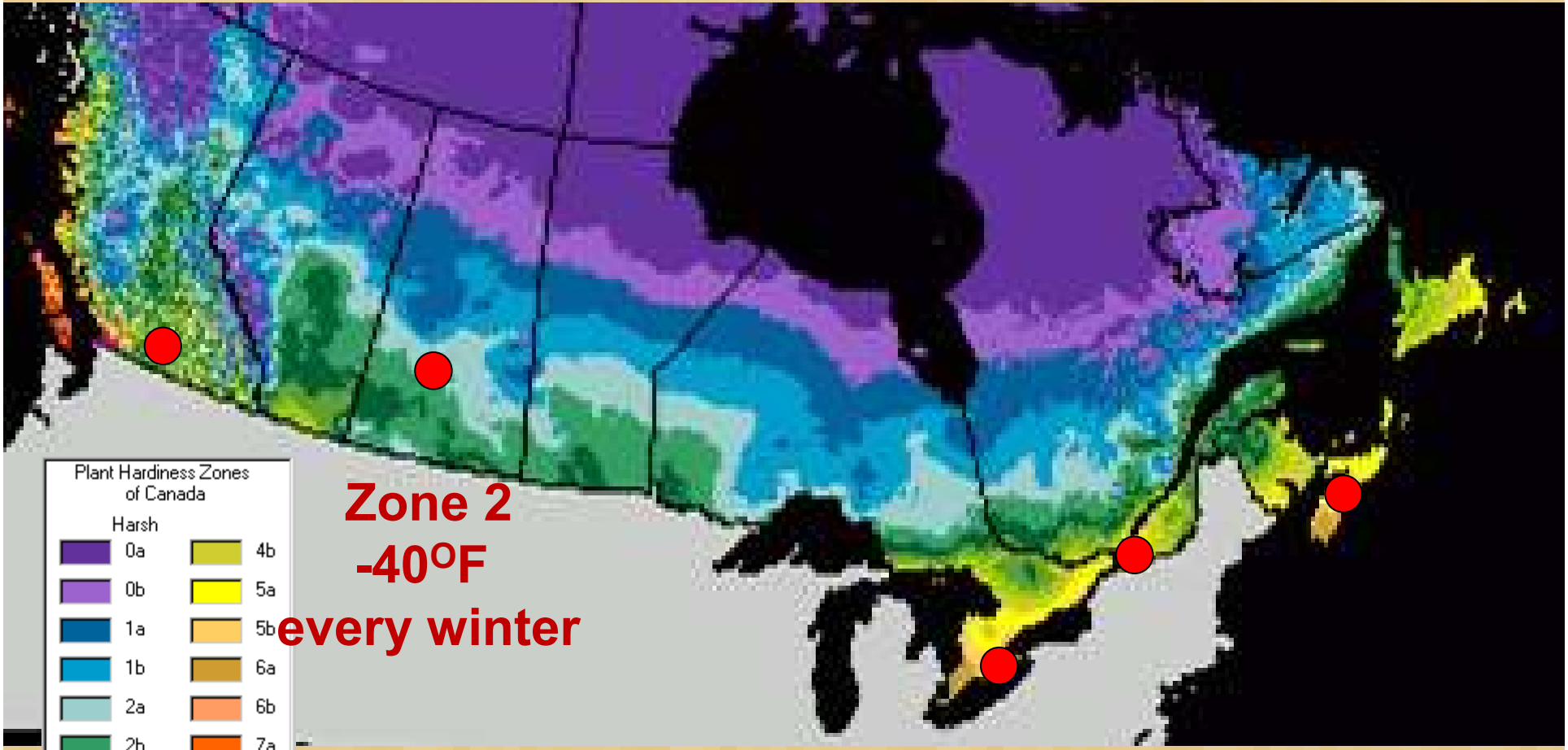
Breeding and Training Dwarf Sour Cherries

Dr. Bob Bors
Department of Plant Sciences
University of Saskatchewan

Outline of talk

- ***Introduction***
- **Breeding Program**
  - **History**
  - **Our goals & methods**
  - **Our Varieties**
- **Training**
  - **Harvester types**
  - **Establishment & Pruning**
  - **Growth and Production**
- **Conclusion**

Fruit Breeding in Canada



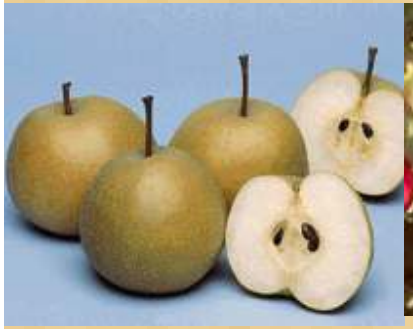
[Plant Hardiness Zones of Canada 2000]

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

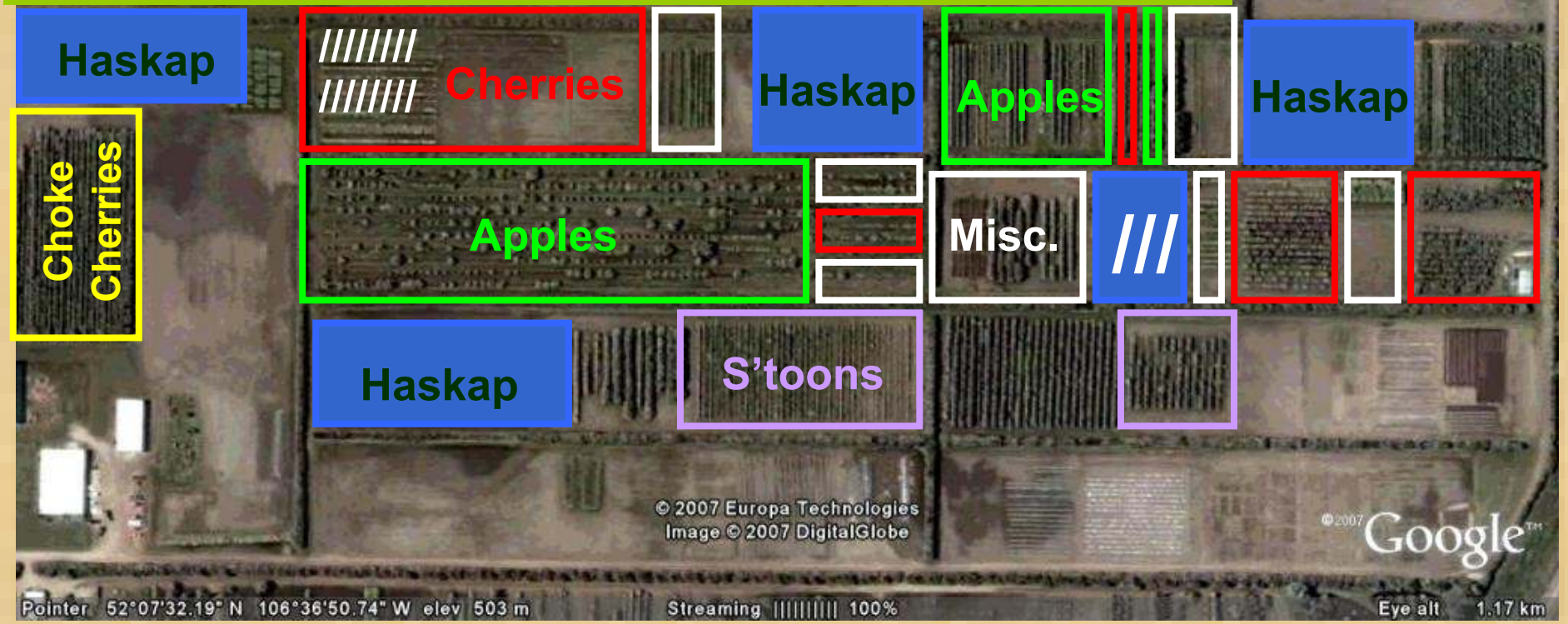






Fruit Program Field Plots (started in 1920)



1.17 km

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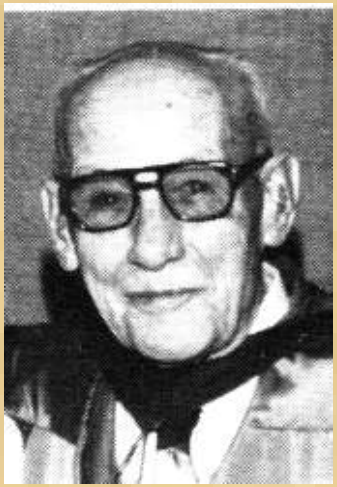
‘New’ Prairie Sour Cherries 70 Years in the making

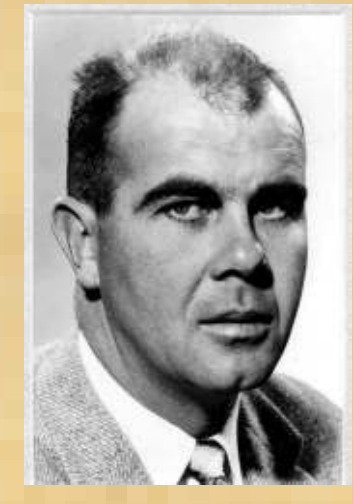


Les Kerr

- Shelterbelt breeder for Feds
- Began crosses in early 1940’s
- Hybridized Mongolian with Tart Cherries
- Bulk Pollen and distribution of seedlings to farmers
- No Records
- Bequeathed germplasm to U of SK in 1982

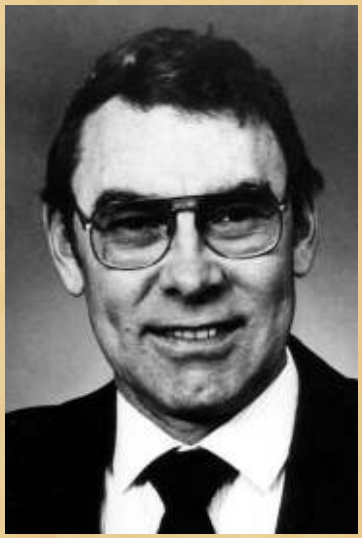
‘New’ Prairie Sour Cherries 70 Years in the making

- Hort Professor at U of SK
- 1968 Obtained ‘Mongolian’ (hybrid?) Cherries from Siberian Botanical Gardens
- 2 generations of mass selection
- Retired 1982



Stewart Nelson

‘New’ Prairie Sour Cherries 70 Years in the making



Cecil Stushnoff

- **Hort Dept. Head, physiology of cold hardiness**
- 1983 Obtained germplasm from Ontario, Minnesota, to cross with Uof Sk and Kerr’s Mongolian cherries
- **Left in 1989**

‘New’ Prairie Sour Cherries
70 Years in the making

Rick Sawatzky

- **Head Technician Fruit Program, 1971-present**
- Continued making crosses after Dr. Stushnoff left
- Emphasis on fruit size and quality
- **Also breeding apples, pears, hazelnuts**

