HORTICULTURE AND LANDSCAPE ARCHITECTURE
COLORADO STATE UNIVERSITY

AGRICULTURAL EXPERIMENT STATION
COLORADO STATE UNIVERSITY

NC-140

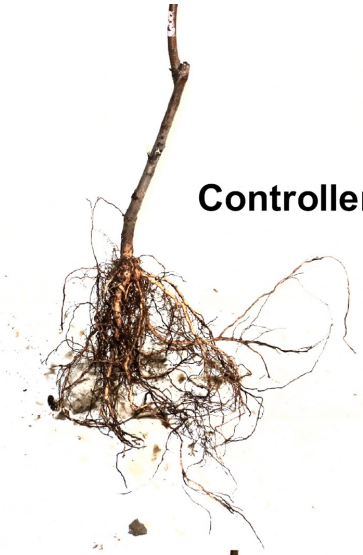
IFTA Research FOUNDATION

Annual Report - IFTA 2022

2017 NC-140 Semi-Dwarf Peach Rootstock Trial

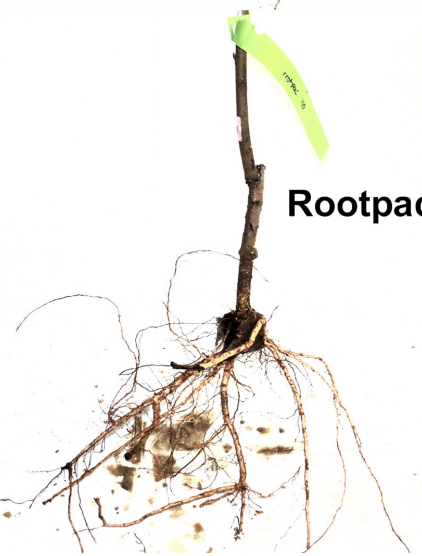
Dr. Ioannis S. Minas
Associate Professor of Pomology
ioannis.minas@colostate.edu

Controller™ 6



Controller™ 7

Controller™ 8



Rootpac® 40

Rootpac® 20

Guardian®

MP-29

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Recently published training systems review in peach

agronomy

MDPI

Review

Optimizing Peach Tree Canopy Architecture for Efficient Light Use, Increased Productivity and Improved Fruit Quality

Brendon M. Anthony and Ioannis S. Minas *

Recently Published: Anthony, B.M. and Minas, I.S., 2021. *Optimizing Peach Tree Canopy Architecture for Efficient Light Use, Increased Productivity and Improved Fruit Quality.* Agronomy, 11(10), p.1961. DOI: https://doi.org/10.3390/agronomy11101961

Rootstocks currently available for various peach training and cropping systems

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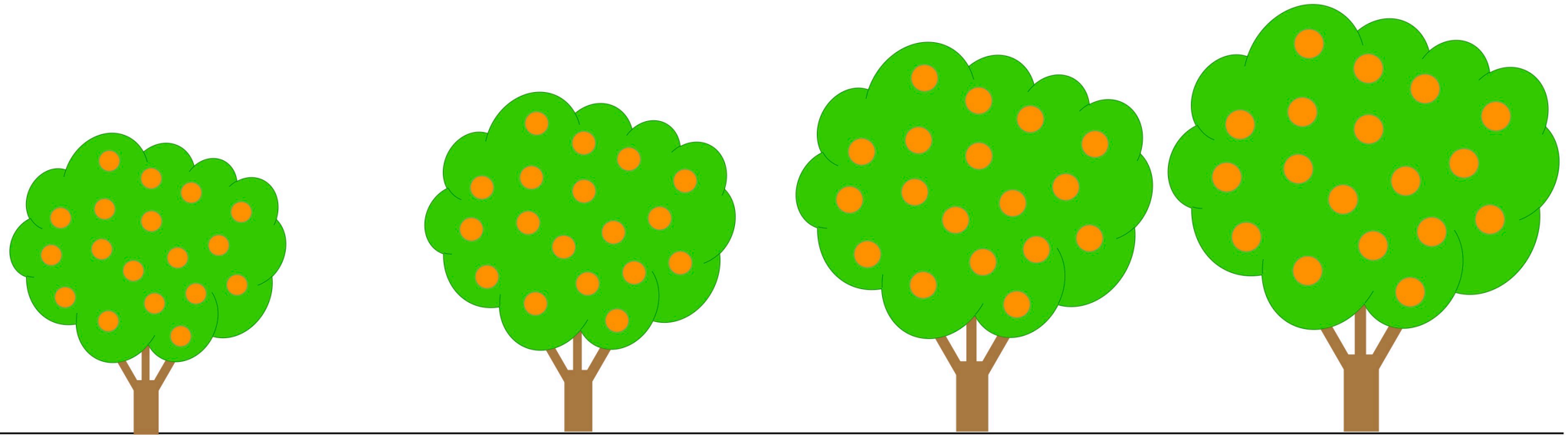

<60%	60–90%	90–110%	110–120%
Dwarf	**Semi-dwarf**	**Standard**	**Vigorous**
Controller™5	Controller™8	Lovell	GF677
Krymsk1	Controller™7	Krymsk®86	Nemaguard
Rootpac®20	Controller™6	Imperial California	Atlas
MP-29	Rootpac®40	Hansen 536	Bright's Hybrid #5
	P. americana	KV 10127	Viking
	Empyrean®2 (Penta)	KV 10123	Guardian®
	Empyrean®3 (Tetra)		Rootpac®R
			Rootpac®70
			Microbac

Anthony, B.M. and Minas, I.S., 2021. *Optimizing Peach Tree Canopy Architecture for Efficient Light Use, Increased Productivity and Improved Fruit Quality.* Agronomy, 11(10), p.1961. DOI: https://doi.org/10.3390/agronomy11101961

Training Systems: Before and after dormant pruning in ‘O’Henry’ on ‘Krymsk®86’ in 2019

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Anthony, B.M. and Minas, I.S., 2021. *Optimizing Peach Tree Canopy Architecture for Efficient Light Use, Increased Productivity and Improved Fruit Quality.* Agronomy, 11(10), p.1961. DOI: https://doi.org/10.3390/agronomy11101961

Effect of canopy volume on light interceprion

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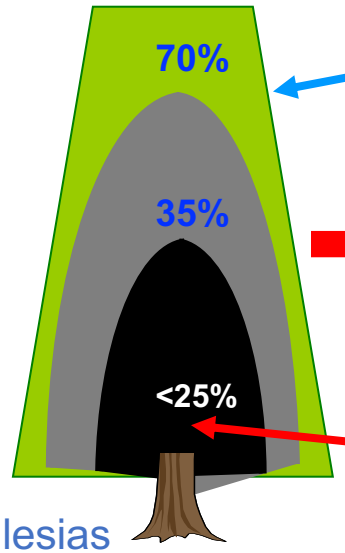
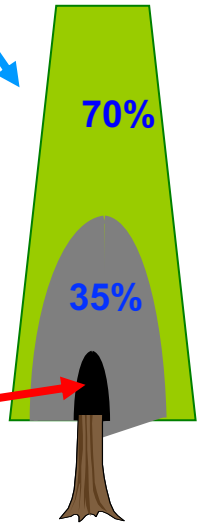
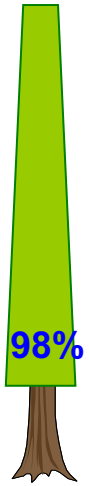
Well light exposed area
receives >70 % or 98% of light







Shaded area
(receives <25% light)

Small trees are more uniform and efficient!

- More well iluminated portion the canopy
- More fruiting wood
- Fruits closer to main permanent structure
- Uniform maturation/quality?

