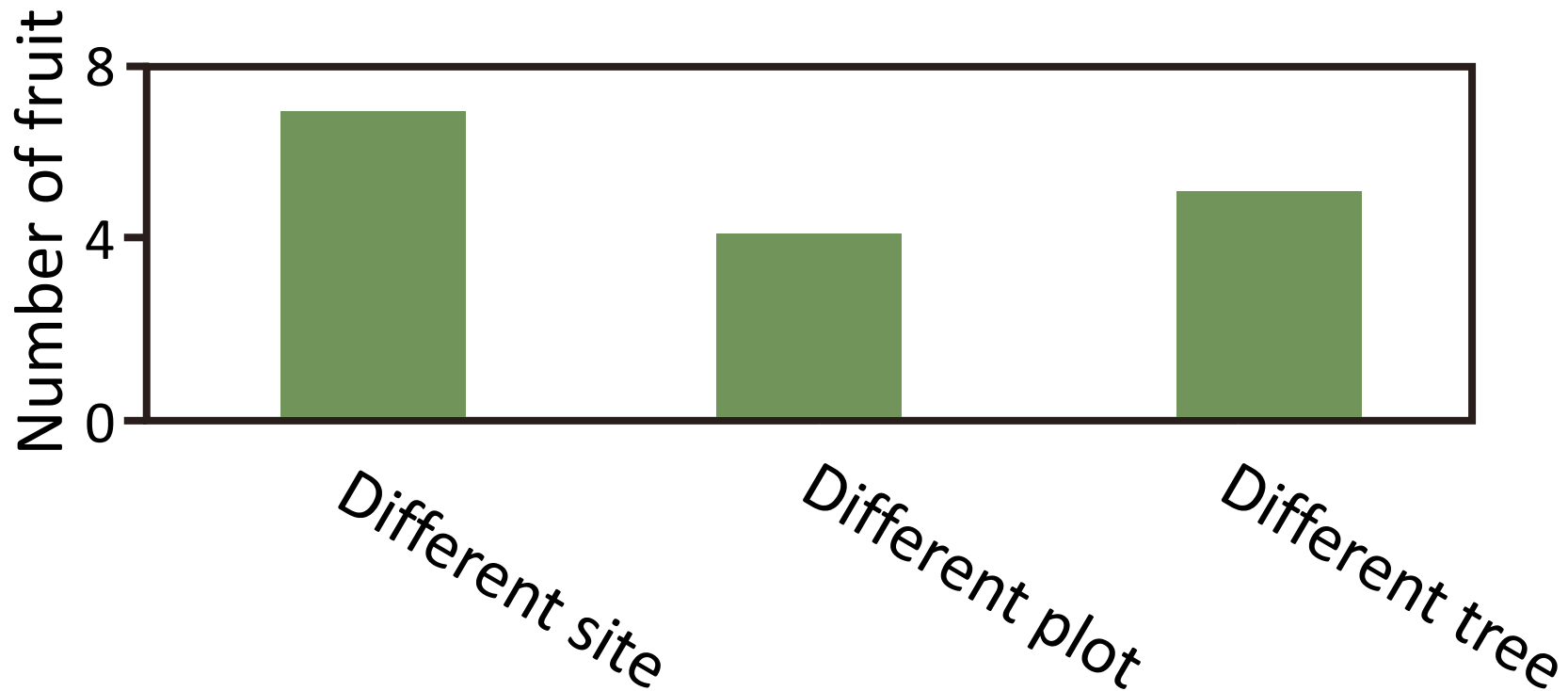
Pollination experiment

Objective – do pollination limitation and self-unfruitfulness control fruit-set?



Pollination experiment

Objective – do pollination limitation and self-unfruitfulness control fruit-set?



