RosBREED

Enabling marker-assisted breeding in Rosaceae
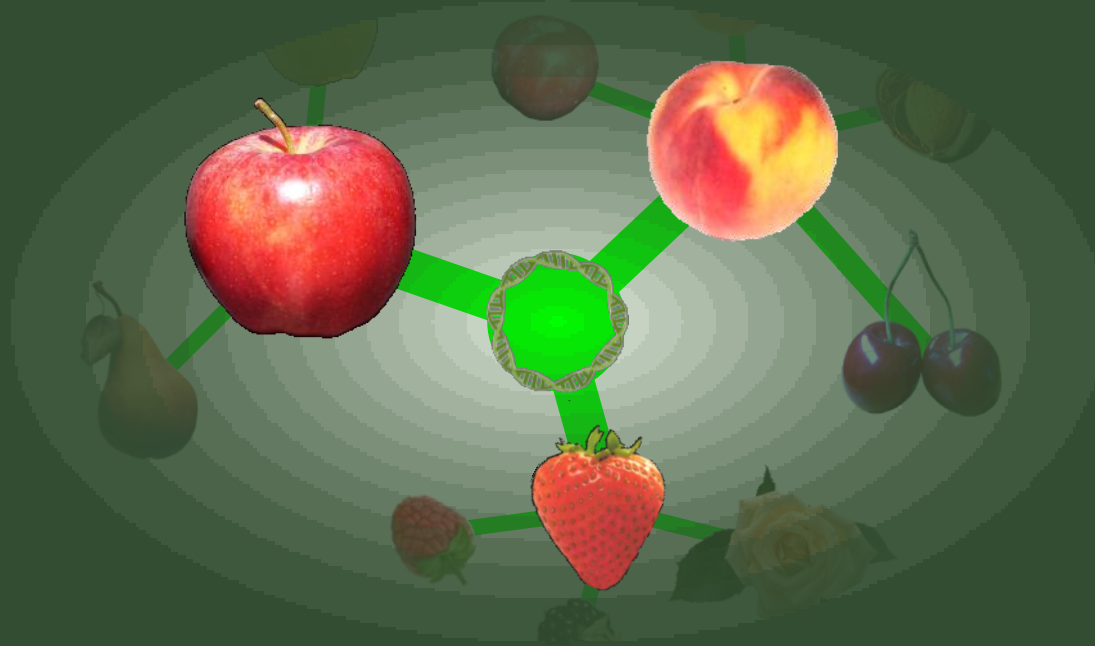
Germplasm Sets and Standardized Phenotyping Protocols