Adopted from I. Iglesias

Development of non-destructive technologies to estimate internal fruit quality

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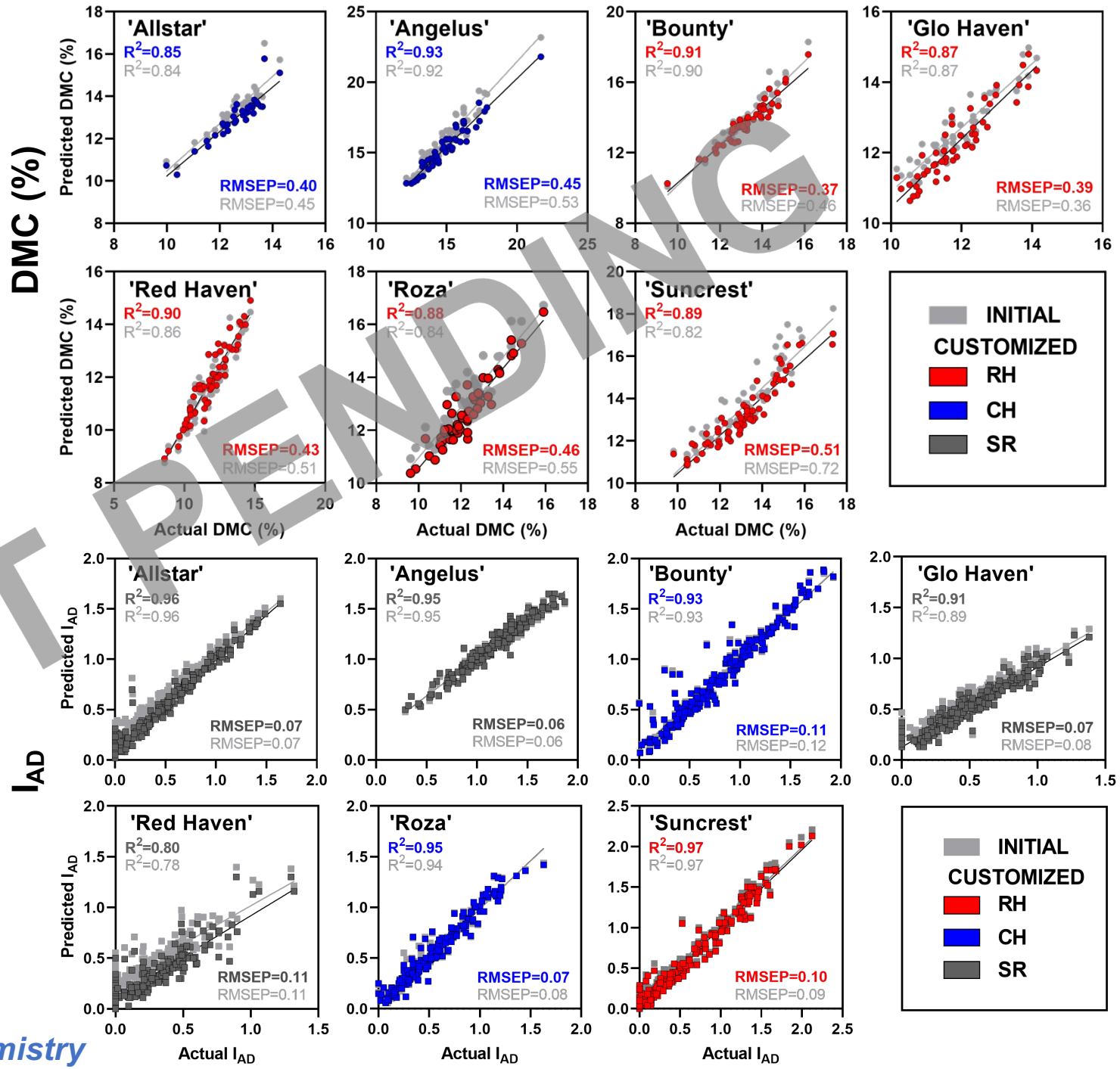
Technology Readiness Level: 5

Proof of concept-real world demonstration stage

Developed models of the concept device are showing strong performance with multiple peach cultivars



Anthony et al, 2022. *Submitted in Food Chemistry*

Influence of rootstocks on peach fruit internal quality

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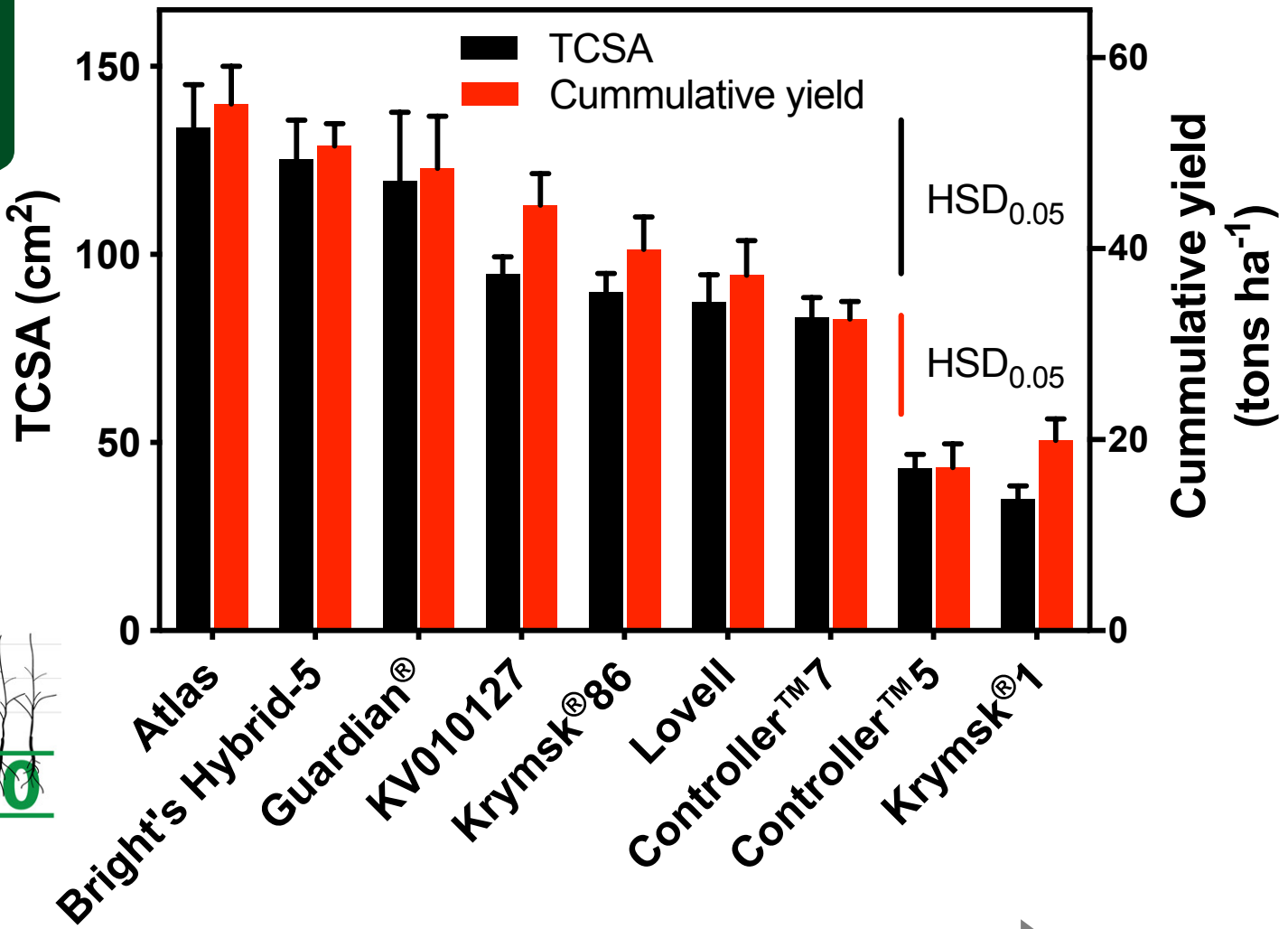
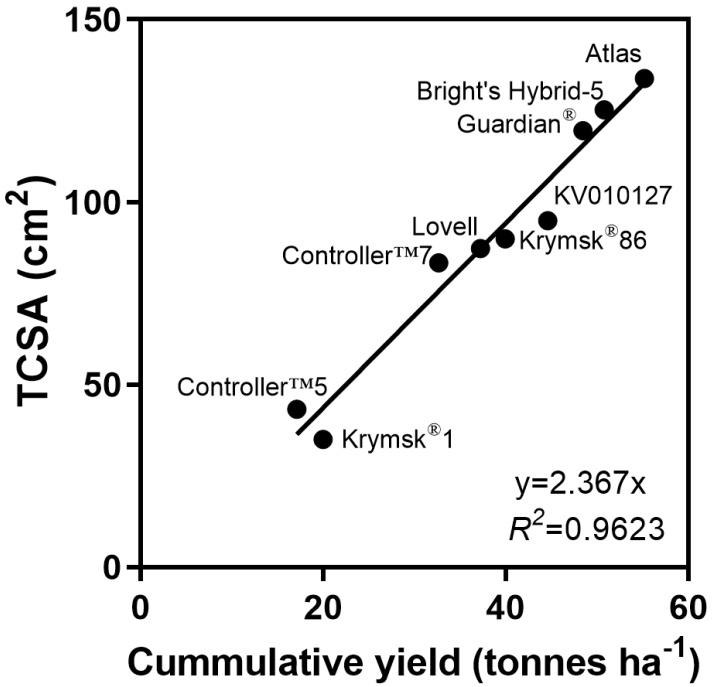
Effect of rootstock on ‘Redhaven’ tree size and cumulative yield (2009-2017)