Improving patch production



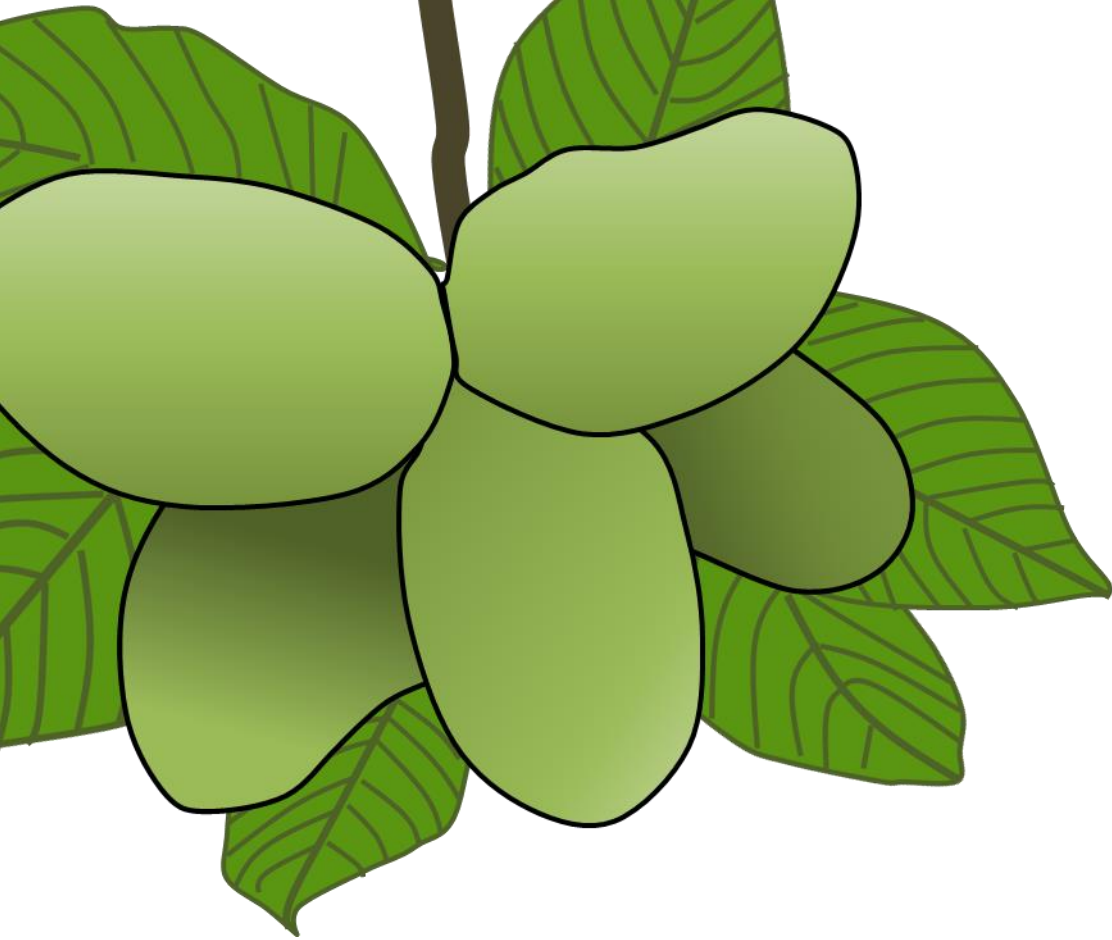
Before management



After management

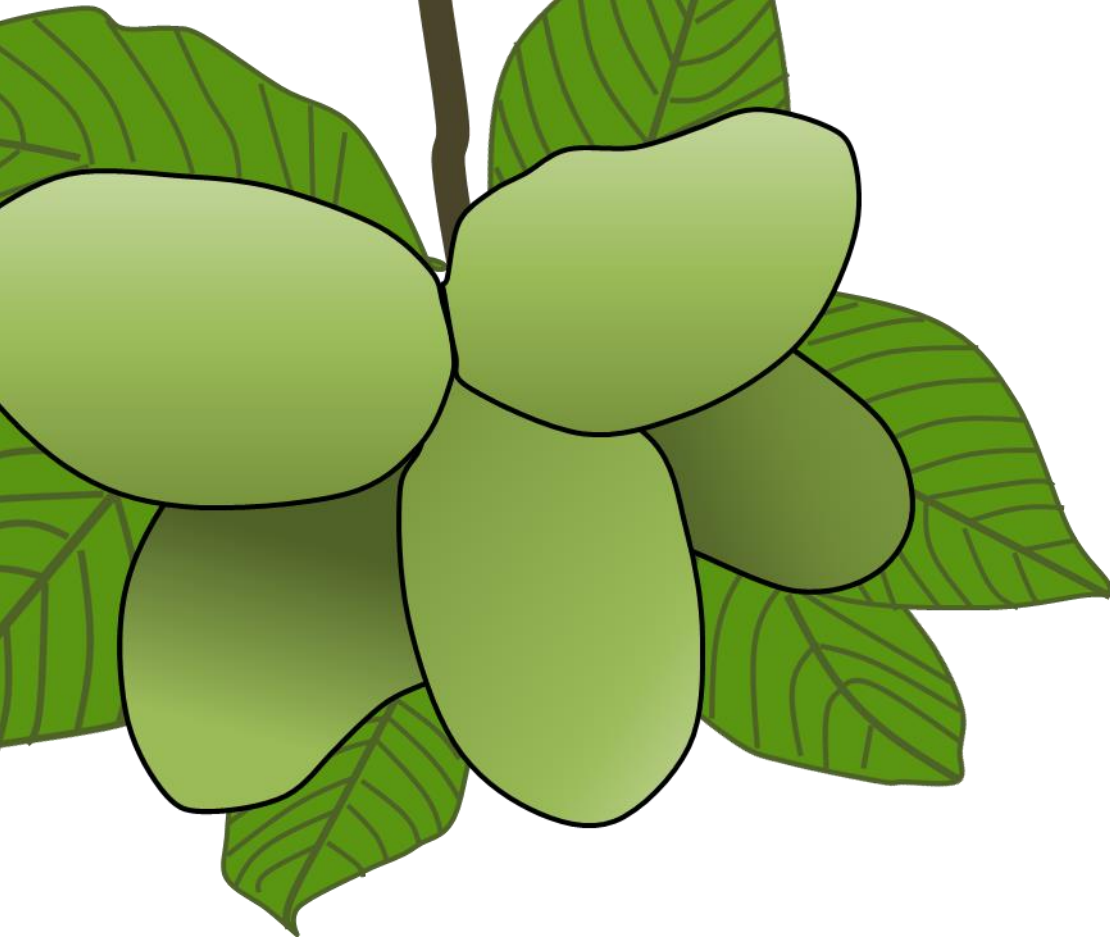


Removing under
competition



Part II.

