Cherry Rootstock Breeding Projects and New Selections

Gregory Lang and Amy Iezzoni

Dept of Horticulture
Michigan State University

Important Cherry Rootstock Traits

Ease of Propagation – seeds, cuttings, tissue culture

Graft compatibility – sometimes problematic: *Prunus mahaleb*, sensitivity to virus-infected scion wood (PDV, PNRSV, etc.)

Modulation of Vigor – in nature, sweet cherry is a forest tree

Promotion of Precocity – often inversely proportional to vigor

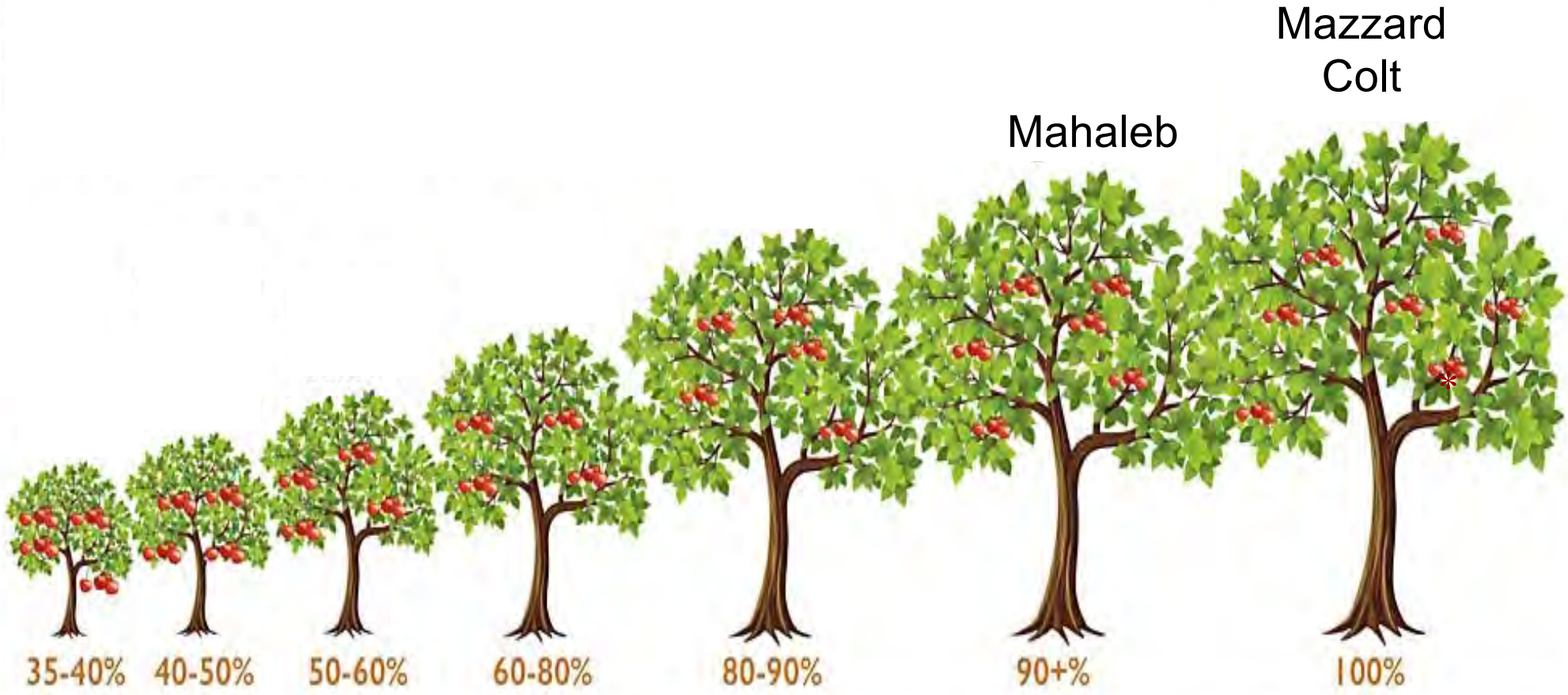
Promotion of Productivity – also inversely proportional to vigor

Adaptability to Soils – type, drainage, pH, replant, suckering, etc.

Adaptability to Climate – cold hardiness, heat tolerance, etc.

Disease/Pest Tolerance – soil-borne diseases, bacterial canker, nematodes, rodents

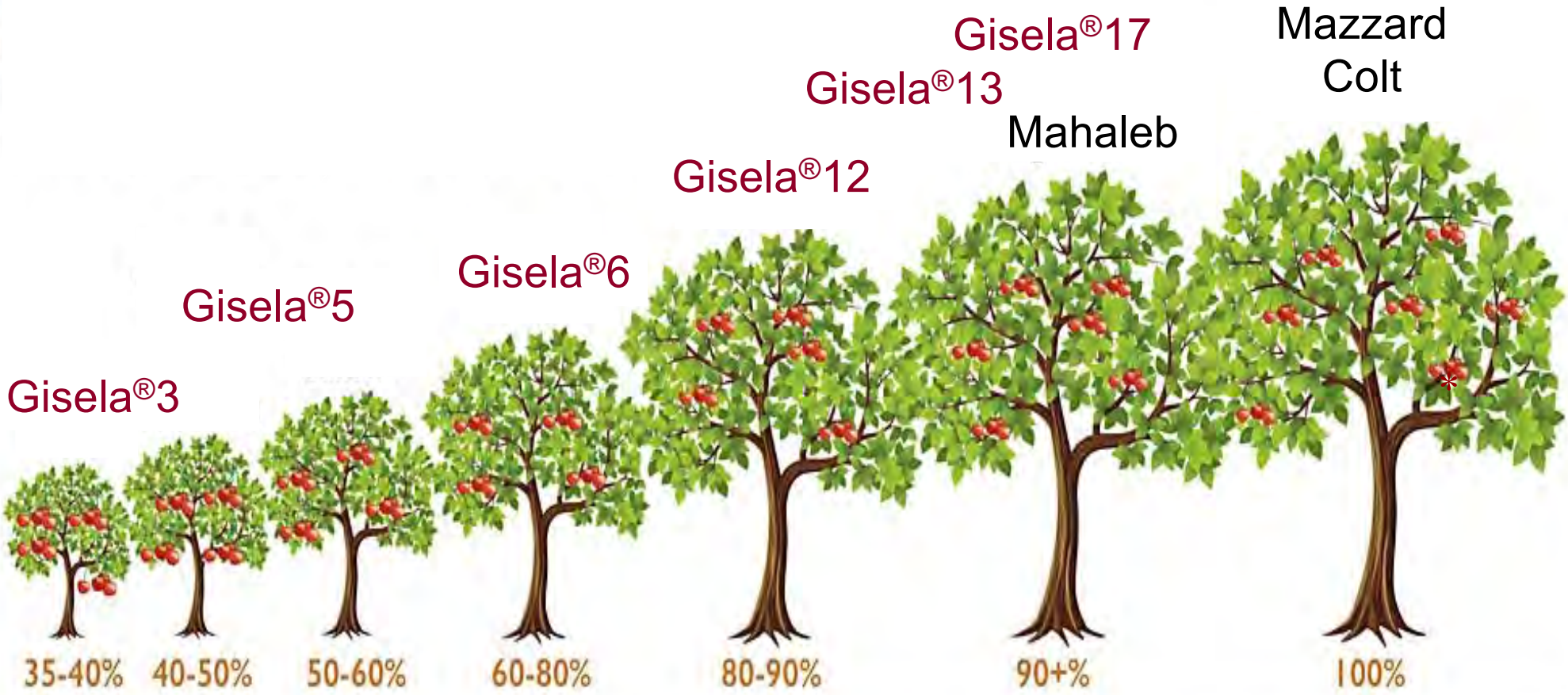
Cherry Rootstock Relative Vigor



Long-time standards: Mazzard and Mahaleb seedlings

Clonal Advancements: Mazzard F12/1, Charger, Colt (hybrid)

