

Variation in Pawpaw (*Asimina triloba* L. Dunal) Cultivar Productivity and Quality Across a Biogeographic Gradient in Ohio

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SCHOOL OF ENVIRONMENT & NATURAL RESOURCES



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Thank you!

Collaborating Farmers

- Ron Powell
- Gary Gottenbush
- Richard Glaser
- Russ Benz
- Marc Stadler
- Ted Beedy
- Lance Sinkowski

Committee

- G. Matt Davies
- Joe Scheeren
- Shoshanah Inwood
- Brad Bergefurd

Funders

- The Ohio Department of Agriculture



Ohio Department
of Agriculture



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Background

- What is a pawpaw?
- Chapter 1: Variation in pawpaw (*Asimina triloba* L. Dunal) cultivar productivity across a biogeographic gradient
- Chapter 2: Effects of the biogeographic gradient of Ohio and ripeness spectrum on fruit quality in ten pawpaw (*Asimina triloba* L. Dunal) cultivars
- Conclusions



Pawpaw Trees



Pawpaw fruit

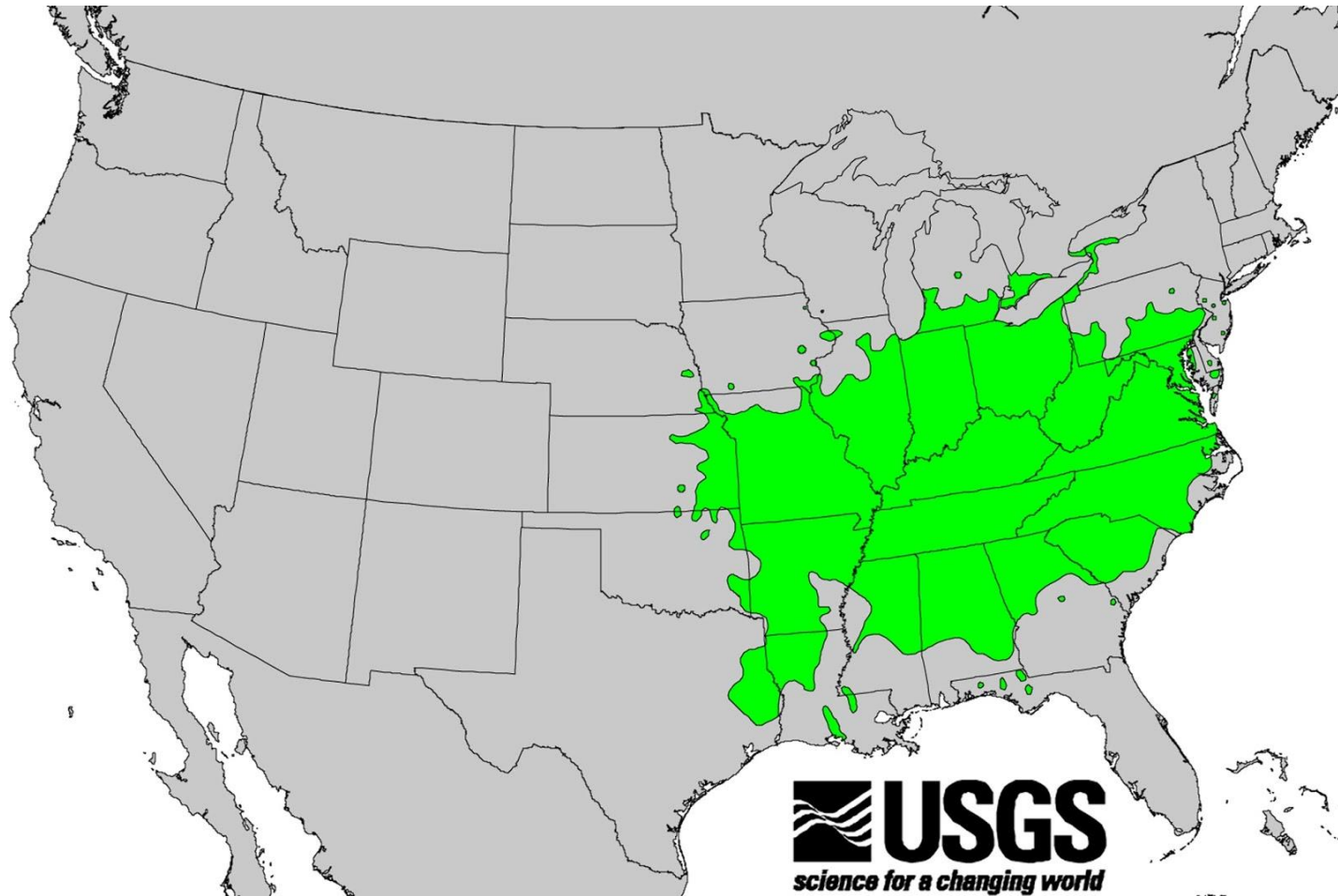


Patch of pawpaw trees



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Natural range of pawpaw in North America