2009 NC-140 ‘Red Haven’ Peach Rootstock Trial

Vigorous — **Rootstock vigor** — Dwarfing

Minas et al., 2022. *In preparation*

Rootstocks influence ‘Redhaven’ peach productivity and dry matter content (DMC) - 2016-18

(@equal maturity & crop load)

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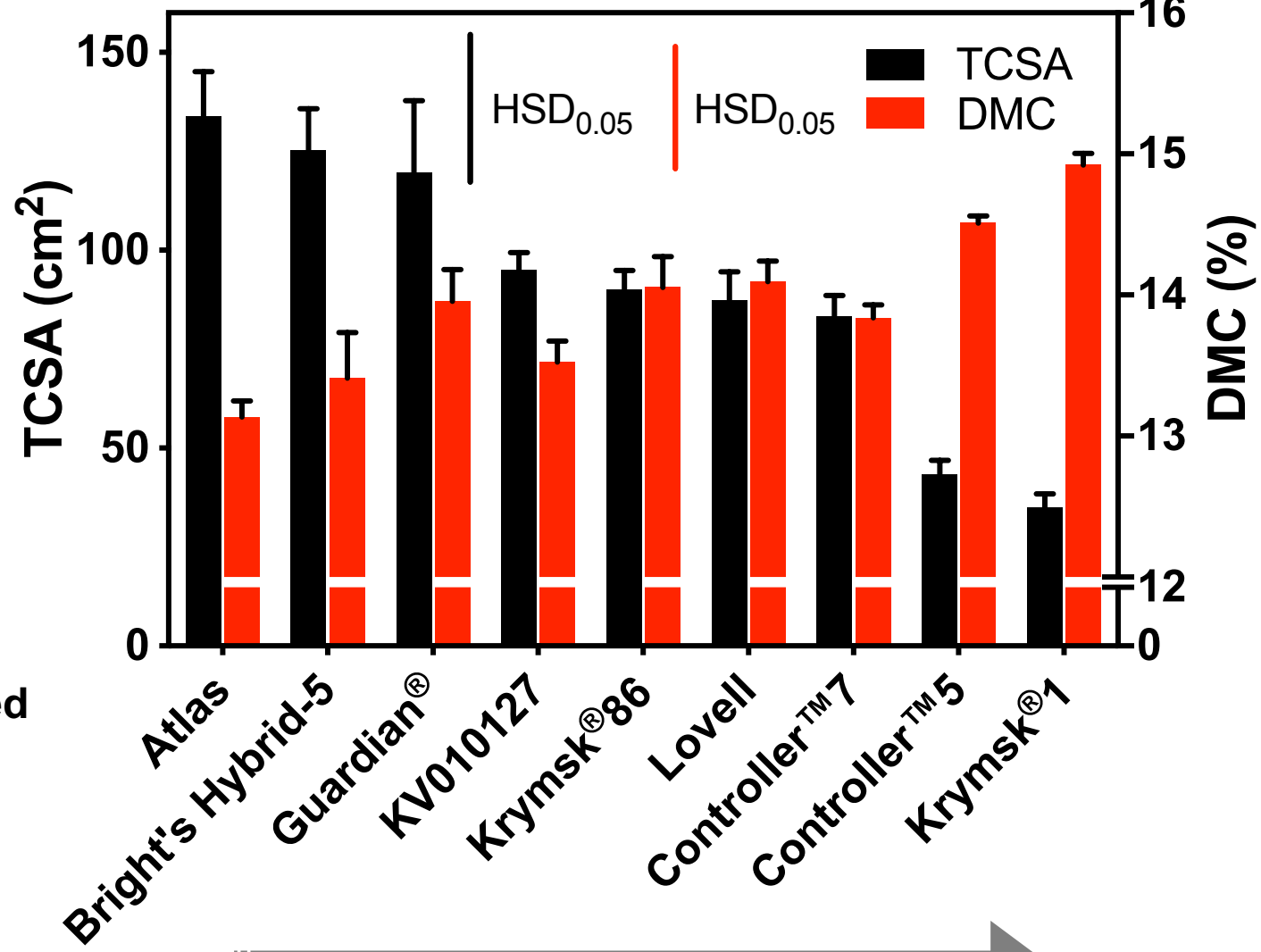