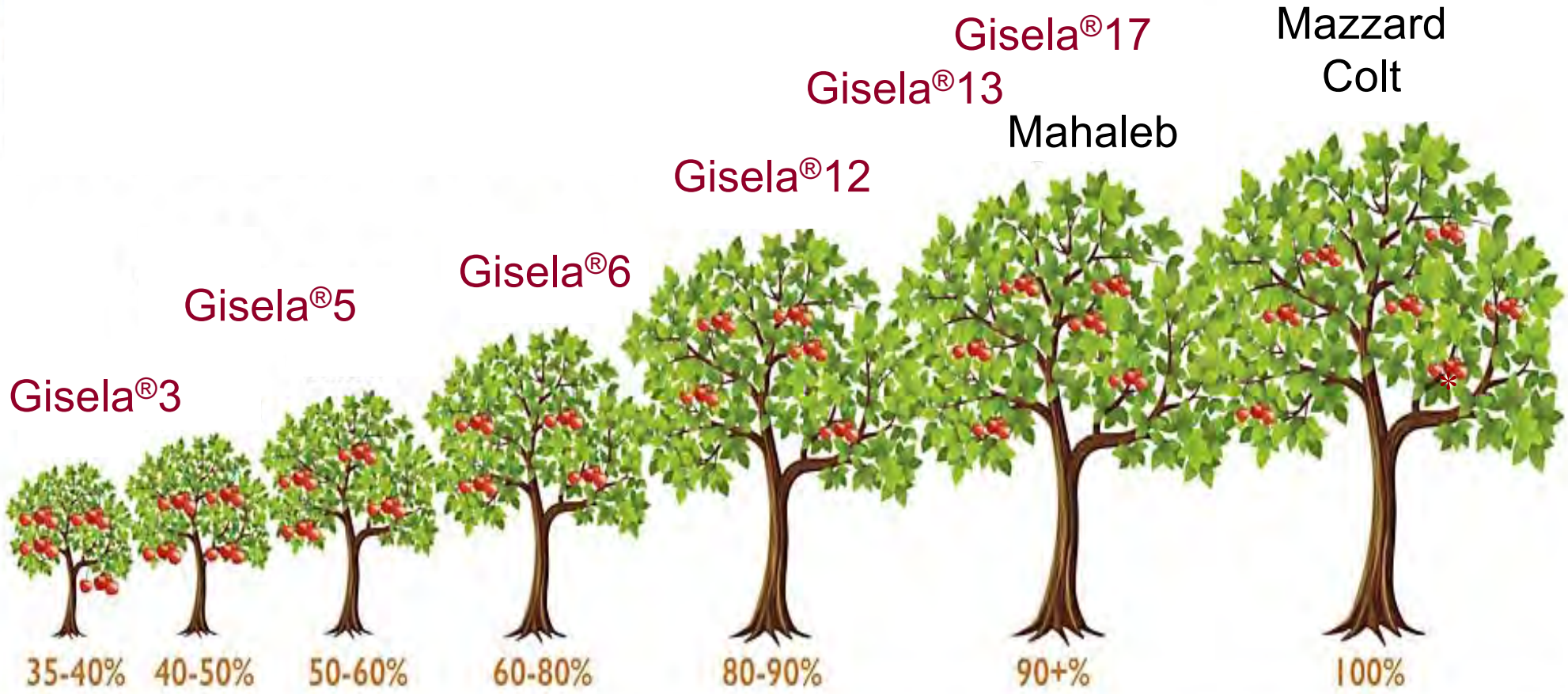
Cherry Rootstock Relative Vigor



Transformational introductions: The Gisela® series (Giessen)

Key traits:
1) Significant vigor control options
2) Significant precocity / high productivity
3) Cold hardy

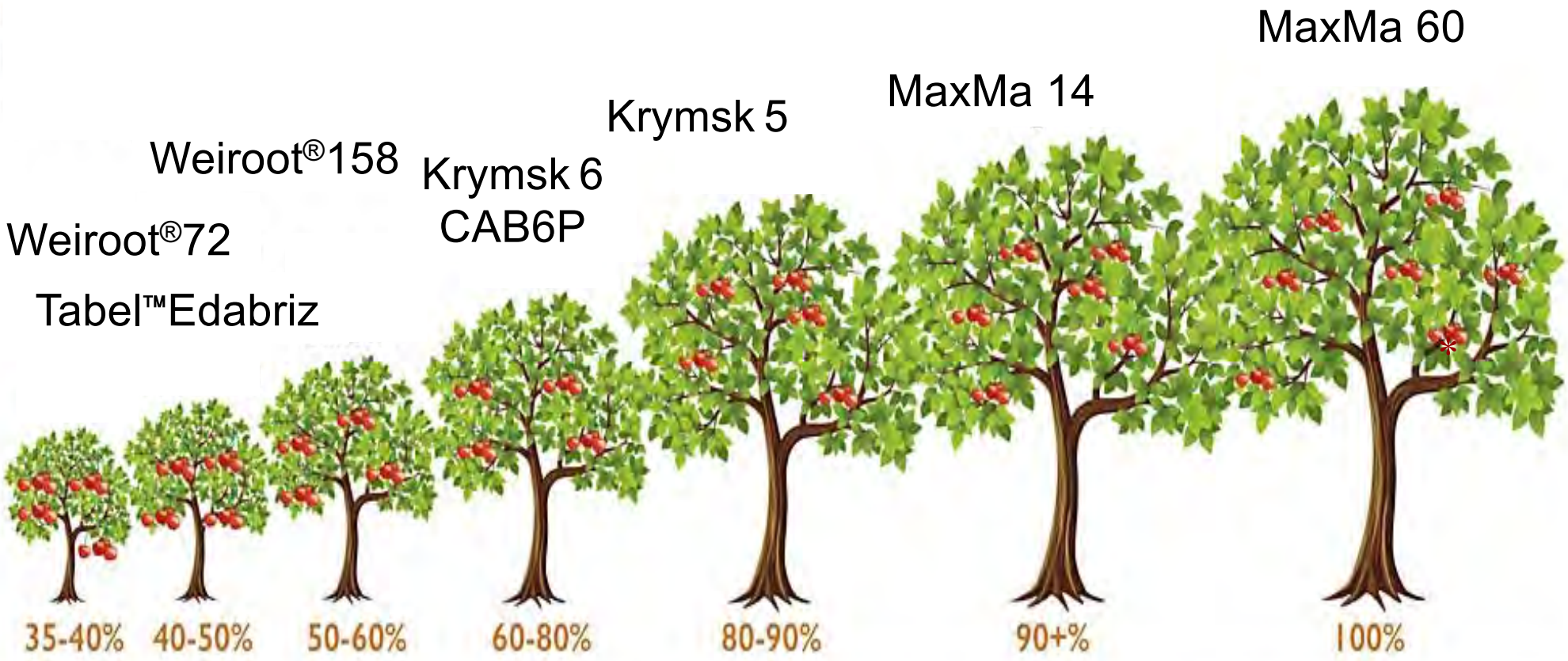
Cherry Rootstock Relative Vigor



Significant challenges:

1) Optimization of fruit yields vs quality (leaf area-to-fruit ratios)
2) Performance in hot, dry, stressful climates and soils (Gisela® 12 better than Gisela®3, 5, 6), weed competition (Gisela ®3 and 5)

Cherry Rootstock Relative Vigor



Some Other Rootstock Introductions of Significance

MaxMa series (Mazzard *x* Mahaleb hybrids from USA)

Weiroot series, Tabel™, CAB6P (*P. cerasus* selections from Europe)

Krymsk series (interspecific hybrids from Russia)

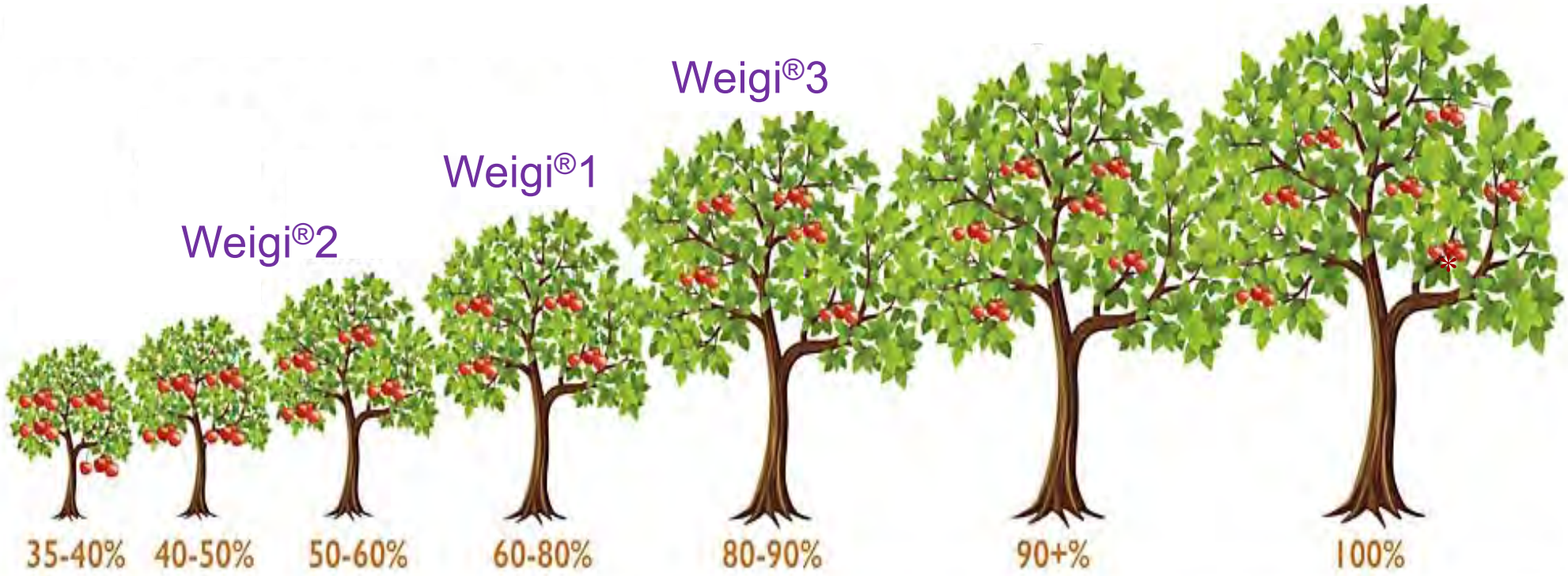
Cherry Rootstock Breeding Resources

Prunus avium	sweet cherry
Prunus cerasus	sour cherry

Other *Prunus* species:

P. canecscens	Giessen, Gembloux, Pillnitz (PiKu)
P. cerasifera	Spain
P. dawyckensis	Gembloux
P. fruticosa	Giessen, Michigan State
P. incisa	Gembloux, Pillnitz
P. lannesiana	Krymsk
P. maackii	Krymsk
P. mahaleb	Hungary, MaxMa
P. nipponica	Pillnitz
P. pseudocerasus	East Malling, Pillnitz
P. sargentii	Pillnitz
P. tomentosa	Pillnitz

Cherry Rootstock Relative Vigor



WeiGi®1 (aka 'STO1') - *P. cerasus* O.P. (presumed to be *P. avium*)

WeiGi®2 (aka 'STO2') - *P. cerasus* x (*P. avium* x *P. canescens*)

WeiGi®3 (aka 'STO3') - *P. cerasus* x (*P. avium* x *P. canescens*)

Corette® Rootstocks derived from the Michigan State University (MSU) Sour Cherry Breeding Program

Late 1990s/early 2000s - MSU sour cherry breeder Amy Iezzoni screened several hundred seedlings as potential rootstocks:

- Ease of propagation by cuttings*; most were discarded
- Virus sensitivity to PDV and PNRSV; 25 advanced
- Budded to ‘Hedelfinger’ sweet cherry and ‘Montmorency’ sour cherry (Michigan), and ‘Bing’ sweet (Washington)
- Precocity* (initial target was to reduce flower bud density)
- Selected 12 elite candidates (many sucker profusely); current testing of 7 with growers and coordinated research trials (NC140, planted 2017) to evaluate commercial potential (sweet cherry cultivars include ‘Benton’, ‘Coral Champagne’, ‘Early Robin’, ‘Regina’, ‘Sweetheart’, and others)

MSU 'Corette™ Series' Cherry Rootstocks

Cass (aka Corette™1) – O.P. (presumed natural hybrid of *P. cerasus*, *P. avium*, and/or *P. fruticosa*), seed collected in Hungary

Clare (aka Corette™2) – O.P. (presumed natural hybrid of *P. cerasus*, *P. avium*, and/or *P. fruticosa*), seed collected in Hungary

Clinton (aka Corette™3) – O.P. seed of Gisela 5 (*P. cerasus* x *P. canescens*)

Crawford (aka Corette™4) – *P. cerasus* 'Balaton' (aka 'Ujfehértói Fürtös') x 'Gisela 6' (*P. cerasus* x *P. canescens*)

