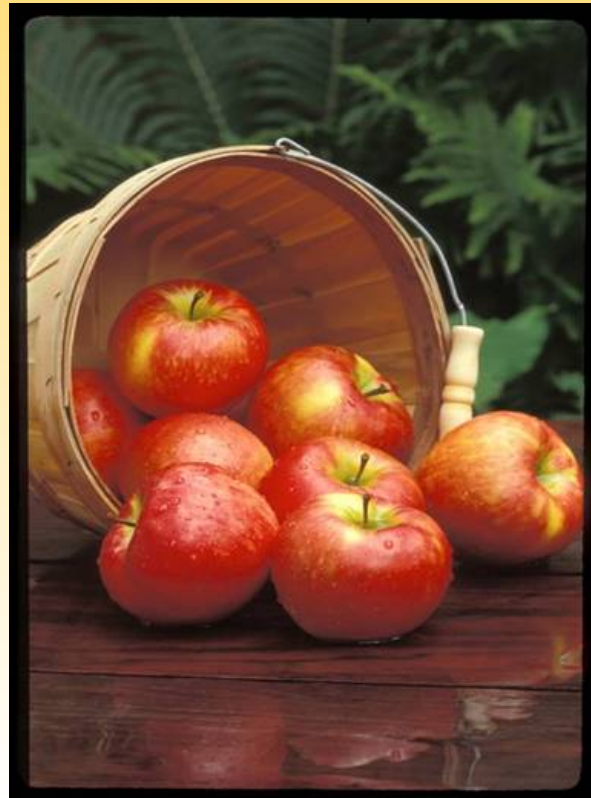


The Crunch Factor: Apple Development at the Minnesota Landscape Arboretum



Slides and Content –Courtesy of:

- David Bedford
- James Luby
- Emily Hoover
- Karl Foord
- Peter Moe



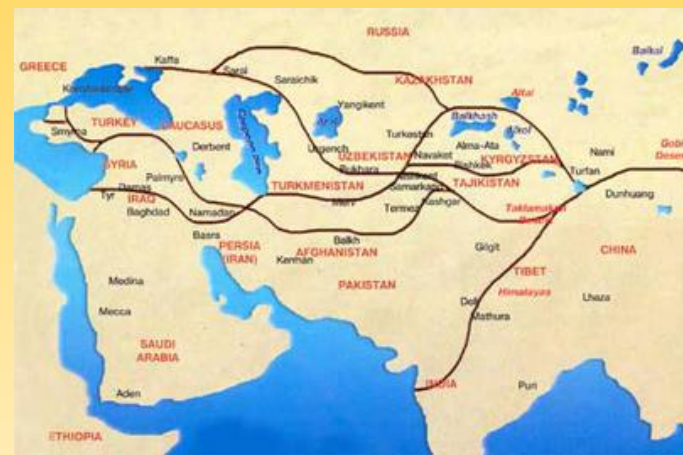
Apple Coevolution and Dispersal

- Animals are attracted to the fruit and unknowingly spread the seeds.



Human Dispersal

- Apples are believed to have originated in Kazakhstan which was part of the ancient silk route.
- As traders passed through that region they picked apples, ate them and dropped the seeds along the way .



Further Dispersal

- These seeds grew into trees that produced fruit and were further spread throughout Europe and Asia.



Domestication by Grafting



- Through the use of grafting, the Greeks and Romans were able to cultivate superior specimens from wild trees.



- They spread them throughout the civilized world.

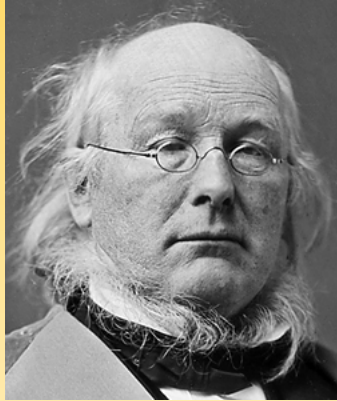


Apples in the New World

- Eventually apples made their way to America with the early settlers.



Apples in Minnesota?



“I would not choose to live in Minnesota because one can not grow apples there.”