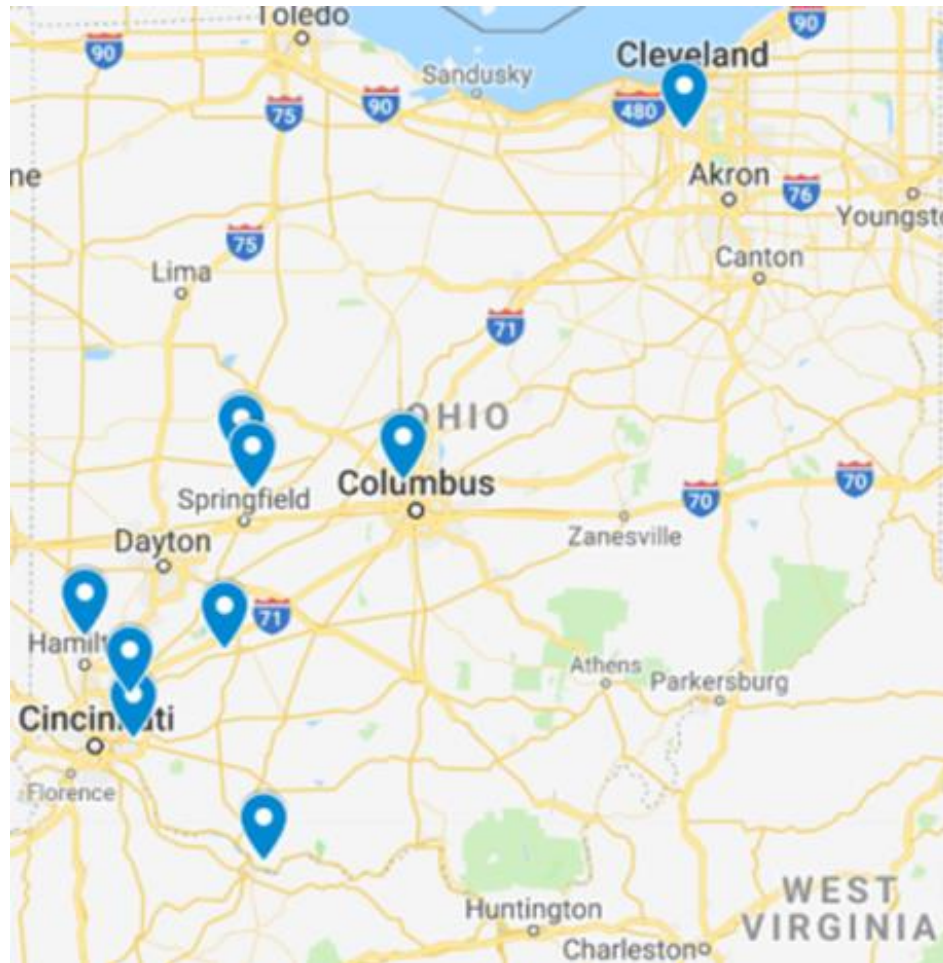
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Chapter 1: Drivers of Yield?

- Objectives
 - Develop allometric relationship for pawpaw fruit
 - Model total number fruit produced
 - Model total fruit mass
 - Model pulp mass



Methods-Site Selection



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Method-Field Monitoring



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Methods-Estimating Yield

1. Tallied fruit by size class for each tree
2. Allometric model to predict mass
 - Applied to size classes for each tree
 - Estimated total fruit mass
 - Estimated pulp mass
3. Estimated yield of each tree

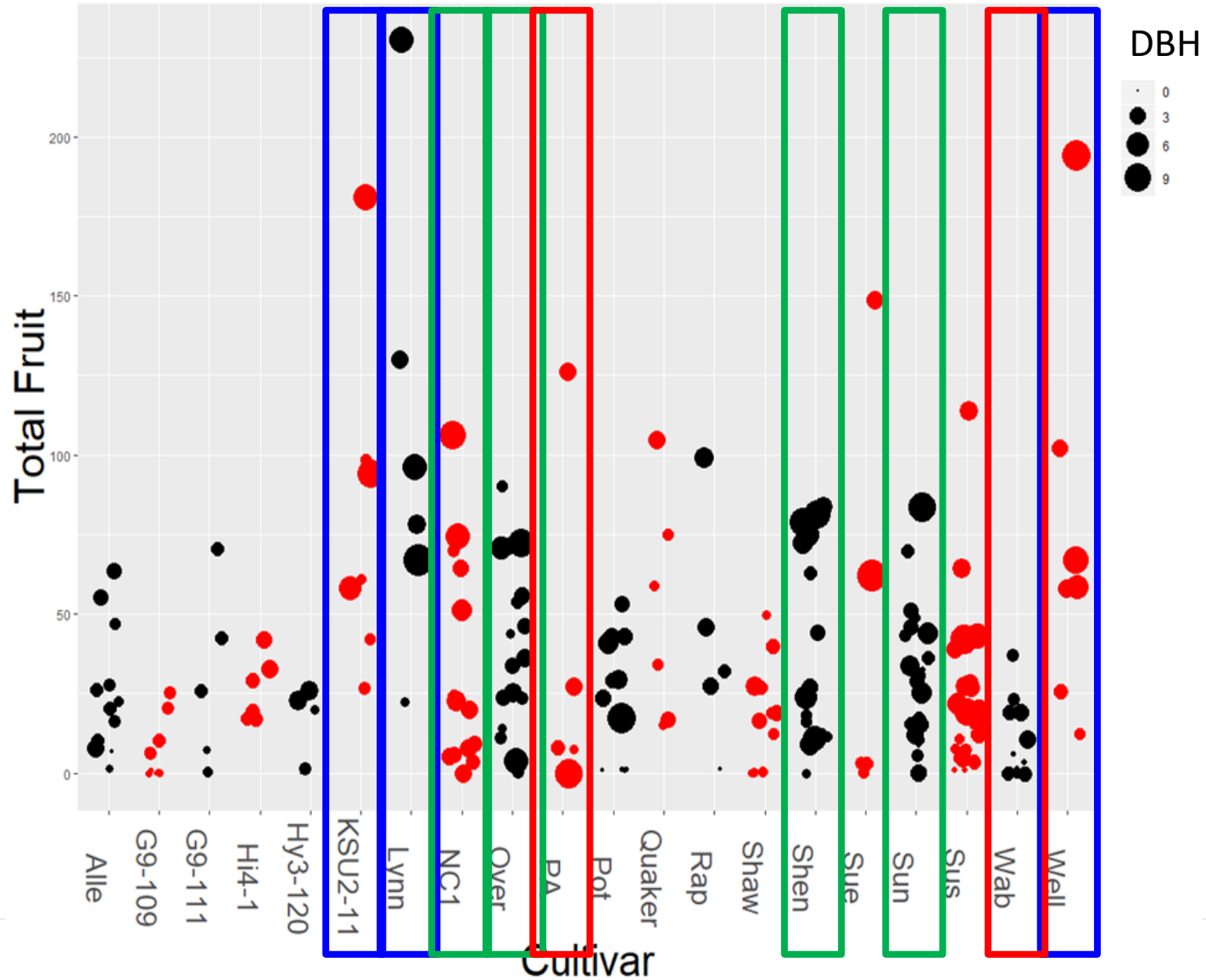


Allometric Relationships

Model	Total Fruit Mass R^2	Pulp Mass R^2
Cultivar \times Fruit size	0.94	0.76
Genetic Grouping \times Fruit size	0.94	0.72