Orchard establishment and production

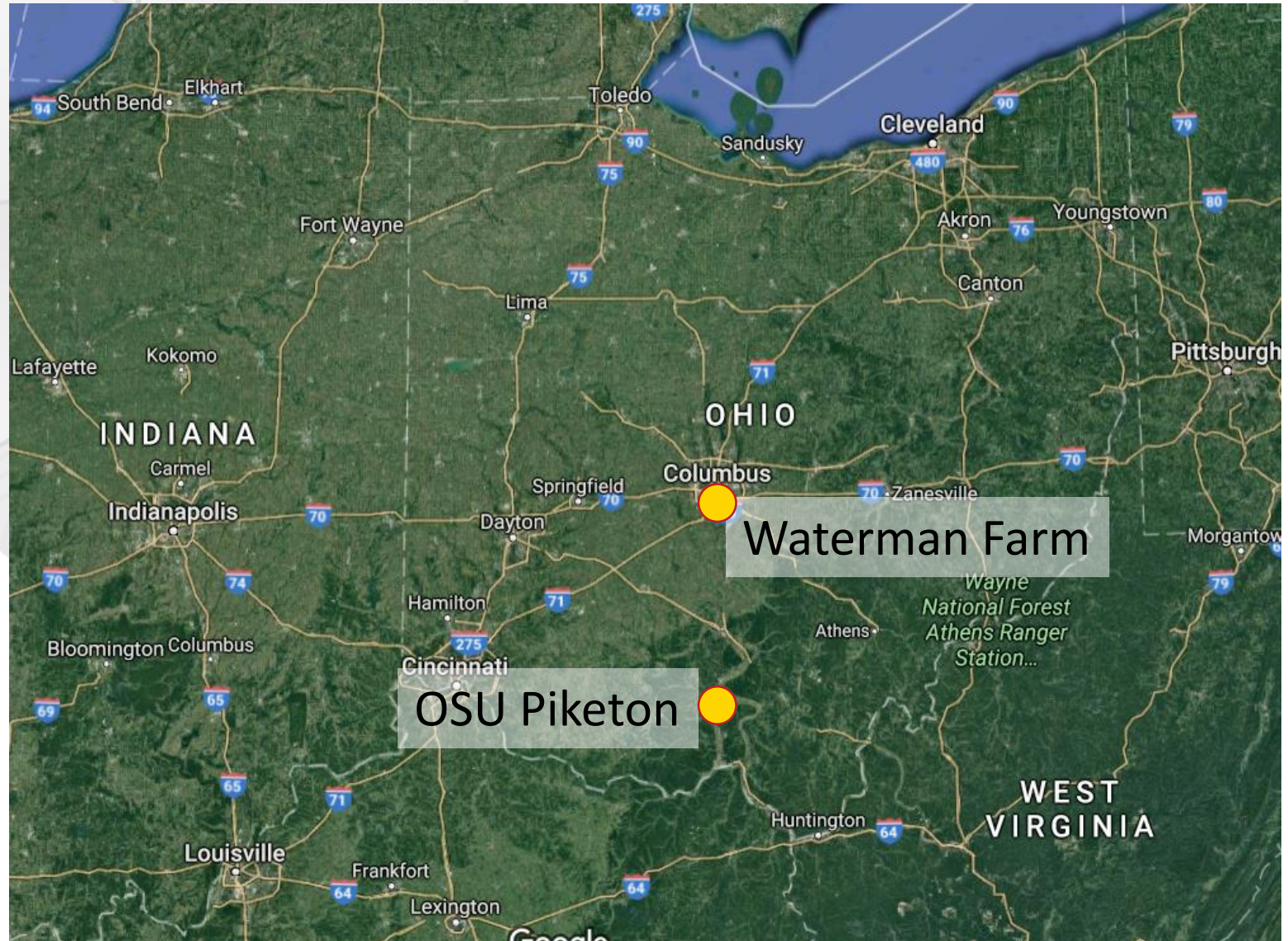


1. Orchard establishment
2. Varietal performance
 - Yield
 - Quality
3. Economics

Part II.

Orchard establishment and production

Experimental orchards





Experimental orchards

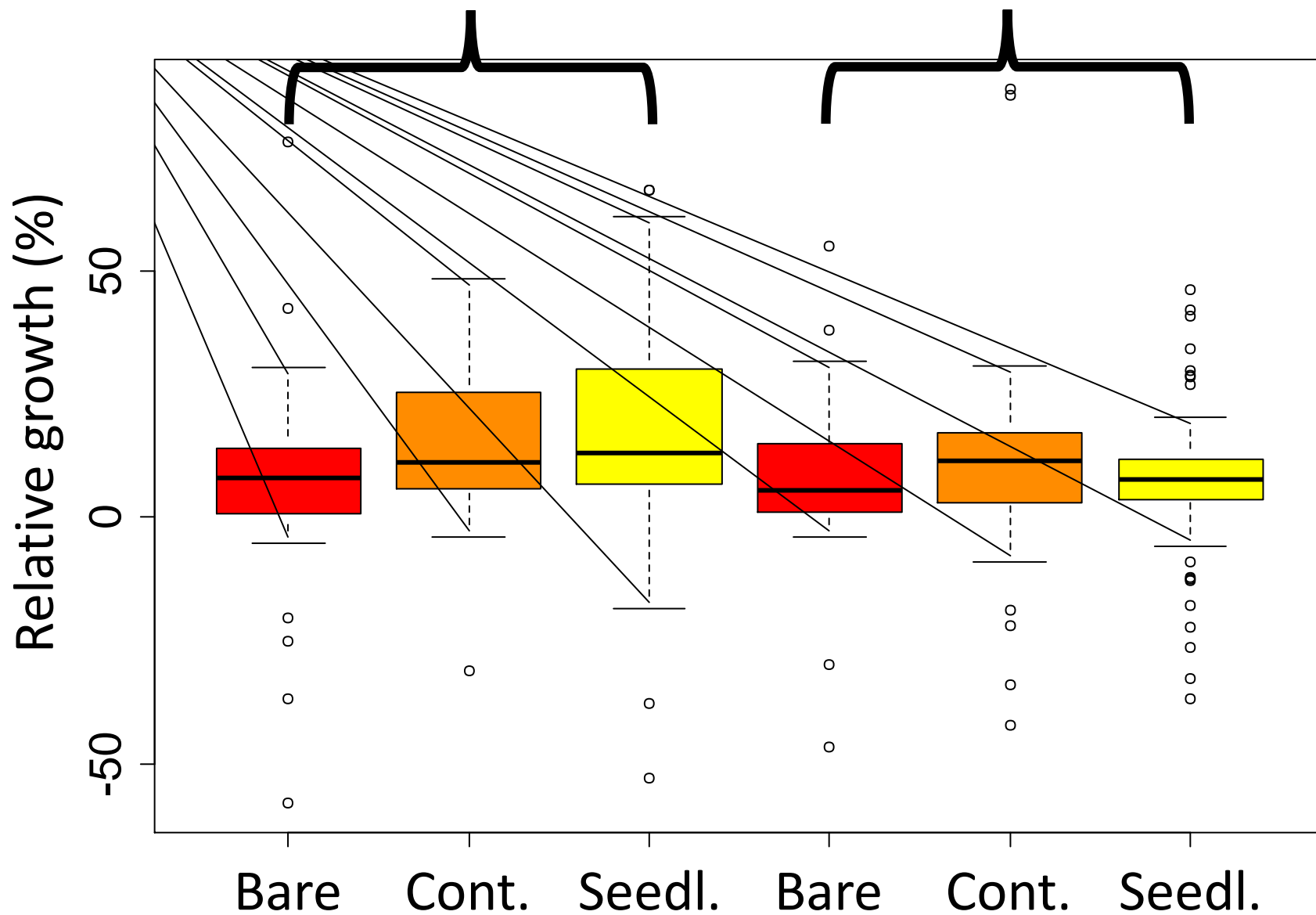
- Percentage tree survival by stock type and system

