Update on New Cherry Rootstocks

and the training systems to support them

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31 January 2019

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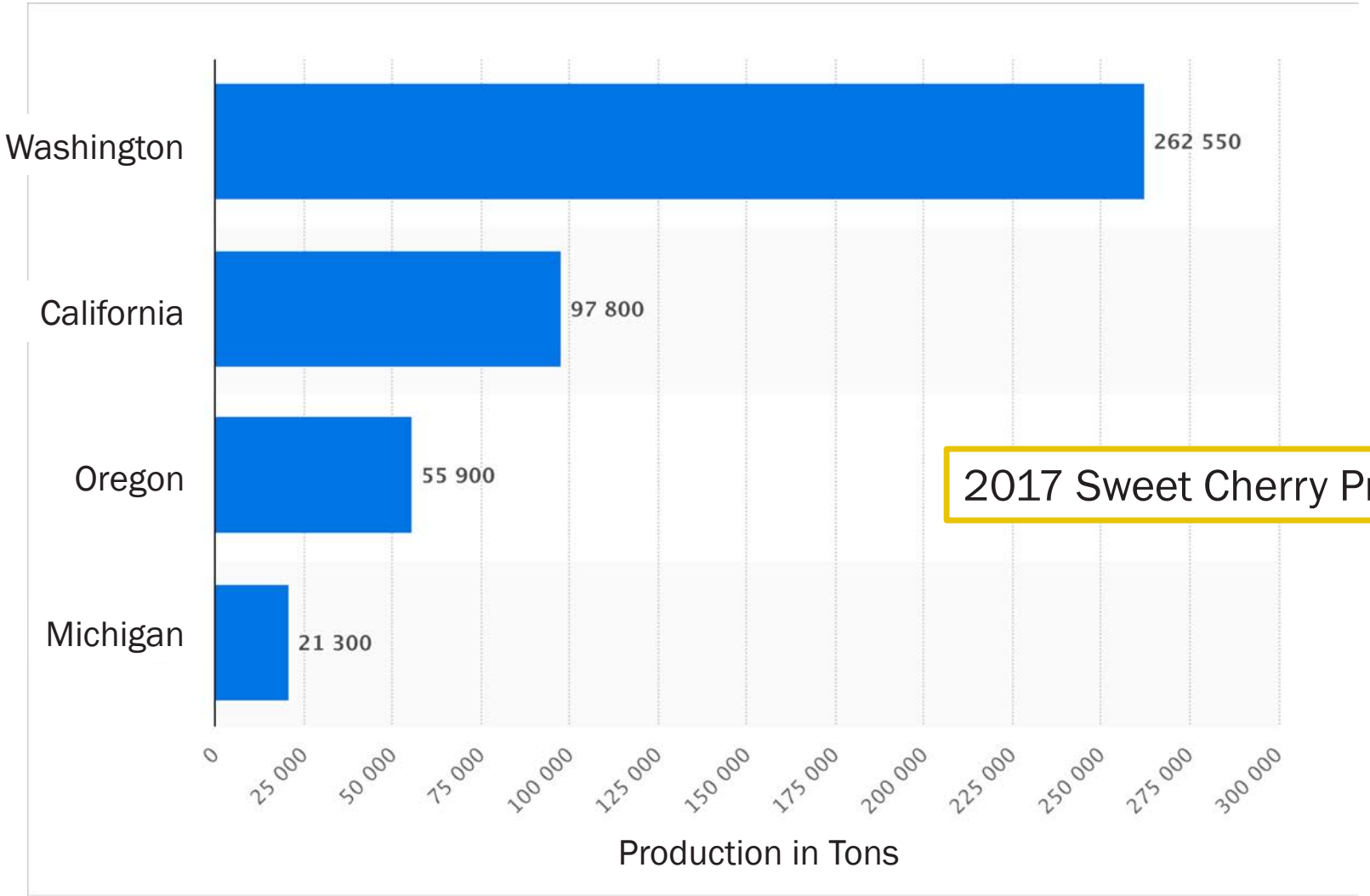
Sweet Cherry in the Mid-Atlantic Region?



2017 Sweet Cherry Production

Statista.com (2019). Sweet cherry production in the United States in 2017, by state (in tons). Downloaded from: https://www.statista.com/statistics/194672/us-leading-states-by-sweet-cherry-production/

Reasons for Low Production

- Climate
  - Late-season freeze/frost
  - Hail
  - Humidity
- Labor
  - Large trees ⟶ ladders/platforms
  - Hand harvest (stem-on harvest)

Reasons to Grow

- Alternative income
  - Ripen mid-June / early July
  - After strawberry, before peach

- Niche markets
  - Tourism, PYO, farmer's market
  - ~$3/lb PYO
  - ~$4-6/pint in urban markets
  - (Amazon: $8.99/lb)

Image: Cherries available from vendors at the U.S. Department of Agriculture Farmers Market on Friday July 22, 2016, in Washington, D.C. by Lance Cheung / USDA.

Outline

- Sweet Cherry Physiology
- Rootstocks: Old & New
- Conclusions

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Elementary Sweet Cherry Physiology

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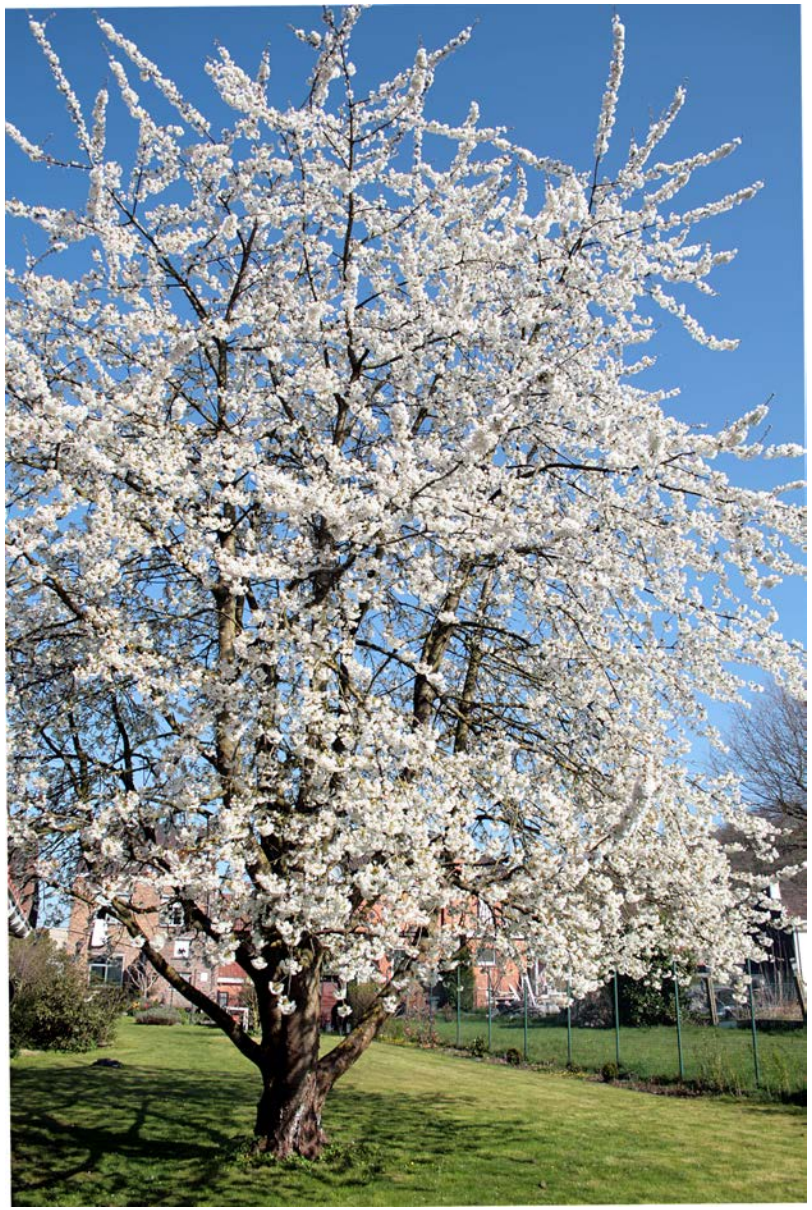

Characteristic Growth Habit of *Prunus avium*

Large tree (35'+ / 11m+), strong upright growth habit, delayed maturation.