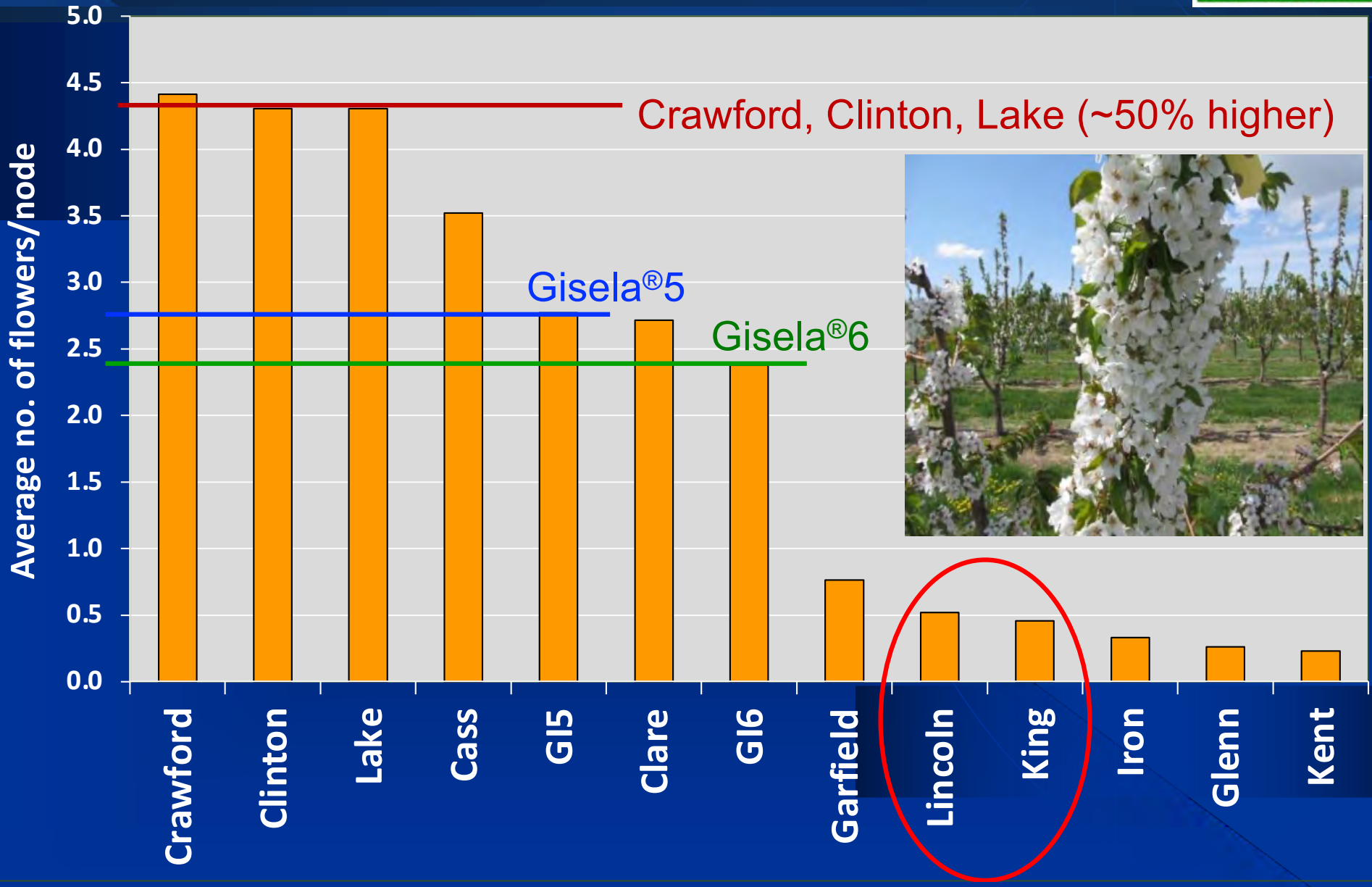
Lake (aka Corette™5) – O.P. (presumed natural hybrid of *P. avium* and *P. fruticosa*), seed collected in Hungary

Lincoln (aka Corette®6) – *P. cerasus* ('English Morello' x 'Sumadinka') x *P. cerasus* 'Akastoi Korai'

King (aka Corette®7) – *P. cerasus* ('English Morello' x 'Maliga Emléke') x *P. cerasus* (O.P. seedling)

4th Year Precocity* (2012, planted 2009)