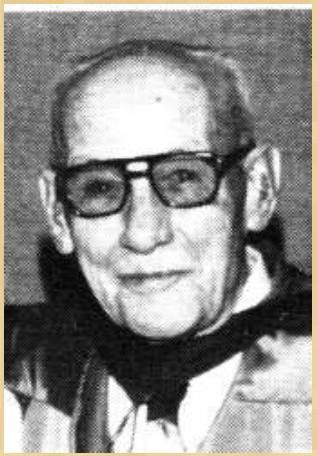
1971 - present

‘New’ Prairie Sour Cherries
70 Years in the making

Bob Bors

- **Started in 1999**
- **Head of Fruit Program**
- Arrived as the second ‘family’ of dwarf sour cherries was beginning to bear fruit
- Emphasized cherry breeding

‘New’ Prairie Sour Cherries
70 Years in the making



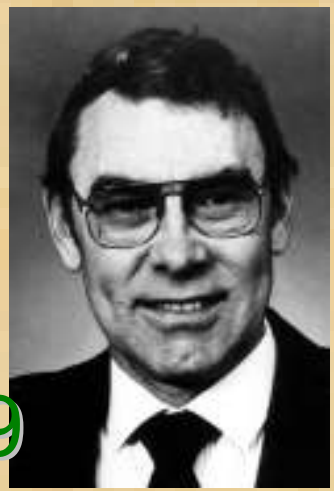
1940 - 1982

Les Kerr

1968 - 1982

Stewart Nelson

Cecil Stushnoff 1983-1989



Rick

Bob

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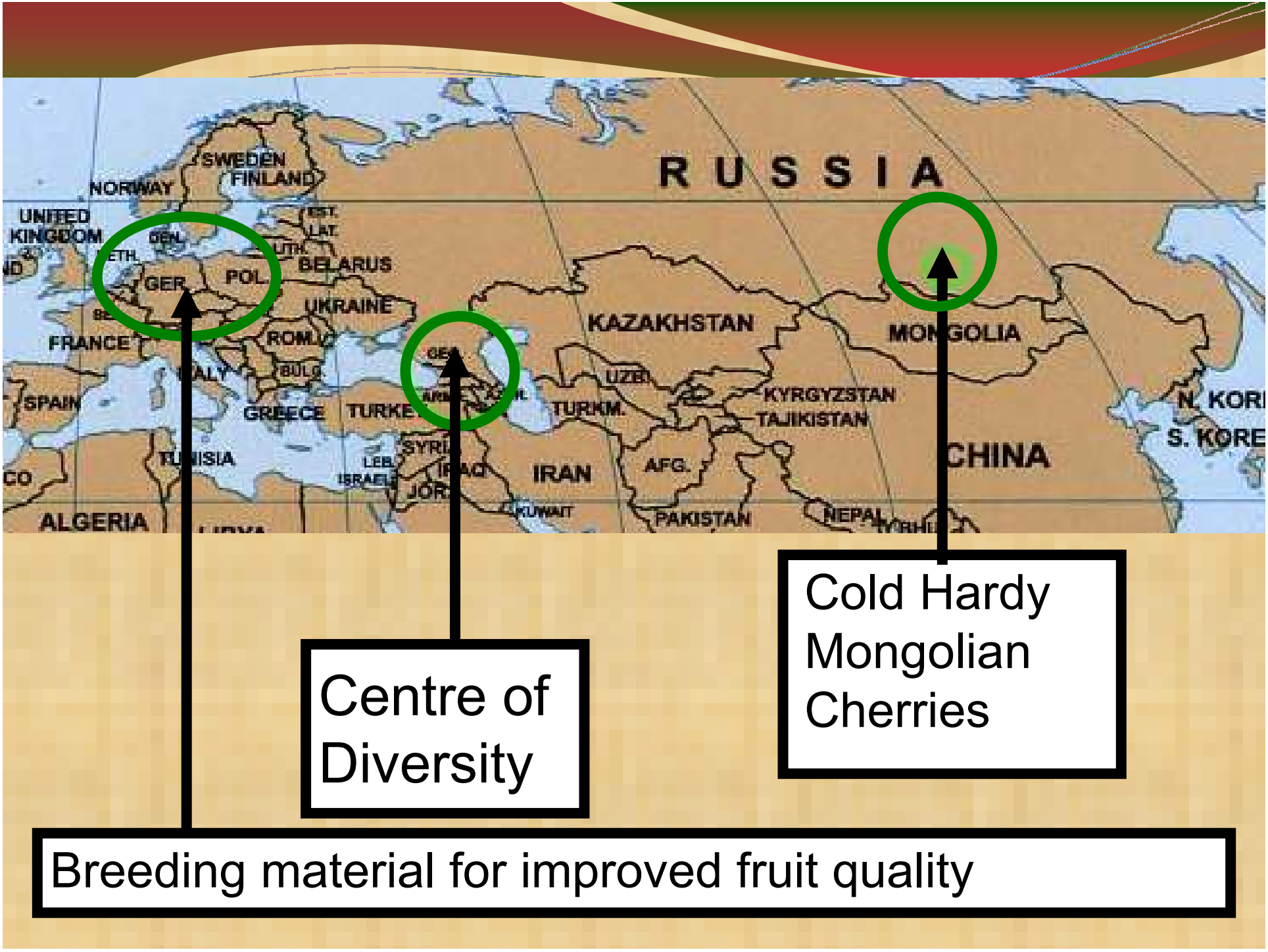

RUSSIA
SWEDEN
FINLAND
NORWAY
UNITED KINGDOM
BELARUS
UKRAINE
KAZAKHSTAN
MONGOLIA
FRANCE
SPAIN
GREECE
TURKE
TURKM.
KYRGYZSTAN
TAJIKISTAN
IRAN
AFG.
PAKISTAN
NEPAL
CHINA
ALGERIA
KUWAIT
Cold Hardy Mongolian Cherries
Centre of Diversity
Breeding material for improved fruit quality

The genetic base of current varieties (1990's Breeding)

- Thousands of 'Improved Mongolian' cherries seedlings distributed
- Only best 2 mongolians used in breeding
- Pure Sour Cherry Cultivars:
  - North Star
  - Cicanski Rubin
  - Planteskole og Frohandel
  - Kelleris 14
  - Note: others used but progeny not selected

Pure Sour Cherries

3 types of sour cherries on the prairie

Frequent Dieback

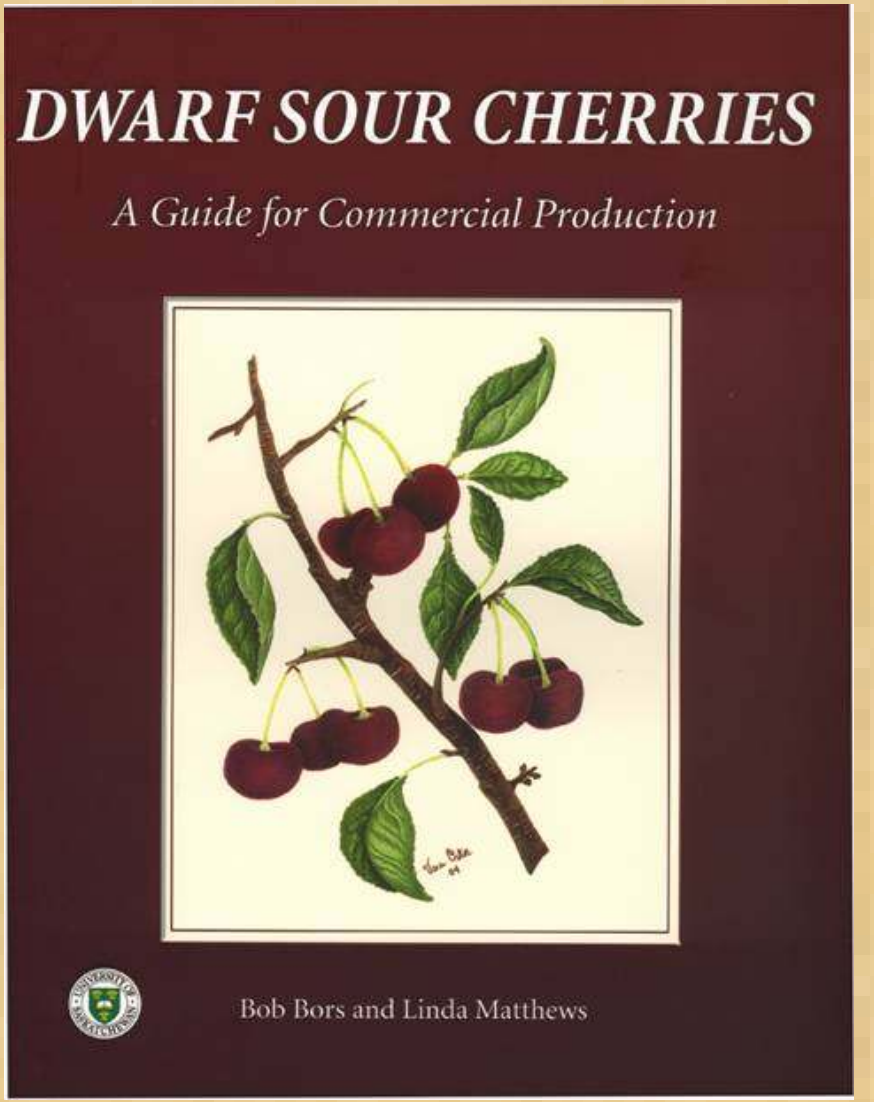
1/4th Mongolian
(U of S hybrids)

Half Mongolian

Hardy

Commercialization

- Mechanical harvesting
- Tissue culture
- Grower manual
- Extension



Selection for Mechanical harvesting & processing

Initial Selection

For Upright harvesters

- Low Suckering
- Upright Growth

The genetic base of Future varieties (2000's Breeding)

- 3000 'Improved Mongolian' seedlings evaluated, ~seeds grown from best 25
- Obtained 10 more Sour Cherry Cultivars
  - U of Guelph
  - Cross with Mongolian pollen
- Intercross the above hybrids

X

Parents: Quite different

X

X

1st Generation ‘uniform average’

2nd Generation Recombination

2nd Generation Recombination

Susceptible

Resistant

Dark

Firm

Not adapted

Sour

Small fruit

Suckers

Bright

Soft

Sweet

Short

Large Fruit

Bitter

tall

Cold Hardy

Weeping

Upright

Current Selection

For Sideways harvesters

- Multiple trunks
- Suckering OK
- Spreading growth
- Small diameter, flexible branches