Stock	Input System	
	Low	High
Seedling*	81	96
Bare root	65	87
Container	80	90

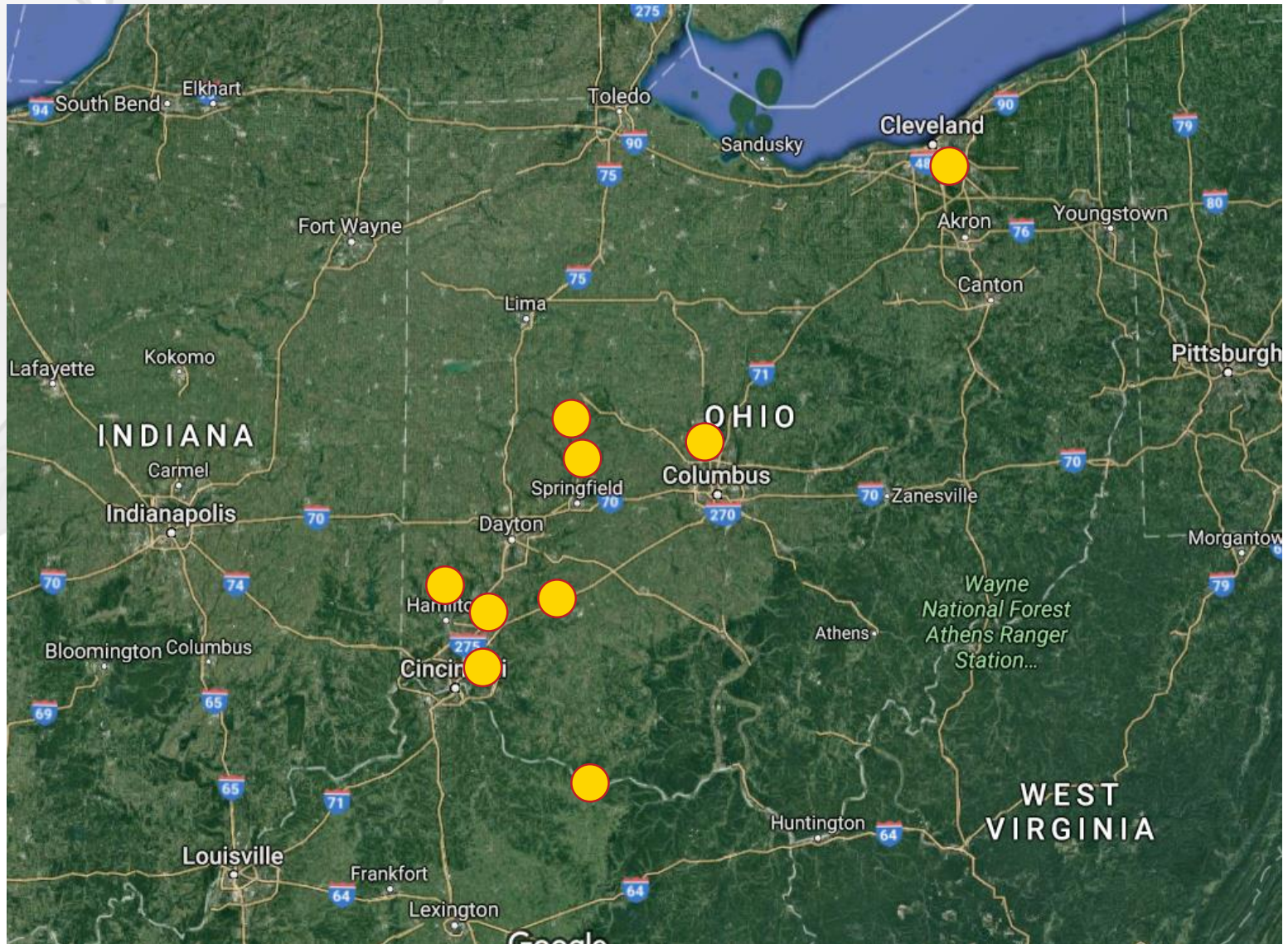
**Also bare root but not grafted*

High Input

Low Input

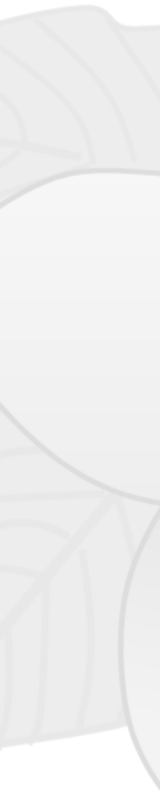


Varietal yield and quality



Assessing yield





Total Fruit

200

150

100

50

0

Alle

G9-109

G9-111

Hi4-1

Hy3-120

KSU2-11

Lynn

NC1

Over

PA

Pot

Quaker

Rap

Shaw

Shen

Sue

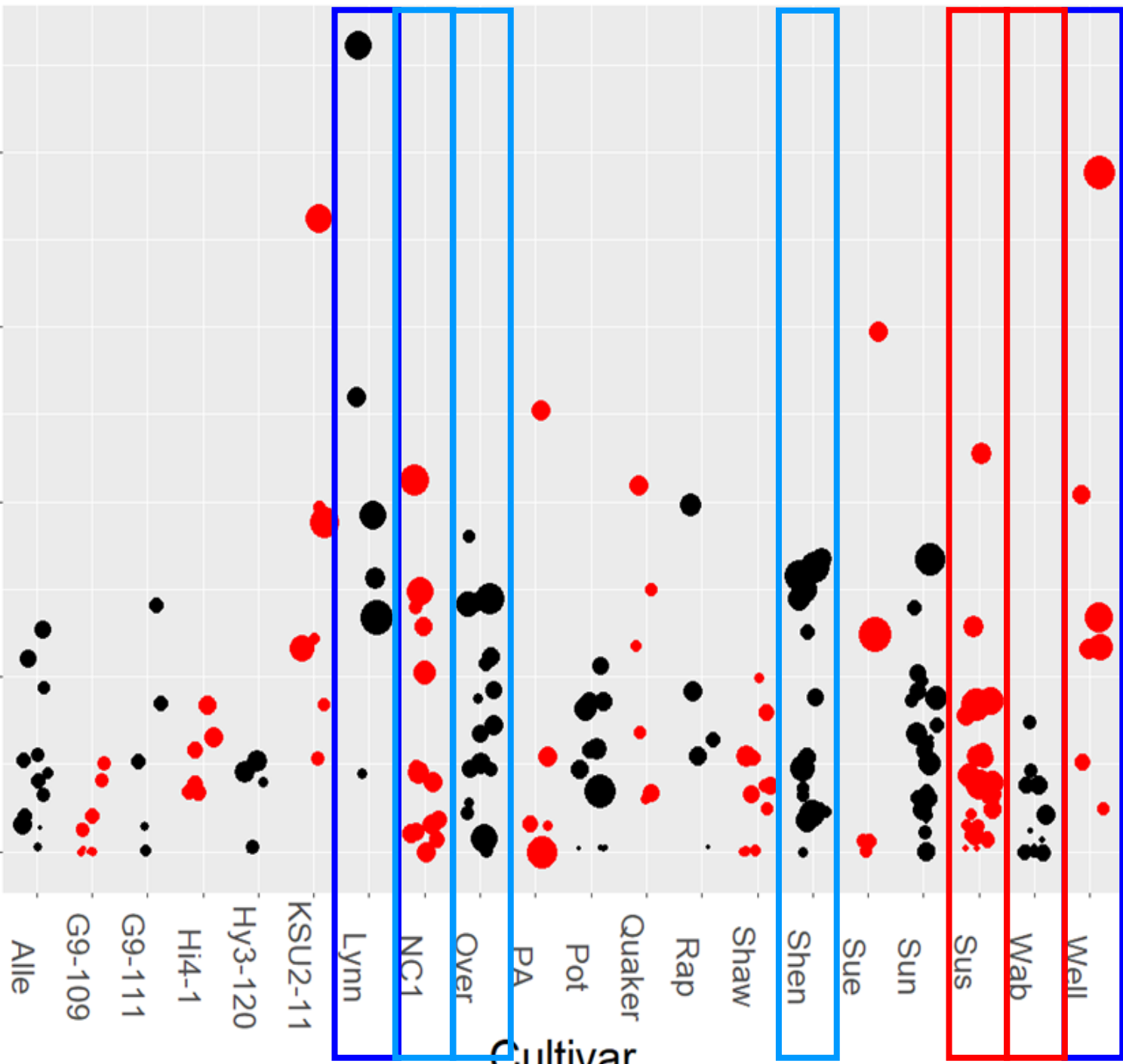
Sun

Sus

Wab