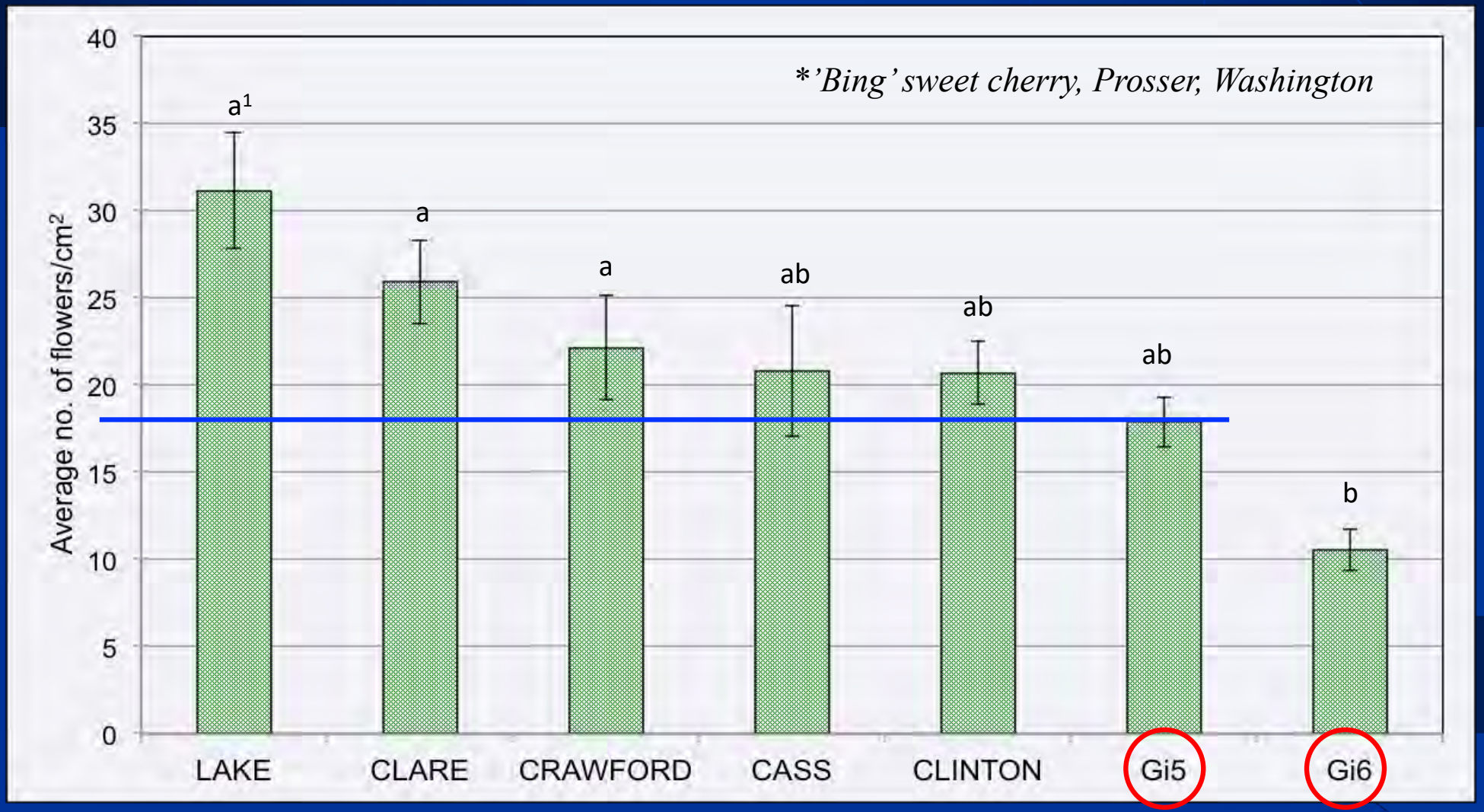
MSU CHERRY RESEARCH



*'Bing' sweet cherry, Prosser, Washington

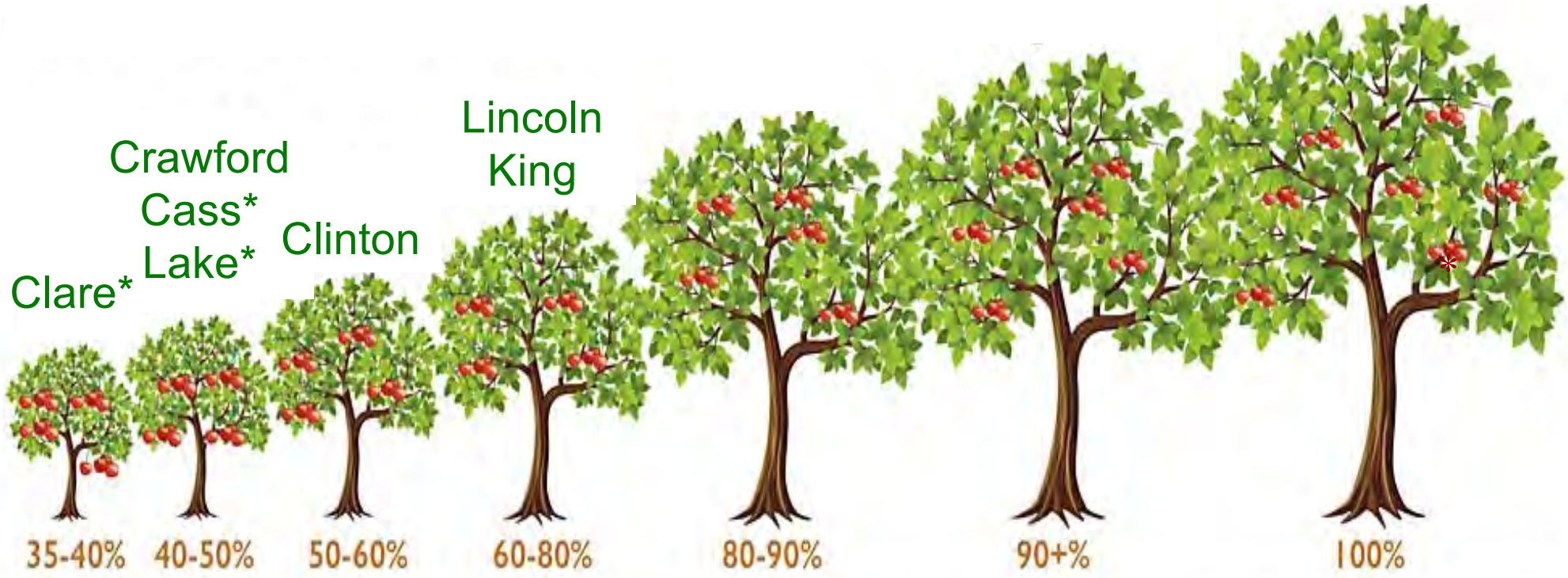
5th Year Precocity* (2013, planted 2009)

Average number of flowers per leader cross-sectional area (Whiting, Iezzoni)



[1]Means that are significantly different for 2013 TCSA ($P < 0.05$) are denoted by different letters.

Cherry Rootstock Relative Vigor



The Corette® series, Michigan State University

*In some soils, suckering can be excessive (most with Clare)

‘Benton’ Sweet Cherry Vigor & Cumulative Yield Efficiency

7-year TCSA / CYE (2021-23)

Rootstock	Loamy Soil	Sandy Soil	% Vigor Reduction
Cass	121.9 / 0.09	80.3 / 0.09	35
Clare	90.7 / 0.09	60.7 / 0.08	33
Lake*	85.3 / 0.09	85.8 / 0.05	0
Clinton	75.1 / 0.22	- / -	
Gi5	157.6 / 0.10	65.6 / 0.14	58
MxM14	155.5 / 0.04	67.7 / 0.02	56

Perhaps Lake tolerates dry soils better than other dwarfing rootstocks?