Image: Ornamental Cherry Tree In Full Bloom, Washington State by TriviaKing. Image: "Cerisier (Prunus avium) - Havré (Belgique) - Lieu-dit 'Hameau du Pire'" by Jean-Pol GRANDMONT.

Characteristic Growth Habit of *Prunus avium*

Flowering and fruiting on one-year old wood and spurs.

Long, L. E., Lang, G., Musacchi, S., and Whiting, M. (2015). *Cherry training systems*. Technical Report PNW 667, Pacific Northwest Extension.

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Rootstocks: Old, Recent, & New

Breeding Objectives

- Size reduction for ease of hand picking
- Increased precocity and cropping
- Wide compatibility
- Uniformity in performance
- Cold hardiness
- Adaptation to soils
- Disease and pest tolerance

Rom, R. C. and Carlson, R. F., editors (1987). *Rootstocks for Fruit Crops*. John Wiley & Sons, Inc. Image: http://www.cdb-rootstocks.com/en/images/gisela3.jpg?crc=4228965408

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Rootstock Availability

- 2016 Survey
  - 12 nurseries
  - 11 varieties
- 2019 Survey
  - 9 nurseries
  - 22 varieties

	VanWell	Dave Wilson	C&O Nursery	ProTree	Cameron	Sierra Gold	N. Am. Plants	Phytelligence	Summit
Mazzard	x	x			x	x	x		x
Mahaleb	x	x			x	x			x
Colt		x		x		x	x		x
Gi3				x		x			x
Gi5			x	x	x	x			x
Gi6	x		x	x	x	x			x
Gi12	x	x	x	x	x	x			x
Krymsk-5			x	x		x	x		x
Krymsk-6			x	x	x	x	x		x
Krymsk-7				x		x	x		
Maxma-14		x				x	x		x
MxM 60			x	x					
Weiroot							x		
Cass						x	x	x	
Clare						x	x	x	
Clinton						x	x	x	
Crawford						x	x	x	
Lake						x	x	x	
Damil GM 61/1		x					x		
Edabriz							x		
NEWROOT-1		x							x
Tabel							x		

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Mazzard: The "Standard"

- Seedling *P. avium* selections
  - Clonal line 'F12/1'
  - Tolerates varied climates, soils
  - Widely graft-compatible
  - Few root suckers
- Multiple Training Methods
  - Open Center
  - Vogel Central Leader
  - Kym Green Bush (pedestrian)
- Large tree if untrained

Kym Green Bush

Image: Long, L. E., Lang, G., Musacchi, S., and Whiting, M. (2015). *Cherry training systems*. Technical Report PNW 667, Pacific Northwest Extension.

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Gisela® Series

- Origin:
  - University of Giessen (Germany) / Dr. Werner Gruppe
  - Licensed by: Consortium Deutscher Baumschulen GmbH

- Rootstock Lines:
  - Gi3 (Gisela-3), Gi5, Gi6, Gi12, *Gi13, Gi17*

Images: *Size controlling rootstocks for sweet and sour cherries*. Downloaded from http://www.cdb-rootstocks.com/en/cdb---products---gisela.html

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Gisela® Series

Gisela-3	Gisela-5	Gisela-6	Gisela-12
P. cerasus × *P. canescens*	*P. cerasus* × *P. canescens*	*P. cerasus* × *P. canescens*	*P. cerasus* × *P. canescens*
• Dwarfing (30-40%) • High-density • Precocious • Wide branch angles • Support needed • Deep soils • Irrigation • Intensive management • No root suckers	• Semi-dwarfing (50-60%) • High-density • Precocious • Deep soils • Irrigation • Intensive management • Tolerant of PDV & PNRSV	• Moderate dwarfing (70-80%) • Medium density • Very precocious • Deep soils good drainage • Irrigation • Intensive management • Tolerant of PDV & PNRSV	• Standard (90+%) • Precocious • Medium density • Requires support • Not susceptible to PDV & PNRSV • No root suckers