Total number produced by 20 cultivars



Different types of Yield models

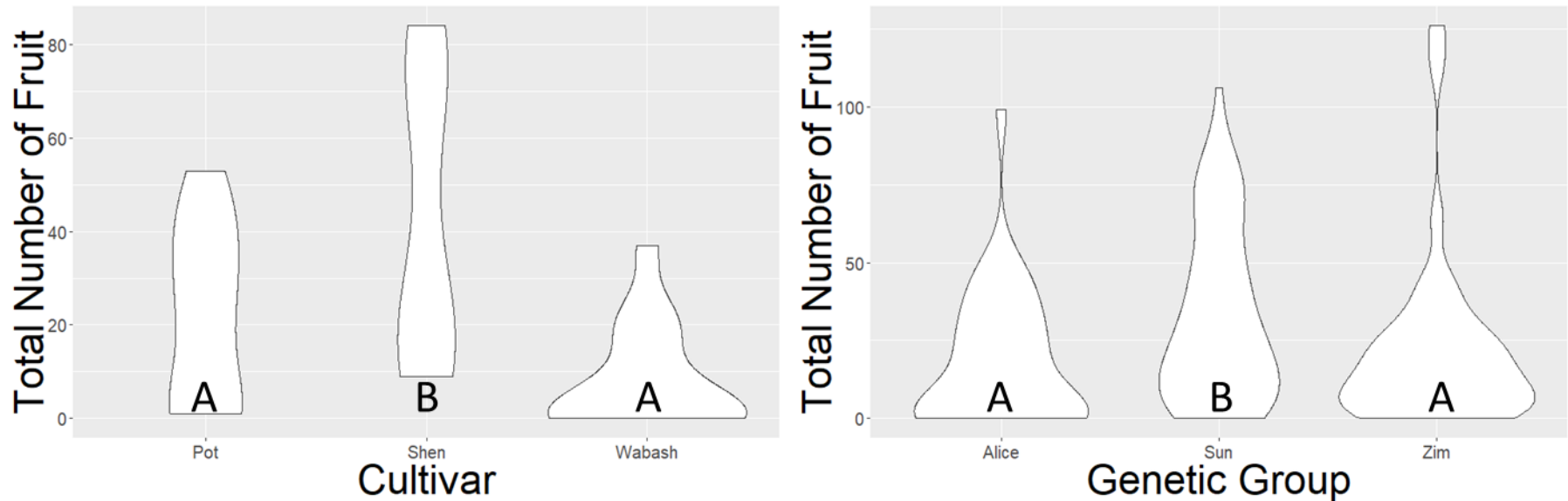
Model	Cultivar	Group	DBH (cm)	Flower Count	R ² c	R ² m
# of Fruit	*		*	*	0.21	0.99
		*	*	*	0.20	0.97

Within a row darker colors are larger effect sizes and asterisk in block indicates significant



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Total Number of Fruit

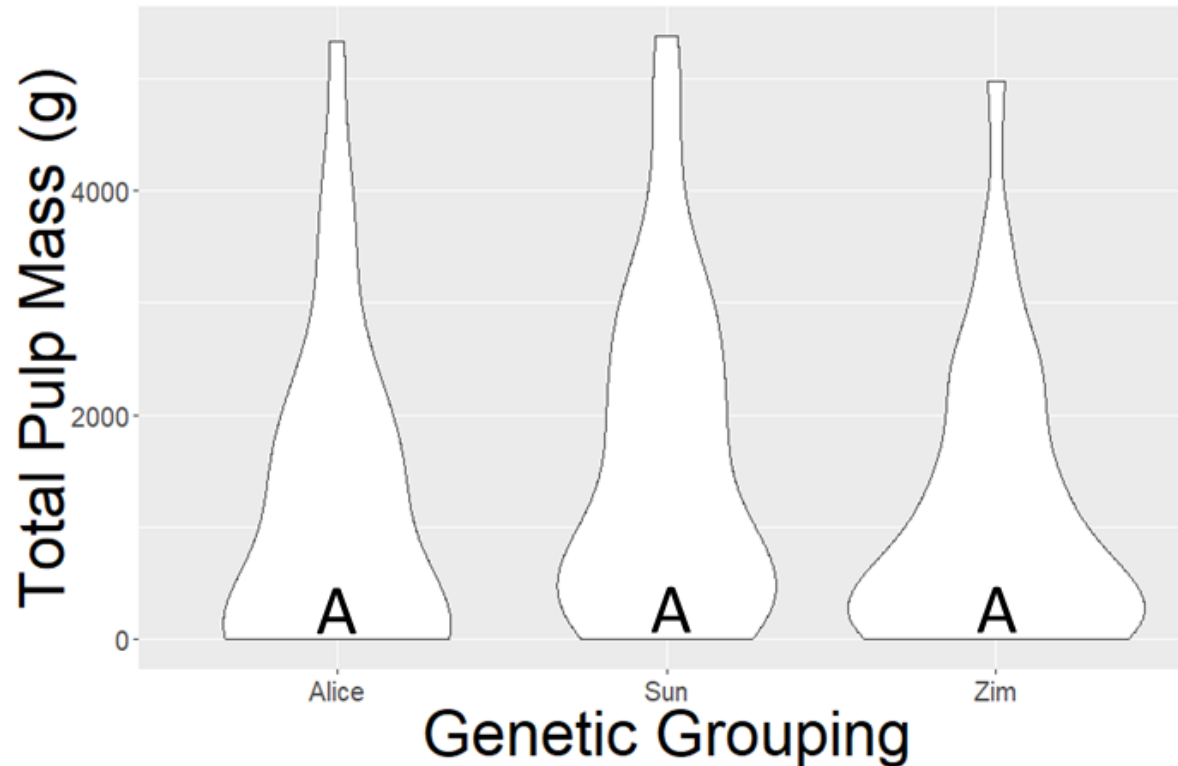


Bars with different letters are significantly different



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Comparing Total Fruit Mass per tree



Bars with different letters are significantly different



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Conclusions

- Allometric relationship allows for non-destructive estimation of yield
- Total number of fruit effected most by size of tree
- Total fruit mass and pulp mass effected most by flower counts
- Site effects substantial part of variance for all models



Objectives Chapter 2

- Objectives
 - Investigate how site, cultivar, and ripeness score effect fruit quality
 - Evaluate how site, cultivar, and ripeness score effect homogeneity of fruit



What is Quality?