2009 NC-140 ‘Red Haven’ Peach Rootstock Trial

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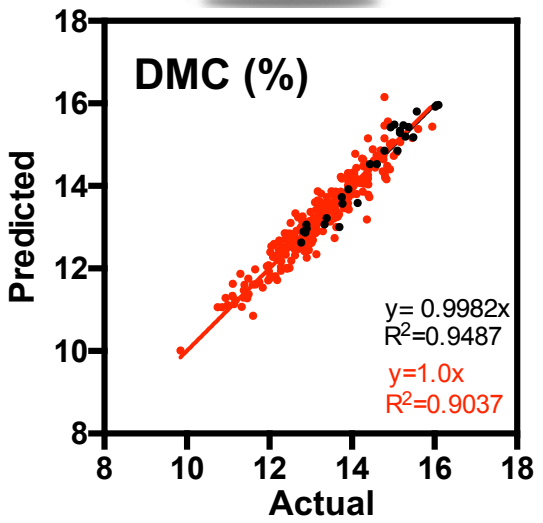
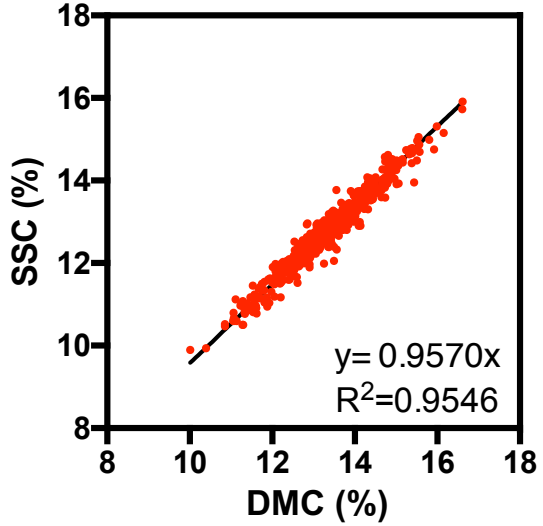
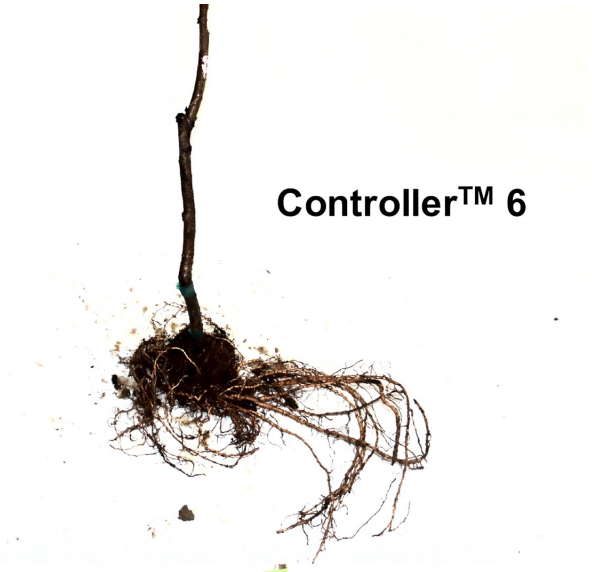
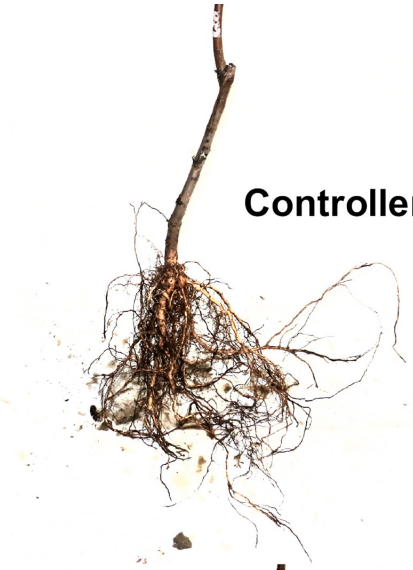


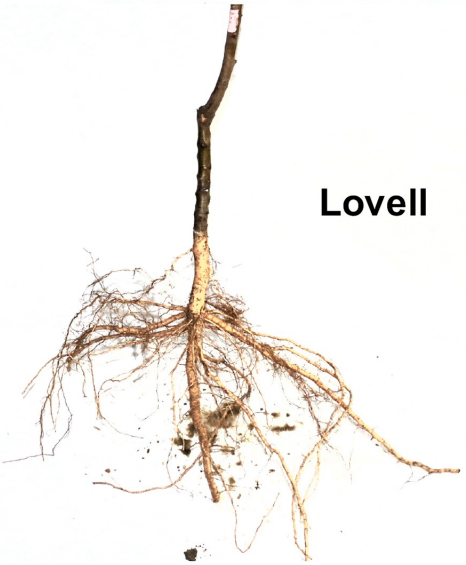


Minas et al., 2022. *In preparation*

The 2017 NC-140 Cresthaven Semi-Dwarf Peach Rootstock Trial







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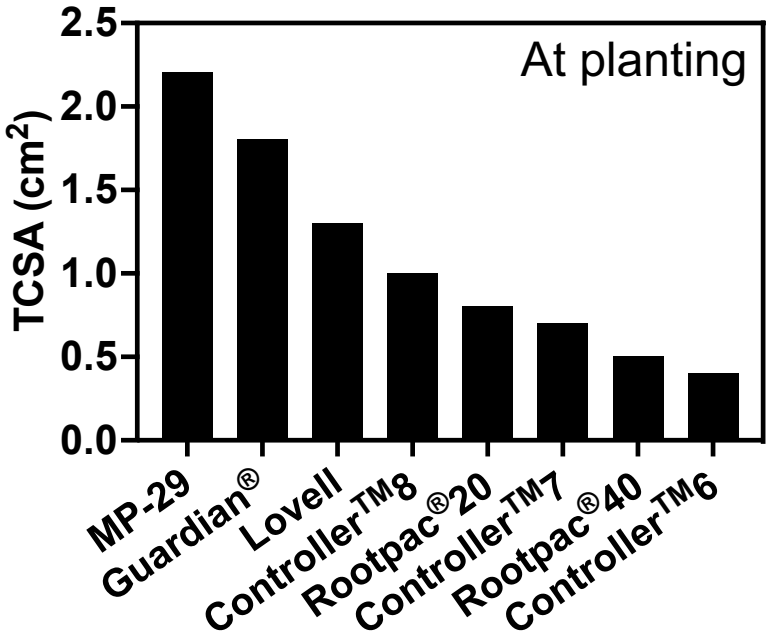
Good Fruit Grower, February 1st, 2018

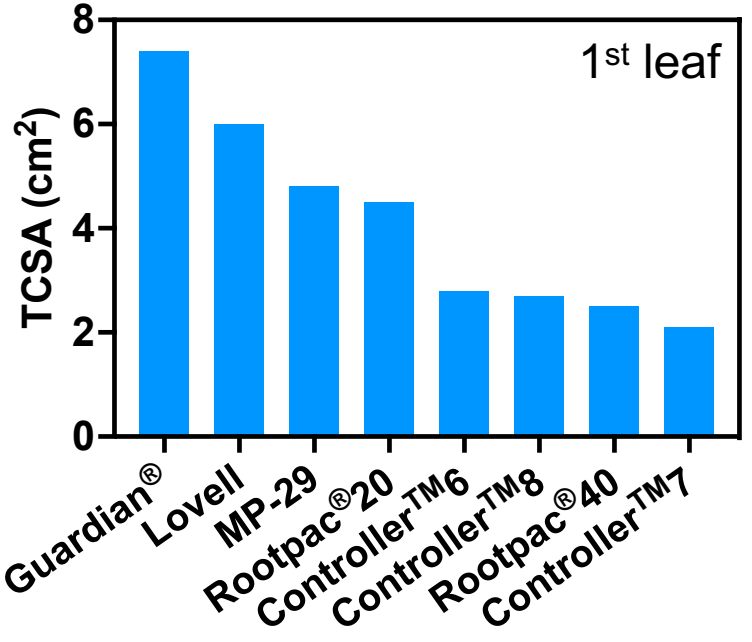
2017 NC-140 Cresthaven Semi-Dwarf Peach Rootstock Trial

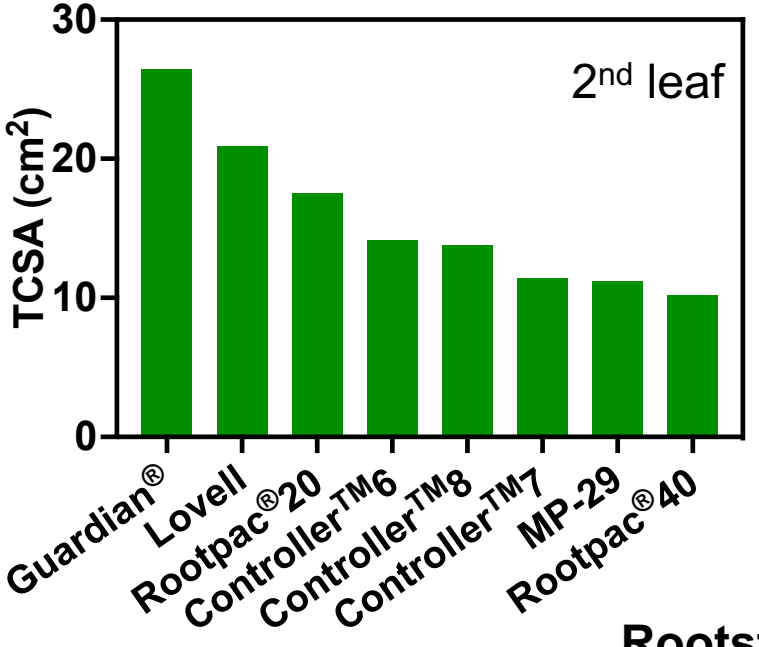
Sites: AL, CO, GA, MI, NC, NY, ONT, PA, SC, UT
Coordinator: Ioannis Minas (Colorado State University)
Cultivar: 'Cresthaven'
Training system: KAC-V
Spacing: 1.8 x 4.5 m (6 x 15 feet)
Trees/ha: 1196 (/acre: 484)