Well

Cultivar





Assessing yield

	Genetic Group		
	Wabash	Overleese	Susquehanna
# of Fruit			
Total Fruit Mass			
Pulp Mass			

Assessing yield

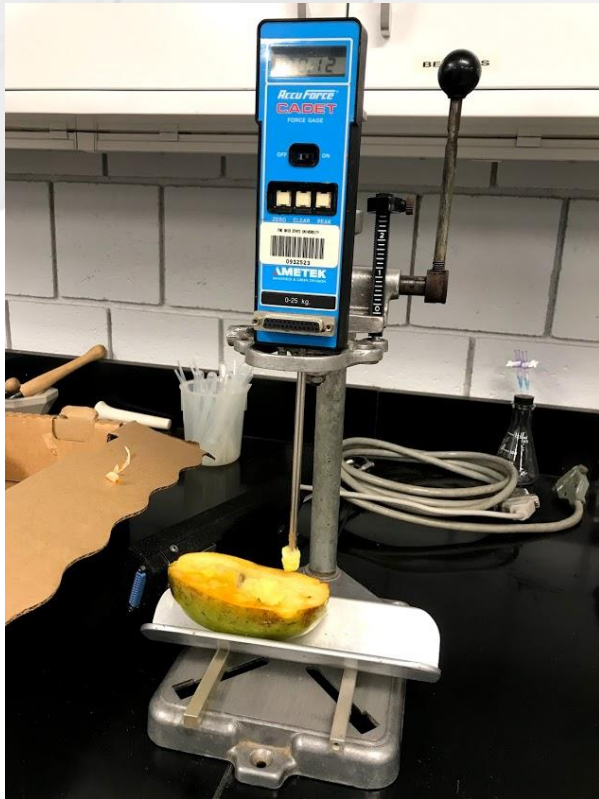
- Number of fruit affected by cultivar, tree size and flowering effort
- Fruit mass affected by group, tree size and flowering effort
- Pulp mass NOT affected by group or cultivar
- Lots of fruit v. bigger fruit?
Know your market
- Site identity BY FAR the most important effect