for Fruit Quality Traits in RosBREED
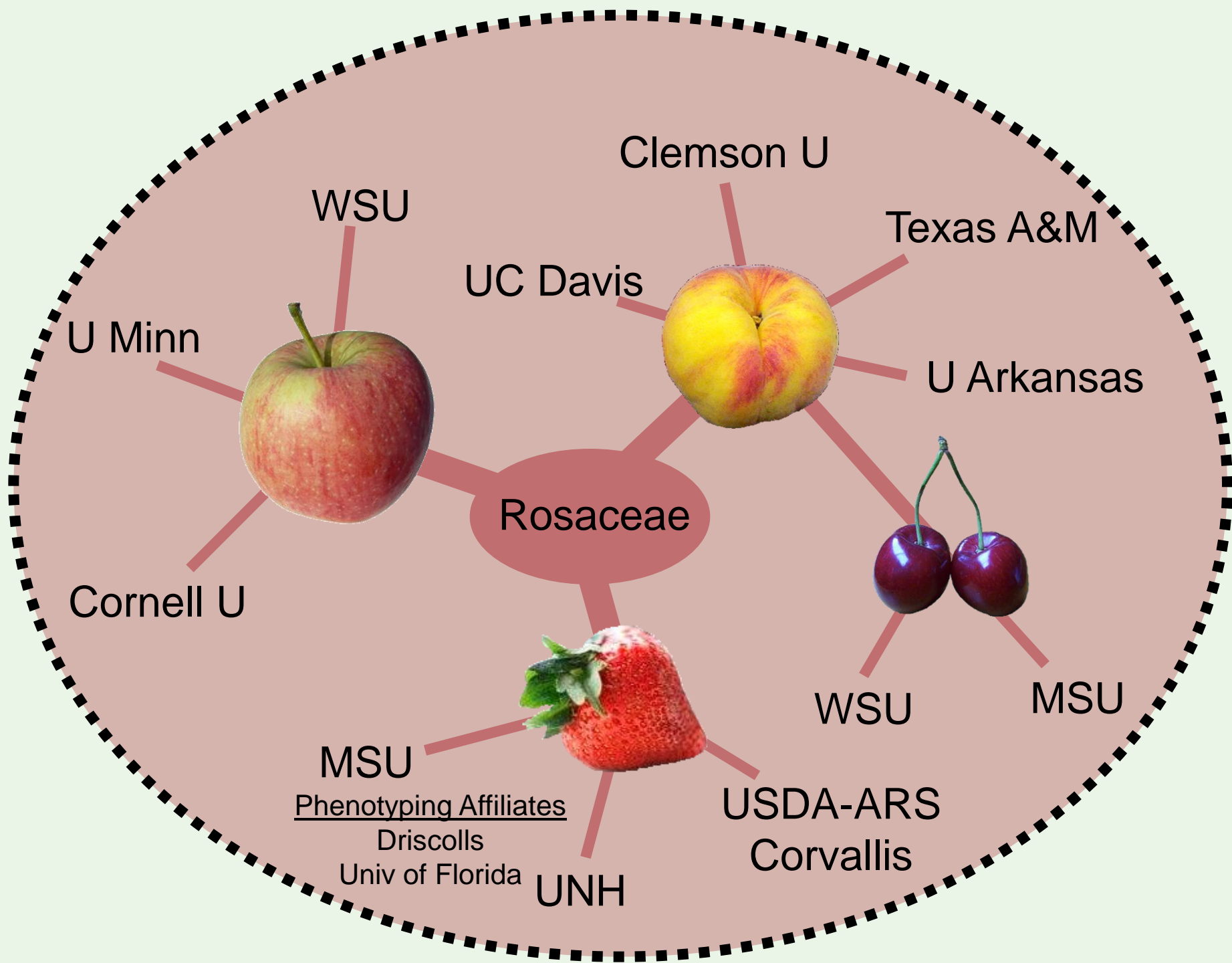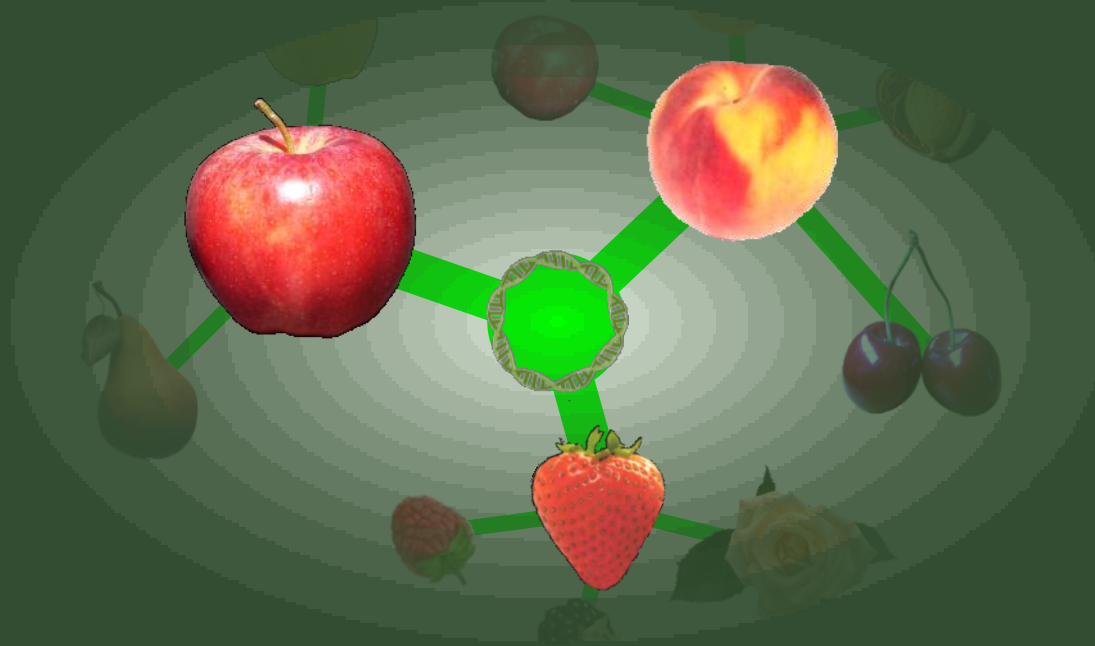
Jim Luby, Breeding Team Leader