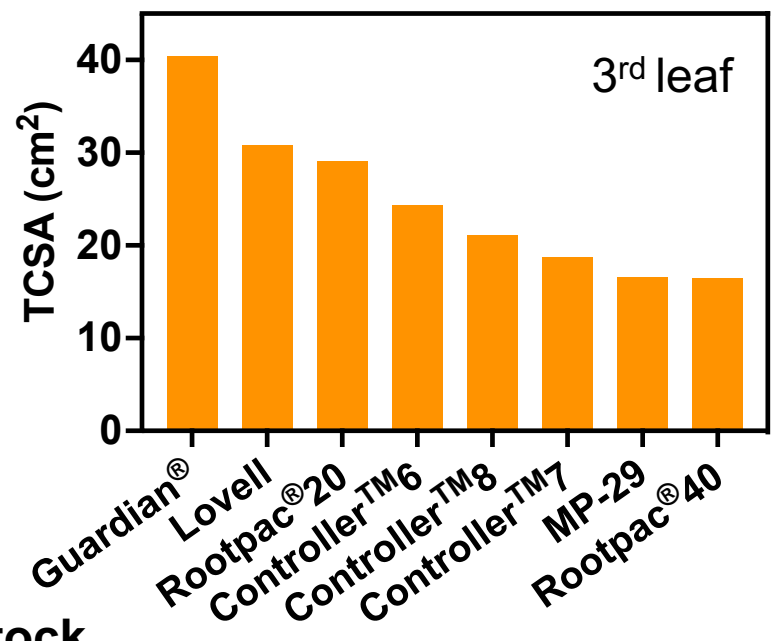
Rootstock	Breeder, Country	Genetic origin
Controller™ 6 (HBOK 27)	UC Davis,USA	peach x peach hybrid (*Prunus persica* x *P. persica*)
Controller™ 7 (HBOK 32)	UC Davis, USA	peach x peach hybrid (*P. persica* x *P. persica*)
Controller™ 8 (HBOK 10)	UC Davis, USA	peach x peach hybrid (*P. persica* x *P. persica*)
MP-29	USDA-Georgia, USA	plum x peach interspecific hyb. (*P. umbellata* x *P. persica*)
Rootpac® 40 (Nanopac)	Agromillora Iberia, Spain	almond x peach interspecific hyb. [(*P. dulcis* x *P. persica*) x (*P. dulcis* x *P. persica*)]
Rootpac® 20 (Densipac)	Agromillora Iberia, Spain	plum x peach interspecific hybrid (*P. besseyi* x *P. persica*)
Guardian®	Clemson/USDA, USA	peach seedling (*P. persica*)
Lovell	G.W. Thissell, USA	peach seedling (*P. persica*)