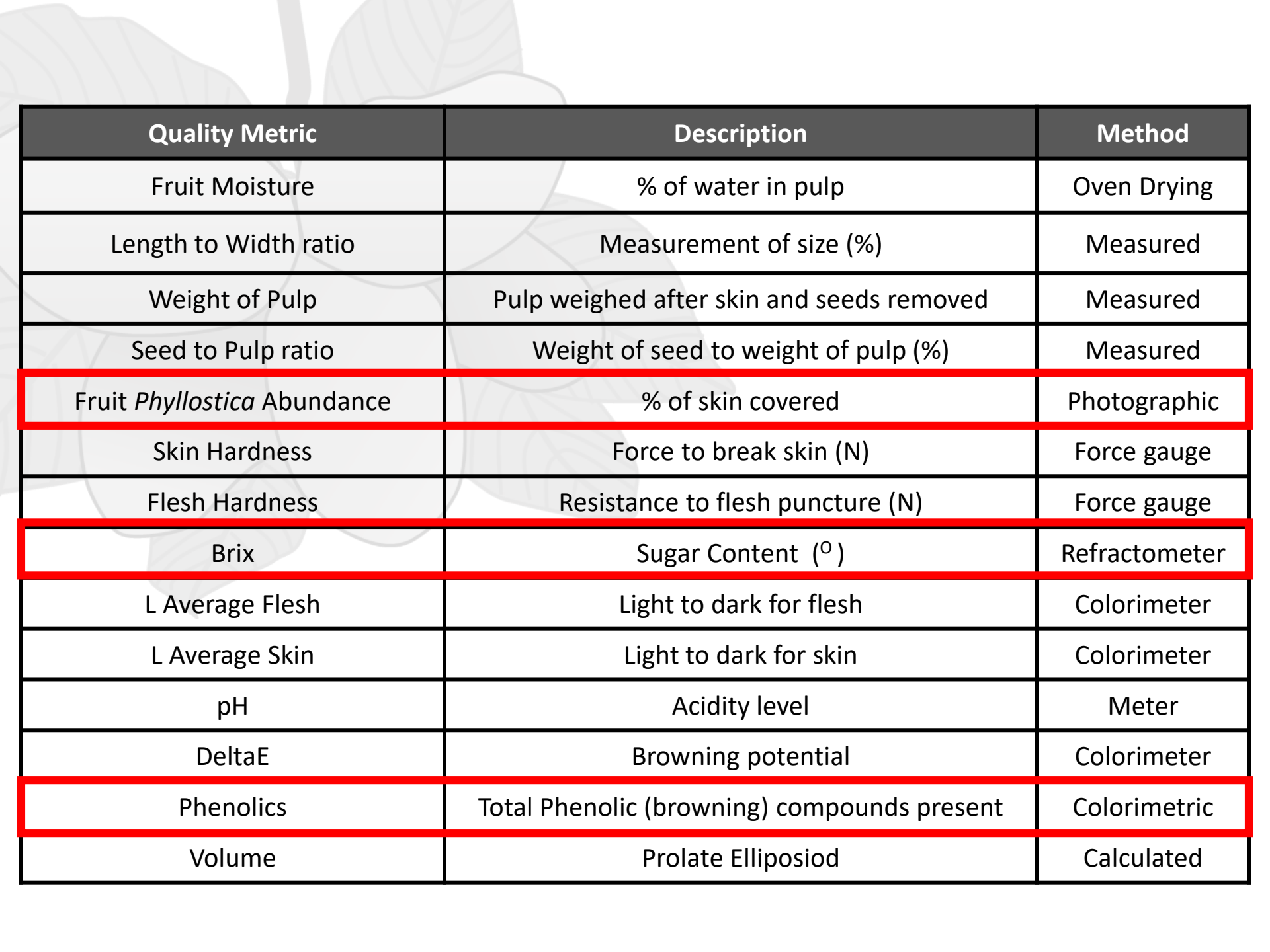


Assessing fruit quality



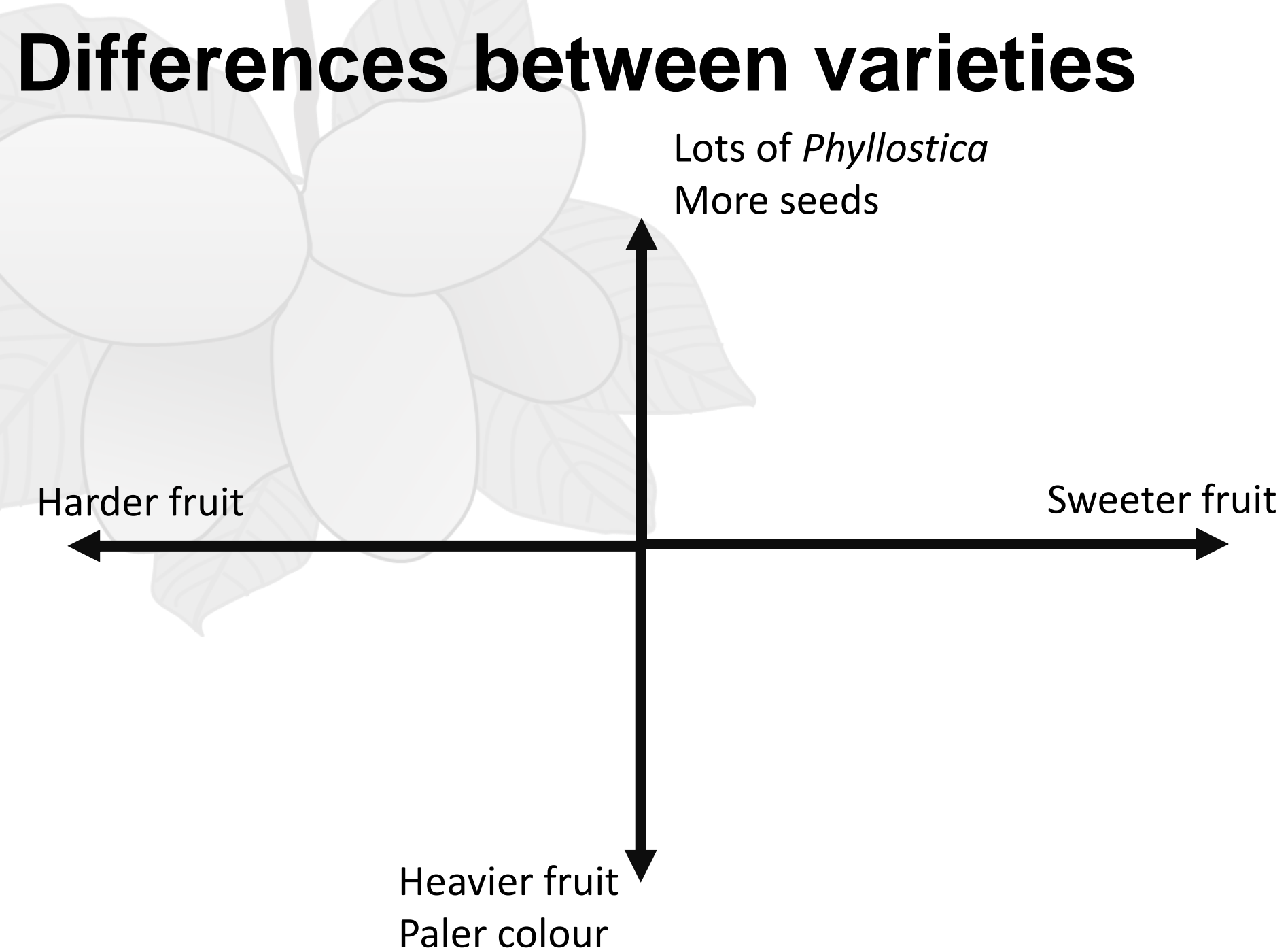
Assessing fruit quality



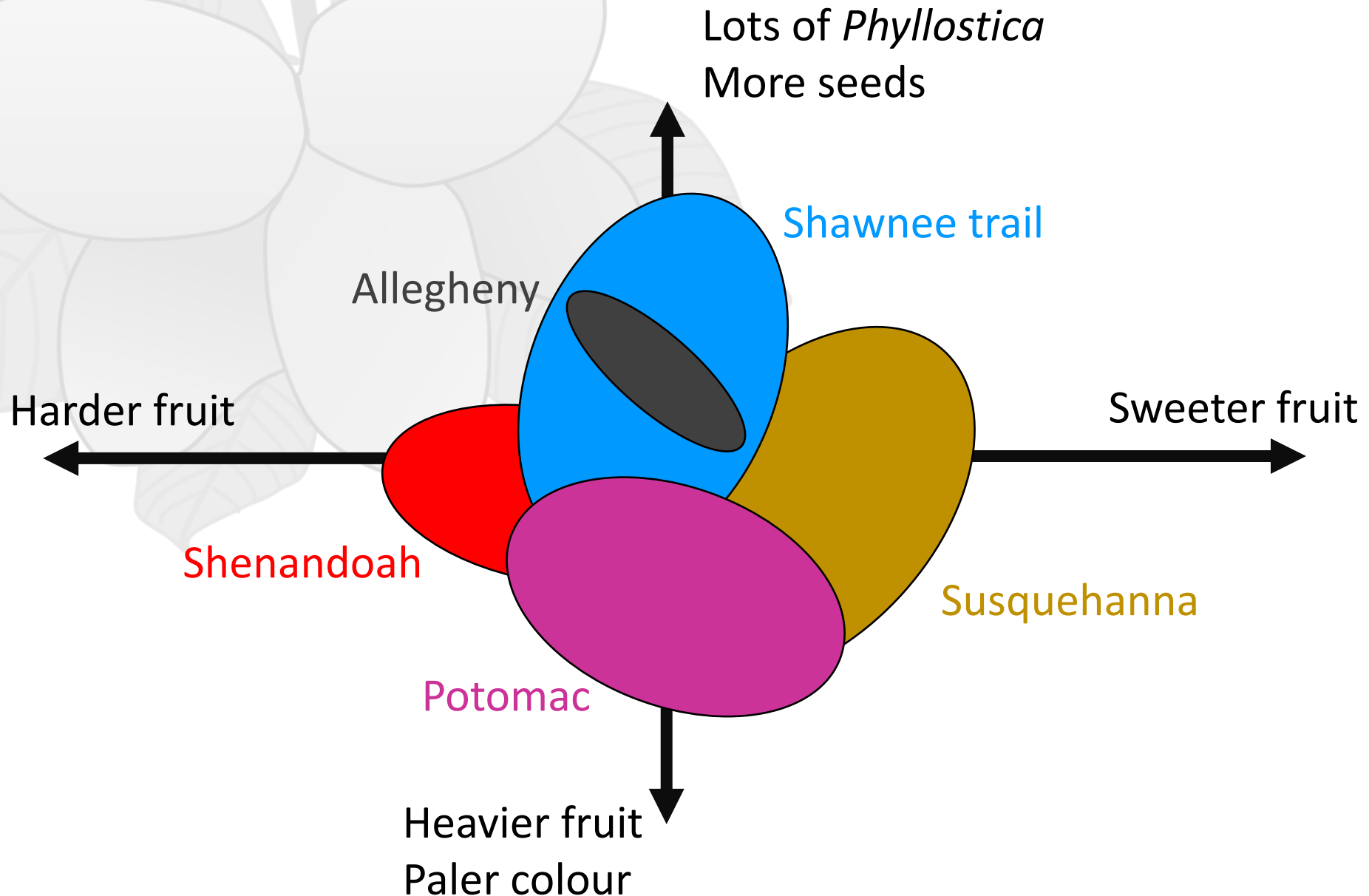


Quality Metric	Description	Method
Fruit Moisture	% of water in pulp	Oven Drying
Length to Width ratio	Measurement of size (%)	Measured
Weight of Pulp	Pulp weighed after skin and seeds removed	Measured
Seed to Pulp ratio	Weight of seed to weight of pulp (%)	Measured
Fruit <i>Phyllostica</i> Abundance	% of skin covered	Photographic
Skin Hardness	Force to break skin (N)	Force gauge
Flesh Hardness	Resistance to flesh puncture (N)	Force gauge
Brix	Sugar Content (°)	Refractometer
L Average Flesh	Light to dark for flesh	Colorimeter
L Average Skin	Light to dark for skin	Colorimeter
pH	Acidity level	Meter
DeltaE	Browning potential	Colorimeter
Phenolics	Total Phenolic (browning) compounds present	Colorimetric
Volume	Prolate Elliposiod	Calculated