Current Selection

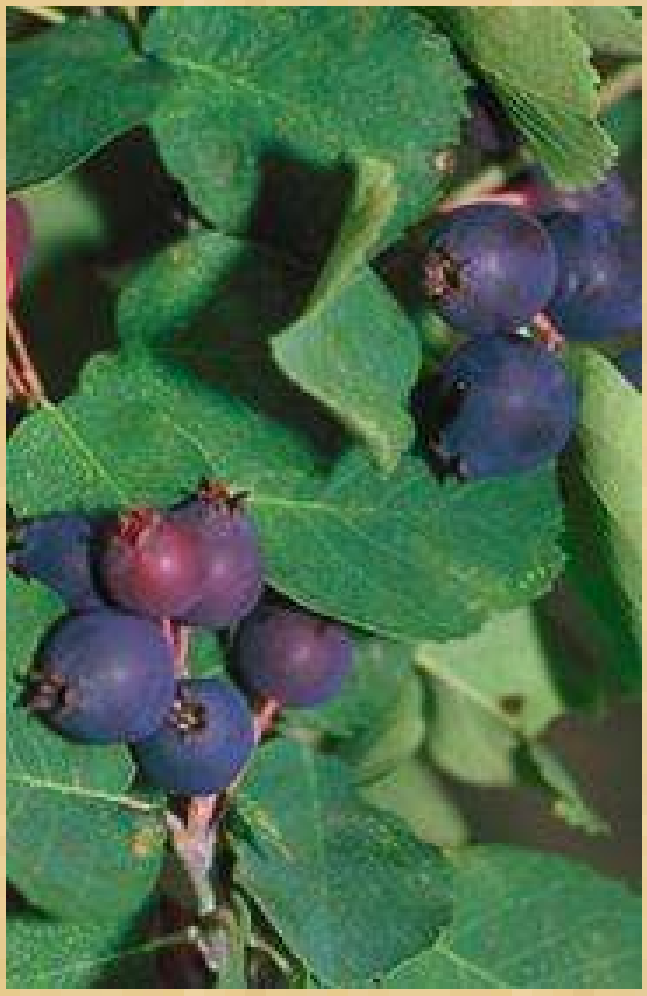
For Sideways harvesters

- Why?
- Harvester of choice for Saskatoon and Haskap Growers
- Less Fruit Damage
- Less Pruning required

June

Haskap
(Blue Honeysuckles)

July



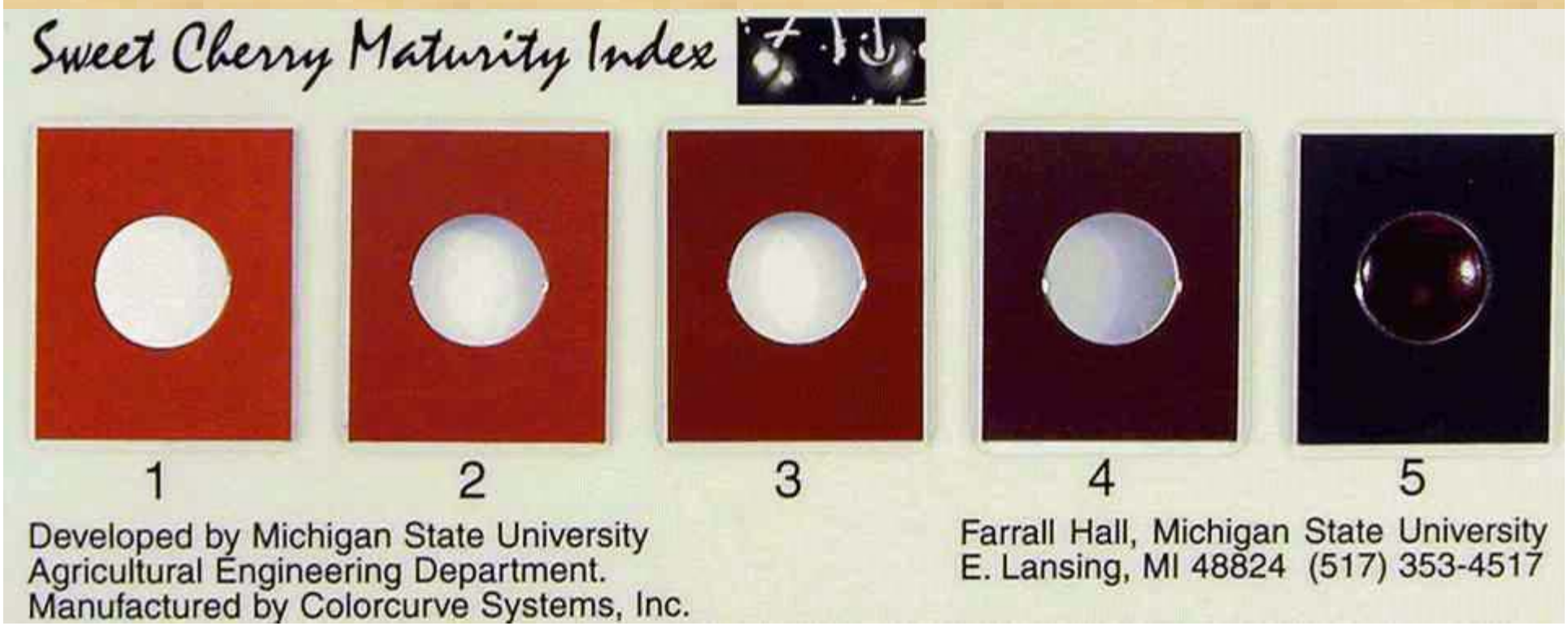
Saskatoons

August

Sour Cherries

Project for 2010

develop a maturity index for each of our Romance Cherries



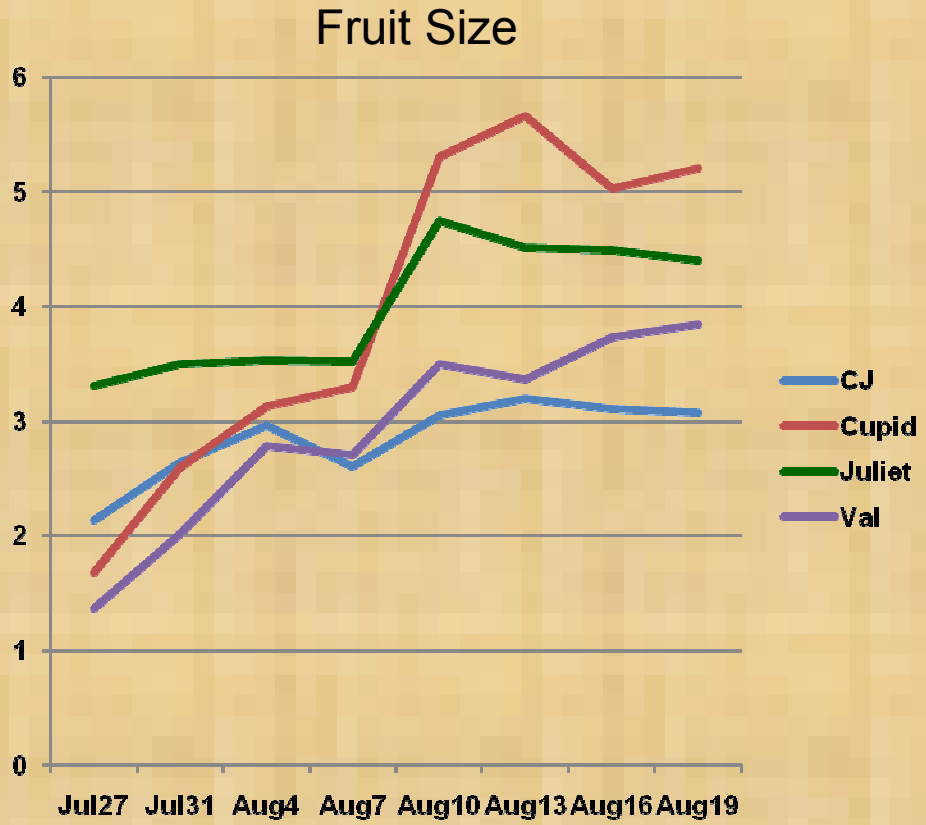
Trung Li's Thesis

Quality at harvest time

4 varieties

Cherry Quality Thesis Trung Le

- CJ and most of Romance series
- Timed harvest of cherries
  - Every 3 or 4 day harvested for 8 times
- Measured Sugar, pH, total acidity, colour, sugar, fruit size,pit size.
- When is the optimum time to harvest?



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How do Saskatchewan Cherries differ from Montmorency?

- Genetically Dwarf, on their own roots
  - 8 ft tall or so
- Most are dark
- Sweeter (Saskatchewan environment?)
  - Normal Year: 16-21 Brixs
  - Cold Year: 15-17 Brixs
- Survives in Hardiness Zone 2

Dark Cherries selected in breeding

- Focus on less traditional markets
- Darker juice
- Higher anthocyanins

Juice extracted by freeze/thaw

undiluted 50% 25% 5%

Carmine Jewel

Cranberry
(all 4 cups are full strength for comparison)

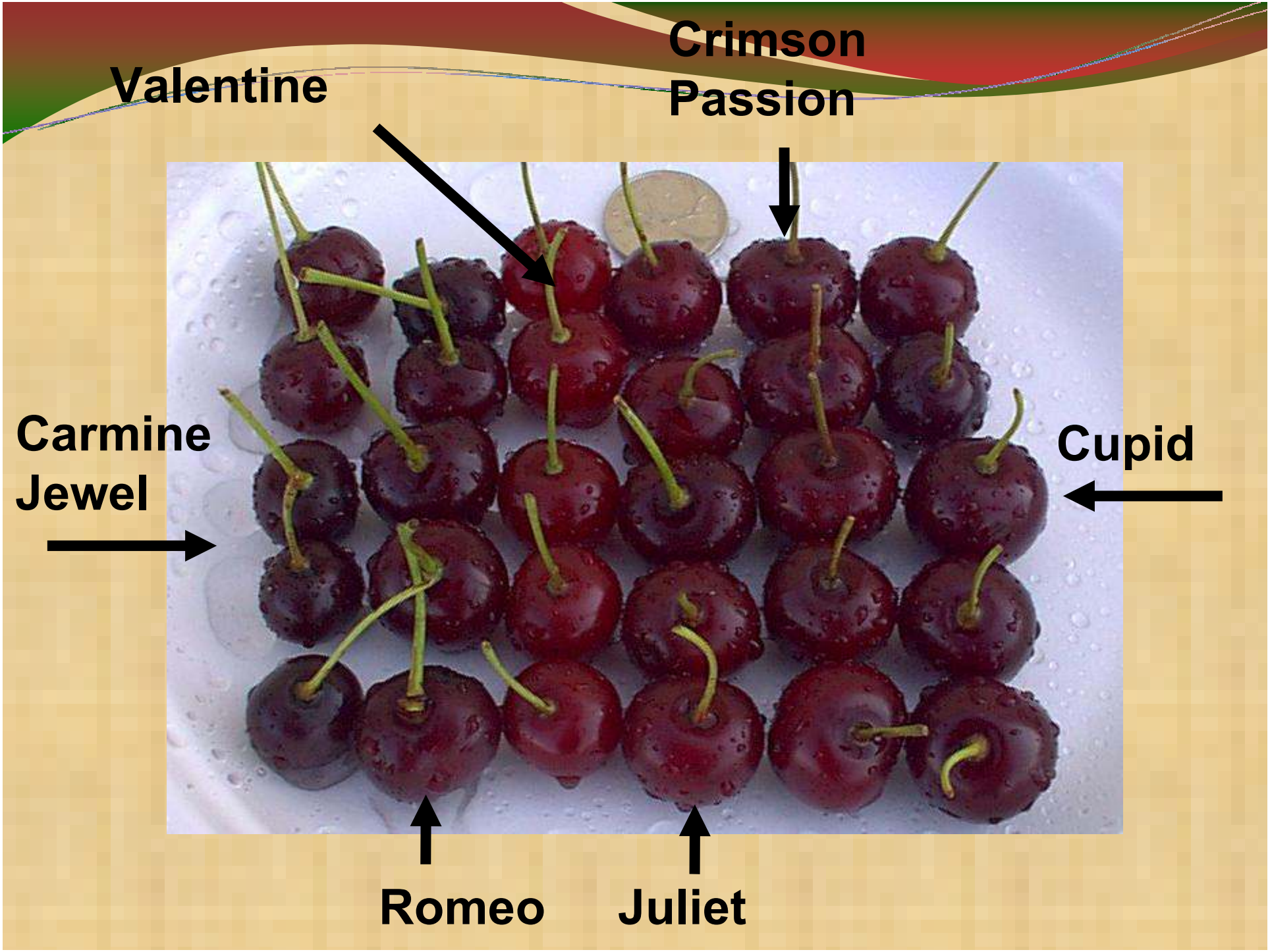
Evans

Our Varieties

- 1999 Carmine Jewel
  - Most widely planted
  - Currently is in production
- 2003
  - 5 numbered selections released for testing
  - Later became the Romance series:
    - Romeo, Juliet, Cupid, Valentine, Crimson Passion
- Canadian nurseries can’t ship to USA
  - Against their contracts
  - Don’t have virus-free certified material