GiSelA®

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Gisela® Series

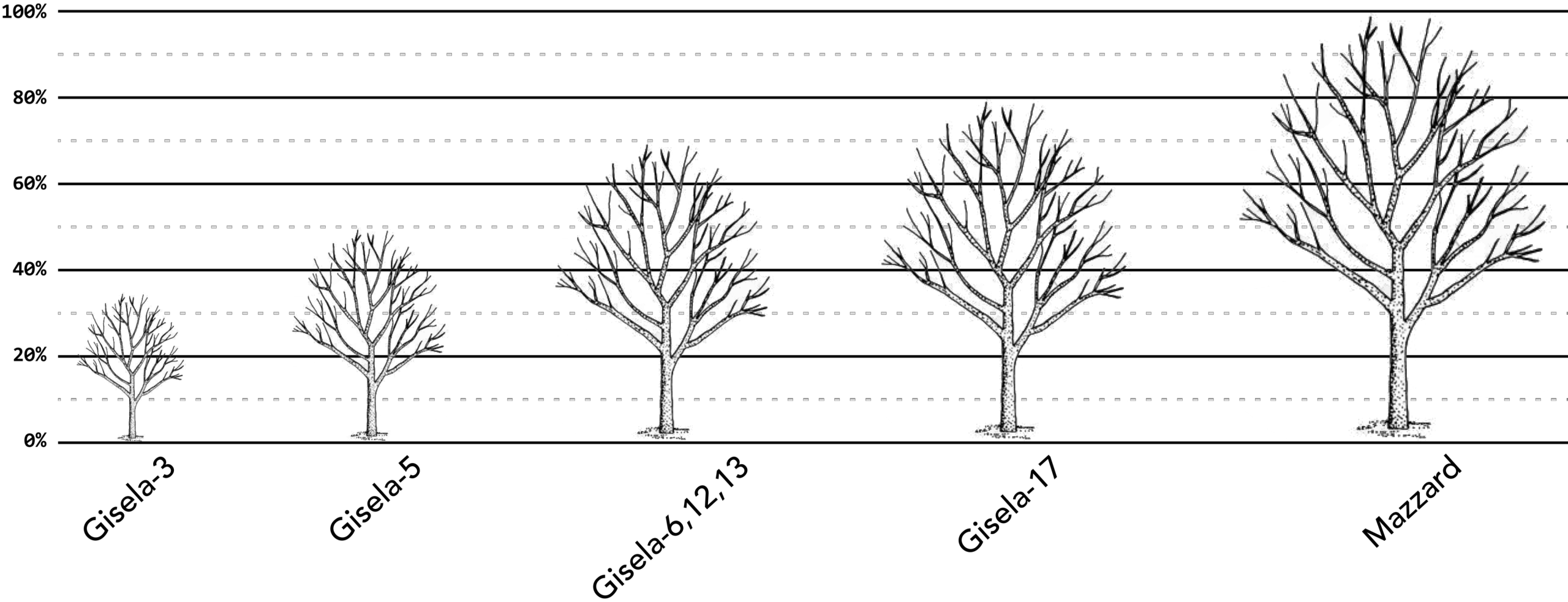
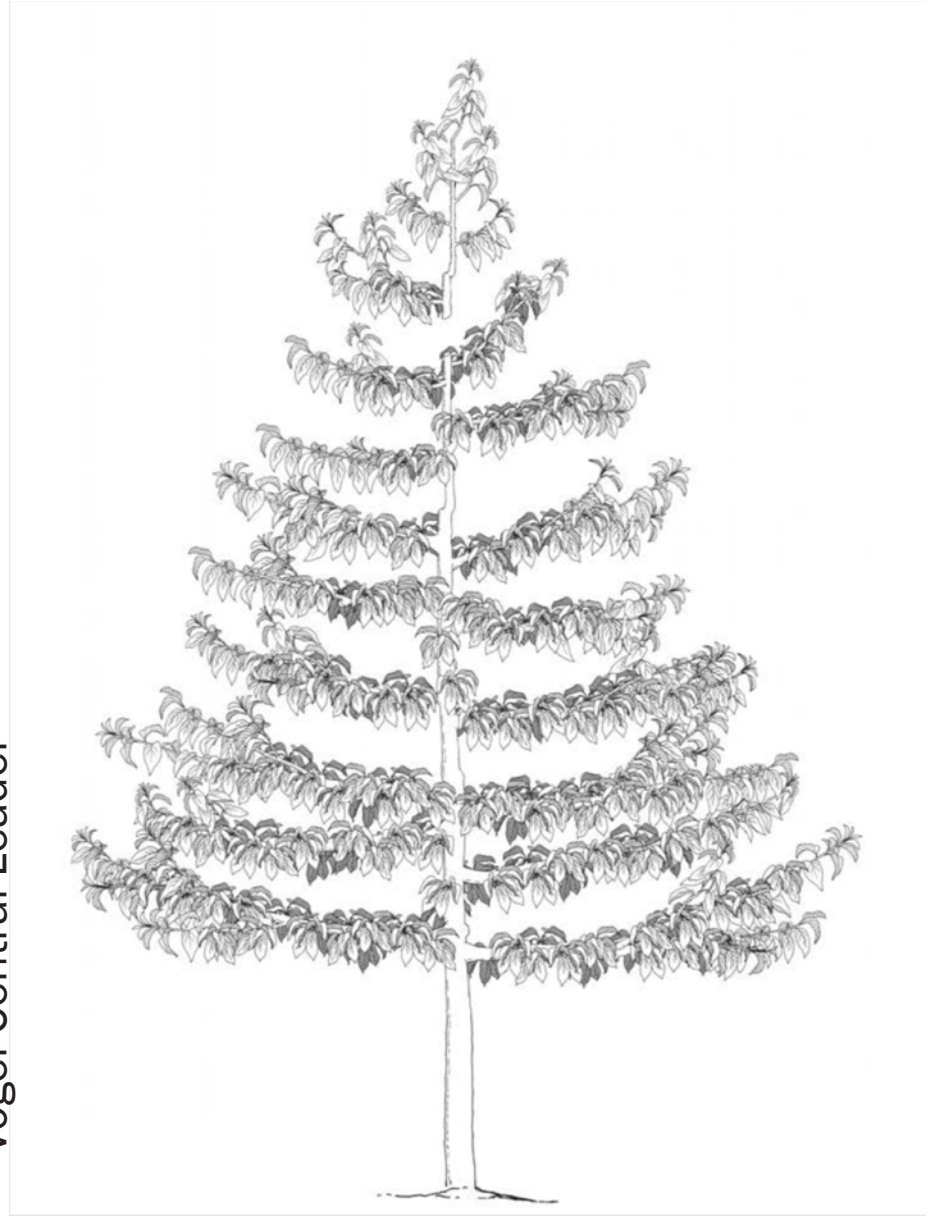


Image based on data collected from multiple sources.

Penn State University / Fruit Research and Extension Center (2010-2017)



Gisela® FREC Trial

- Objective
  - Evaluate self-fruitful* and cross-pollinating sweet cherries on dwarfing Gisela rootstocks, to determine if these are suitable for southern/southeastern PA.
- Rootstocks
  - Gi5, Gi6, Gi12
- Varieties
  - *Black Gold, Chelan, Kristin, Regina, * Skeena
- Training
  - Vogel central leader
  - Topped at 10’

Image: Long, L. E., Lang, G., Musacchi, S., and Whiting, M. (2015). *Cherry training systems*. Technical Report PNW 667, Pacific Northwest Extension.

Penn State University / Fruit Research and Extension Center (2010-2017)

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Gisela® FREC Trial – Results

		Number of cherries harvested					
Cultivar	Rootstock	2013	2014	2015	2016	2017	Cumulative
Black Gold	Gi6	132	0	2921	*	916	3969
Black Gold	Gi12	65	0	1678	*	19	1761
Chelan	Gi6	30	80	1645	*	192	1948
Kristin	Gi5	100	1	2624	*	852	3576
Kristin	Gi6	194	8	3402	*	650	4254
Kristin	Gi12	97	0	2610	*	169	2876
Regina	Gi5	174	0	979	*	411	1564
Regina	Gi6	58	0	1194	*	43	1295
Regina	Gi12	99	0	1588	*	30	1717
Skeena	Gi6	144	0	846	*	260	1249

* Complete crop failure.

Data courtesy: Jim Schupp, Ph.D., compiled by Edwin Winzeler, Ph.D.

Penn State University / Fruit Research and Extension Center (2010-2017)

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Gisela® FREC Trial – Results

		Average cherry weight (g)				
Cultivar	Rootstock	2013	2014	2015	2016	2017
Black Gold	Gi6	6.4	†	7.8	*	10.2
Black Gold	Gi12	7.7	†	9.8	*	13.1
Chelan	Gi6	8.4	8.5	4.8	*	8.1
Kristin	Gi5	6.8	7.2	6.6	*	8.3
Kristin	Gi6	7.4	8.5	6.5	*	8.6
Kristin	Gi12	6.9	†	7.3	*	8.0
Regina	Gi5	7.9	†	9.9	*	10.1
Regina	Gi6	8.0	†	10.0	*	12.0
Regina	Gi12	8.3	†	9.5	*	13.3
Skeena	Gi6	8.4	†	7.7	*	9.2

* Complete crop failure; † No harvest.

Data courtesy: Jim Schupp, Ph.D., compiled by Edwin Winzeler, Ph.D.