- Horace Greeley, New York Tribune, 1860



19th Century Successes Spur Interest in Fruit Breeding



Minnesota State Horticultural Society

Peter Gideon, of Excelsior, introduces the Wealthy
apple in 1868



Wealthy Apple



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UMN Fruit Breeding Program

- The present program began in 1908 on property purchased west of Chanhassen.
- Early introductions
 - Minnehaha apple - 1920
 - Haralson apple - 1922



CHAS. HARALSON, SUPT. MINNESOTA STATE FRUIT-BREEDING FARM
AT EXCELSIOR, MINN.



The University of Minnesota Fruit Breeding Farm – now part of the Landscape Arboretum



RESIDENCE OF CHAS. HARALSON, SUPT.,—AND GREENHOUSE—AT MINNESOTA STATE FRUIT-BREEDING FARM.
AT ZUMBRO HEIGHTS, MINN.

The Minnesota Horticulturist, 1909



“To get the best results in fruit breeding, a large number of varieties of all fruits adapted to this region should be planted as soon as possible at our (new) fruit farm.”

•Charles Haralson, The Minnesota Horticulturist, Nov. 1908



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What is Plant Breeding?

- Art and science of developing new plants using knowledge of genetics, genomics and other fields
- Most important tools:
 - Hybridization
 - Selection



Scientific American



Pollen from male parent
is placed by hand on
stigmas of the flowers of
female parent



The flowers are
covered with bags to
prevent unwanted
pollination.



Apple Variety Development Timeline

- Hybridization

-Plan and make crosses in orchard

Hybridization is
the easy part

- It only takes 1 week every year.



Hybridization - produces a hybrid seed

- Doesn't affect the apple...just the seeds.

- What is a hybrid?

An individual that results from a combination of genes from two parents.

- We are hybrids!



Apple Genetics



- Apples are very heterozygous... they have a lot of variation.
- Apple trees grown from seeds will not be true-to-type.
- This makes it difficult to perpetuate improved selections



Apple Seedlings Growing in HRC Greenhouse



Apple Breeding Timeline

- **Year 1:** Make crosses in the orchard
- The apples are collected in the Fall
- The seeds are removed and must be cold stratified.
- **Year 2:**
- Seedlings grown in containers in greenhouse and gravel beds.
- Dwarfing rootstock planted in orchard in spring and budded with seedling scion buds in July-August.



Apple Breeding Timeline

First Test

Year 3 – 5: First Test Pre-fruiting period

-Cull seedlings in field for winter injury, disease susceptibility, etc.



Year 5 – 10: Fruiting and selection period

-Evaluate for tree and fruit quality

-Select Superior Seedlings and give a test number e.g. MN 1711

-Propagate new selections for further testing on two dwarfing rootstocks



Apple Breeding Timeline

Second Test

Year 7-10

- Plant cloned trees of selections in Second Test
- Fruit harvested from 2nd Test Blocks sold at Arboretum Applehouse

Year 10-15

- Evaluate fruit and trees in Second Test trials
 - Use sensory panels to confirm fruit quality
- Send best selections to other sites for evaluation



Apple Breeding Timeline



Year 15 – 20 Third Test

- Propagate best selections for commercial testing
- Apply for US Plant Patent and other IP protection
- Identify and contract with commercial partners
- Virus testing and commercial propagation by nurseries
- Send to plant quarantine sites in other countries for international commercialization

Year 20 - 25 Commercialization

- Initial trees available to producers

Year 25-30 First substantial amount of fruit available to consumers



Asexually propagated varieties – the product of fruit breeding



Why are fruit varieties asexually propagated?

- Maintain a superior genotype
- Market will pay for higher cost of plants
- Barriers to True-breeding Seed Production
 - Long juvenile phase
 - Self Incompatibility systems
 - Highly heterozygous



Many Important Traits in a Good Variety

.....many genes must be combined

- Texture ***
- Flavor
- Appearance
- Fruit size
- Storage life
- Disease resistance
- Productivity
- Cultural traits (annual bearing, tree form etc.)



Our Philosophy

- **Appearance** is an important factor in the initial purchase of an apple.
- **Texture and flavor** are the most important factors in the repurchase of an apple.



University of Minnesota Apple Introductions

27 varieties introduced from Univ. of Minnesota including...