- What is Quality?
 - Multivariate concept of best fruit possible for the market
 - Differs for each specific market
- Is homogeneity wanted?
 - Consistency across all marketed fruit
 - Desired by distributors



Methods-Ripeness

- OPGA ripeness chart developed by Terry Powell
- Score 1 least ripe
- Score 5 most ripe



Methods- Laboratory Assessments

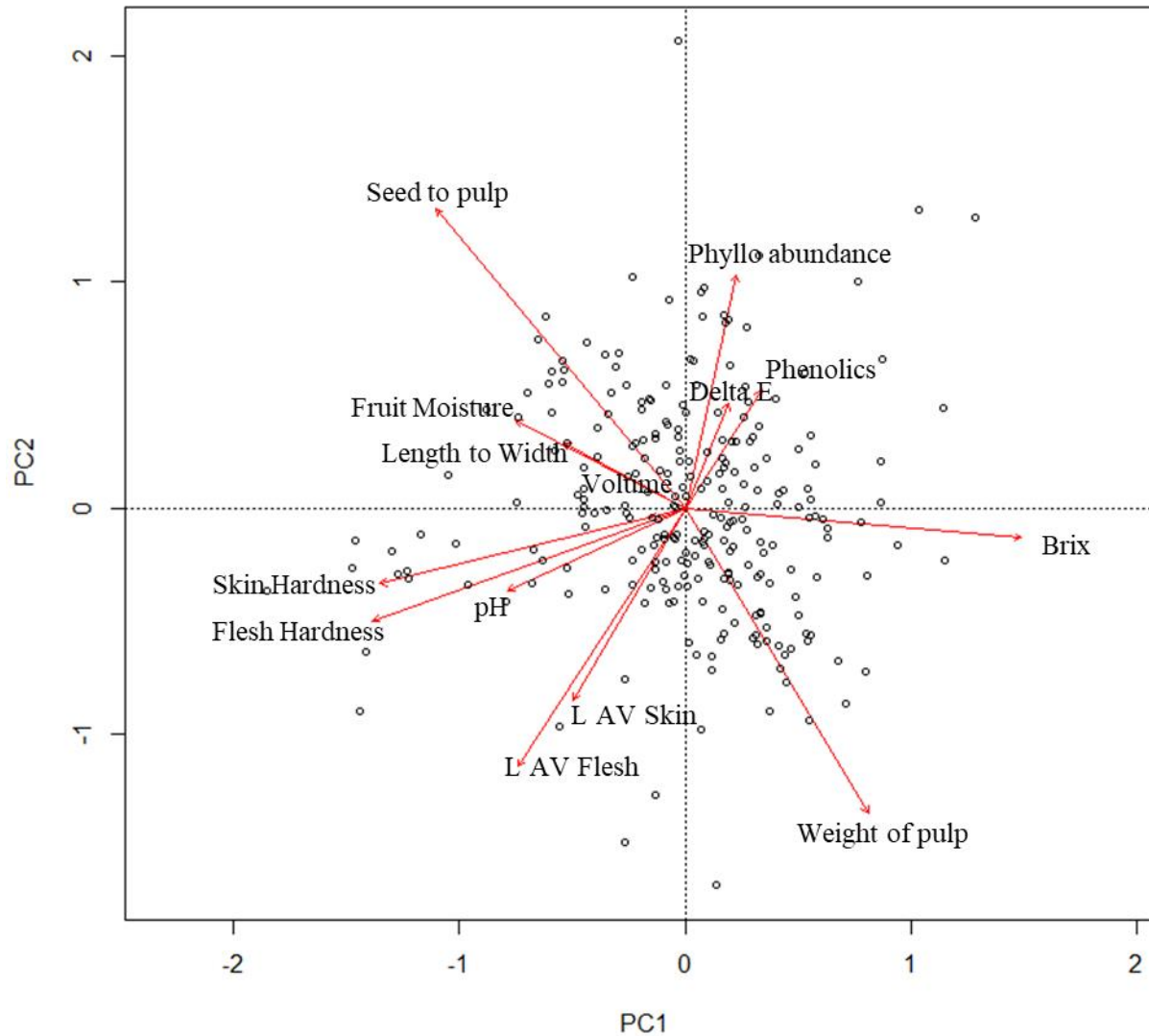


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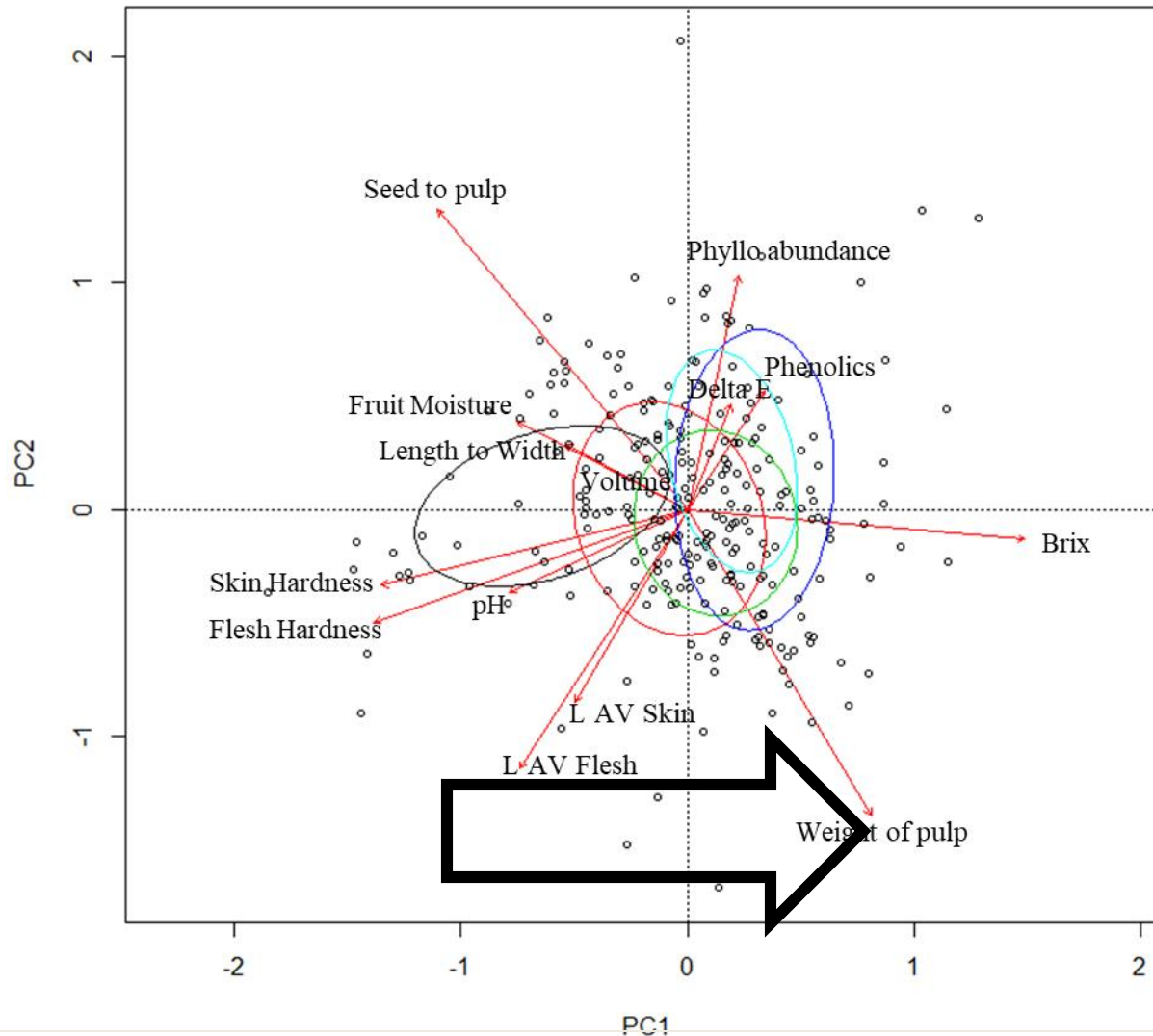
Fruit Quality Metrics Definitions