Differences between our cherry varieties

- Cold hardiness
- Flavour
- Tree size
- Fruit and juice colour
- Time of ripening


Valentine
Crimson Passion
Carmine Jewel
Cupid
Romeo
Juliet

Cherries
Spring 2009 Observations at U of SK

- No Winter Damage:
  - Cupid
  - St. Valentine
  - Juliet
- Slight Damage:
  - Carmine Jewel
- ~25% injury
  - Romeo & Crimson Passion

Cherry Bloom, June 1, 2009

Cherry Bloom, June 1, 2009

Romeo

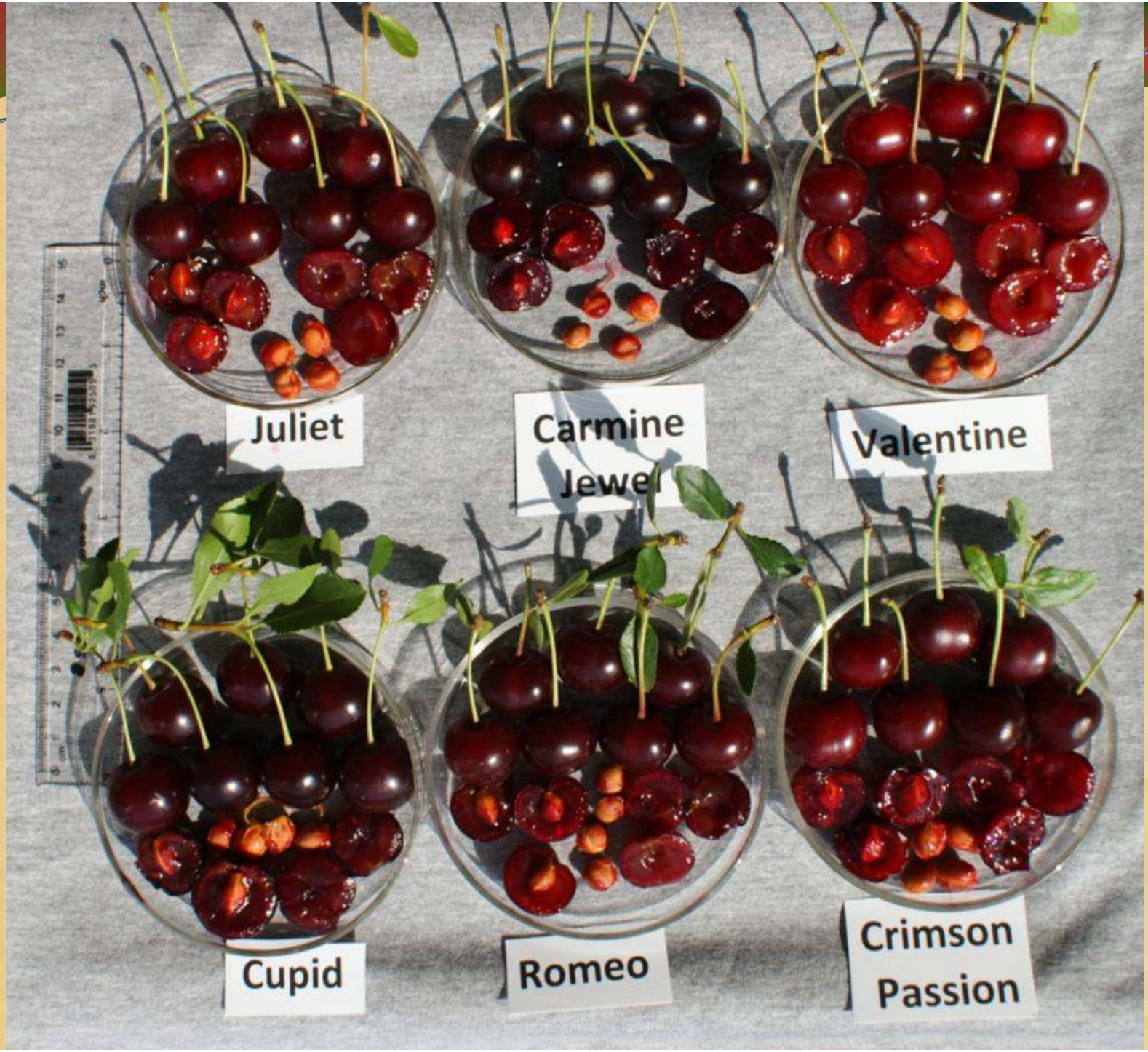
Crimson Passion

Crimson Passion

Cherry Bloom, June 11, 2009

Cupid

Cupid


Juliet
Carmine Jewel
Valentine
Cupid
Romeo
Crimson Passion

Plant Breeders Rights for ‘Juliet’ and ‘Valentine’

Juliet Cherries 2009

+No Winter damage

+Best Flavour

+Tart enough for pies

+Good Size

+Productive

+1st to go dormant in fall

+Good Mech Harvest

- 1st bloomer
  - (we didn't lose any)

Carmine Jewel

+ Darkest Cherry
+ Earliest to ripen
+ Good Flavour
+ Productive
+ Good Mech Harvest
- Slight winter damage
  - Uneven bloom and ripening this year
- Smallest fruit size

Valentine

+sweeter than previous evals

+/- average bloom time

+/- only bright red

- Some damage from mech harvester (bushes too vigourous, will need more pruning)

Cupid

+ Darkest Cherry
+ last to bloom
+ Good Flavour
+ Productive
+ Good Mech Harvest
+ No winter damage
+/- Fruit so large ½ of fruit wouldn't fit in pitting machine holes (specialized use?)
- Needs extra year to come into production?

Romeo

+ Excellent flavour
+ No mech harvester damage
+ production a year earlier than other varities
+/- average bloom time
+/- medium red
- 25% winter damage

(overproducer?)

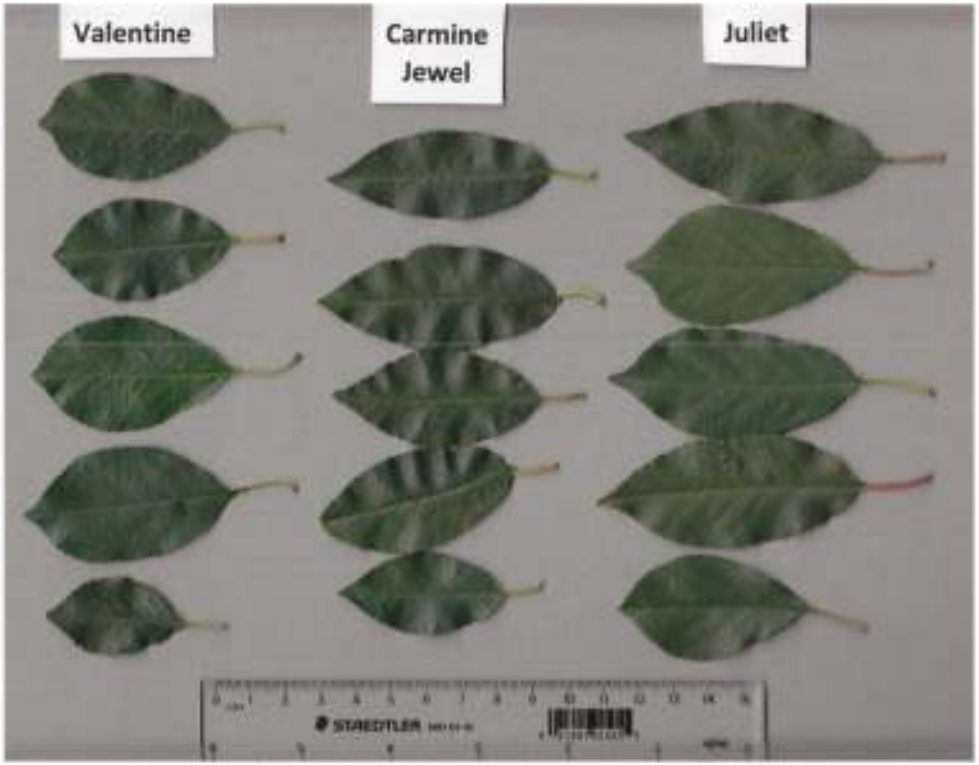
Crimson Passion

+ Excellent flavour
+ Best firm cherry
- 25% winter damage
- low vigour & slow to root:
  - Smaller plants>Poor establishment
  - Lower yields

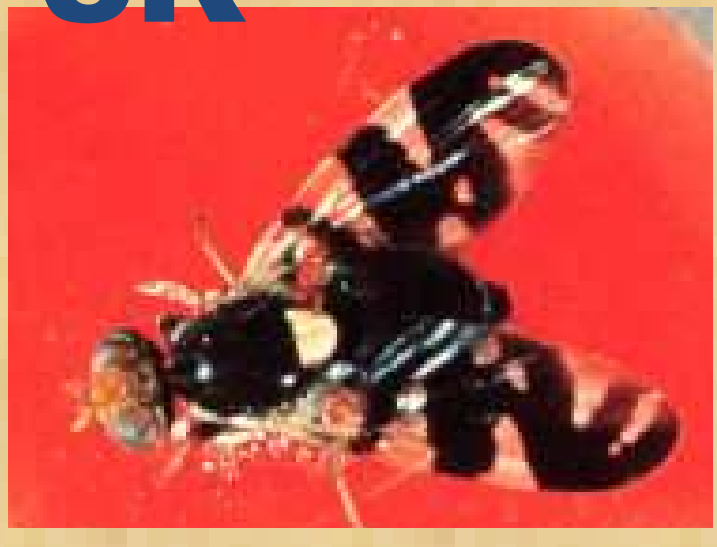
? Might be best for gardeners

Juliet & Valentine Plant Breeders Rights Completed in 2009

- 25 page forms comparing many botanical differences



Worst pests in SK



- Deer: Major
- Cherry Fruit Fly: Minor
- Bacterial Canker (?): Minor
- Bacterial Leaf Spot: extremely rare in fall