Outline of Presentation

❖ RosBREED Demonstration Breeding Programs

❖ Standardized Phenotyping Protocols

❖ Reference Germplasm Sets
   ❖ SNP Detection Panels
   ❖ Crop Reference Set
   ❖ Breeding Pedigree Set

RosBREED Demonstration Breeding Programs

WSU

UC Davis

Clemson U

Texas A&M

U Minn

U Arkansas

Cornell U

Rosaceae

MSU

Phenotyping Affiliates
Driscolls
Univ of Florida

UNH

USDA-ARS
Corvallis

WSU

MSU

Standardized Phenotyping Protocols

Traits and Standardized Phenotyping Protocols

- Identify critical fruit quality traits and other important traits

- Develop standardized phenotyping protocols to enable data pooling across locations/institutions

- Protocols available at www.RosBREED.org

Apple Standardized Phenotyping

At harvest

Storage 10w+7d

Storage 20w+7d

5 fruit (reps) per evaluation
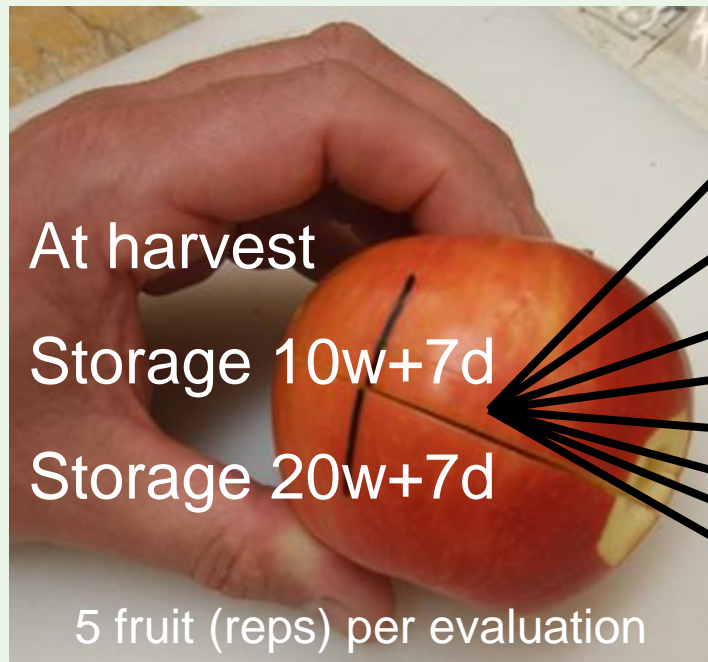
Firmness, Crispness

– Instrumental, Sensory

Sweetness, Acidity – Intstrumental, Sensory

Color, Appearance, Juiciness, Aroma – Sensory

Cracking, Russet, Sunburn

Maturity

Fruit size

Postharvest disorders

Harvest date, Crop, Dropping

RosBREED Apple Phenotyping Locations

Wenatchee, WA

St Paul, MN

Geneva, NY

- One location for all evaluations would reduce variation among instruments and evaluators

- Local evaluations more sustainable and relevant for future efforts at each institution

- Conduct standardized phenotyping of Germplasm Sets at respective sites over multiple (2-3) seasons