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

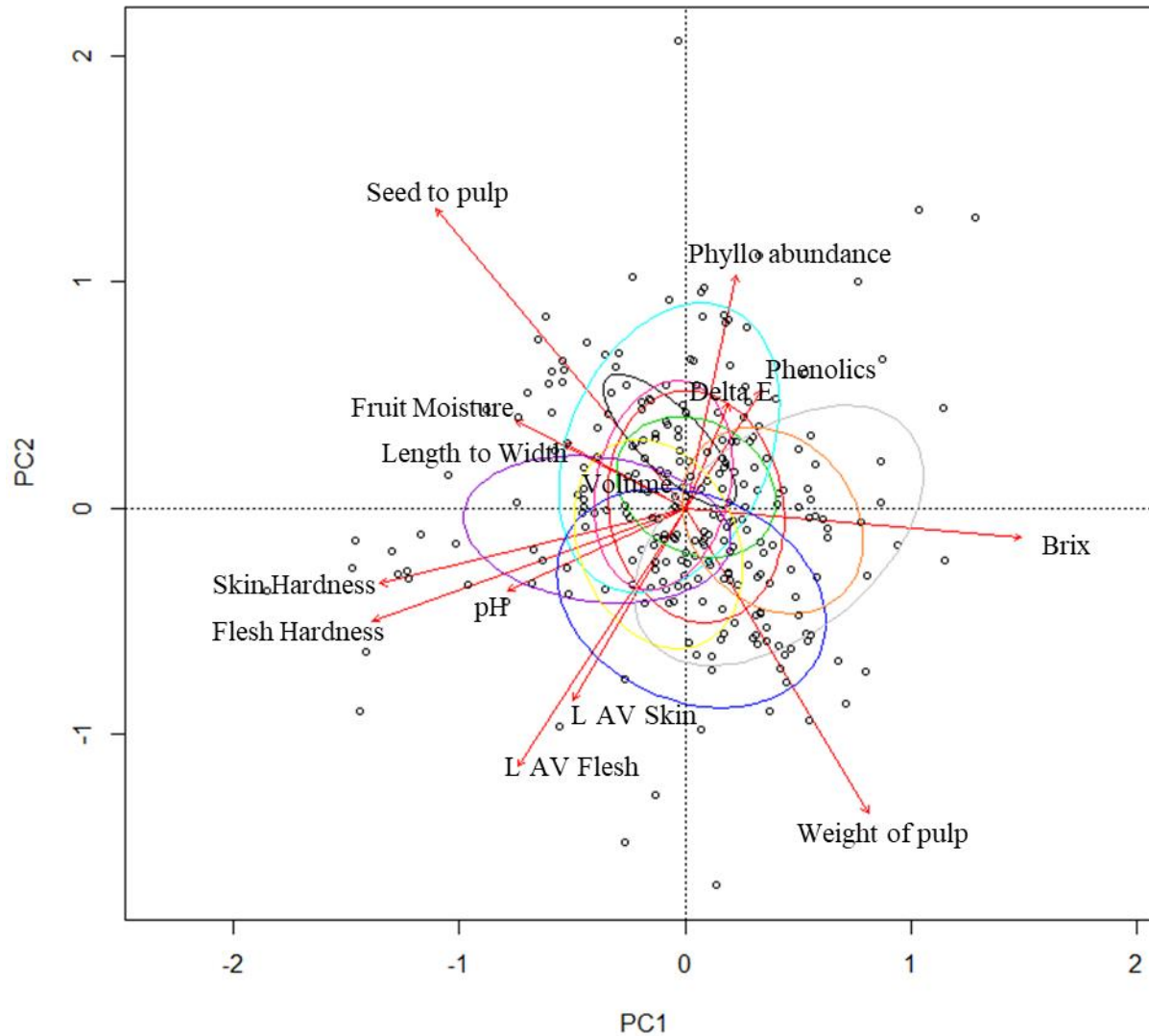
PCA of Fruit Quality Metrics



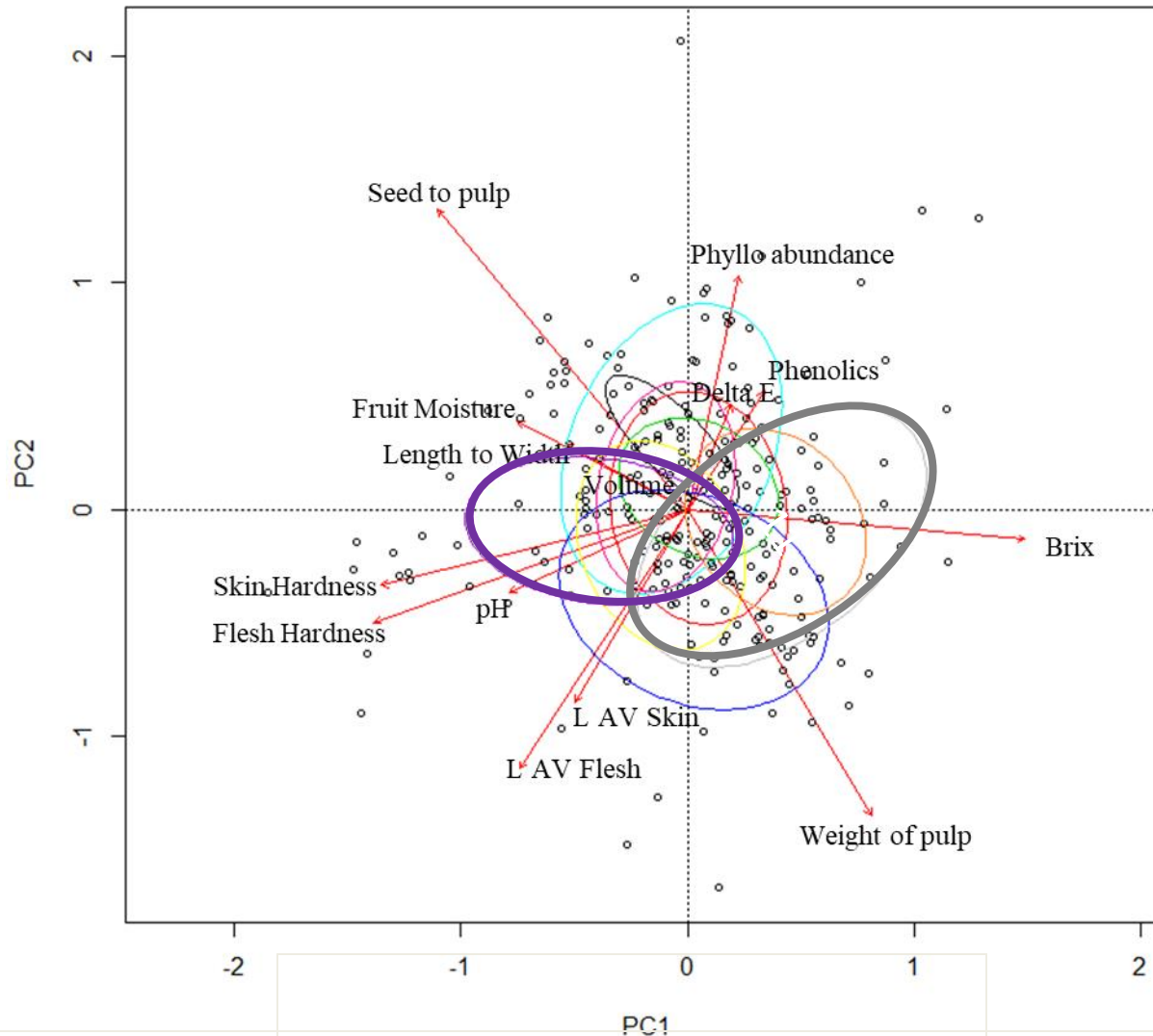
PCA-Effect of Ripeness on Fruit Quality



PCA-Effect of Cultivar on Fruit Quality



PCA-Effect of Cultivar on Fruit Quality