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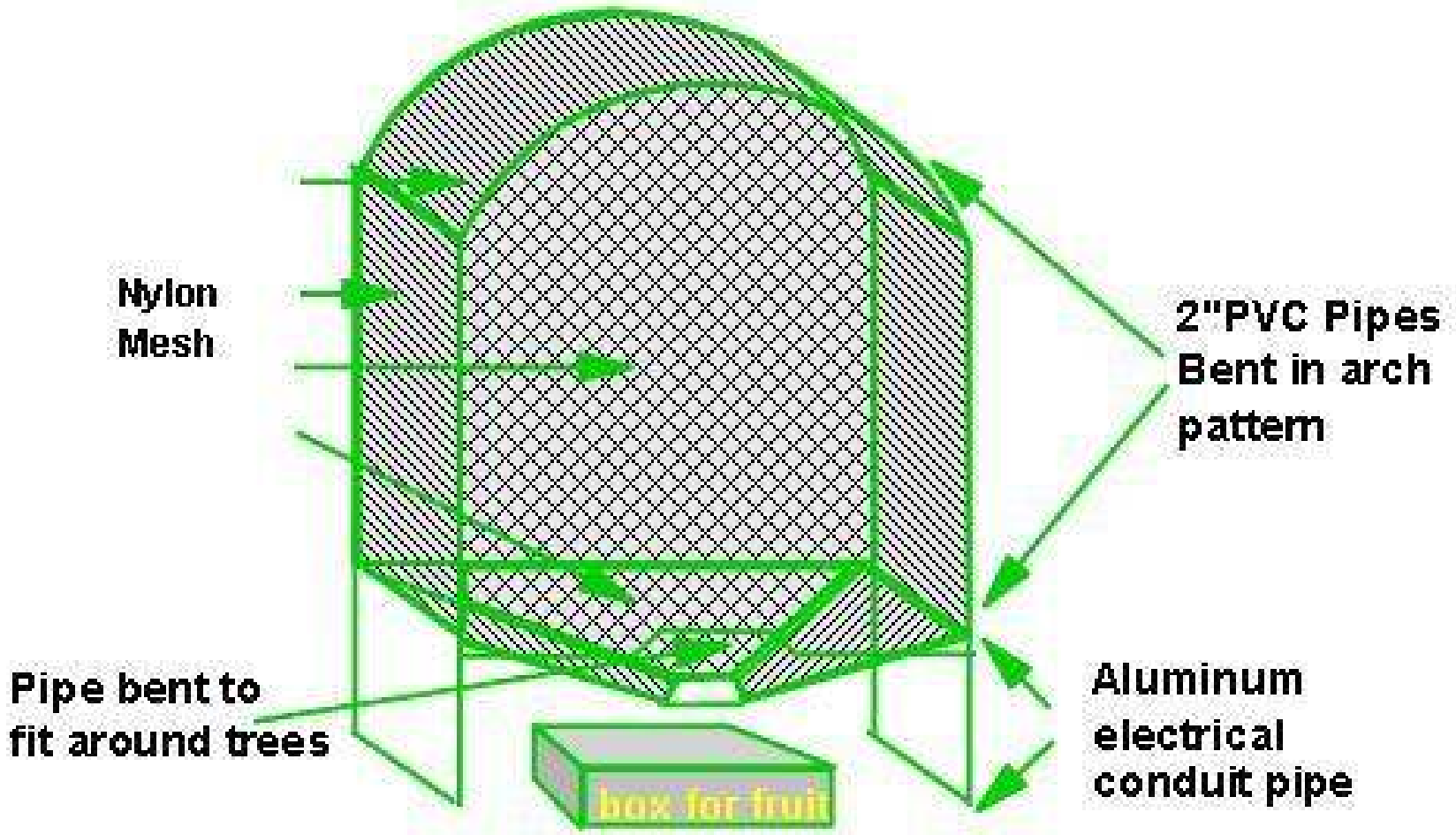
Type of harvester you will use should impact your planting and training plans

Figure 1. Catch Frame for Dwarf Sour Cherry harvesting



Approximate dimensions: 2 m (height) x 1.5 m (width) x 0.75 m (depth)


Joanna-2


Joanna-2
Berry Harvester

Upright harvesters

Choosing an Orchard tractor

- Small enough to fit between rows for cultivation
- Will you be pulling a harvesting machine?
  - 30+ hp
  - Hydrostatic Drive
    - Harvest machines often pulled at very slow speeds
      - Not designed for high yield!


ML
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MAHINDRA

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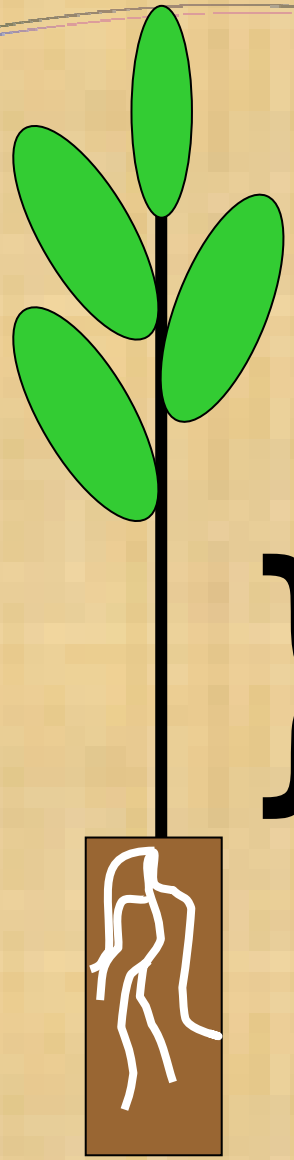
Dwarf Sour Cherries grown on own roots

Planting Density

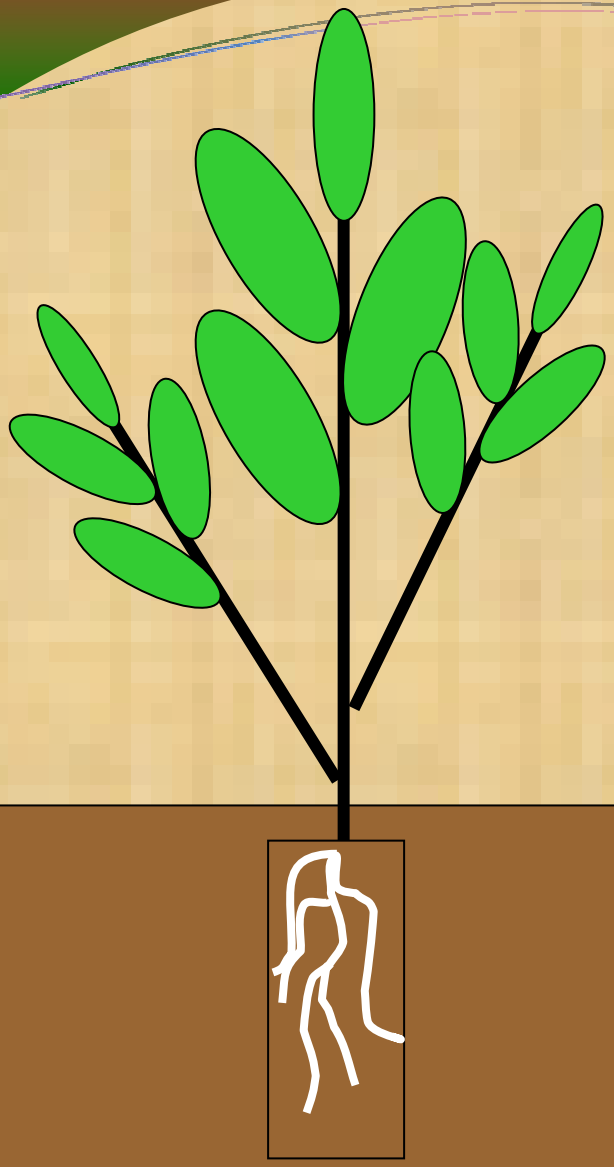
- Within Rows: 5 to 6 ft
- Between Row: 13 to 16 ft
- ~800 bushes per acre

- Exception: Crimson Passion
- Within Rows: 3 to 4 ft



Typical planting stock: 1 year old plugs from tissue culture

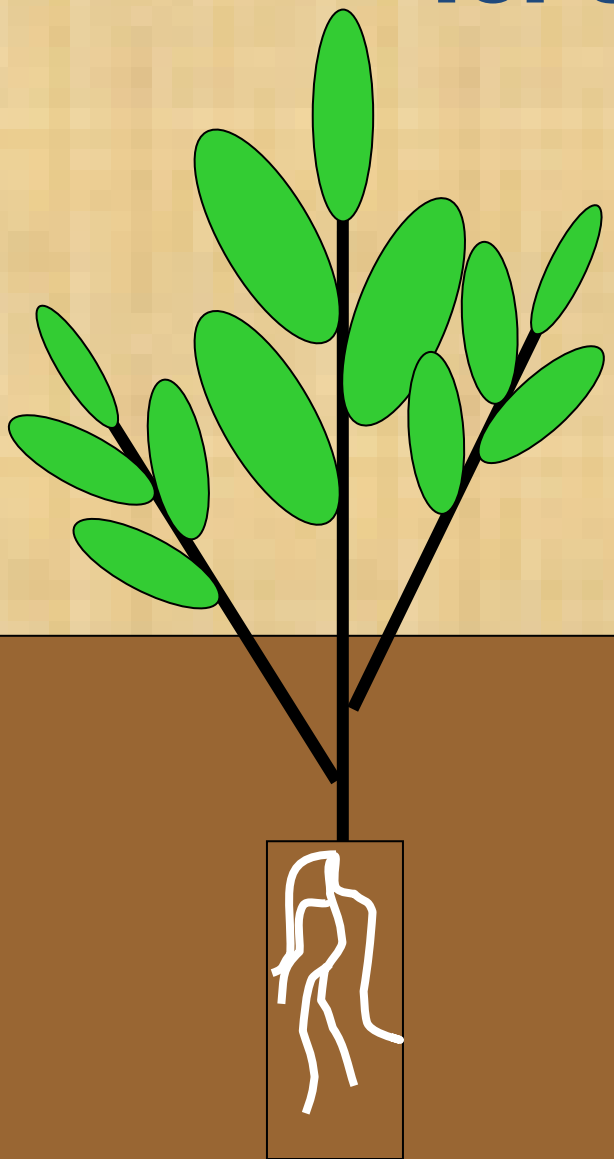
Side shoots form here



Shallower Planting for Upright Harvesters

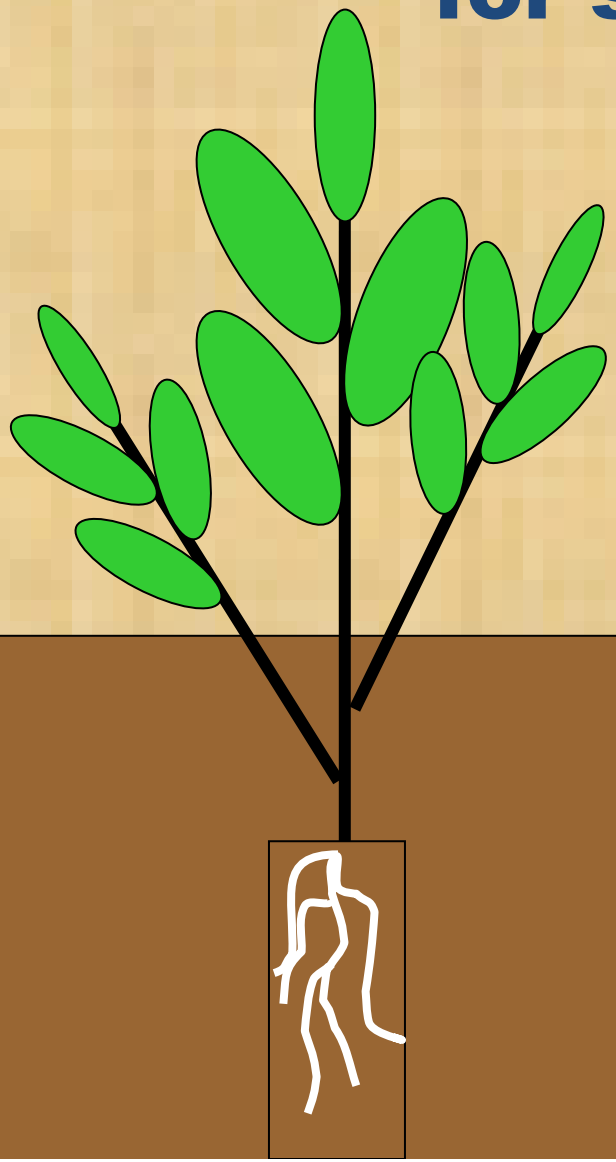
- Reduced suckering
  - But eventually will sucker from roots
- More likely to heave during 1st winter if fall planted
- Single trunk more vulnerable