- Collate data in PBA format, conduct quality control, archive
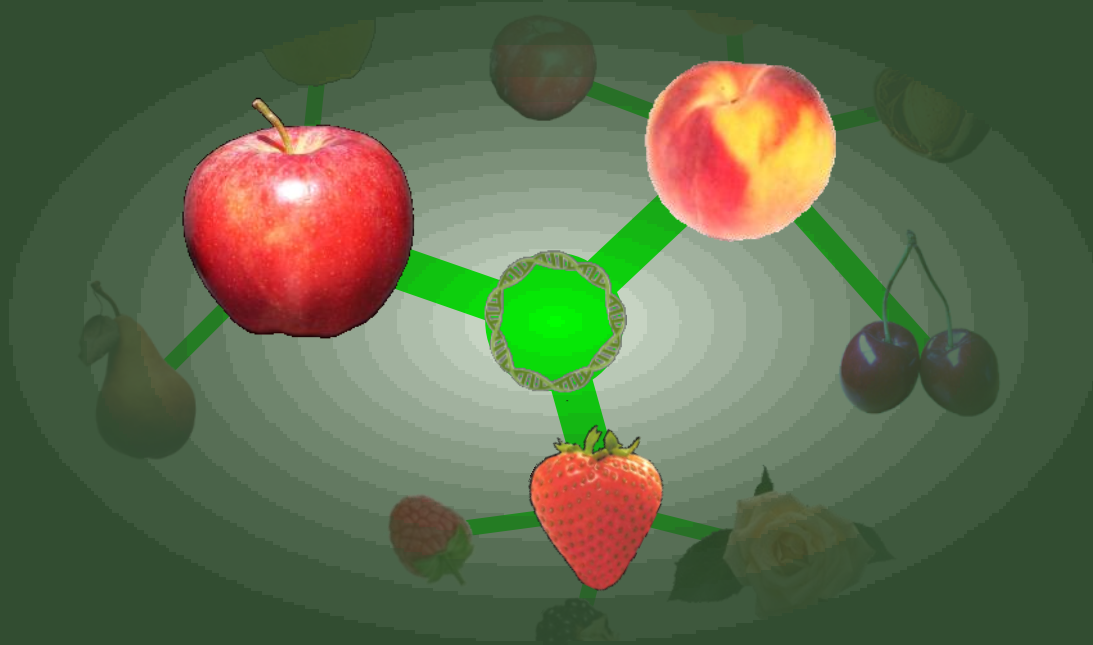
Reference Germplasm Sets

Crop Reference Set

Breeding Pedigree Set

SNP Detection Panel

Crop Reference Sets

- Enable efficient validation and utility assessment of M-L-T associations

- Resource for common benefit

- Genotyped genome-wide with SNP markers and phenotyped for fruit quality traits and other high-impact traits.

- ~480 individuals (cultivars, ancestors, founders, breeding lines, selections, and seedlings) that are fruiting in 2010-2012

Breeding Pedigree Sets

- Resource for proprietary benefit of breeding program benefit only

- ~100-300 extra plants for each breeding program that, <u>together with the Crop Reference Sets</u>, allow full representation of founders of interest to that program

- Information may remain with each breeding program; data-sharing improves power

Reference Germplasm Sets

- Approach:
    - Identify important parents among breeding programs
    - Trace pedigrees to founders and identify available founders and intermediates
    - Identify progeny available in breeding programs
    - Use PediMap™ to visualize pedigree relationships
    - Calculate allele representation of important parent back through available founders and intermediates
    - Include progeny to adequately represent important parents
    - Crop Reference Sets will be publicly archived