NC-140 Trial / Michigan State University (2010-2019)

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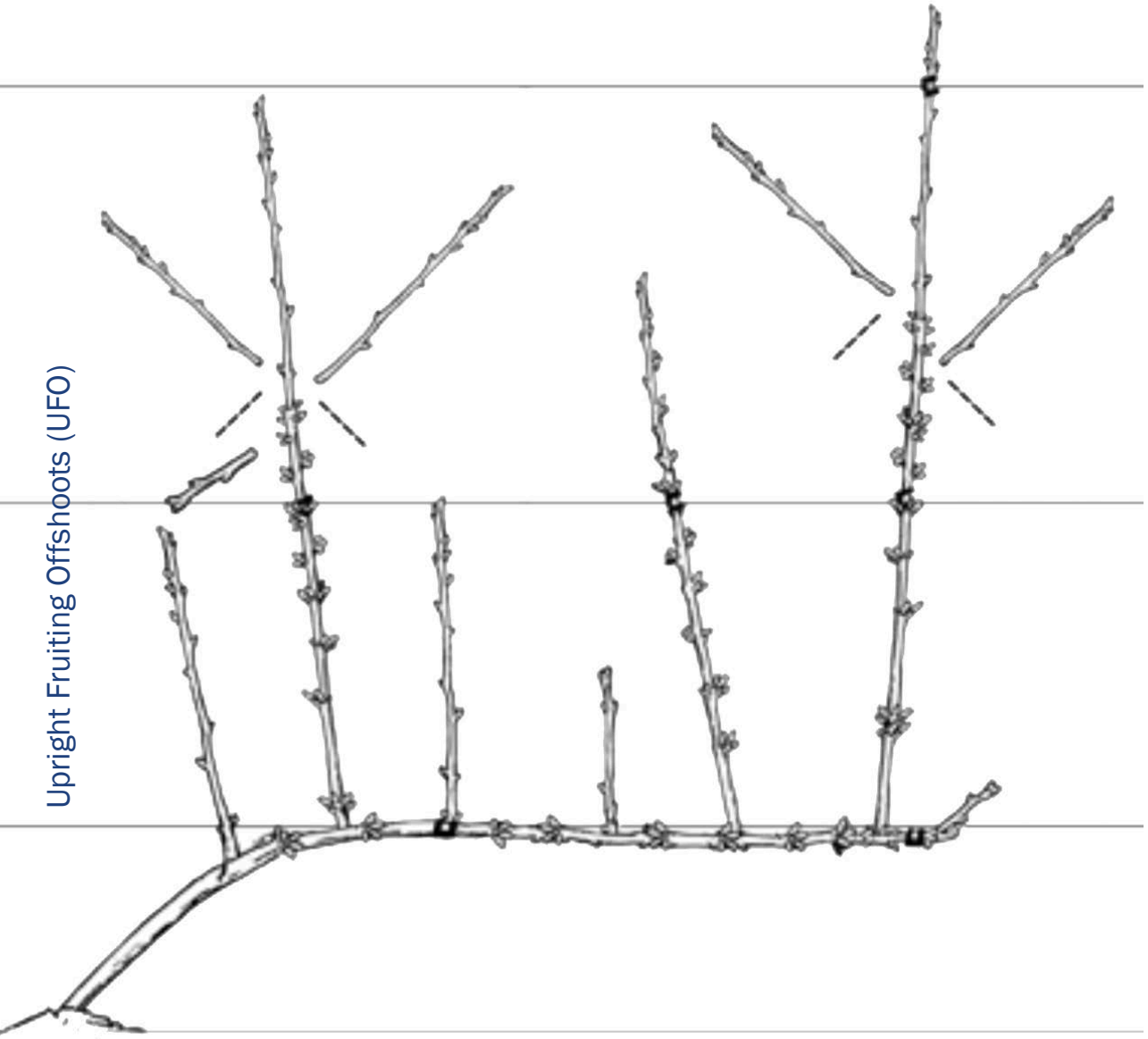

Gisela® Trial

- Objective
  - Evaluate the influence of rootstocks on temperate-zone fruit tree characteristics grown under varying environments and training systems using sustainable management practices.
- Rootstocks
  - Gi3, Gi5, Gi6
- Varieties
  - Benton
- Training
  - KGB, TSA, SSA, UFO
  - Cravo and VOEN row covers

Image: Long, L. E., Lang, G., Musacchi, S., and Whiting, M. (2015). *Cherry training systems*. Technical Report PNW 667, Pacific Northwest Extension.

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Gisela® Trial – Results

KGB: Highest yield and highest fruit mass.

Table 1. 2018 'Benton' sweet cherry yield (per tree) and fruit quality data under Cravo automated roof covers in the 2010 NC140 Cherry Rootstock x Systems Trial planted near Clarksville, MI.

	Yield (kg/tree)				Fruit mass (g/fruit) and [diameter (mm)]			
	KGB	**SSA**	**TSA**	**UFO**	**KGB**	**SSA**	**TSA**	**UFO**
Gi3	2.61	0.68	0.52	2.15	14.2 [32]	13.3 [32]	13.2 [32]	13.4 [32]
Gi5	2.24	-	1.00	2.14	13.4 [31]	-	12.0 [31]	13.8 [32]
Gi6	2.12	0.48	1.08	1.32	13.2 [32]	12.8 [31]	12.1 [31]	12.5 [31]

Yield reduction due to Cravo vs. VOEN row covers (theory).

Table 2. 2018 'Benton' sweet cherry yield (per tree) and fruit quality data under Voen row covers in the 2010 NC140 Cherry Rootstock x Systems Trial planted near Clarksville, MI.

	Yield (kg/tree)				Fruit mass (g/fruit) and [diameter (mm)]			
	KGB	**SSA**	**TSA**	**UFO**	**KGB**	**SSA**	**TSA**	**UFO**
Gi3	1.15	0.43	1.04	0.92	12.6 [31]	11.9 [31]	11.9 [30]	11.9 [30]
Gi5	1.26	-	1.27	0.67	12.2 [31]	-	11.3 [30]	11.8 [31]
Gi6	1.30	0.52	1.45	1.22	11.5 [30]	11.4 [30]	11.4 [30]	12.1 [31]

Data courtesy: Gregory Lang, MSU

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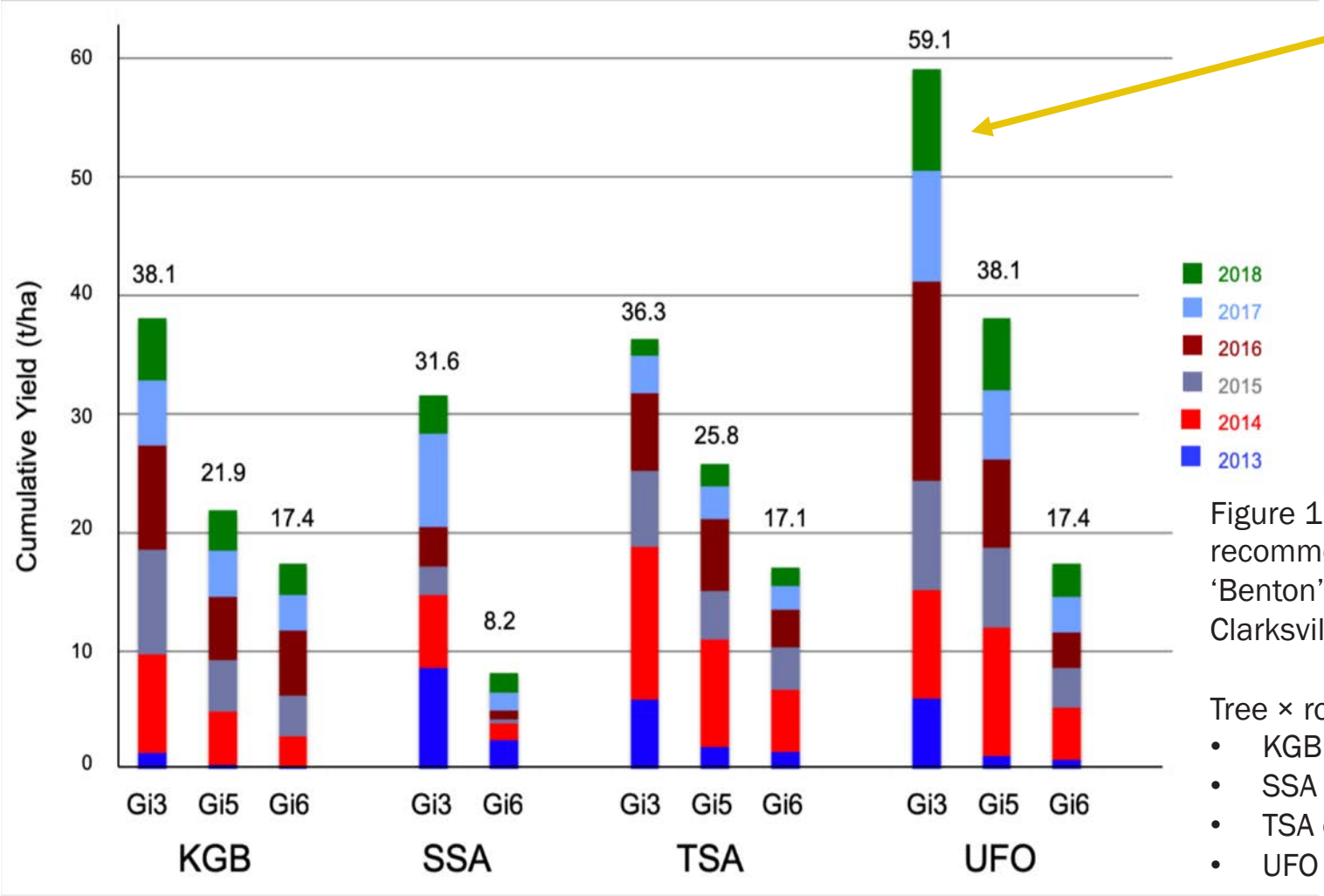
Gisela Trial – Results