Deep Planting
for sideways harvesters



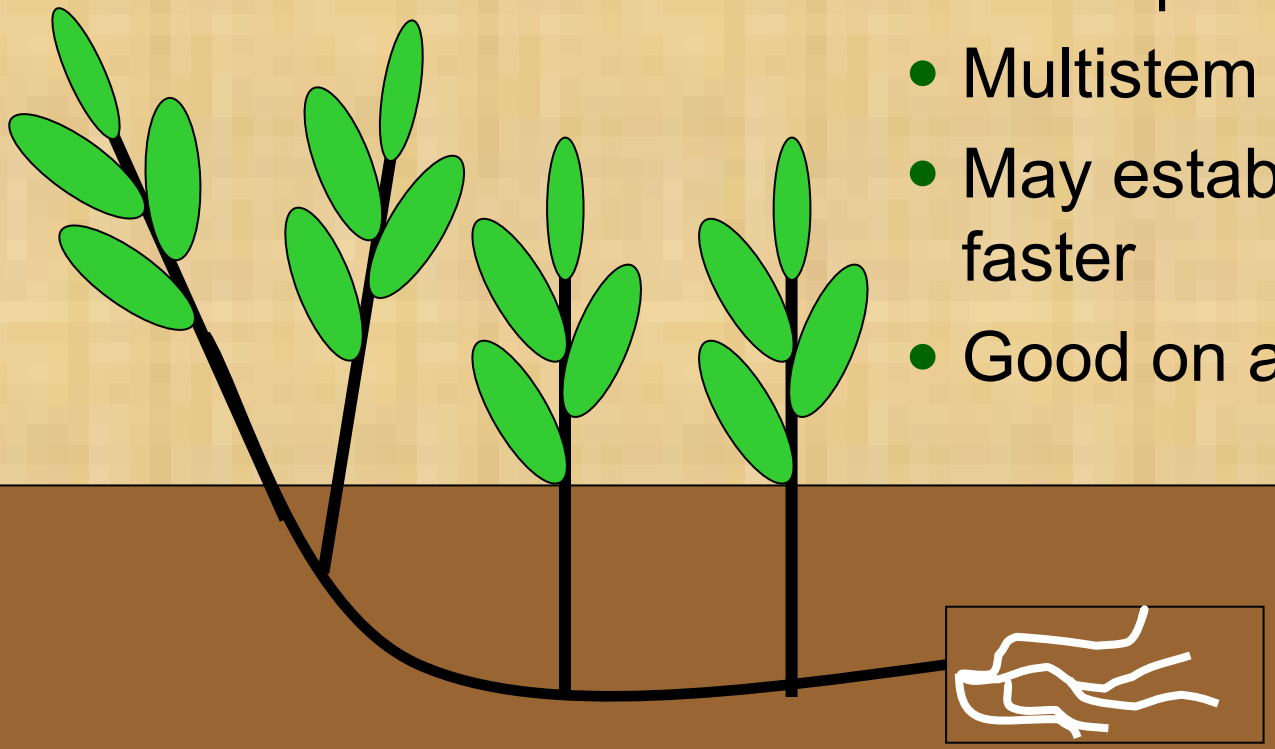
- Increased suckering
  - May need thinning
- Less likely to heave during 1st winter
- Multiple trunks less vulnerable

Deep Planting
for sideways harvesters

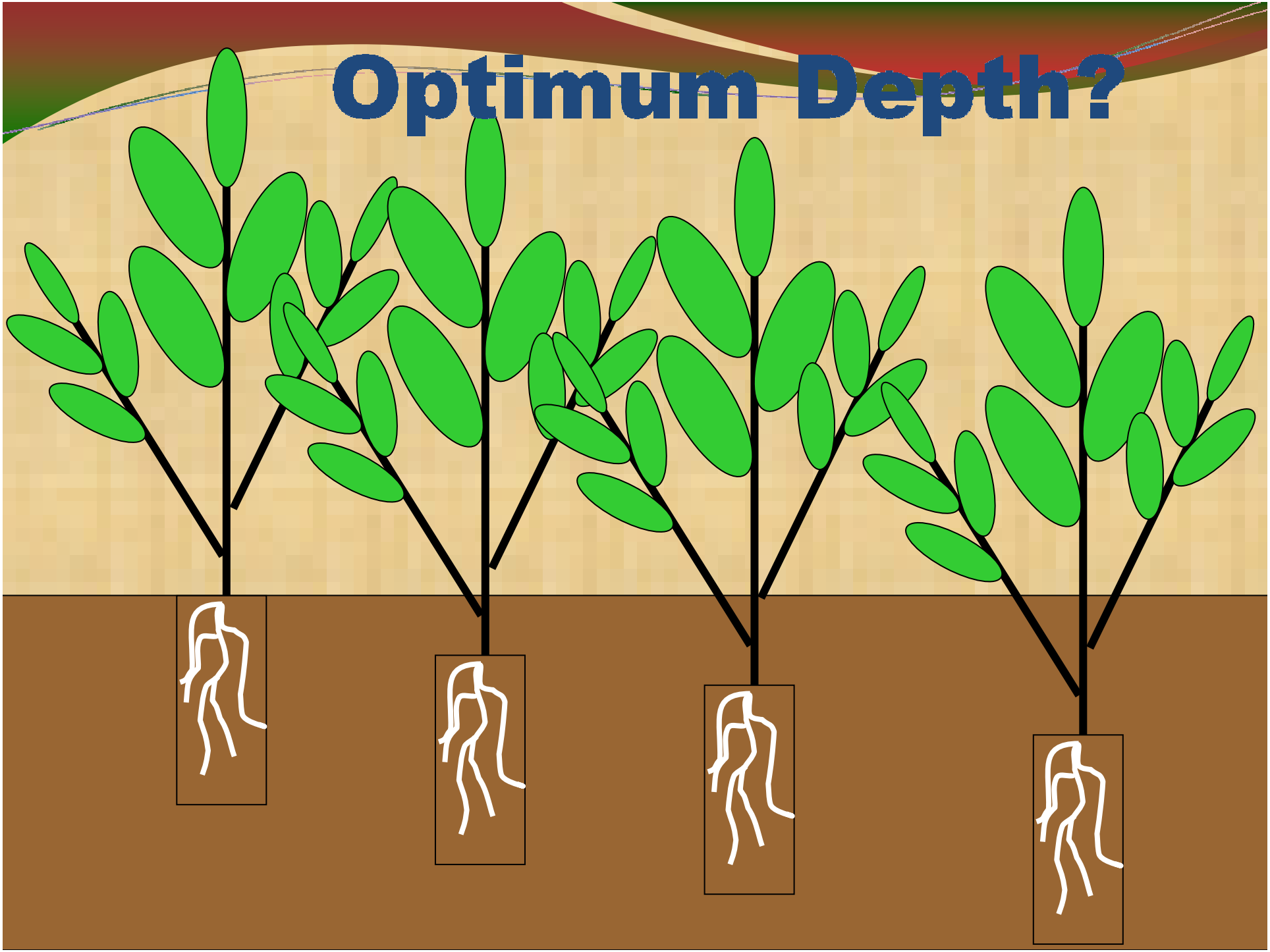


- If plug plants too small plant in trench and fill in when taller
- 1st spring after planting: prune back to a few buds to encourage multiple stems

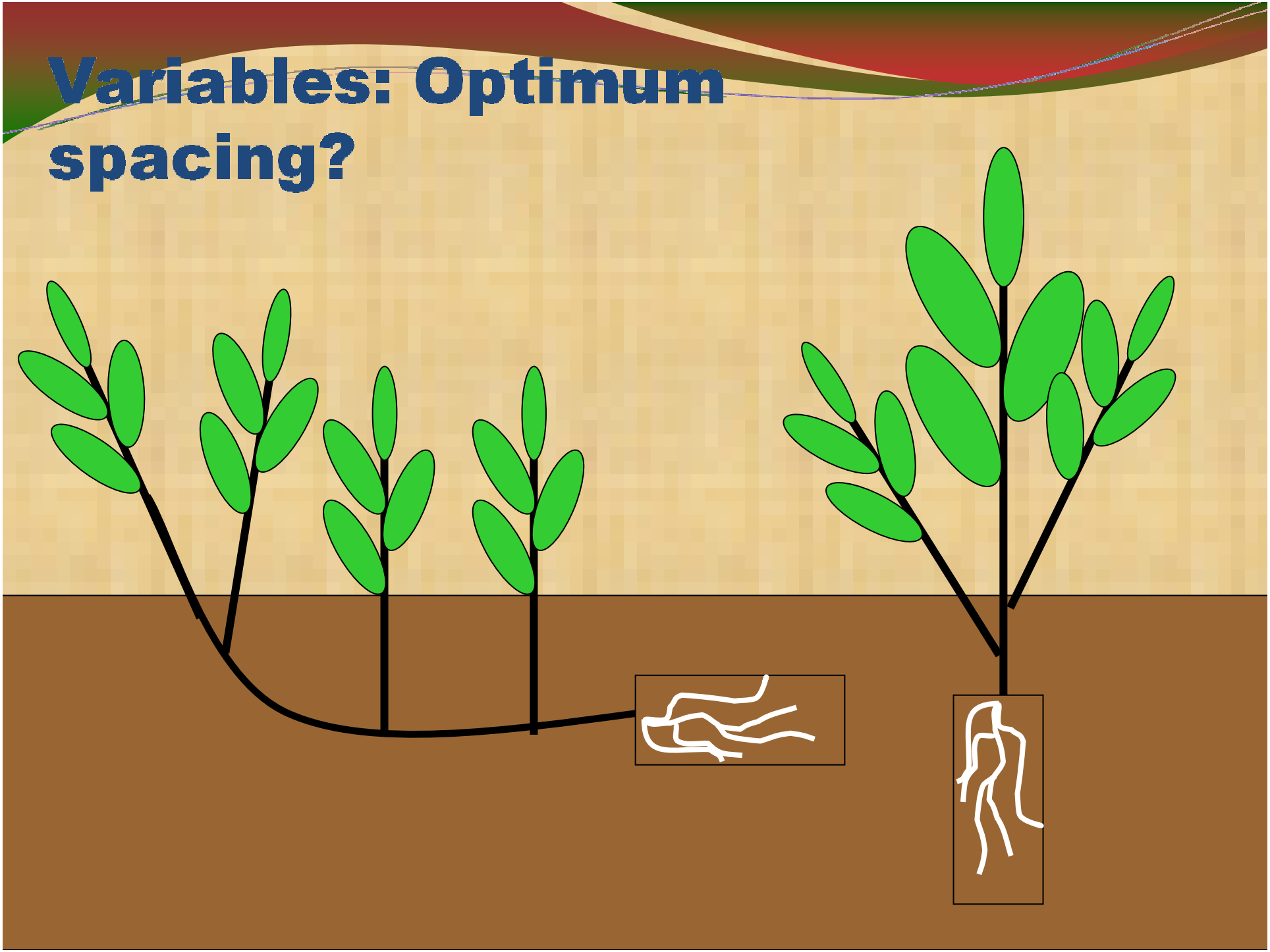
Sideways Planting



- Taller plants
- Multistem but in a line
- May establish roots faster
- Good on a drought year


Optimum Depth?

