Performance of Semi-Dwarfing Peach Rootstocks for High-Density Plantings in the Southeastern States

SE Regional Fruit & Vegetable Conference
January 7, 2022

Gregory L. Reighard, Clemson University
Michael Parker, NC State University
Elina Coneva, Auburn University
Dario Chavez, University of Georgia
Tom Beckman, USDA-Byron, GA
Lorraine Rodriguez-Bonilla, USDA-Byron
Ioannis Minas, Colorado State University

Desirable rootstock characteristics for sustainable peach production in the southeastern U.S.

1) Replant disease tolerance of PTSL & ARR

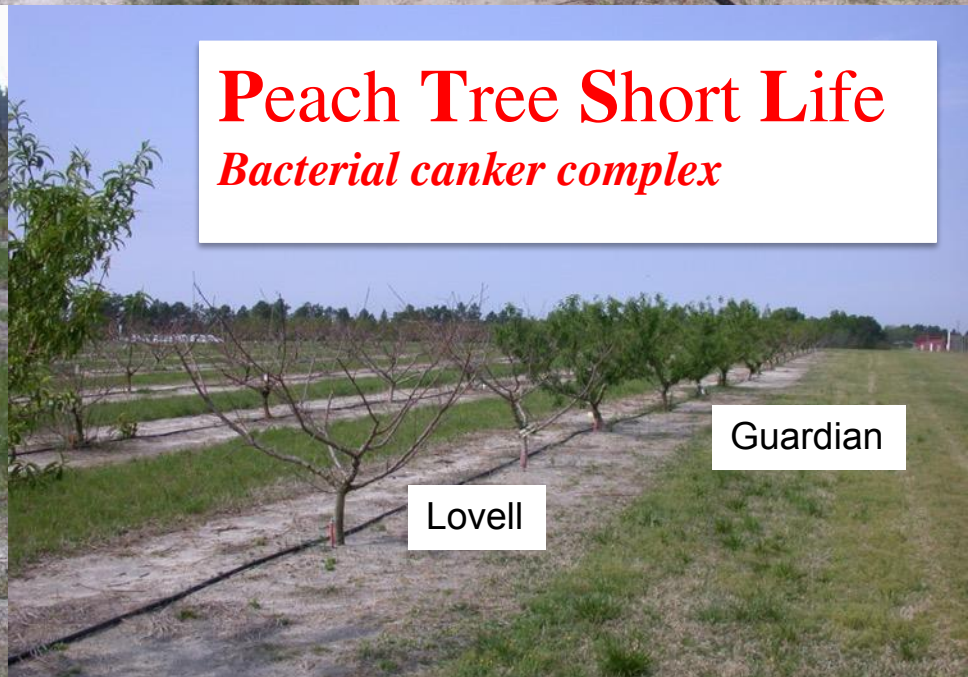
2) Resistance to soil nematodes, fungal & bacterial pathogens

3) High Productivity (e.g., fruit yields)

4) Vigor control (reduce labor costs)


Jackson Springs, NC
Photo Mike Parker


Redhaven


Peach Tree Short Life
Bacterial canker complex
Guardian
Lovell

CLEMSON
College of AGRICULTURE, FORESTRY AND LIFE SCIENCES

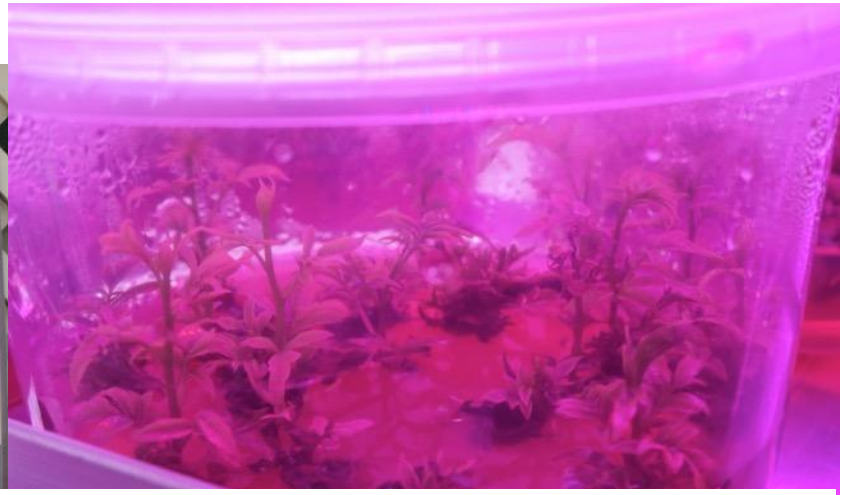
Armillaria/Desarmillaria sp. tolerance/resistance


Peach seedling roots = Too much vigor !