TCSA at planting and during establishment years

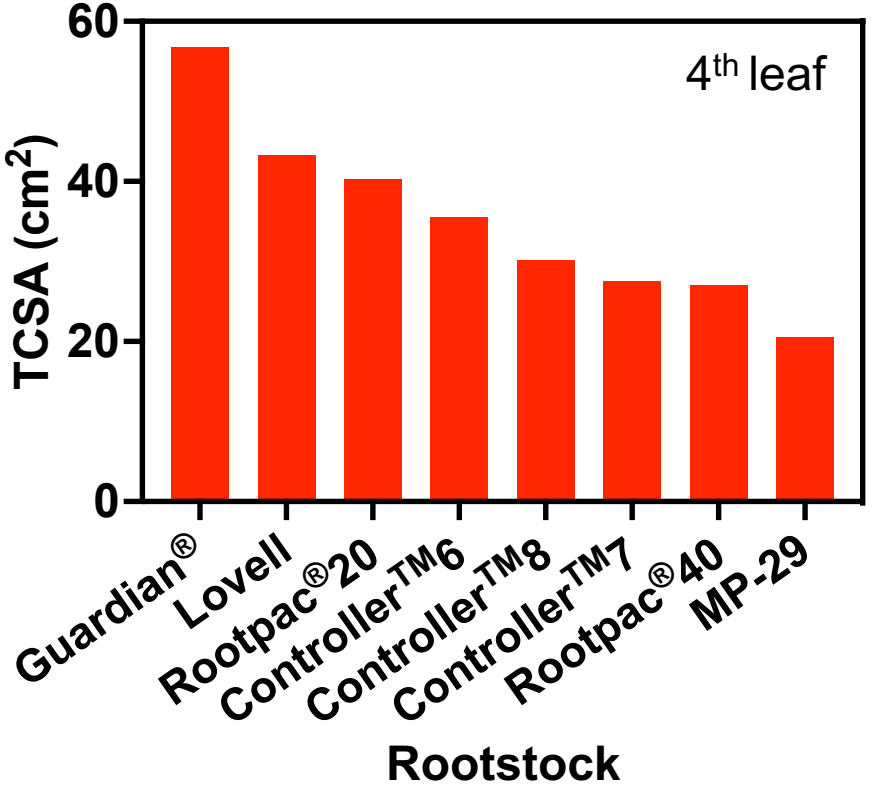






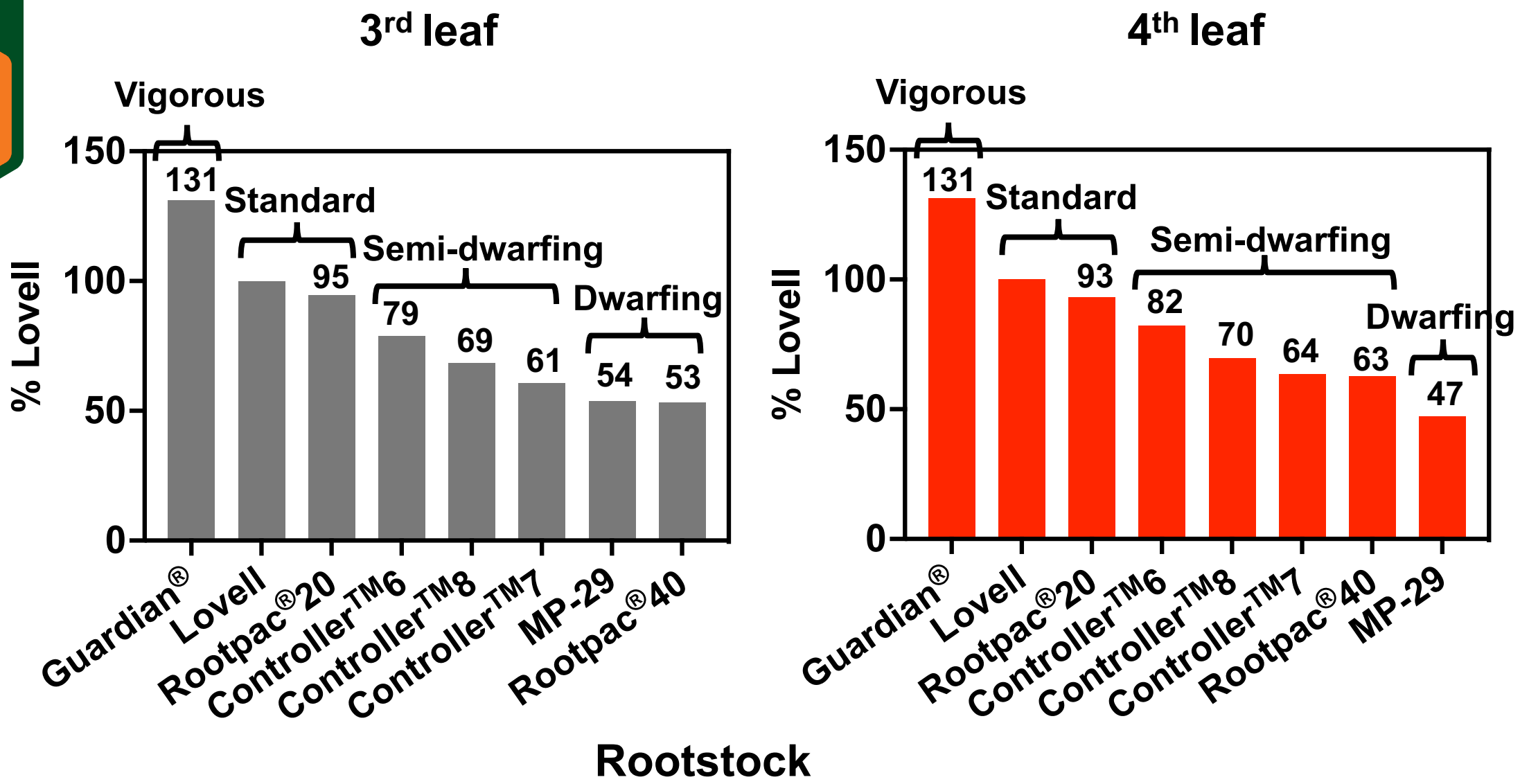


Rootstock



Rootstock

Relative peach tree size after the first 4 establishment seasons



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Rootpac®20?

Rootpac®40?

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Genetics: fundamental pillar

AGROMILLORA
It's in our nature

From our own breeding program we obtained recognized high quality products, such as:

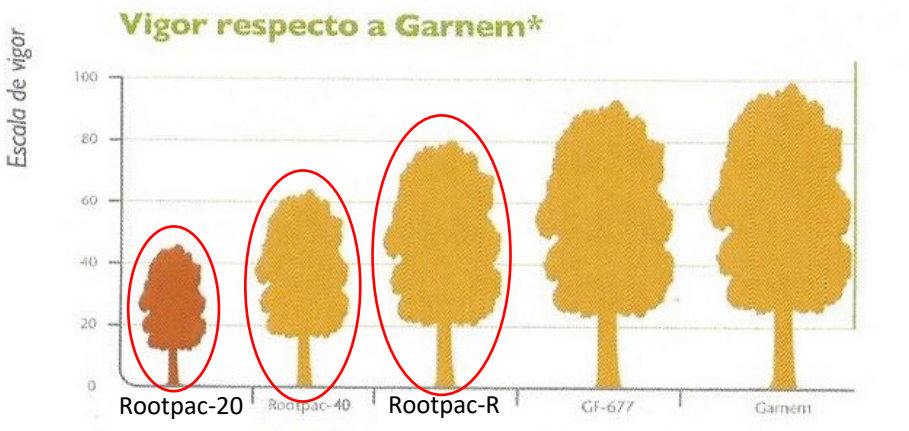
PRUNUS ROOTSTOCKS

ROOTPAC®

ROOTPAC 20

ROOTPAC 40

ROOTPAC R



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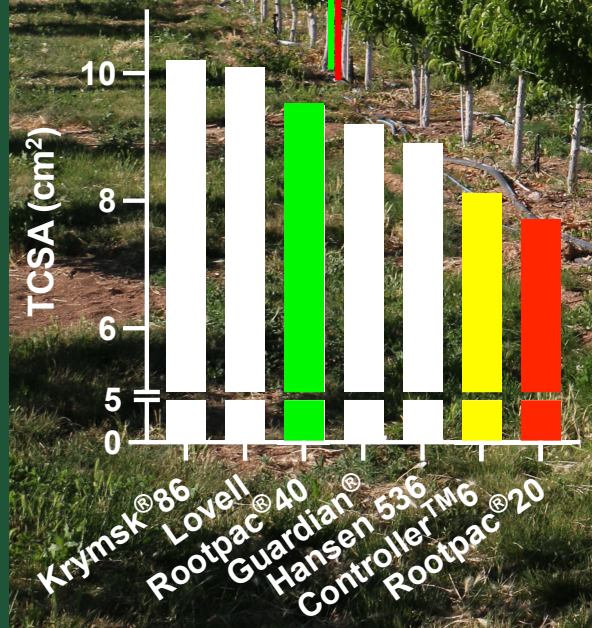
2nd leaf 2019 Next Generation 2D Peach Orchard Trial, Grand Junction, CO

Rootpac®40

Rootpac®20

Controller™6



Anthony et al., unpublished

2017 NC-140 Semi-Dwarf Cresthaven Peach Rootstock Trial

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3rd leaf -2019

Rootstock performance (all sites)

Rootstock	Survival (%)	Suckers (count)	TCSA (cm^2) 2020	% of Lovell	% of Guard.	Julian 90% Bloom	Julian 10% Ripe	Yield (kg/tree)	Fruit FW (g)
Controller™6	87.7^{a}	0.3^{b}	24.3^{cd}	78.9	60.1	103.0	226.2	4.7^{bc}	249.2^{a}
Controller™7	85.0^{ab}	0.1^{b}	18.7^{de}	60.7	46.3	102.9	221.8	4.3^{bc}	228.7^{ab}
Controller™8	89.0^{a}	0.3^{b}	21.1^{de}	68.5	52.2	102.5	225.7	4.4^{bc}	230.9^{ab}
MP-29	86.8^{ab}	0.1^{b}	16.6^{e}	53.9	41.1	92.8	221.6	4.6^{bc}	210.4^{b}
Rootpac®20	86.1^{ab}	4.1^{a}	29.1^{bc}	94.5	72.0	100.1	221.8	6.5^{b}	230.3^{ab}
Rootpac®40	72.1^{b}	0.0^{b}	16.4^{e}	53.2	40.6	101.7	219.2	3.0^{c}	241.6^{ab}
Guardian®	96.0^{a}	0.9^{b}	40.4^{a}	131.2	100.0	104.1	223.5	9.8^{a}	210.4^{b}
Lovell	94.0^{a}	1.1^{b}	30.8^{b}	100.0	76.2	107.8	228.4	6.9^{b}	227.3^{ab}
Estimated HSD	15.7	3.0	6.5			ns	ns	2.9	38.8

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**Mean separation in columns by Tuckey's HSD (P=0.05). HSD was calculated based on the number of observations per mean.*