Identify Important Parent, Ancestors, Progreny Example at U of Minn: Zestar!
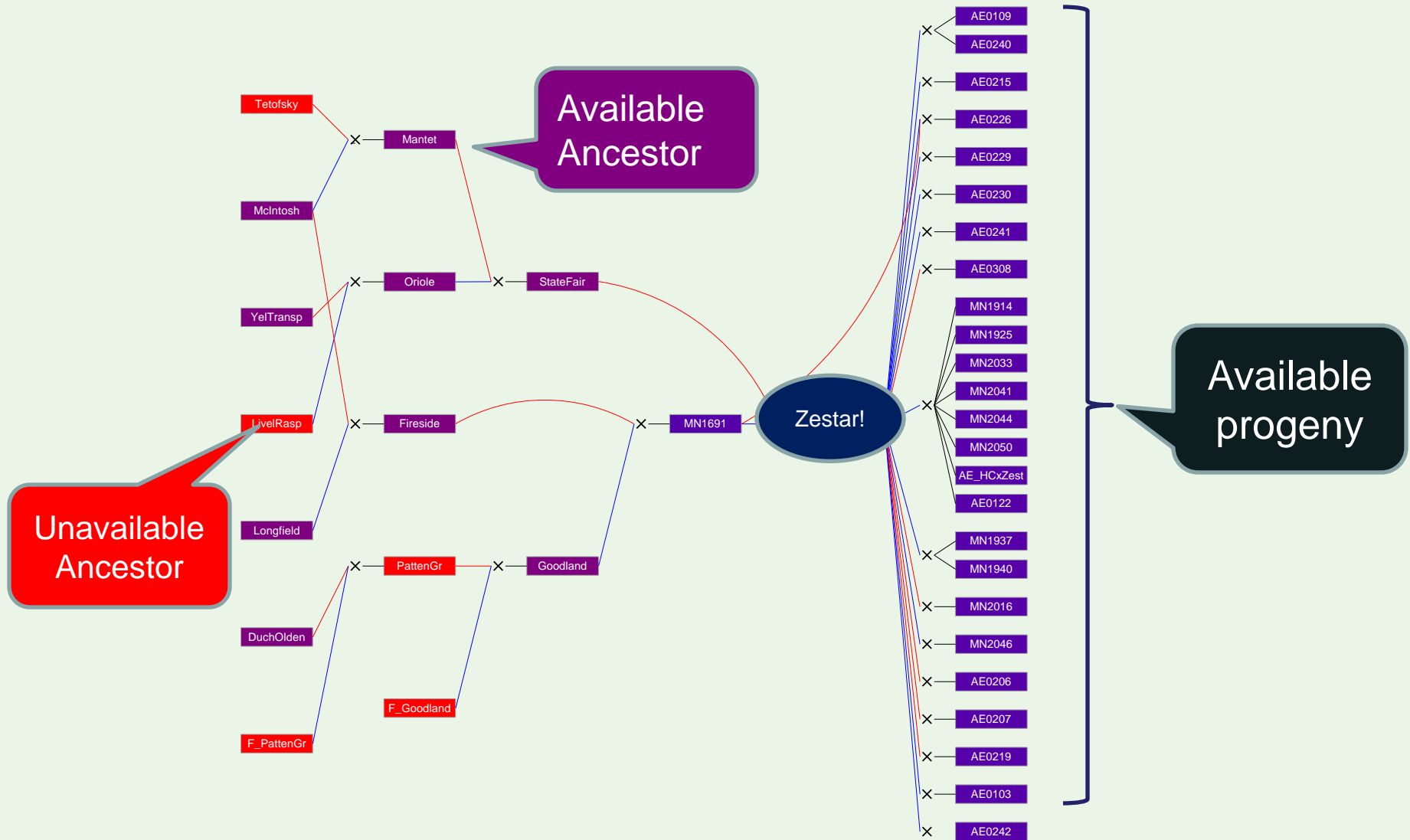
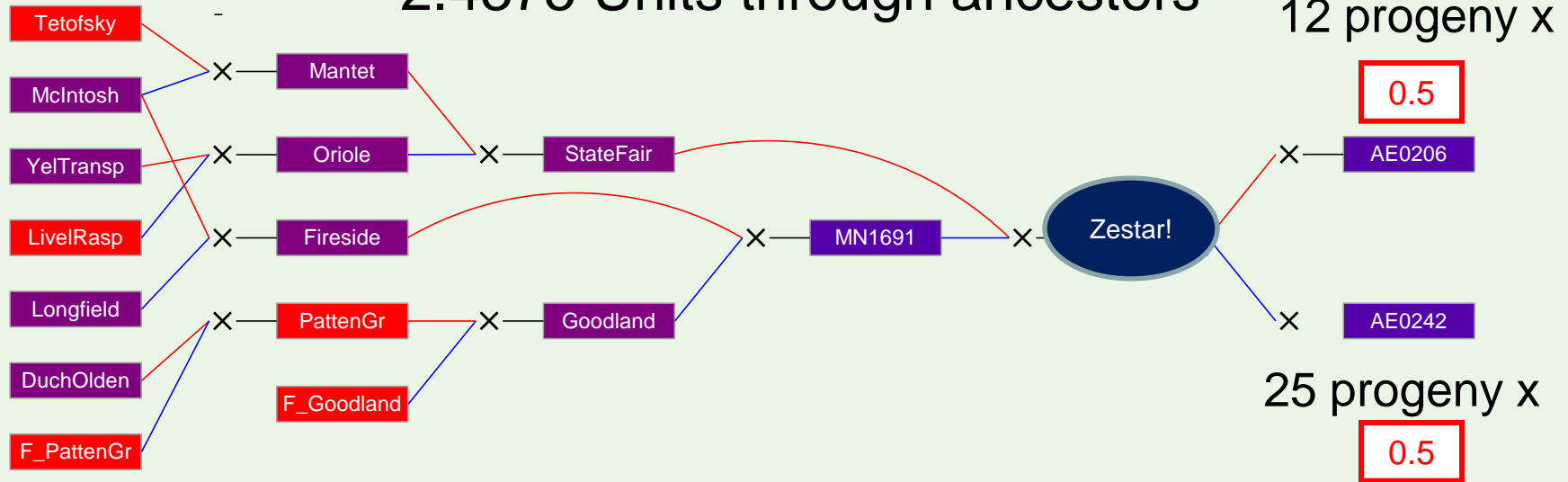# Calculate allele representation of important parent back through available ancestors