Note UFO/Gi3 produced the highest yield (t/ha) when spacing for the training system was taken into account.

Figure 1. Cumulative orchard yields (2013-2018, based on recommended plant spacing, below) for the 2010 NC140 'Benton' Sweet Cherry Training Systems × Rootstock Trial, MSU Clarksville Research Center, Michigan.

Tree × row spacing (m):

- KGB on Gi3 / Gi5 / Gi6: 1.4 × 3.5 / 1.7 × 3.8 / 2.0 × 4.0
- SSA on Gi3 / Gi6: 0.75 × 2.8 / 1.0 × 2.8
- TSA on Gi3 / Gi5 / Gi6: 1.2 × 3.1 / 1.5 × 3.5 / 1.8 × 3.7
- UFO on Gi3 / Gi5 / Gi6: 1.0 × 2.5 / 1.4 × 2.5 / 1.9 × 2.5

Data courtesy: Gregory Lang, MSU

Lang, G., Einhorn, T., Rothwell, N., Schwallier, P., and Shane, B. (2018). State: Michigan (2018). Technical report, NC-140 Regional Rootstock Research Project.

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Krymsk®

- Origin:
  - Gennady Eremin at the Krymsk Vavilov Institute
  - Licensed by Progressive Genetics Group

- Rootstock lines:
  - K-5, K-6, K-7, also K-1 (plum), K-86 (almond)

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Krymsk®

Krymsk-5	Krymsk-6
P. fruticosa × *P. serrulate* var. *lannesiana*	*P. cerasus* x (*P. cerasus* × *P. maackii*)
• Moderately dwarfing rootstock (80-90%) • Precocity between Gi6 and Mazzard • Good yield efficiency, less flower density than Giselas • Some crop load management • Cold hardy • Suckers heavily in heavy soils • Very sensitive to PDV and PNRSV	• Semi-dwarfing (60-80%) • Precocious • Good yield efficiency • Crop load management (overbearing) • Cold hardy • Tolerant of wet and calcareous soils • Drought tolerance greater than Giselas • Suckers heavily in heavy soils • Very sensitive to PDV and PNRSV

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Krymsk® Series

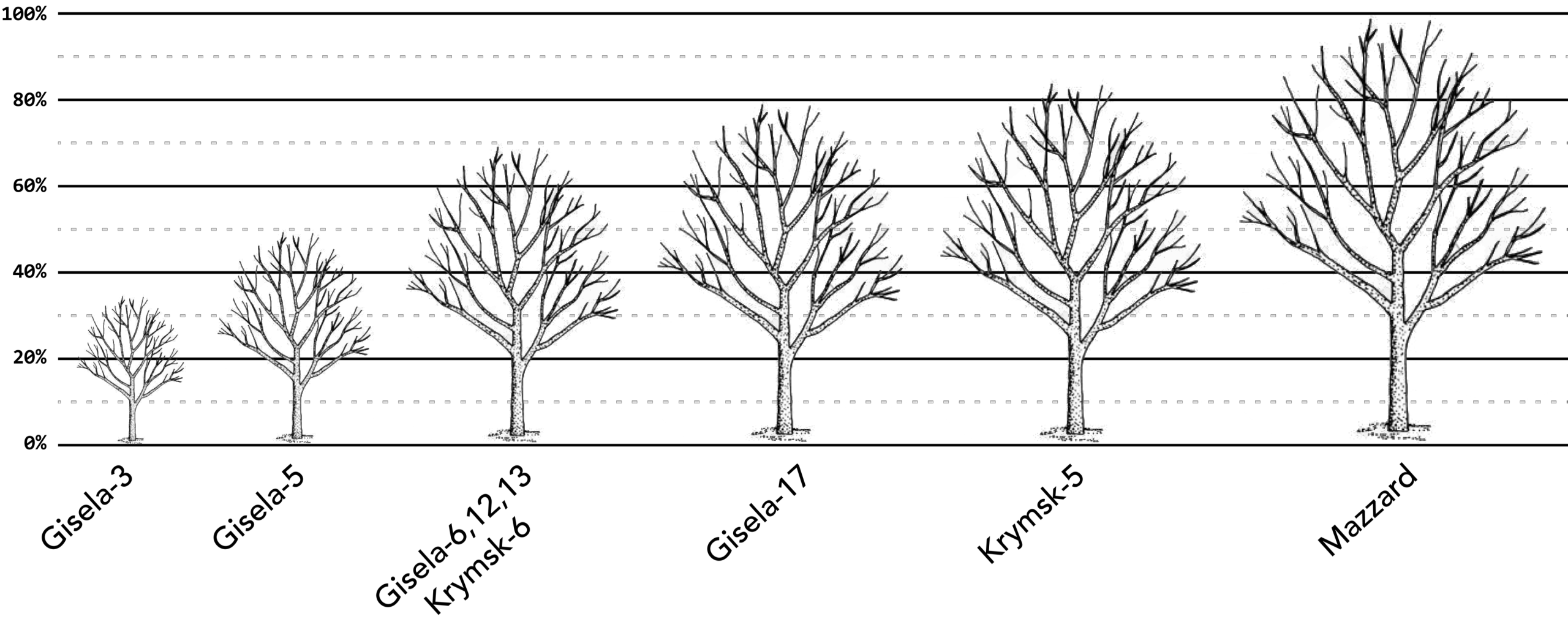

Image based on data from multiple sources.

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Corette™

- Breeding Objectives:
  1. Develop a large cherry germplasm collection – particularly from Eastern Europe and native NA *Prunus* species, e.g. *Prunus serotine.*
  2. Develop new tart cherry varieties for the MI cherry industry.
  3. Identify selections with potential to serve as tart and sweet cherry dwarfing rootstocks.
  4. Identify molecular markers and loci in the *Prunus* genome associated with traits of importance (e.g. disease resistance, cold tolerance, dwarfing, etc.) (RosBREED)

- Collection begun in 1983, from germplasm collected in Hungary.