Blue = highest cumulative yield efficiency after 7 years

Red = lowest cumulative yield efficiency after 7 years

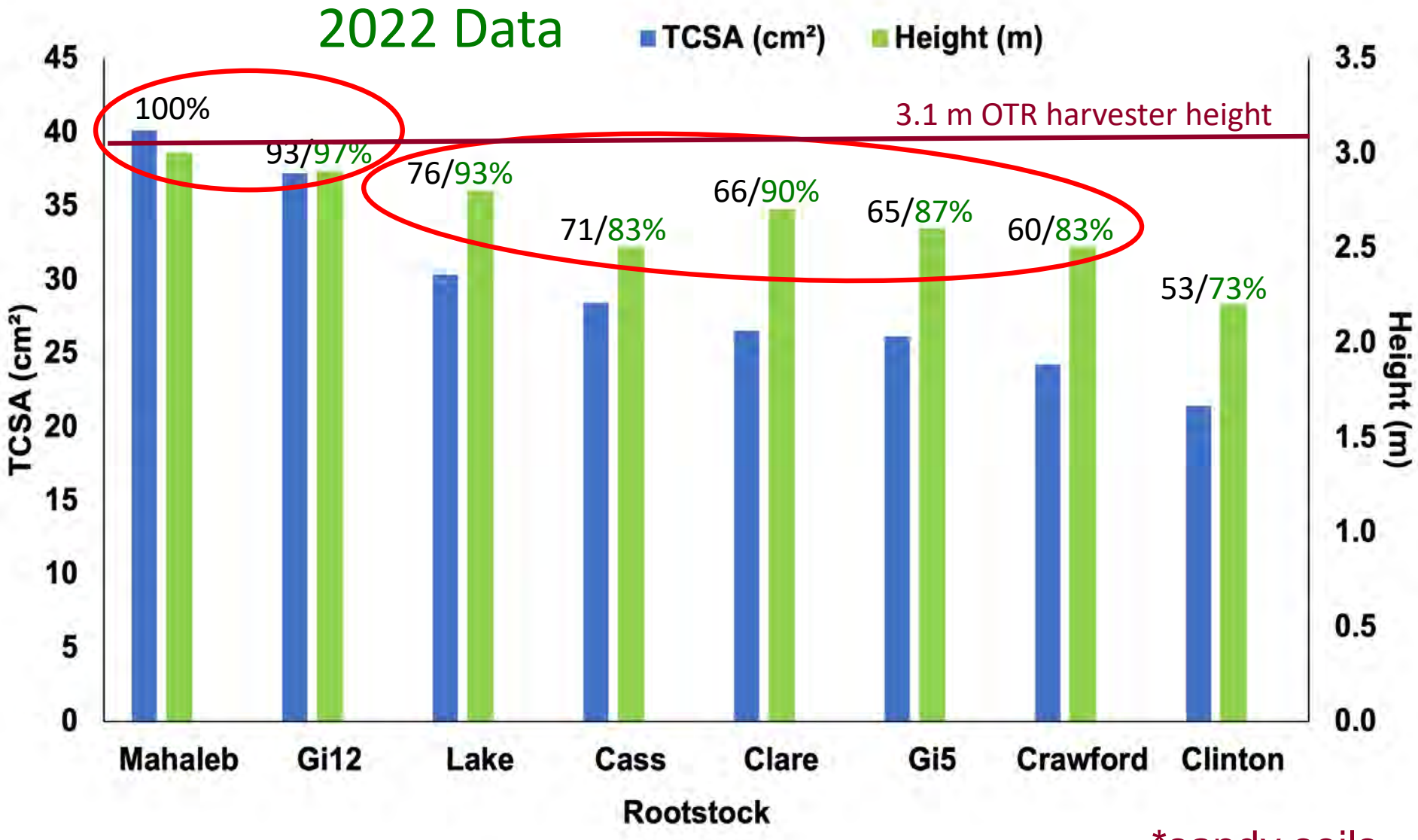
MSU Cherry Research

Training Systems in Corette™ Rootstock Trials:

Super Slender Axe (SSA)
Kym Green Bush (KGB)
Steep Leader (SL)
Tall Spindle Axe (TSA)
Upright Fruiting Offshoots (UFO)

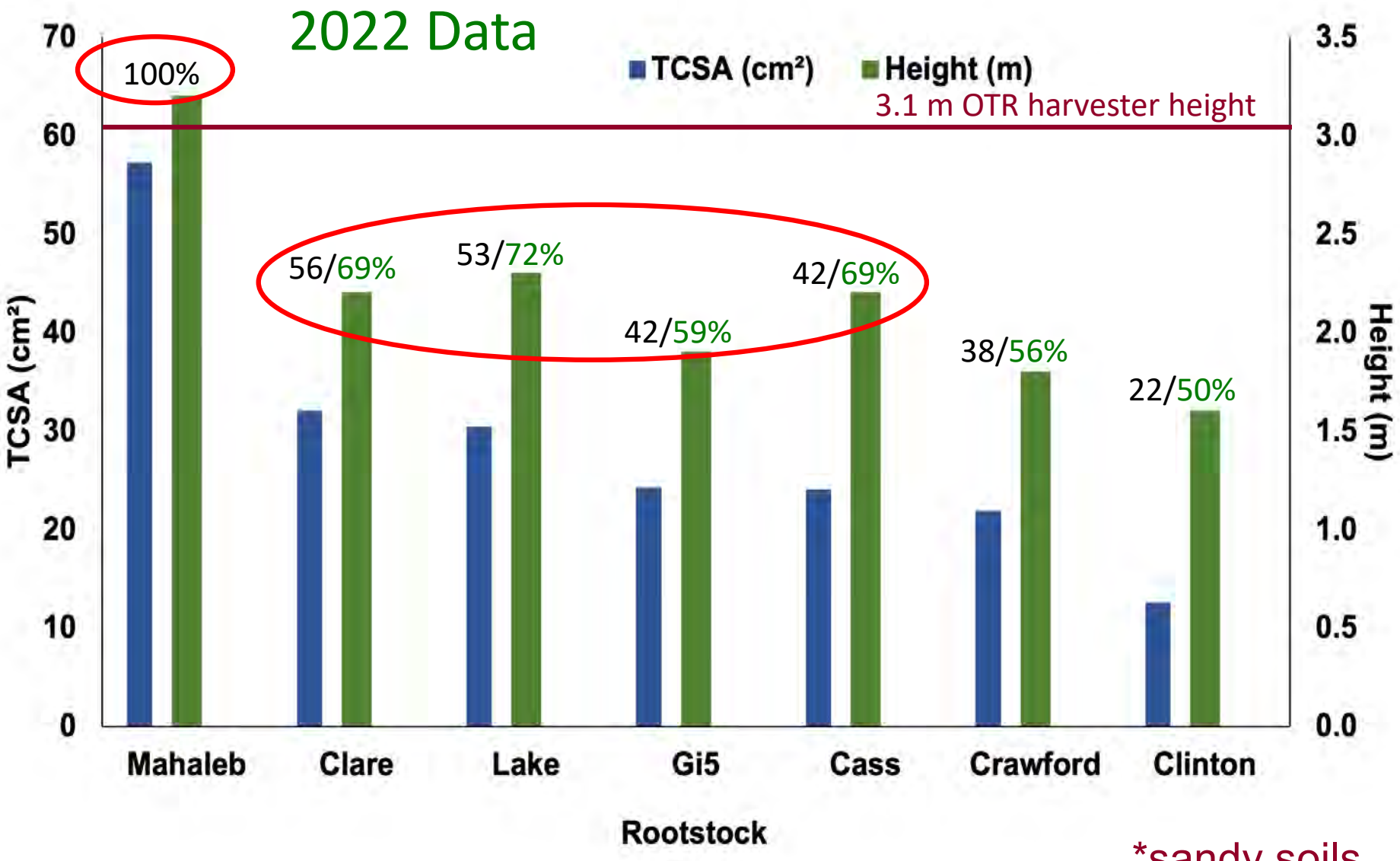
‘Montmorency’ Sour Cherry Over-the-Row (OTR) harvest (maximum height 3.1 m)