Variables: Optimum spacing?



Establishment : 2 bad ideas?

- Grass roots will compete with bushes
  - Plant grass when bushes are full size
  - Could work if site is overly fertile and gets enough water
- Plastic can lead to shallow root systems
  - Sideways harvesters have pulled plants out
  - Upright harvesters are more gentle on the bushes

Establishment

- Common to have partial dieback 1st spring after establishment especially if summer or fall planted
- Greenhouse plants out of sync with season?
- Too much water and nutrients causing late growth?

Pruning

- Tree form or narrow base bushes for upright harvesters
  - similar to other tree fruits
- Bush form for sideways harvesters
  - Renewable shrub
  - similar to blueberries or saskatoons

Pruning

- Most bearing occurs on 1 year old wood
- Some varieties have spurs
  - production on 2 or 3 year old wood
- Late winter / early spring
  - never late summer or fall
- Remove 25% or less
  - too much reduces yield
  - tree has reduced hardiness if grows too fast

Pruning Bush Cherries

- Minimal pruning during establishment years
- Start pruning
  - After bushes come into full production
  - Too tall or wide or too crowded
  - Machinery is damaging thicker trunks
- Thin: Remove branches at base
- Open Center
- Allow new shoots to renew bush

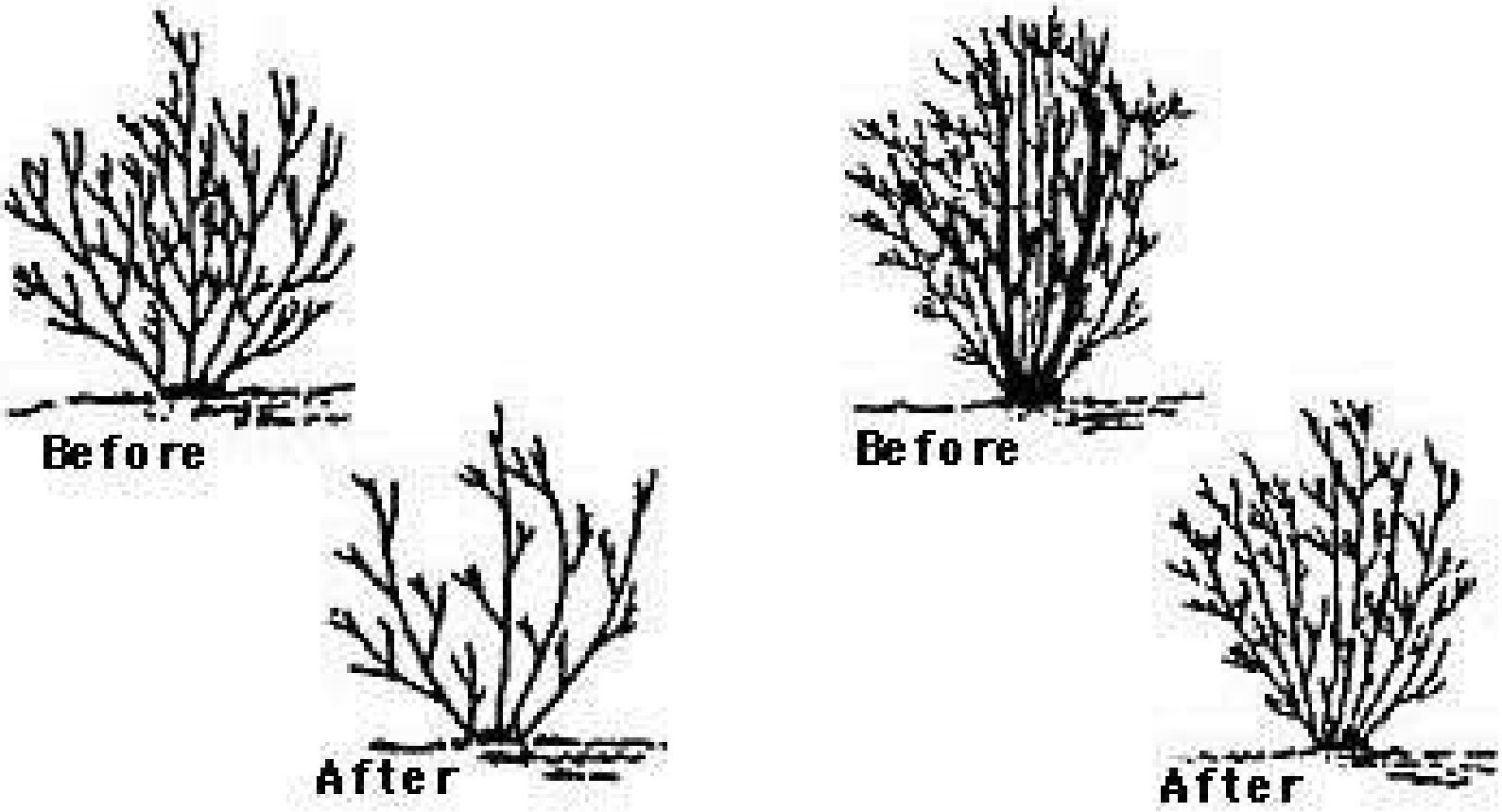


Figure 8. Deciduous shrub pruning

Suckering of Dwarf Sour Cherries (on their own roots)

- North-South rows have less suckers than East-West Rows
  - More shade mid day
- Usually originate from roots 2 ft down
  - Cultivation doesn't cause more
  - Not worth effort to propagate that way
- Useful for rejuvenating orchard and filling in rows

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Cherry tree growth over 4 years

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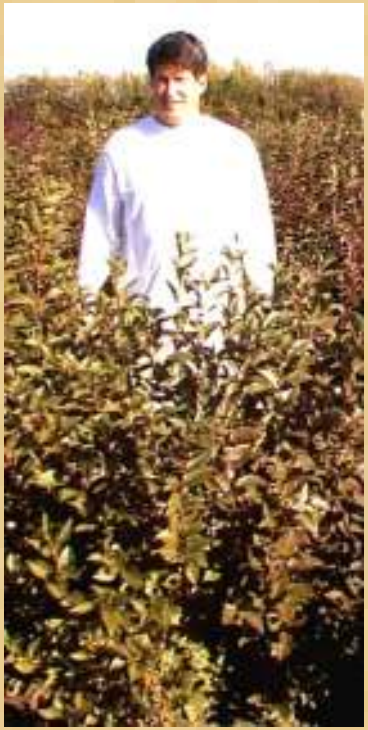

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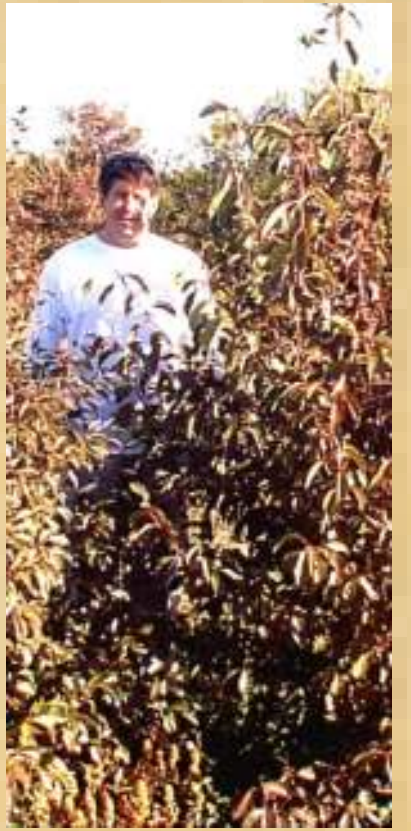

4

August 2004

August 2005

Carmine Jewel Yields on better farms

- 3rd Year 2-4 lbs
- 4th year: 20 – 30 lbs
- 5th & 6th years: 25 to 50 lbs
- Fluctuating yields?
  - 20 to 40?
  - Winter damage possible after several bumper crops? But mainly on old branches