- Rootstocks
  - Tested in 2004-Present

https://www.canr.msu.edu/profiles/dr_amy_iezzoni/balaton_cherries/history_of_tart_cherries

Michigan State / Oregon State / Washington State Universities / WTFRC / NC-140

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Amy Iezzoni, MSU

Corette™

Gregory Lang, MSU

Lynn Long, OSU

Matthew Whiting, WSU

Images: msu.edu, osu.edu, wsu.edu

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Corette™: 2001-2004

- Objective:
  - Evaluate 92 lines in MI; replicate 21 in WA.
  - Scions: ‘Hedelfingen’, ‘Bing’
  - Control: Gi6
  - Pollinator: ‘Ulster/Gi6’

- Evaluation rejected:
  1. Cold susceptible
  2. Poor anchorage
  3. Graft incompatibilities

Iezzoni, A. (2004). *2002–2004 final research report*. Project #CH-01-02, Washington Tree Fruit Research Commission.

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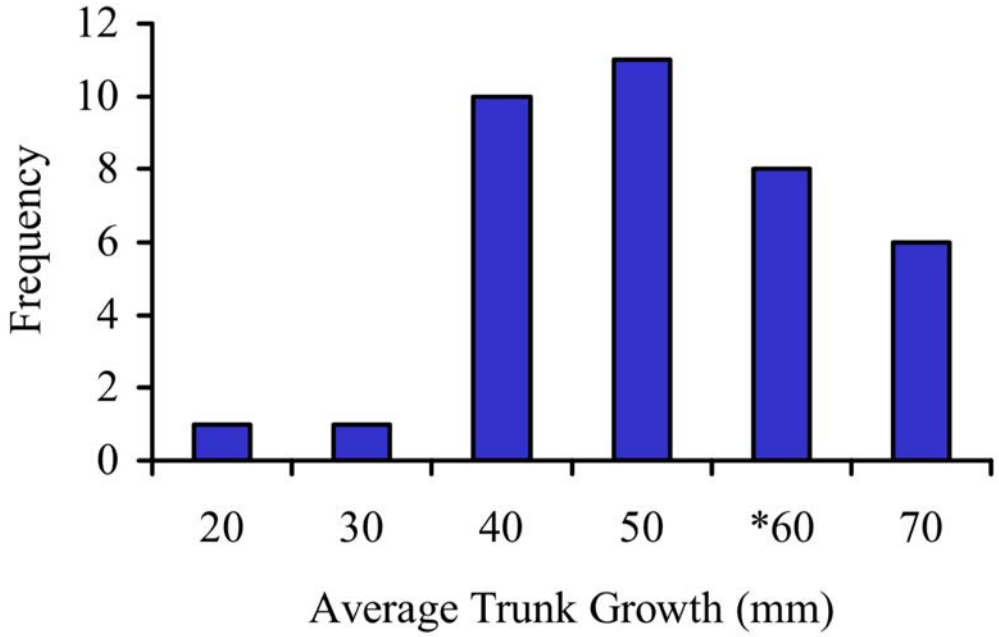
Corette™: 2001-2004

- Results:
  - Precocity in 2nd leaf. Similar to Gi6.
  - Freeze tolerance > Gi6.
  - Cropping: 0-5 scale (0 = no crop):
    - Gi6: 3
    - MSU mean: 2
  - TCSA < Gi6

Fig. 4. Average trunk growth (mm) for MSU selections with Bing or Hedelfingen as its scion at Clarksville, MI. Trees were planted in 2001. *Denotes GI 6.



Iezzoni, A. (2004). *2002–2004 final research report*. Project #CH-01-02, Washington Tree Fruit Research Commission.

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Corette™: 2005-2014

- Objective
  - Determine yield efficiencies for multiple dwarfing/semi-dwarfing rootstocks in Prosser, WA.
- Rootstocks
  - Gi5, Gi6, Cass, Clare, Clinton, Crawford, Lake
- Varieties
  - ‘Bing’
- Training
  - Three-leader / steep leader

Image: Long, L. E., Lang, G., Musacchi, S., and Whiting, M. (2015). *Cherry training systems*. Technical Report PNW 667, Pacific Northwest Extension.

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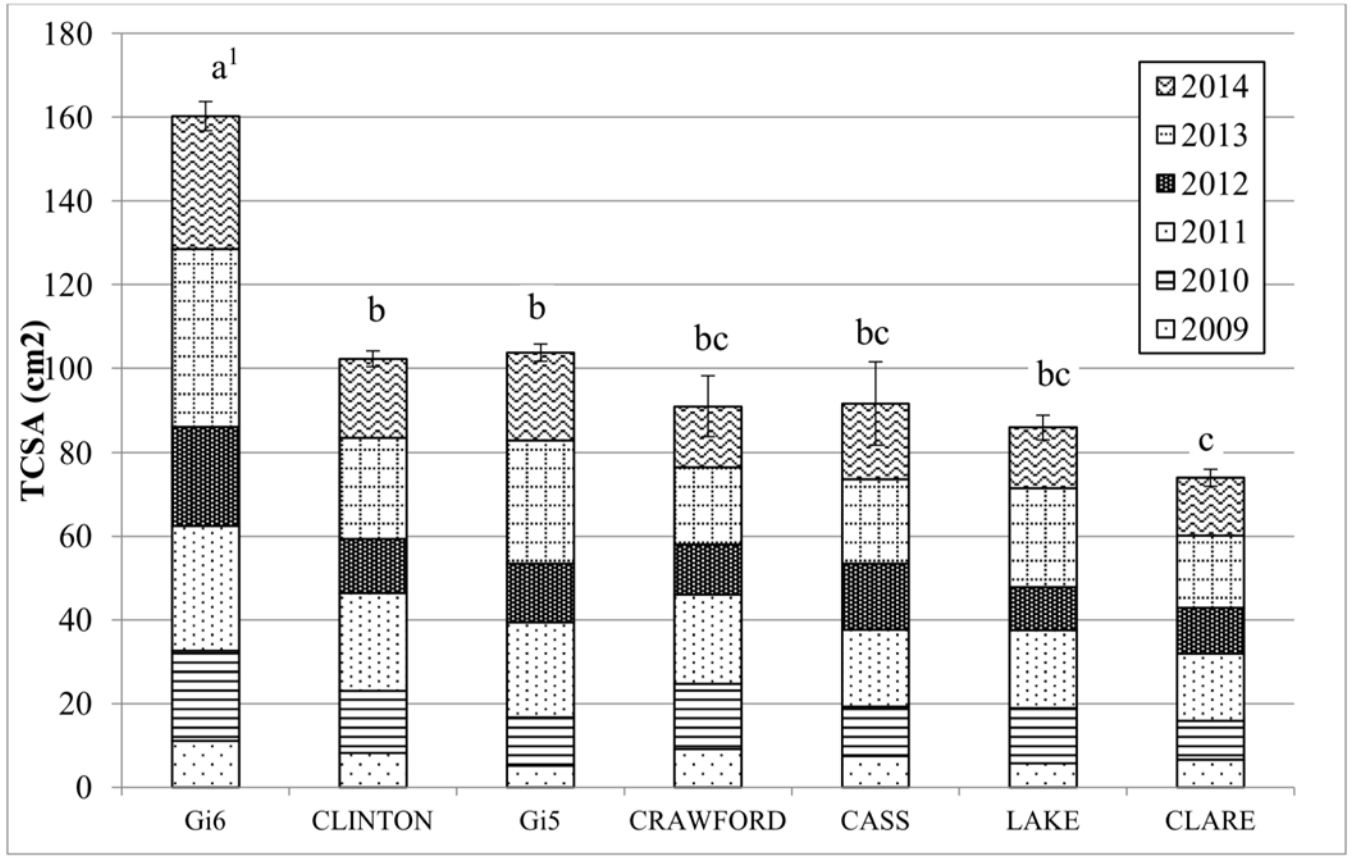
Corette™: 2005-2014

Fig. 1. Trunk cross-sectional area (TCSA; cm^2) of 'Bing' trees grafted on 5 MSU rootstocks, Gi5, and Gi6 for trees planted in 2009 at the WSU-Prosser. Boxes represent growth over one season. TCSA measurements in 2014 were taken on June 16. Bars represent standard error of the means for 2014 TCSA.