Rootstock Affects 'Montmorency' Vigor (TCSA and Height) in North Michigan*



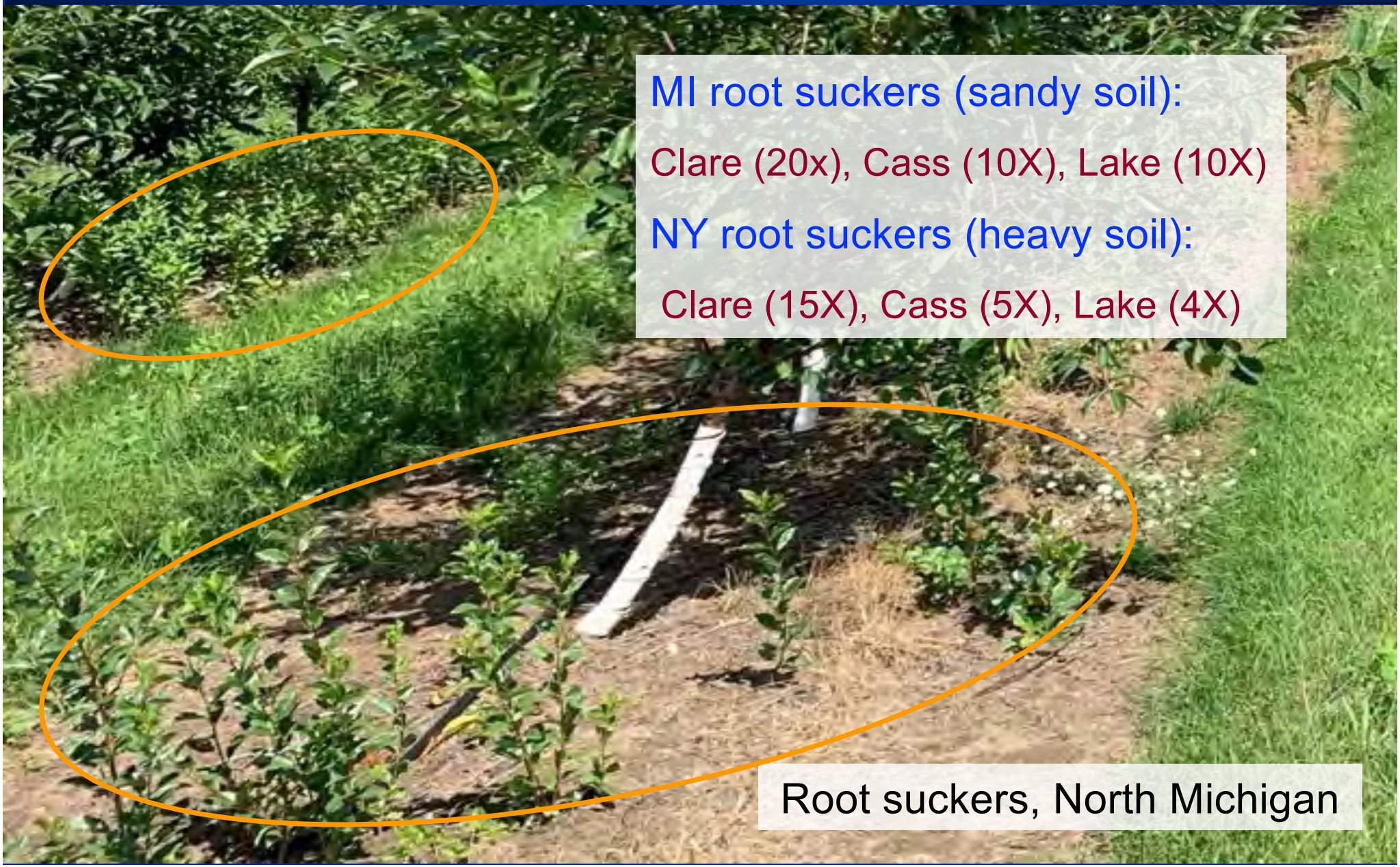
*sandy soils

Rootstock Affects 'Montmorency' Vigor (TCSA and Height) in South Michigan*



*sandy soils

Rootstock Suckering on Sandy (Michigan) or Heavy (New York) Soils



2023 ‘Montmorency’ Vigor (TCSA, cm^2) & Cumulative Yield Efficiency

Rootstock	SW Michigan	NW Michigan	New York
Mahaleb	77.1 / 0.18		
Gi12	-		
Lake	42.3 / 0.30		
Clare	42.0 / 0.28		
Cass	35.0 / 0.22		
Gi5	32.8 / 0.21		
Crawford	30.3 / 0.18		
Clinton	16.0 / 0.23		

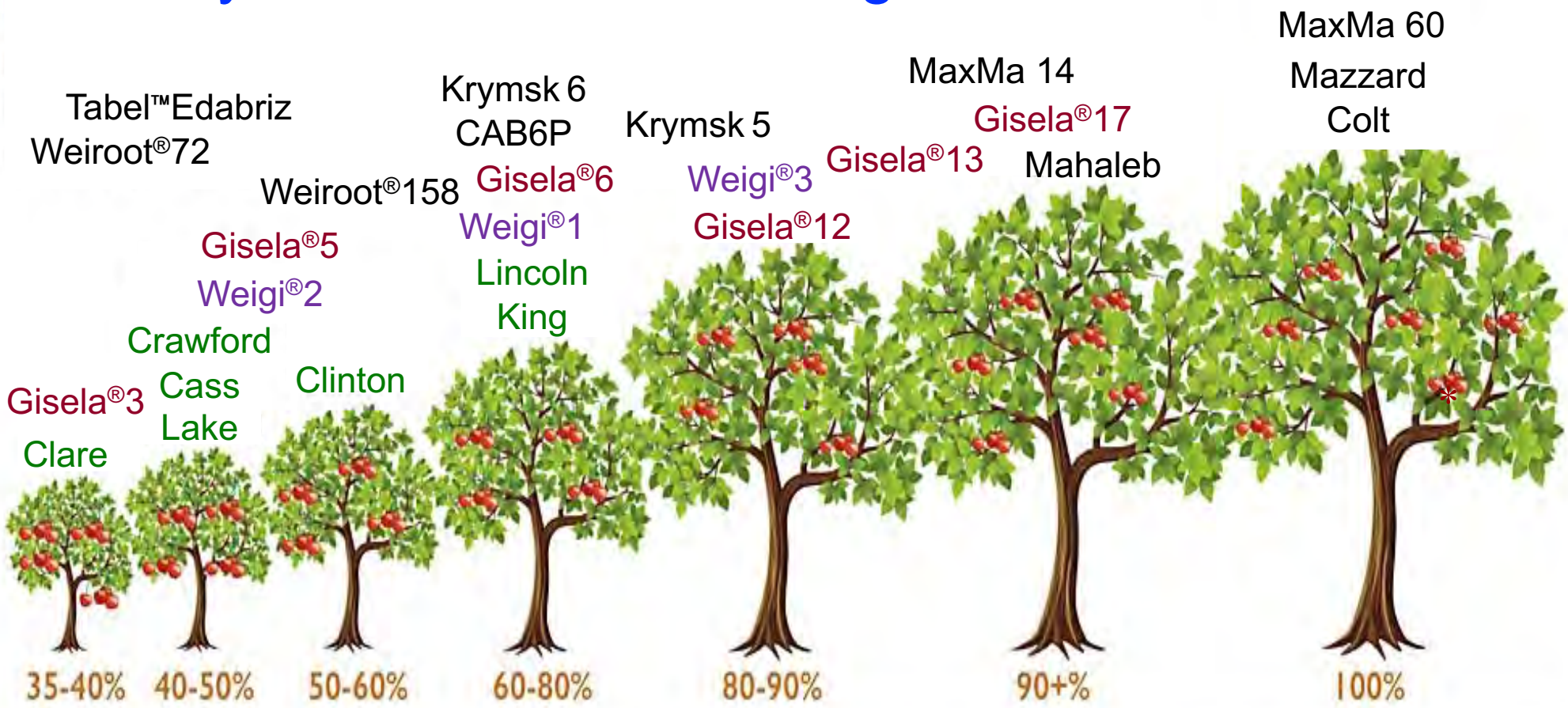
2023 'Montmorency' Vigor (TCSA, cm^2) & Cumulative Yield Efficiency

Rootstock	SW Michigan	NW Michigan	New York
Mahaleb	77.1 / 0.18	52.2 / 0.07	
Gi12	-	43.7 / 0.10	
Lake	42.3 / 0.30	36.2 / 0.15	
Clare	42.0 / 0.28	32.7 / 0.13	
Cass	35.0 / 0.22	33.5 / 0.09	
Gi5	32.8 / 0.21	33.9 / 0.16	
Crawford	30.3 / 0.18	28.6 / 0.17	
Clinton	16.0 / 0.23	23.1 / 0.41	

2023 'Montmorency' Vigor (TCSA, cm^2) & Cumulative Yield Efficiency

Rootstock	SW Michigan	NW Michigan	New York
Mahaleb	77.1 / 0.18	52.2 / 0.07	73.8 / 0.21
Gi12	-	43.7 / 0.10	80.4 / 0.27
Lake	42.3 / 0.30	36.2 / 0.15	44.9 / 0.29
Clare	42.0 / 0.28	32.7 / 0.13	34.9 / 0.37
Cass	35.0 / 0.22	33.5 / 0.09	51.8 / 0.26
Gi5	32.8 / 0.21	33.9 / 0.16	79.7 / 0.18
Crawford	30.3 / 0.18	28.6 / 0.17	61.4 / 0.23
Clinton	16.0 / 0.23	23.1 / 0.41	50.3 / 0.29

Cherry Rootstock Relative Vigor



Worldwide, cherry rootstock standards have remained skewed towards higher vigor (Mazzard, Mahaleb, Colt, MaxMa14, Krymsk 6, Gisela®6, Gisela®12, CAB6P), with Gisela®5 as the main lower vigor choice

Conclusions

MSU Cherry Research

Great advances have been made in cherry rootstock traits over the past 35 years, achieving vigor control, precocity, and productivity.