Carmine Jewel, 4 yrs old

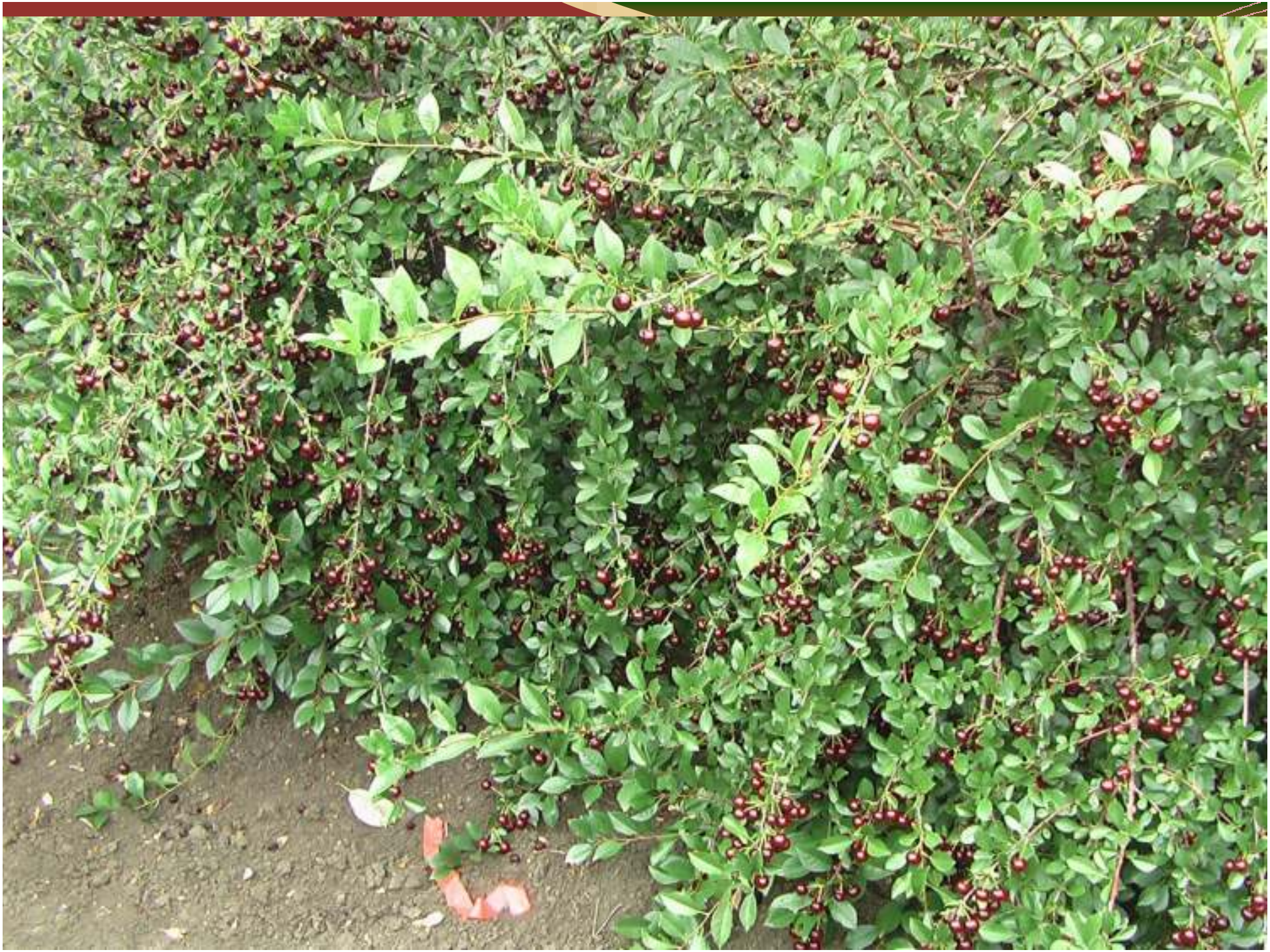

Photo by Bob Mason

Photo by Bob Mason

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Our Varieties in the USA & Gardens Alive Inc.

- 2007
  - Gave grant for fruit research to U of Sask.
  - Funding for virus-free cleanup and certification
  - Selected plants at U of SK for testing in USA
- 2009
  - Received 5 virus-free certified selections for propagation (only some of Romance Series)
  - Exclusive distribution rights
- 2010
  - Providing plants to MSU and other locations for trials

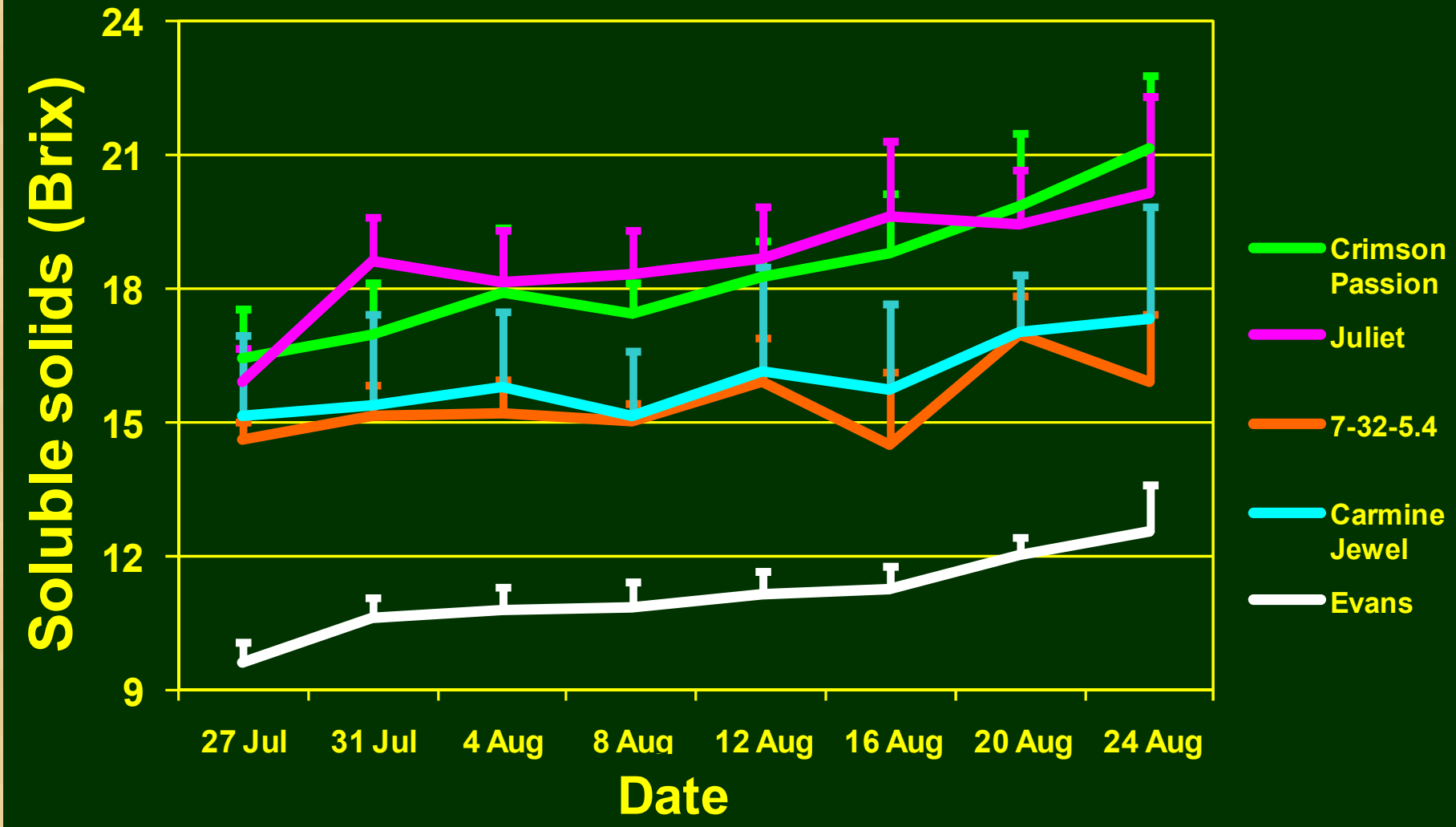
Will Saskatchewan Cherries do well in Michigan?

- **Bred in a colder, drier climate & shorter growing season**
- **Taller?**
- **Earlier harvest?**
- **Higher Sugar content?**
- **Earlier bloom?**
- **More disease?**

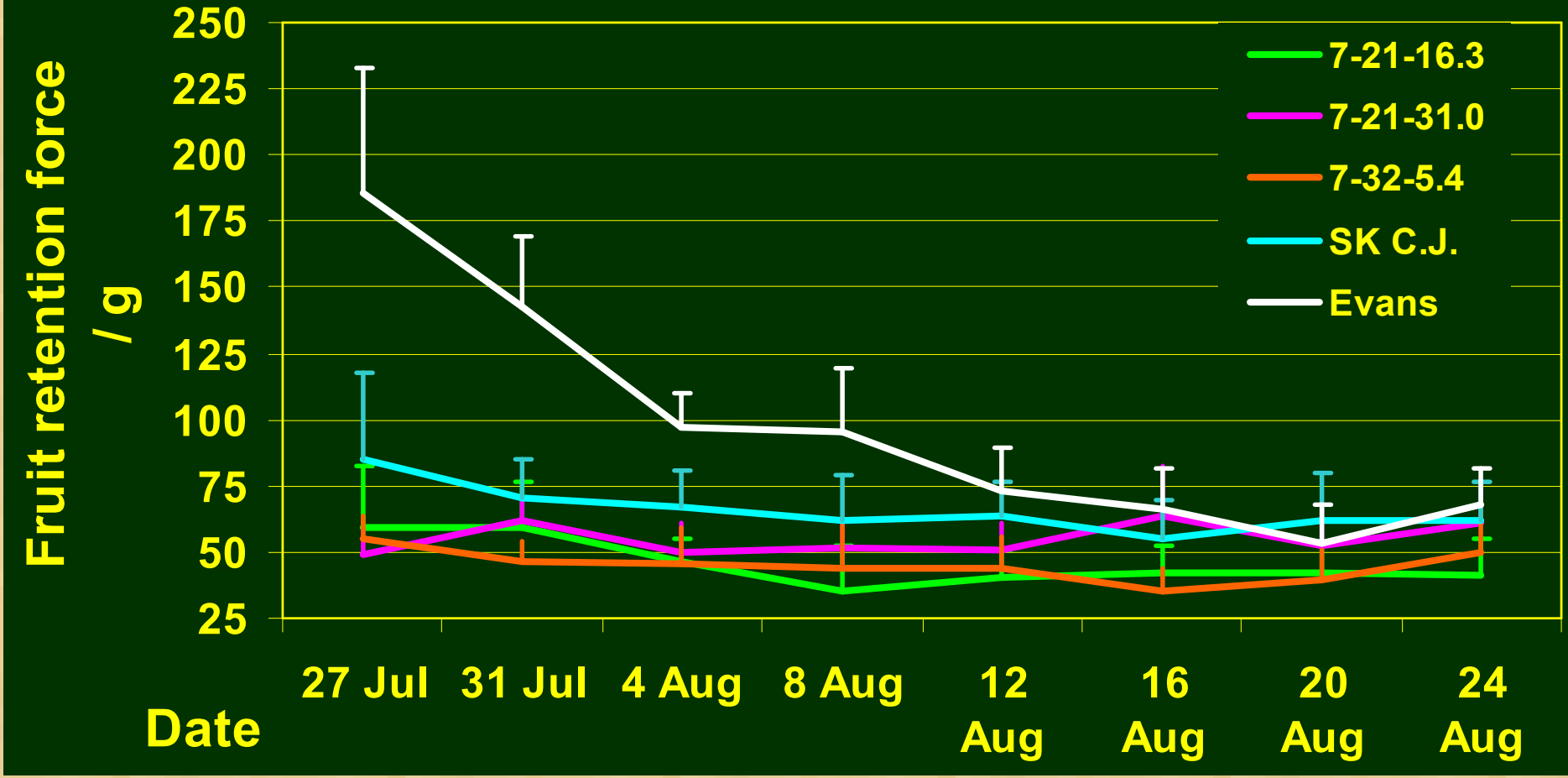
Evans Sour cherry

- Discovered in Canada but not from a breeding program
- A seedling of Meteor?
- Montmorency was a parent of meteor
  - **Hardiness depends on grower & location**
    - **poor in zone 2**
    - **fair to poor zone 3,**
    - **good zone 4**
  - **bright red: pie cherry**
  - **yellow flesh oxidizes quickly**
  - **large tree (by our standards)**
  - **large long pits**

Soluble solids of five cherry selections in 2000



Ease of harvesting five cherry selections in 2000



U. of Sask. Fruit Program:

www.fruit.usask.ca

Cherry Grower Group:

www.cherryproducers.com

Gardens Alive