[1]Means that are significantly different for 2014 TCSA ($P < 0.05$) are denoted by different letters.

Iezzoni, A., Whiting, M., Susaimuthu, J., and Auvil, T. (2014). *Final research report: Establishment and testing of MSU sweet cherry rootstocks*. Technical report, Washington Tree Fruit Research Commission.

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Corette™: 2005-2014

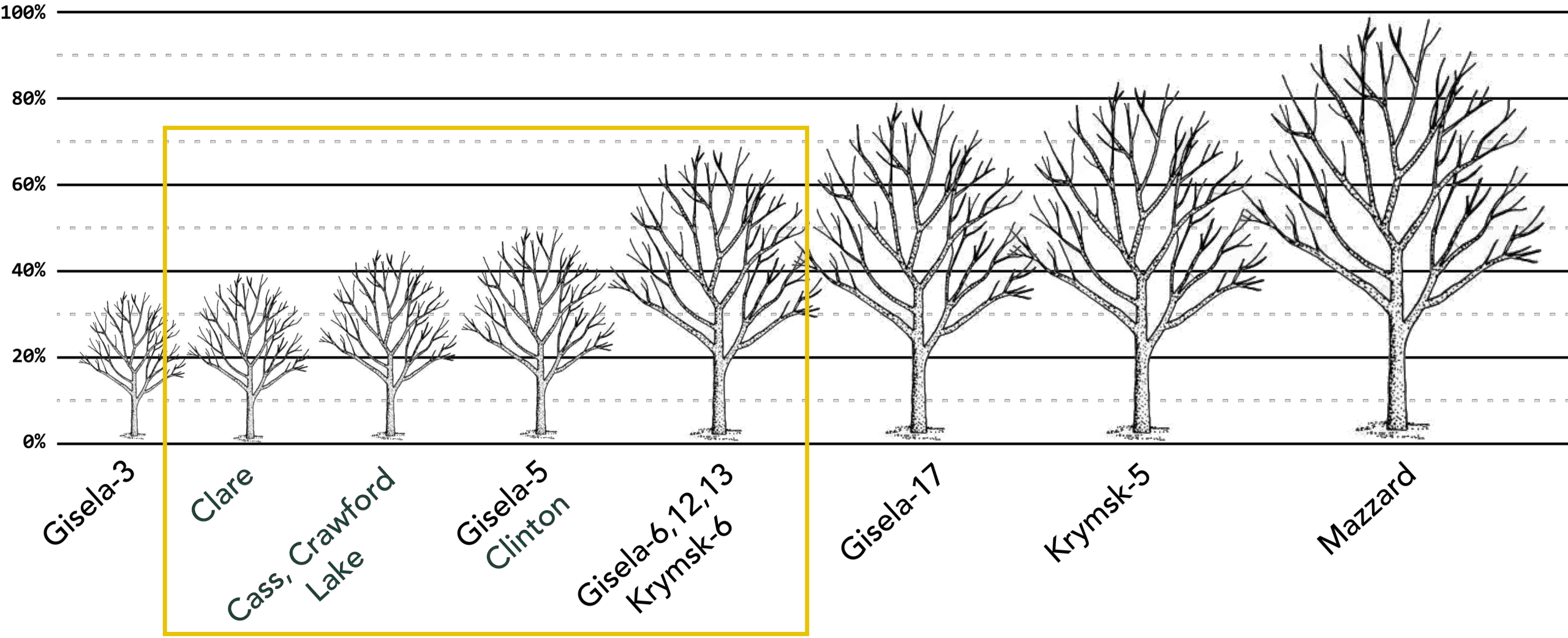

Image data based upon multiple sources.

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Corette™: 2005-2014

Table 2. Fruit weight, mean row size and yield efficiency for 'Bing' grown on five MSU rootstocks in the Corette™ series, 'Gisela 5' and 'Gisela 6'. Fruit were harvested in 2012 on June 28 and in 2013 on June 18 for 'Lake' and on June 26 for the remaining selections due to a rain delay.[1]

Rootstock selection	2012 Fruit weight (g)	2013 Fruit weight (g)	2012 Mean row size	2013 Mean row size	2012 Yield efficiency (kg/cm^2)	2013 Yield efficiency (kg/cm^2)
'Gisela 5'	10.2 a[2]	11.1 a	9.8 a	9.6 a	0.066 ab	0.107 b
'Gisela 6'	9.6 a	10.4 a	9.9 a	9.8 a	0.037 b	0.091 b
'Cass'	10.3 a	10.7 a	9.7 a	9.8 a	0.059 ab	0.120 ab
'Clare'	9.9 a	10.3 a	9.9 a	9.8 a	0.086 a	0.160 a
'Clinton'	10.1 a	10.5 a	9.8 a	10.0 a	0.086 a	0.161 a
'Crawford'	9.5 a	9.3 a	10.0 a	10.2 a	0.099 a	0.173 a
'Lake'	9.0 a	9.6 a	10.1 a	10.0 a	0.106 a	0.118 ab

[1] Pea-sized fruit were thinned by 50% in 2012. In 2013, fruit were thinned based on achieving standard crop loads for each selection.
[2] Means that are significantly different ($P < 0.05$) are denoted by different letters.

Data courtesy Lynn E. Long, Oregon State University

Long, L. E. (2017). *Corette - IHSH*. From a presentation at ISHS VIII Cherry Symposium, Yamagata, Japan, and Iezzoni, A., Whiting, M., Susaimuthu, J., and Auvil, T. (2014). *Final research report: Establishment and testing of MSU sweet cherry rootstocks*. Technical report, Washington Tree Fruit Research Commission.

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Corette™: 2005-2014

Table 2. Fresh and post-harvest values for fruit firmness (g/mm^2) and acidity for 'Bing' on five MSU rootstocks, Gi5 and Gi6. Fruit were harvested in 2012 on June 28 and in 2013 on June 18 for LAKE and June 26 for the remaining selections due to a rain delay. Storage acidity and firmness in 2013 was measured from fruit stored at 33°F for 4 days. [1]

Rootstock selection	2012 Firmness (g/mm^2)	2013 Firmness (g/mm^2)	2012 Storage firmness (g/mm^2)	2013 Storage firmness (g/mm^2)	2013 Acidity (%)[2]	2013 Storage acidity (%)[2]
Gi 5	269 ab[3]	235 ab	369 a	261 a	0.86% ab	0.82% ab
Gi 6	262 abc	214 ab	360 a	227 b	0.83% abc	0.81% ab
CASS	231 d	228 ab	332 b	261 a	0.85% ab	0.81% ab
CLARE	252 c	222 ab	357 a	250 a	0.83 abc	0.81% ab
CLINTON	238 d	200 b	333 b	216 b	0.77% bc	0.72% b
CRAWFORD	253 bc	224 ab	312 b	212 b	0.72% c	0.72% b
LAKE	277 a	248 a	311 b	255 a	0.90% a	0.86% a

[1]Pea-sized fruit were thinned by 50% in 2012. In 2013, fruit were thinned based on achieving standard crop loads for each selection.
[2]Data not shown for 2012 because statistical analyses were not possible due to lack of replicated data for CASS and LAKE.
[3]Means that are significantly different ($P < 0.05$) are denoted by different letters.

Conclusions: inconsistencies not attributable to MSU rootstocks.