Adaptation to variations in soils and climates needs to be evaluated with widespread, coordinated research trials to better understand and help identify such traits in current rootstocks or potential rootstock parents.

Potential Coordinated NC140 Sweet Cherry Rootstock Trial Sites

CDB
Consortium Deutscher Baumschulen GmbH

AGROMILLORA
It's in our nature

eufrin
EUROPEAN FRUIT RESEARCH INSTITUTES NETWORK

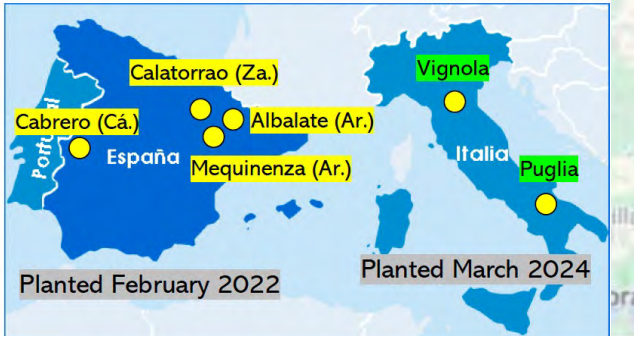
European Cherry Rootstock Trials

Planar Canopy Training

Leader number to be proportional to expected vigor imparted by rootstock

LEVEL 2

Provinces/locations involved

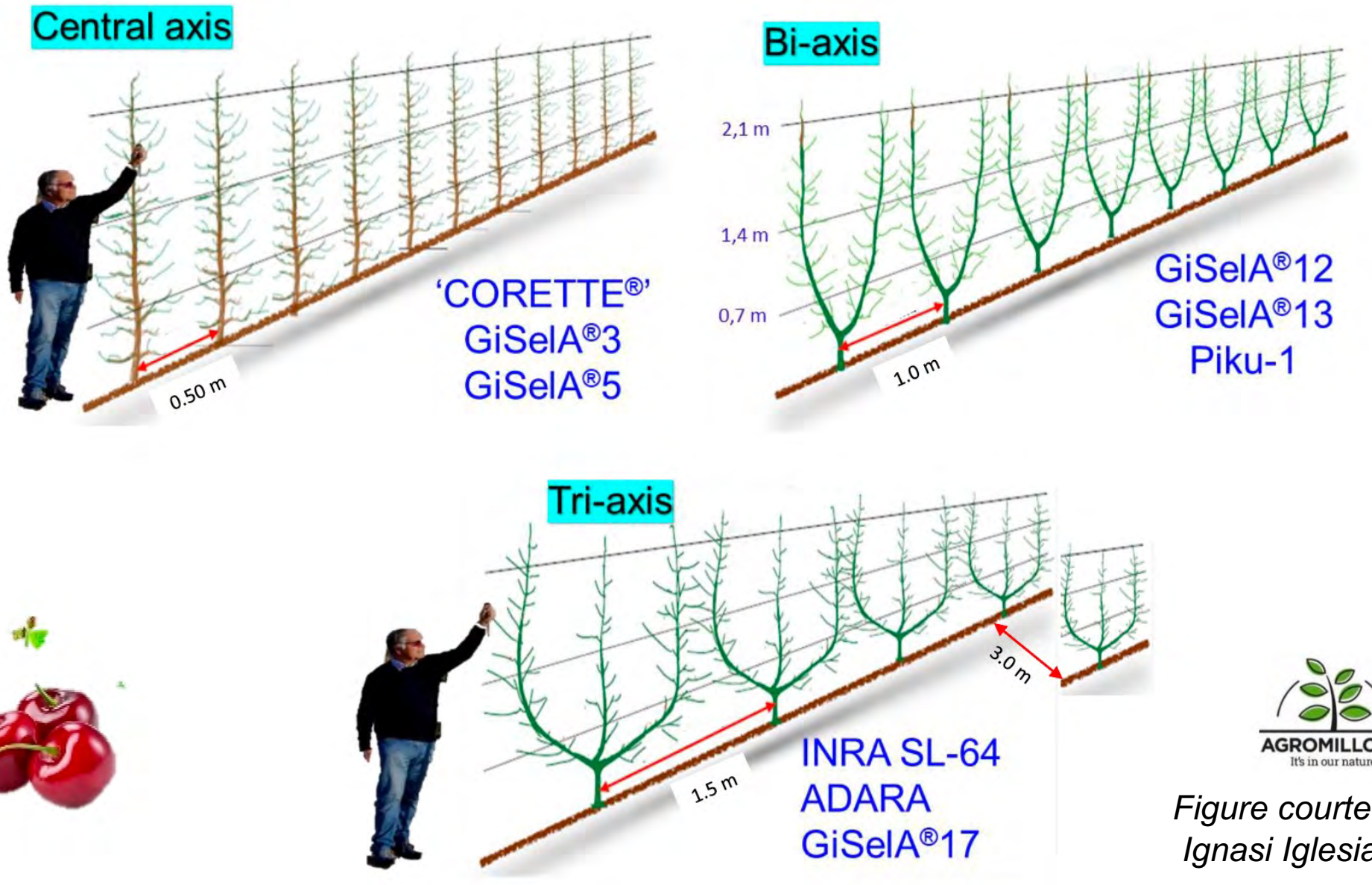


LEVEL 1

Research centers involved

New Cherry Rootstock Trials – Planar Canopy Training

Leader number/ha and row spacing are standardized; leader number/tree and tree spacing vary proportionally to rootstock-imparted vigor



AGROMILLORA
It's in our nature

Figure courtesy Ignasi Iglesias

MACFRUT 2024

IRS International Rootstocks Symposium

Scientific Collaboration and Funding Acknowledgements:

Brent Black, Essie Fallahi, Ignasi Iglesias, Lynn Long, Terence Robinson, Nikki Rothwell, Bernardita Sallato, Matthew Whiting, and Becky Wiepz, with funding from the International Fruit Tree Association, Michigan Cherry Committee, Oregon Sweet Cherry Commission, USDA-NIFA Regional Research, and Washington Tree Fruit Research Commission

NC-140

Michigan Tree Fruit Commission

IFTA INTERNATIONAL FRUIT TREE ASSOCIATION