2017 NC-140 Semi-Dwarf Cresthaven Peach Rootstock Trial

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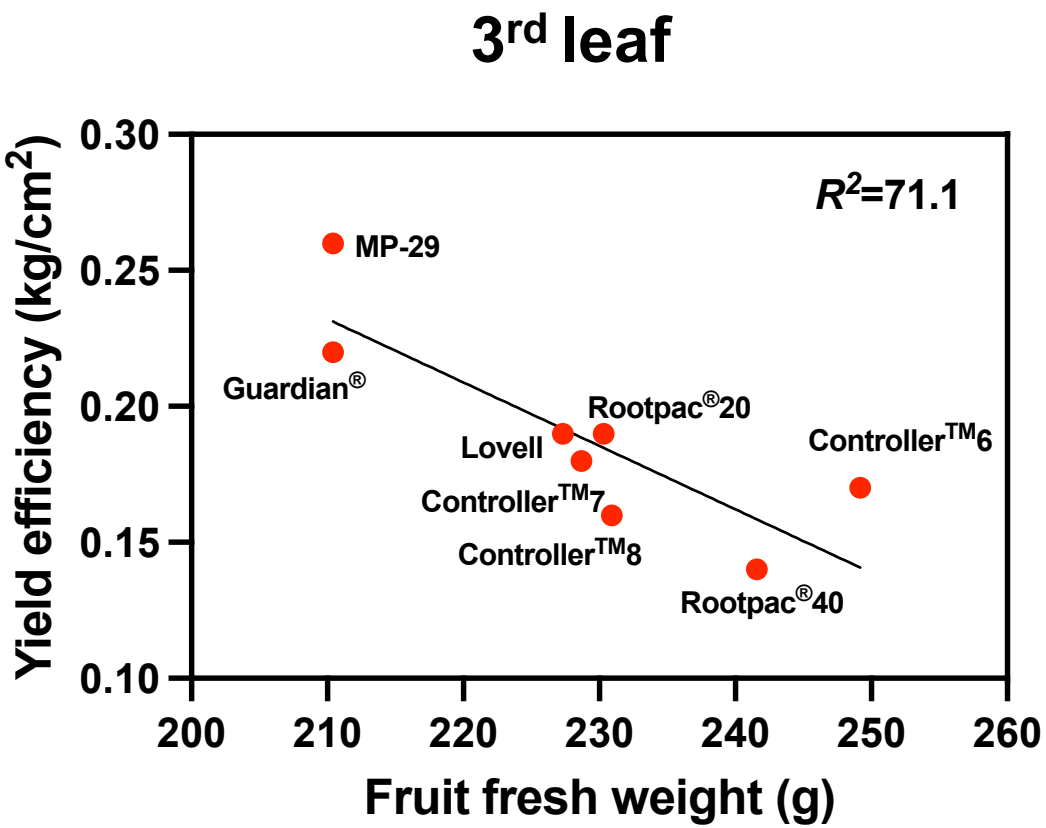
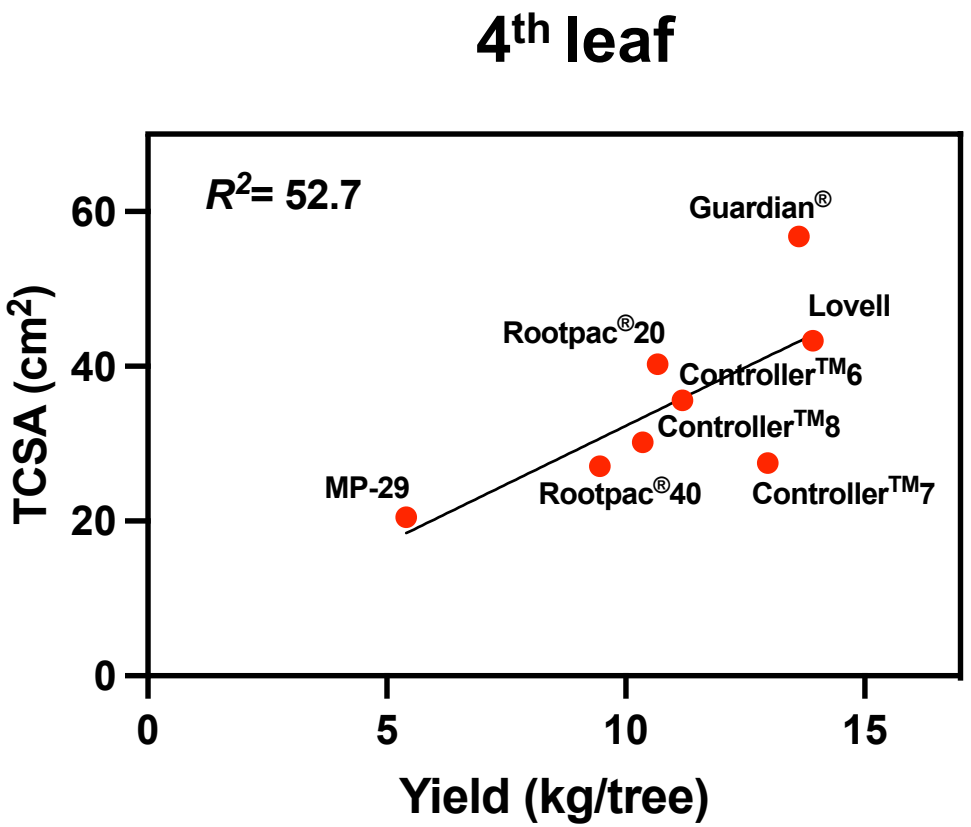
4th leaf -2020 Rootstocks performance (all sites)

Rootstock	Survival (%)	Suckers (count)	TCSA (cm^2) 2020	% of Lovell	% of Guard.	Julian 90% Bloom	Julian 10% Ripe	Yield (kg/tree)	Fruit FW (g)
Controller™6	90^{ab}	1.1^{bc}	35.6^{bc}	82.2	62.7	98.4^{a}	217.3^{ab}	11.2^{a}	217.4^{a}
Controller™7	88^{ab}	0.0^{c}	27.5^{de}	63.5	48.4	102.1^{a}	221.9^{a}	13.0^{a}	188.8^{a}
Controller™8	90^{ab}	0.5^{bc}	30.2^{cd}	69.7	53.2	97.1^{a}	215.6^{ab}	10.4^{ab}	216.1^{a}
MP-29	86^{ab}	0.9^{bc}	20.5^{e}	47.3	36.1	88.9^{a}	201.7^{b}	5.4^{b}	216.9^{a}
Rootpac®20	80^{bc}	5.0^{a}	40.3^{b}	93.1	71.0	95.5^{a}	214.5^{ab}	10.7^{ab}	189.5^{a}
Rootpac®40	67^{c}	1.5^{bc}	27.1^{cde}	62.6	47.7	99.2^{a}	218.6^{ab}	9.5^{ab}	212.4^{a}
Guardian®	97^{a}	2.5^{b}	56.8^{a}	131.2	100.0	98.1^{a}	211.8^{ab}	13.6^{a}	185.7^{a}
Lovell	93^{ab}	0.6^{bc}	43.3^{b}	100.0	76.2	100.8^{a}	217.2^{ab}	13.9^{a}	201.5^{a}
Estimated HSD	15.2	2.2	7.9			15.3	16.8	5.2	47.3

**Mean separation in columns by Tuckey's HSD (P=0.05). HSD was calculated based on the number of observations per mean.*

Fruit size correlated with yield efficiency & yield with tree size





Conclusions

- Past NC-140 peach rootstock trials have shown rootstock productivity and performance can be safely judged after at least three bearing years
- This report is on year 3 and 4 after planting
- So far 'Controller™6' seems to be a promising semi-dwarfing rootstock, as well as Controller™8 for eastern states (e.g., PA)
- 'MP-29' has the potential to make an interesting dwarfing rootstock
- Performance of Rootpac®20 and 40 in this trial across all sites is in contrary with previous reports or other plantings
- This year an SSR analysis with 10 markers indicated Rootpac®20 and 40 are in fact the correct genotypes
- More confident conclusions on the performance of the rootstocks under evaluation in this trial can only be made with the collection of additional data in year 5 (2021)

Developing the Next Generation 2D Peach Orchard

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7 Rootstocks: Krymsk®86, Hansen, Guardian®, Lovell, Controller™6, Rootpac®40, Rootpac®20

4 Training Systems: SSA (single leader, 3’), Bi-axe-U (wide crotch, 6’), Bi-axe-V (narrow crotch, 6’), Quad-axe (bi-cordon with 4 uprights, 8’)

SSA (3’ x 11’, 1320 trees/acre)

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Bi-axe-U (6’ x 11’, 660 trees/acre)

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Quad-axe (8’ x 11’, 495 trees/acre)

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SUSTAINABLE PEACH ORCHARD SOIL MICROBIOME MANAGEMENT TO CONTROL REPLANT DISEASE

Western SARE Research and Education

A research-extension-producer team approach to identify peach RD etiology, evaluate alternative sustainable strategies of management and impact farmer decision.