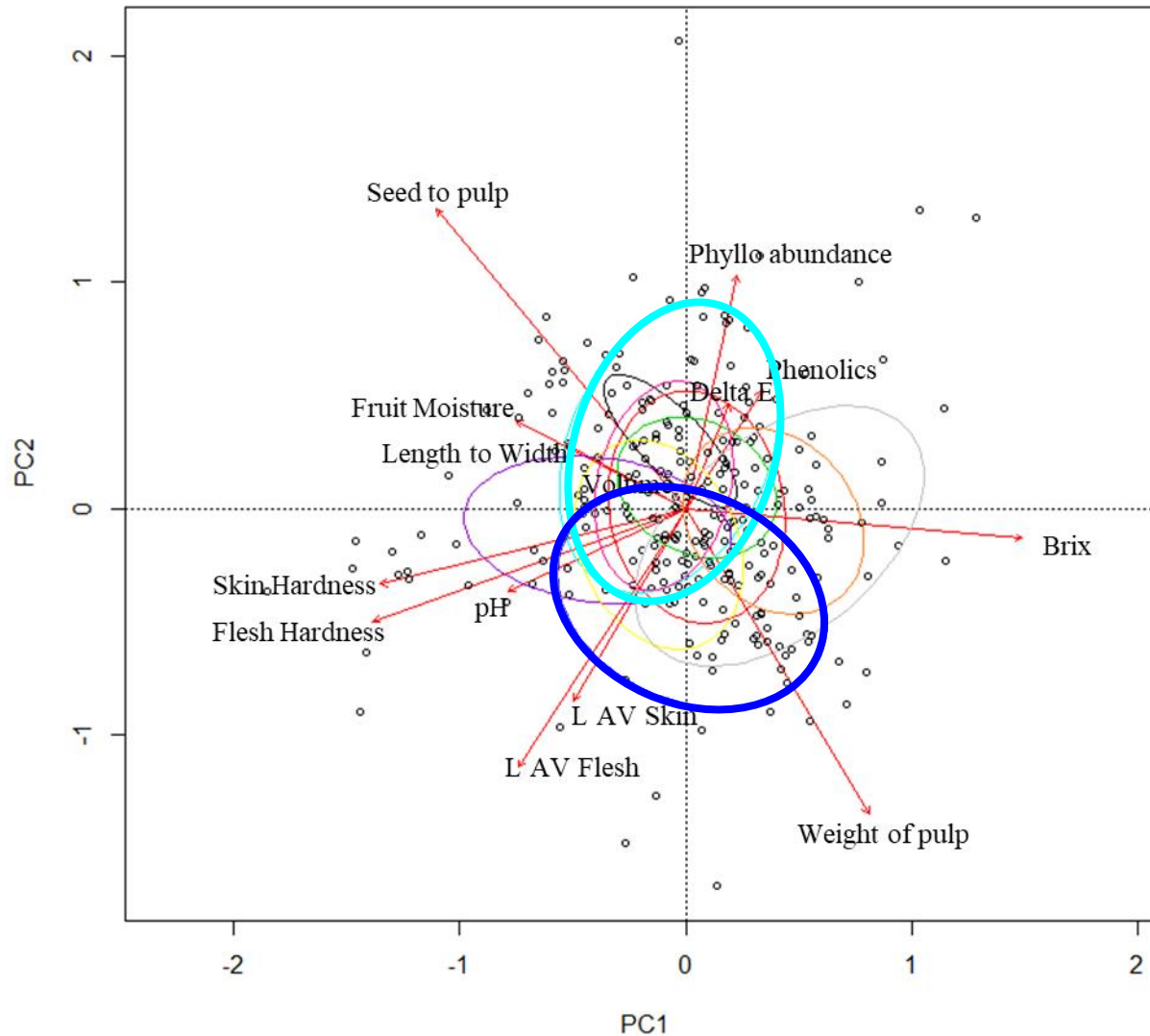


Shenandoah

Susquehanna

PCA-Effect of Cultivar on Fruit Quality

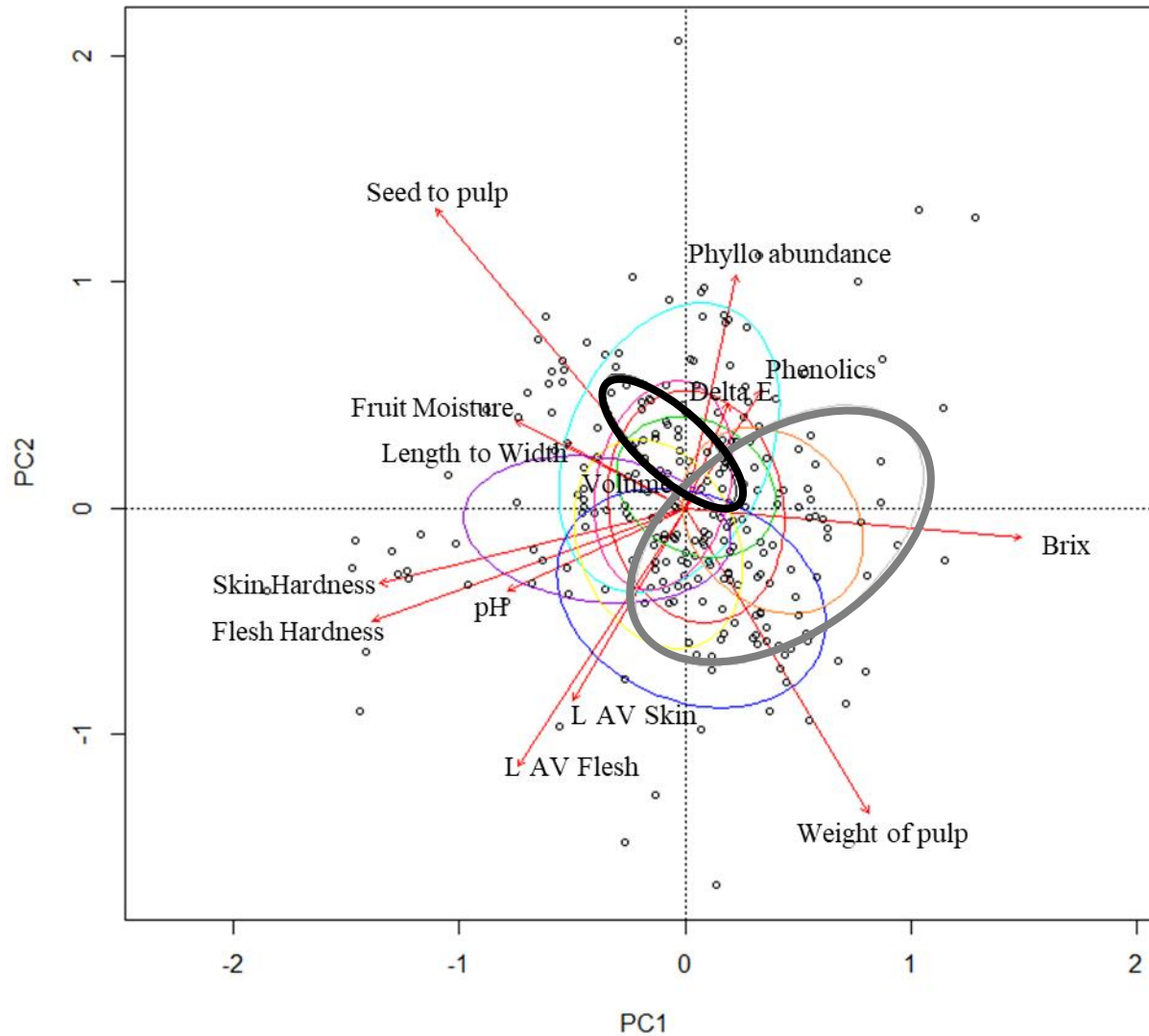
Shawnee
Trail



Potomac

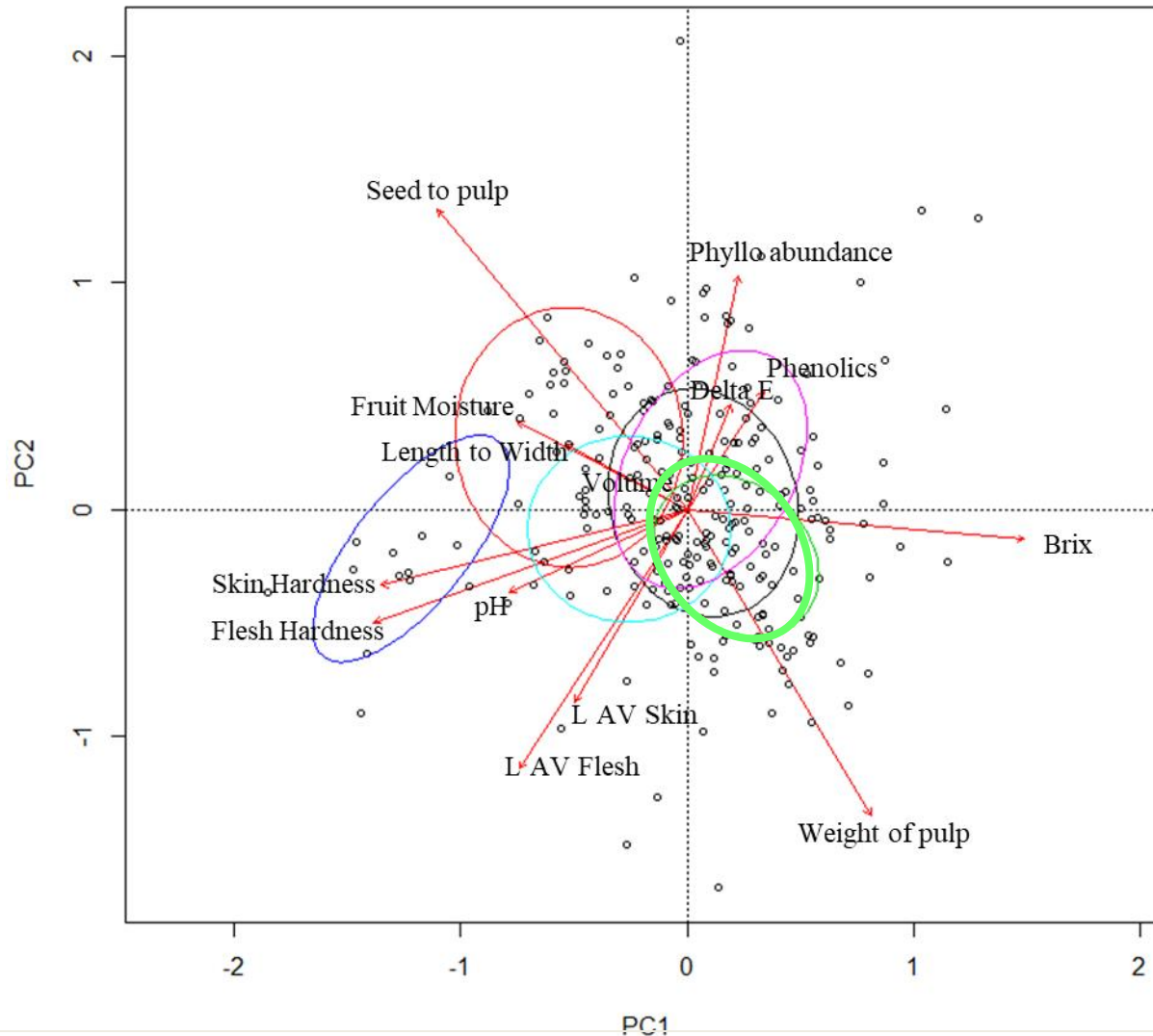
PCA-Effect of Cultivar on Fruit Quality

Allegheny