Zestar! = 3.4375 Units through ancestors and itself
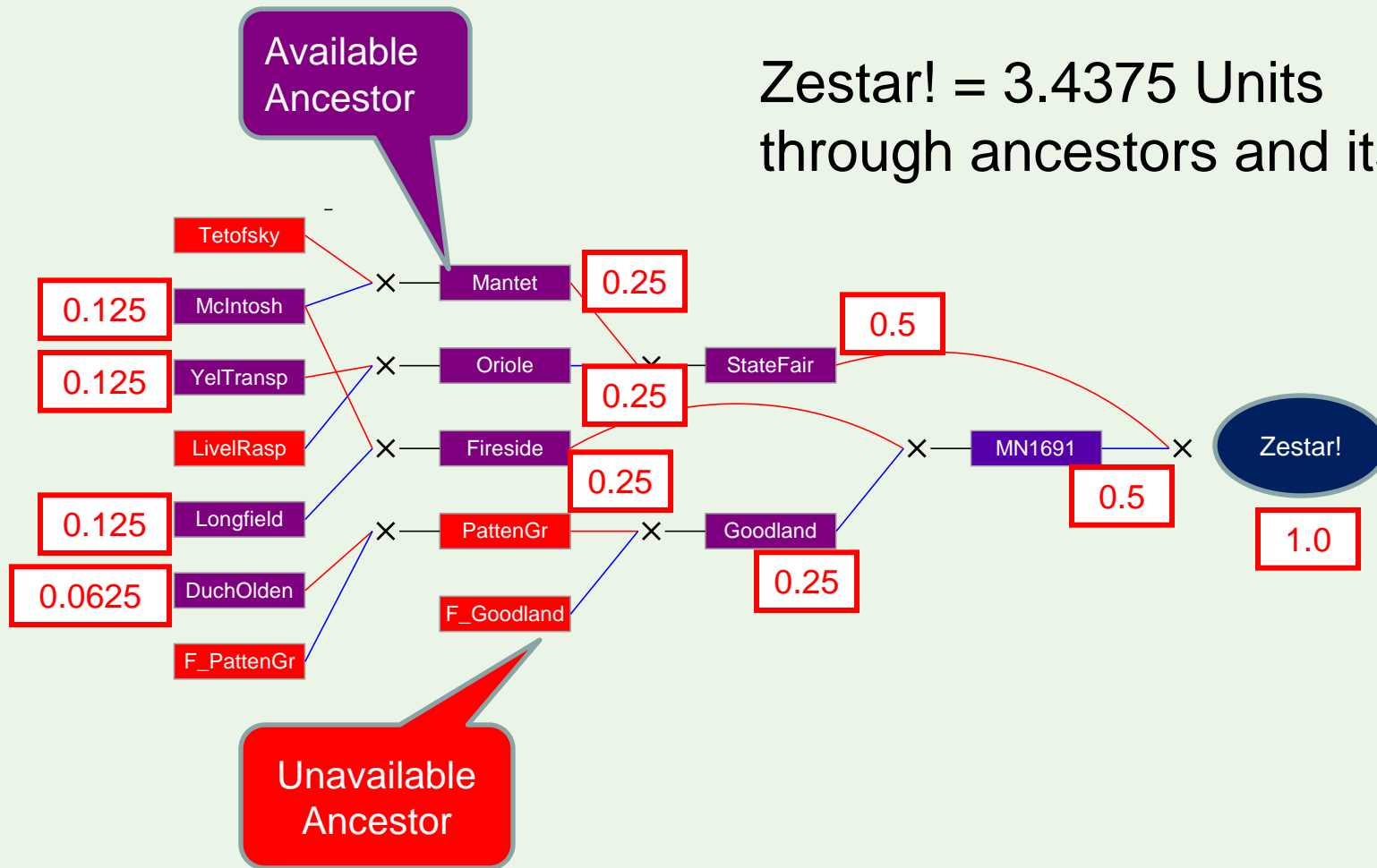
Include progeny to adequately represent important parents