OBJ 3 EDUCATION & OUTREACH

Materials: scientific articles, factsheets, videos & website

Dissemination: locally, regionally, nationally & globally

Activities: grower meetings, seasonal workshops, field days, webinars & on-farm trial tours

OBJ 2 ROOTSTOCKS

TREATMENTS:

Peach rootstocks: 7 *Prunus* hybrids

Soil types: replant & sterilized

DATA COLLECTION:

- ✓ Peach rootstocks growth
- ✓ Rhizosphere soil microbiome profiling

OBJ 1 PGPRs & COVER/ROTATION CROPS

TREATMENTS:

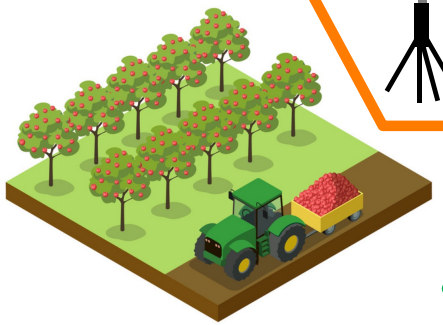
Cover crops: alfalfa & fescue

Rotation crops: corn & tomato

Soil types: replant & sterilized

DATA COLLECTION:

- ✓ Susceptible peach seedlings growth
- ✓ Rhizosphere soil microbiome profiling



ON-FARM
(CO)

GREENHOUSE

XII ORCHARD SYSTEMS 2021

HORTICULTURE AND LANDSCAPE ARCHITECTURE
COLORADO STATE UNIVERSITY

SARE Sustainable Agriculture Research & Education

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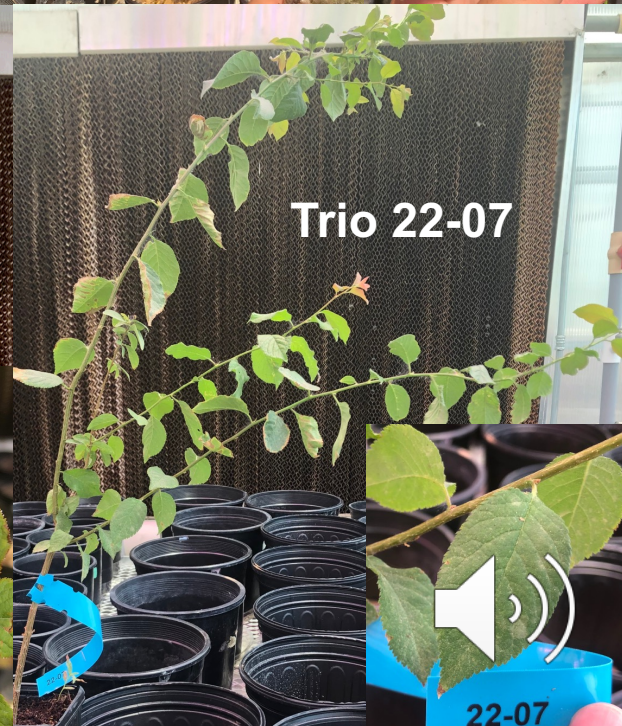


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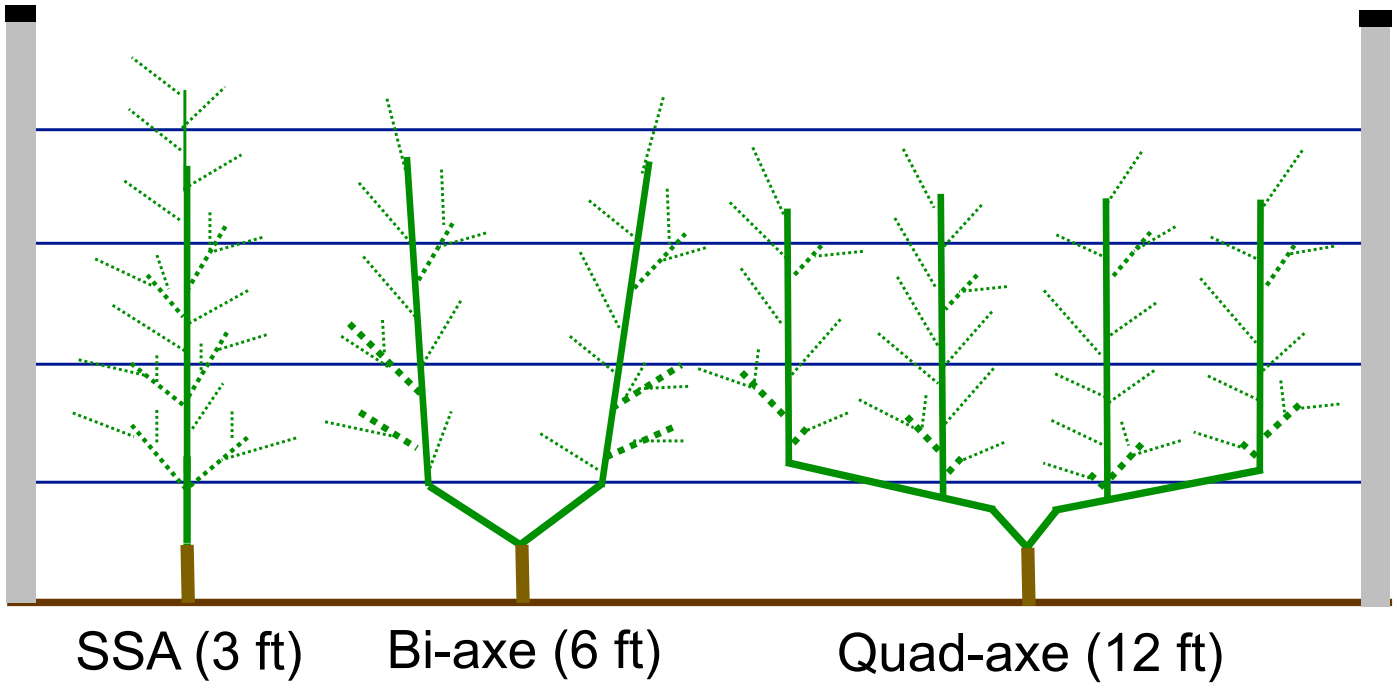
SARE
Sustainable Agriculture
Research & Education

2022 Peach Replant Rootstock x Training Plan

3 training systems:

- SSA - 1 leader (3 ft)
- Bi-axe - 2 leaders (6 ft)
- Quad-axe - 4 leaders (12 ft)



3 rootstocks

- Trio 2507 (1 leader or 2 leaders)
- Trio 2207 (1 leader or 2 leaders)
- Krymsk® 86 (2 or 4 leaders)

Scion: ‘Cresthaven’

Questions?

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Acknowledgements

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- Brent Black, USU (UT)
- John Cline, UoG (ONT)
- Mike Parker, NCSU, (NC)
- Jim Schupp, PSU (PA)
- Elina Coneva, UA (AL)
- Dario Chavez, UG (GA)

CSU_Pomology Team


David Sterle


Brendon Anthony


Jeff Pieper


Emily Dowdy

Questions?

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USDA

NC-140

IFTA Research Foundation

Support:

Talbott Farms

CropWorx

Sierra Gold Nurseries

Agromillora

The Burchell Nursery Inc.

Since 1907 ELA Family Farms

Cherry Hill Farms

Tree Connection
representing leading nurseries since 1990

Fowler Nurseries, Inc.
Foothill Grown Since 1912

Western Colorado Horticultural Society

Agricultural Experiment Station
Colorado State University