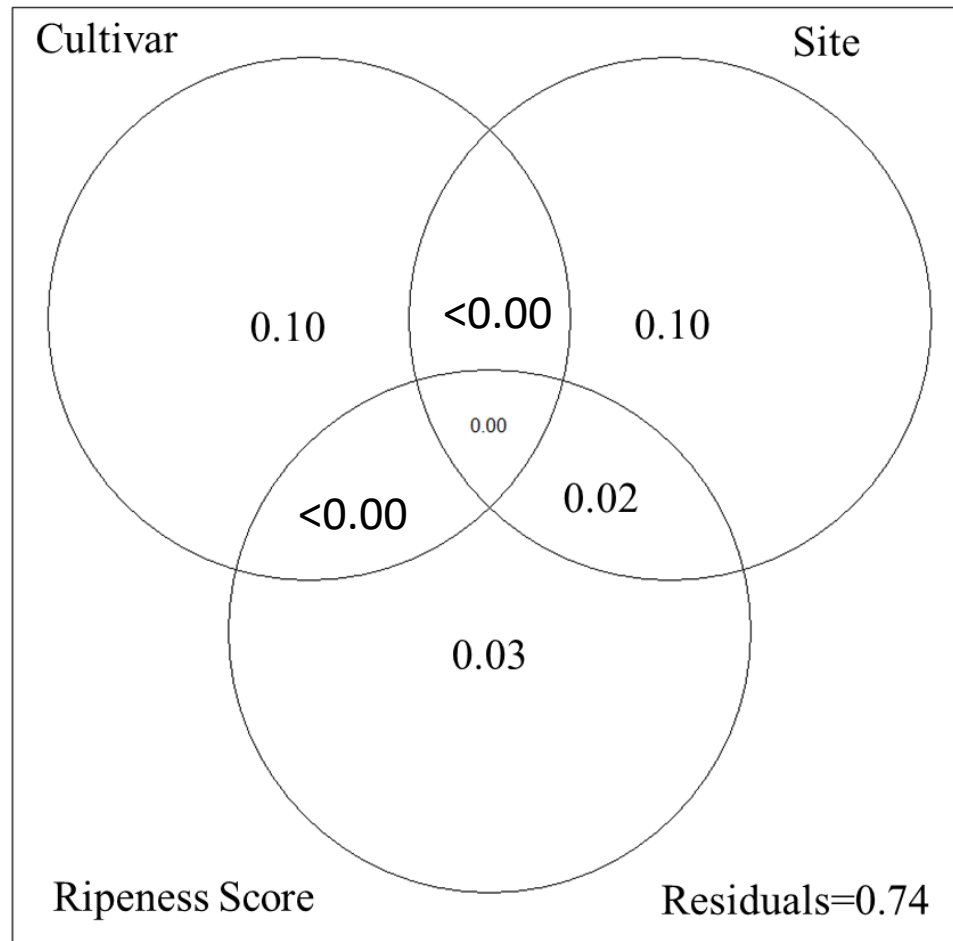
Susquehanna

PCA-Effect of Site on Fruit Quality



Valley View

Partitioning of Variance



Values <0 not shown



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Conclusions

- Predicted Total fruit mass and pulp mass show significant interaction between DBH and Flowering counts.
- Site is important factor in quality and yield
 - Cultural practices may lead to more homogenous fruit
 - More rigorous testing for some of the individual fruit metrics
 - Cultivar recommendations
 - Susquehanna and Potomac