- Haralson
- Fireside
- Regent
- Honeygold
- Chestnut Crab
- Sweet Sixteen
- Honeycrisp (Honeycrunch™)
- Minnewashta (Zestar!™)
- Wildung (SnowSweet™)
- Minneiska (SweeTango™)
- Frostbite



Early Apples

Zestar!™

- Ripens ~ Sept 1.
- Zones 3-5
- Well balanced sweet/tart flavor.
- Excellent for fresh eating and cooking.
- Good storage for an early apple.
- Very susceptible to scab

Chestnut Crabapple

- Ripens ~ Sept 8.
- Nutty flavor.
- Small and homely
- Fresh eating only.
- Hardy to zone 3-5

Wealthy

- Ripens ~ Sept 10.
- Tart flavor
- Excellent for baking
- Hardy to zone 3-5
- Susceptible to scab and fireblight



Midseason Apples

Honeycrisp

- Ripens ~ September 25.
- Well balanced flavor.
- Good for fresh eating and cooking.
- [Incredibly crisp texture.](#)***
- Outstanding storage life ... 7 months.
- Scab resistant
- Zone 3-5



Sweet Sixteen

- Ripens ~ September 20.
- [Sweet, unusual flavor.](#)
- Fresh eating mostly.
- Upright tree, slow to come into bearing.
- Zone 4-5



Honeycrisp Apple

- Over 10 Million Trees planted worldwide
- Introduced to Europe, South Africa New Zealand as Honeycrunch™
- A Parent of other new apples being introduced in New York and Washington



Late Midseason Apples

Haralson

- Ripens ~ September 30.
- Tart flavor.
- Good for fresh eating and especially cooking.
- Good storage life.
- Very prone to biennial bearing.
- Nice compact tree.
- Zone 3-5



Honeygold

- Ripens ~ October 5.
- Sweet, balanced flavor.
- Good for fresh eating and cooking.
- Very susceptible to bruising and fire blight.
- Zone 4-5



Late Season Apples

Regent

- Ripens ~ October 10.
- Well balanced flavor.
- Good for fresh eating and cooking.
- Good storage life.
- Rather susceptible to scab.
- Zone 4b-5



Keepsake

- Sweet unusual flavor.
- Best for fresh eating.
- Somewhat small and not overly attractive.
- Excellent storage life.



SnowSweet™

- Ripens ~ Oct 10
- Snow white firm flesh
- Flesh browns very slowly
- Great for fruit plates, salads and for dried apples



SweeTango™ Apple

- Only premium quality fruit can be sold as SweeTango™
- Parents are Honeycrisp and Zestar!™
- SweeTango™ fruit offers another superior apple-eating experience — a satisfying crunch and a juicy blast of sweet-tart flavor.





Minneiska variety apples



- Apples available at retail stores and the Arboretum Applehouse
- Typically harvested the last week in August or first week of September
- Stores well for over 6 weeks
- Multi-purpose apple



Sweetango[®]



- Trees in various stages of quarantine or testing in several countries around the world
- Test plantings established in EU and NZ (2008), South Africa (2010) and Chile (2011)



HoneycrunchTM



POMANJOU

- U of M licensed production, marketing and trademark rights for EU to the French Groupe Pomanjou in 2000, a privately held production, packing, and marketing organization.
- Have planted 200+ ha in France and Germany.
- Eventual goal is ~500 ha or ~ 750,000 bushels

- Marketed as a premium variety in selected markets in the EU.

- Has maintained some of the highest returns in the EU market.

Croquez & Craquez !



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Honeycrunch™



- Trademark name used in Europe for Honeycrisp
- Production commencing in South Africa, Chile, and New Zealand to provide fruit for winter sales in EU and US.
- Cub stores in Minnesota sold Honeycrisp Apples grown in Chile last May



What's New From the "U" ?

- MN 55

- MN 1984

Need Names for Both



MN 55 – A New Apple Variety

- Derived from a cross of Honeycrisp with AA44 (MonArk)
- Ripens early in the season (Late August)
- Crisp, juicy, explosive texture of its Honeycrisp parent, a bright red color and sprightly flavor
- Storage life up to 6 month
- Commercial growers only



MN 1984

- Parents -Frostbite x Honeycrisp
- Texture- very crisp;
- Flavor- sweet, well balanced
- Ripens mid- September
- Storage life – excellent, 7-8 months
- Shows field tolerance to Apple Scab fungus
- No license required