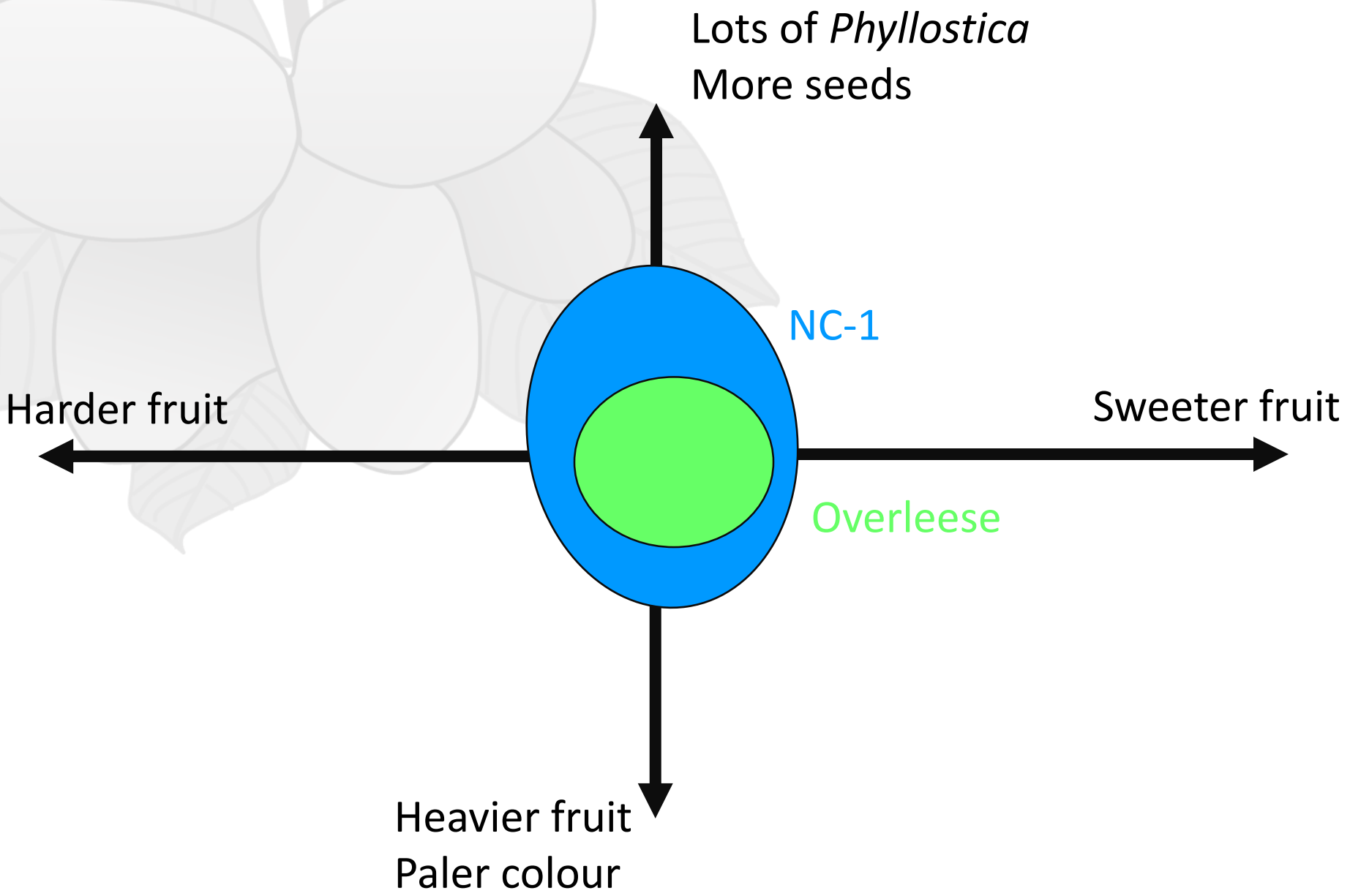
Differences between varieties



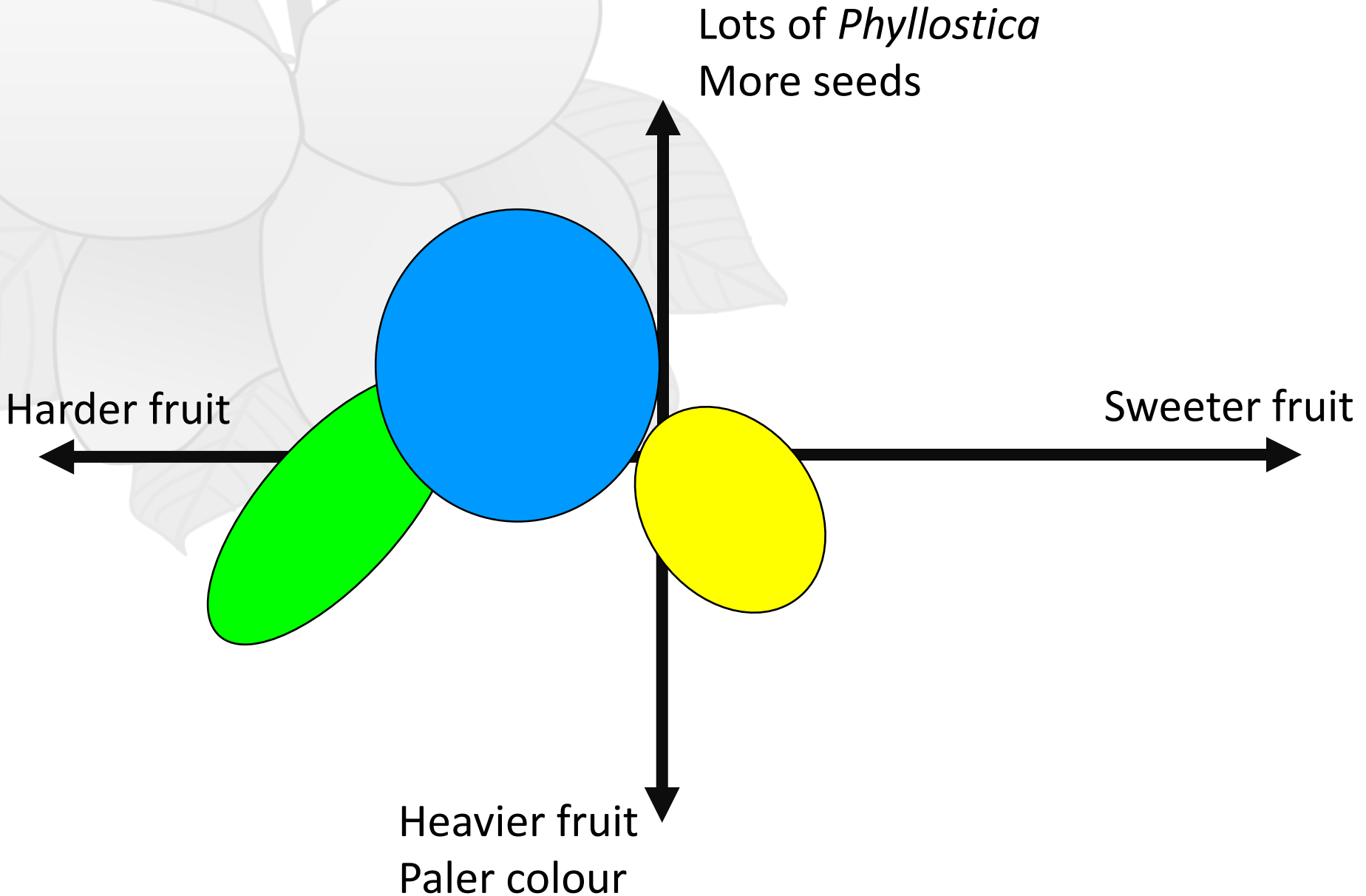
Differences between varieties



Differences between varieties



Differences between sites



Potential Economic Return

Site	Variety	Fruit/tree
1	PA-Golden	5
	Lynn's F	133
2	Overleese	4
	Potomac	42
3	Quaker's D	17
	Wells	131
4	Susquehanna	24
	Wilson	146
5	Susquehanna	9
	Quaker's D	46
6	NC-1-6	6
	Rappanhannock	99

Assumes 233 trees / acre of single variety

Excluded infrastructure, equipment and start-up costs



Conclusions

1. Economically viable production from wild stands will require management to improve productivity
 - Thinning, grafting, supplemental planting
2. High input systems and minimally stressed stock maximize orchard establishment
 - Use container stock or graft in-situ
3. Fruit yield, quality and economic returns are highly dependent upon cultural practices and varietal selections
 - Choose high yielding, consistent varieties matched to your chosen market.
 - Maintain diverse pollination partner trees