Goal = 12.5 units minimum

1.0 unit through itself
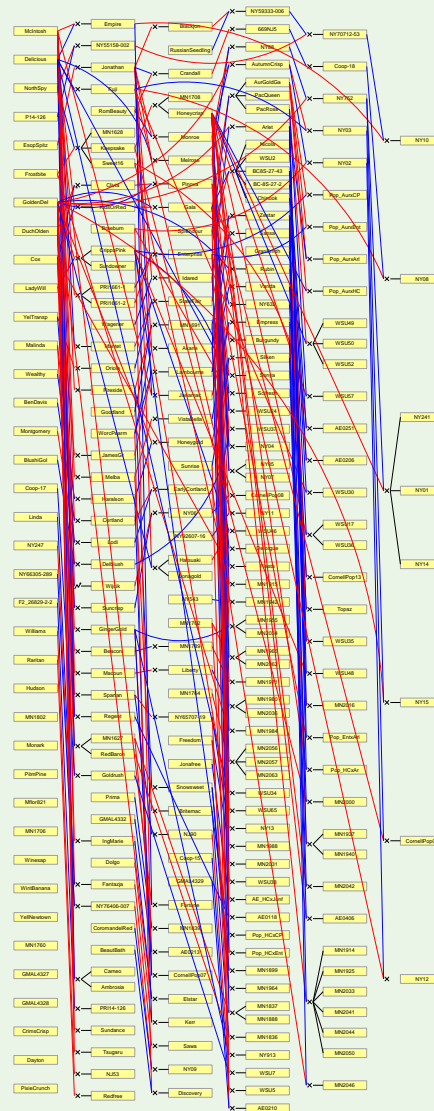2.4375 Units through ancestors

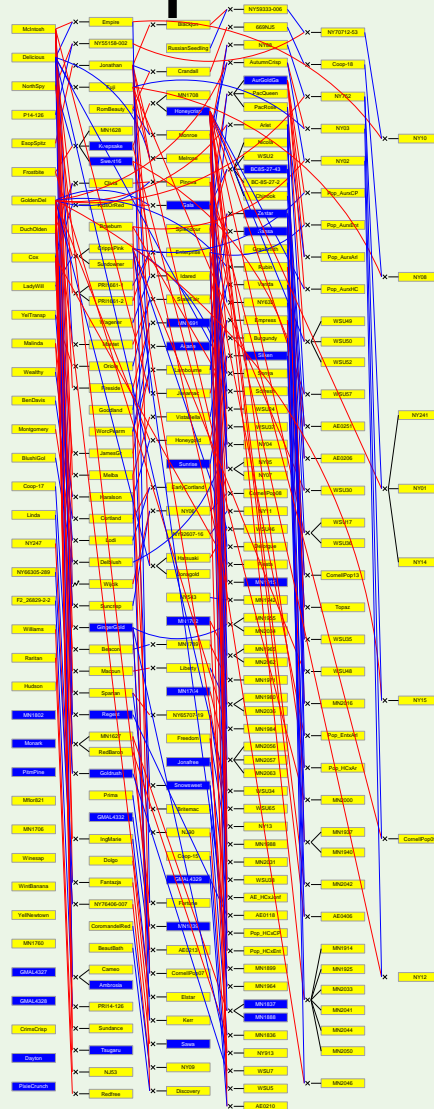12 progeny x

0.5

25 progeny x

0.5

18.5 units through 37 progeny
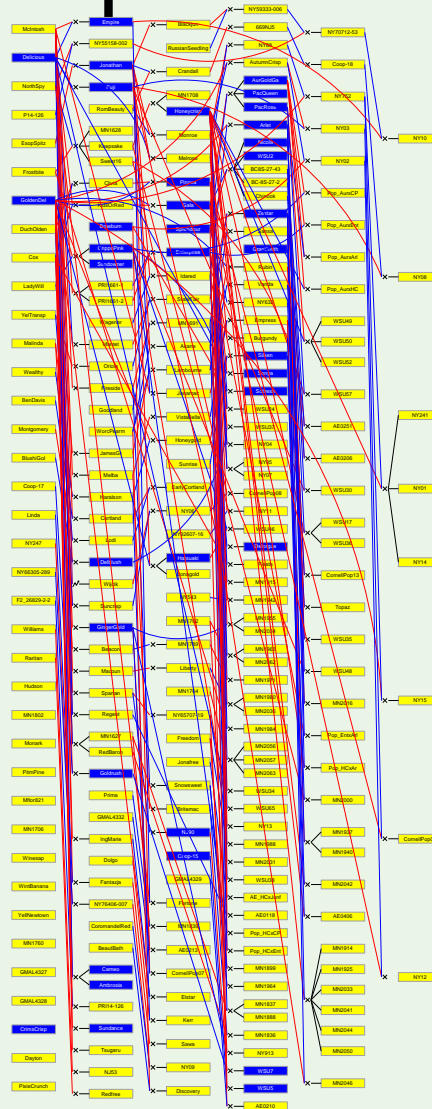
Zestar! allele representation = ~22 units