Iezzoni, A., Whiting, M., Susaimuthu, J., and Auvil, T. (2014). *Final research report: Establishment and testing of MSU sweet cherry rootstocks*. Technical report, Washington Tree Fruit Research Commission.

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Corette™: 2005-2014

Table 3. Fruit skin color, Brix and percentage of fruit cracked for 'Bing' grown on five MSU rootstocks, Gi5 and Gi6. Fruit were harvested in 2013 on June 18 for LAKE and on June 26 for the remaining selections due to a rain delay[1,2].

Rootstock selection	2013 Fruit skin color	2013 Brix (%)	2013 Fruit cracked (%)
Gi5	6.3 ab[3]	20.4 ab	38% a
Gi6	6.3 ab	19.6 ab	34% a
CASS	6.8 a	22.0 a	44% a
CLARE	6.8 ab	20.9 ab	38% a
CLINTON	6.6 ab	19.5 ab	40% a
CRAWFORD	5.9 b	18.6 b	44% a
LAKE	4.9 c	19.2 ab	25% a

[1]Pea-sized fruit were thinned by 50% in 2012. In 2013, fruit were thinned based on achieving standard crop loads for each selection.
[2]Data not shown for 2012 because statistical analyses were not possible due to lack of replicated date for CASS and LAKE.
[3]Means that are significantly different ($P < 0.05$) are denoted by different letters.

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Iezzoni, A., Whiting, M., Susaimuthu, J., and Auvil, T. (2014). *Final research report: Establishment and testing of MSU sweet cherry rootstocks*. Technical report, Washington Tree Fruit Research Commission.

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Corette™: 2015-2018

- Further evaluation:

> **Despite the potential of the MSU dwarfing cherry rootstocks to contribute to profitability due to precocious fruiting, and a reduced cost of harvest labor, critical performance-related questions have not yet been answered.** These include **performance with scions with different cropping potential**, and suitability with **different training systems, soils and growing conditions.** All the fruit data for the MSU rootstocks from the Pacific Northwest is from one plot at WSU-Prosser with 'Bing' scion trained to a multiple leader architecture. Therefore plantings were established in 2015 and will be established in 2017 … to include a wider range of scions and management systems.

Iezzoni, A., Whiting, M., Auvil, T., and Long, L. (2017). *Final project report: MSU cherry rootstocks: Pre-commercialization*. Technical report, Washington Tree Fruit Research Commission.

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Corette™: 2015-2018

Table 2. Summary of rootstock plantings made in spring 2015 at three locations: The Dalles (TD), Ore., Mattawa (MA) & East Wenatchee (EW), Wash.

Scion cultivars	Regina, Early Robin, Sweetheart
MSU rootstocks	Cass[a], Clare, Clinton and Lake
Control rootstocks	Gi5, Gi6, Krymsk 6 (Sweetheart), Krymsk 5 (Regina, Early Robin)
Pollinators	Chelan (Early Robin), Sam (Regina)
Replication	20 trees per each scion/rootstock combination (four 5 tree replications)
Training system: TD	Sweetheart and Early Robin trees were headed to establish a bush system. Regina trees were trained to a steep leader system.
Training system: MA	Two narrow rows on a 4 wire Angle canopy trellis
Training system: EW	Super Slender Axe, 2 very narrow rows on 4 wire angle canopy trellis[b]
Within row spacing: TD	8 ft
Within row spacing: MA	3 ft (Gi6), 2.5 ft (K5, K6, Clinton), 2ft (Cass, Lake, Clare)
Within row spacing: EW	4 ft (Gi6, K5, K6, Clinton), 2 ft (Cass, Lake, Clare)

[a]'Regina'/Cass was not included at East Wenatchee due to insufficient tree numbers.

[b]Wires 2.3 (0.7m) apart vertically

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Corette™ Rootstock Availability

- Provisional release program through 2021:
  - 2000 trees/line (i.e. ‘Variety’/ ‘Cass’)
  - 1000 variety/line, maximum (i.e. 1000 ‘Regina/Cass’ + 1000 ‘Benton/Cass’
  - Consistent training system across blocks (e.g. 500 each on UFO, 500 each on SSA)
  - Report to Amy Iezzoni / Greg Lang / MSU

- Source nurseries
  - Sierra Gold (https://www.sierragoldtrees.com/)
  - ProTree (https://protreenursery.com/)
  - Gold Crown ((509) 664-2973)
  - North American Plants (http://www.naplants.com/)
  - Phytelligence (http://phytelligence.com/)

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Conclusions

Sweet Cherries for Mid-Atlantic Regions?

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Pedestrian Orchards in the Mid-Atlantic Region?

- "Pedestrian"-trained, high-density orchards possible (in WA):
  - KGB, VCL, UFO, TSA, SSA
  - Gisela®, Krymsk®, Corette™
  - Suitable for PYO and direct market
  - Mechanization (eventually)
  - Need additional trials for PA/M-A

Image: Cherry Institute Orchard Systems Tour by Matthew Whiting. http://treefruit.wsu.edu/article/cherry-institute-orchard-systems-tour/

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Choose the Right Training System

Table 1. Appropriate Plant Material Considerations and Uses of Various Training Systems

	KGB	SB	SL	SSA	TSA	UFO	UFO-Y	VCL
ROOTSTOCKS								
Full-size rootstock	X	X	X					
Semi-dwarfing rootstocks	X	X	X	on low vigor sites	X	X	X	X
Dwarfing rootstocks			X	X	X			X
FRUITING HABIT								
Spur type	X	X	X		X	X	X	X
Non-spur type		X	X	X	X			X
CHARACTERISTICS OF THE TRAINING SYSTEM								
Precocious				X	X	X	X	X
Low establishment costs	X	X						
Consists of repeatable units that simplify maintenance	X			X		X	X	
Reduces harvest cost	X	X		X		X	X	

Long, L. E., Lang, G., Musacchi, S., and Whiting, M. (2015). *Cherry training systems*. Technical Report PNW 667, Pacific Northwest Extension.

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Corette™ Rootstocks in the Mid-Atlantic Region

- Best training system?
  - Will vary with vigor + variety + soil
  - Expect to improvise.

- Gisela® and Corette™ similar behaviors in WA
  - Shallow, sandy soils: higher density and irrigation
  - Irrigation necessary for dwarfing rootstocks
  - Density of trees may be wider than expected

Modified SSA

Image: Modified SSA at Mattawa Main Ranch, Zirkle Fruit Company, Mattawa, WA by Matthew Whiting. http://treefruit.wsu.edu/article/cherry-institute-orchard-systems-tour/

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Corette™ Rootstocks in the Mid-Atlantic Region

- Incompatibility with variety?
  - E.g. Hedelfingen/Crawford
  - Most Corette™ appear fully compatible

- Match vigor of scion and rootstock:
  - Productive variety ⟶ vigorous rootstock
  - Less productive ⟶ more dwarfing
  - E.g. SSA can produce blind wood and a lack of lateral development when on dwarfing rootstock.

Sweetheart/Clare and Lack of Vigor and Lateral Development

Image: Figure 1. Sweetheart/Clare Lack of Lateral Development by Matthew Whiting. http://treefruit.wsu.edu/article/cherry-institute-orchard-systems-tour/

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Credits

- Jim Schupp – Penn State University / FREC
- Rob Crassweller – Penn State University

- Amy Iezzoni – Michigan State University
- Gregory Lang – Michigan State University

- Lynn E. Long – Oregon State University
- Bernardita Sallato – Washington State Extension

- Justin Weaver – Weaver's Orchards
- Corey McCleaf – McCleaf's Orchards

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End of Presentation