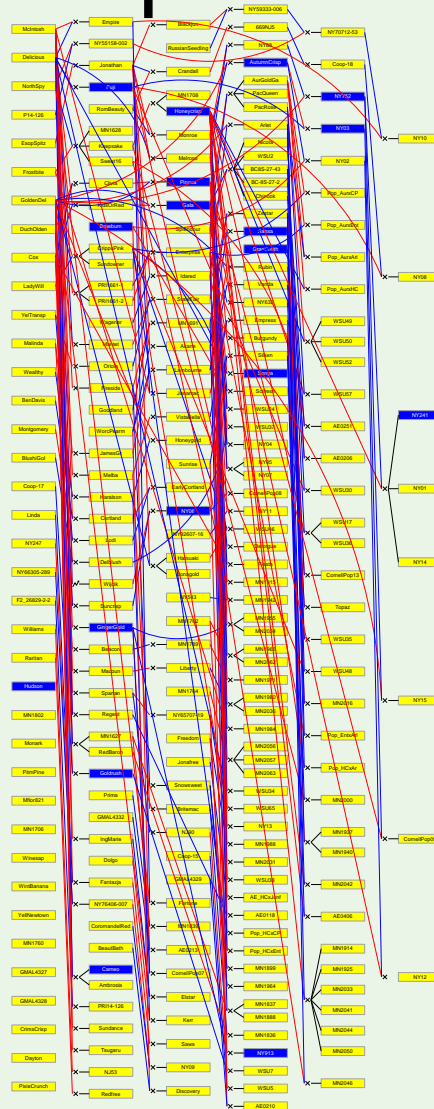# Apple Crop Reference Set

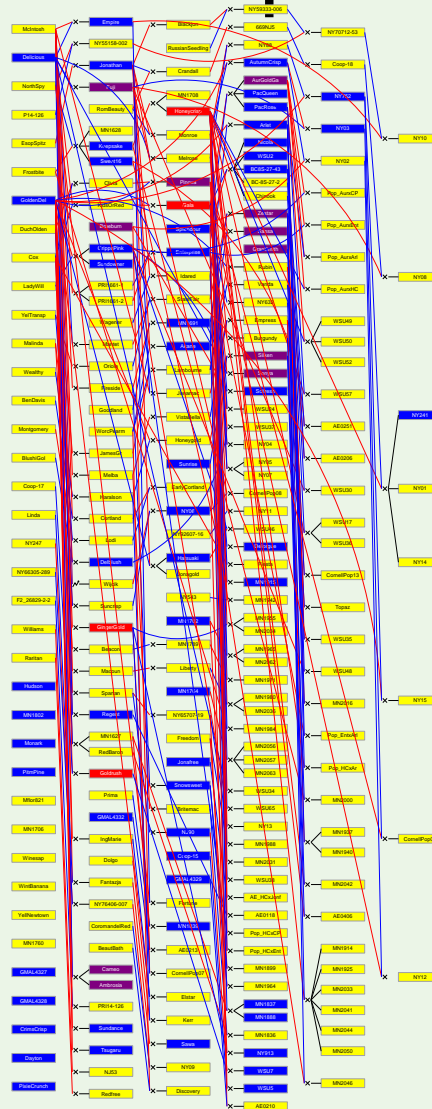# Apple Crop Reference Set:
U of MN Important Parents

Apple Crop Reference Set: WSU Important Parents

Apple Crop Reference Set: Cornell Important Parents

Apple Crop Reference Set:
All Programs' Important Parents

SNP Detection Panel

- Used for genome scans to identify SNPs distributed along genome

- Up to 20 individuals from Crop Reference Set

- Includes Diverse Key Founders or Intermediate Ancestors

Apple SNP Panel

Founders

Delicious
Golden Delicious
McIntosh
Jonathan
Cox's Orange Pippin
Rome Beauty
Northern Spy
Dolgo
Duchess of Oldenburg
Wagener

Intermediate Ancestors

Cripp's Pink
Fuji
Honeycrisp
Zestar!
Goldrush
CrimsonCrisp
Coop-15
F2 2689-2-2
Frostbite
Haralson

Acknowledgements

Questions?