Less vigorous rootstocks are desirable to reduce labor

Perpendicular V-System on peach seedling rootstock

New Zealand Tatura Trellis with apricot on dwarfing Prunus hybrid rootstock



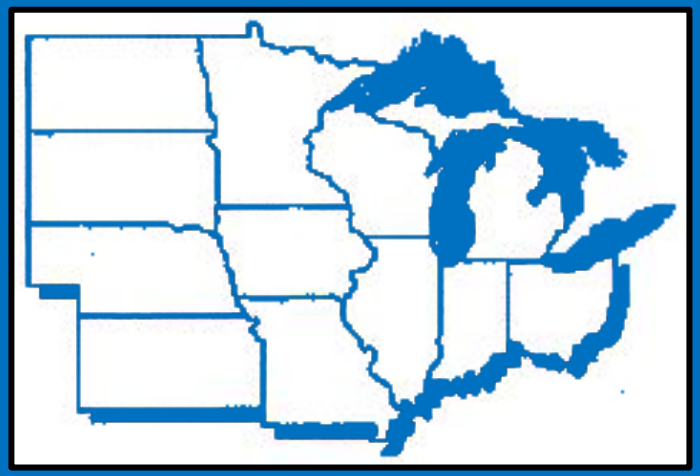
Prunus sp. hybrids via micropropagation

CLEMSON
College of AGRICULTURE, FORESTRY AND LIFE SCIENCES

NC-140 Regional Rootstock Research Project

www.nc140.org

Three countries involving 25 states and 29 State Universities and 3 federal research centers (USDA, Ag Canada, INIFAP)



CLEMSON
College of AGRICULTURE, FORESTRY AND LIFE SCIENCES

= Peach Test Locations

United-States-Map.com

CLEMSON
College of AGRICULTURE, FORESTRY AND LIFE SCIENCES

NC-140 Peach Rootstock Trials in the Southeastern U.S.

Site locations and history

North Carolina – Sandhills Research Station, Jackson Springs, NC
Lakeland sand, replant site with history of severe bacterial canker

South Carolina – Musser Fruit Research Center, Seneca, SC
Clay loam soil planted continuously in peaches for 30+ years

Georgia – USDA Fruit & Nut Laboratory Research Station, Byron, GA
Sandy loam soil planted previously in stone fruit (i.e., peaches)

Alabama – Chilton Research & Education Center, Clanton, AL
Sandy Coastal Plains soil with no previous peaches the past 40+ years

All sites were pre-plant fumigated with Telone II and provided irrigation

Trees were Cresthaven budded to 8 rootstocks and planted at 1.8 m (~ 6 ft.) in-row by 5 or 5.5 m (~16 - 18 ft.) between rows in January/February 2017

- **Controller™ 6, 7** and **8** rootstock cultivars
- UC Davis crosses of Harrow Blood peach and Okinawa peach for nematode resistance and size control
- Clonally propagated by hardwood cuttings
- Reported to be approximately 60, 70 and 80 percent in size compared to trees on the vigorous Nemaguard rootstock

- **Rootpac® 20** and **Rootpac® 40**
- Breeding program of Agromillora Iberica in Spain
- Selected for dwarfing and disease resistant traits
- Interspecific plum and almond hybrid rootstocks clonally propagated
- Reported to be approximately 20 and 40 percent in size compared to GF 677, a vigorous hybrid rootstock
- In Spain, Rootpac® 40 produces a larger tree than Rootpac® 20 in field trials

MP-29

- USDA breeding program Byron, GA
- Redleaf, clonally propagated peach plum hybrid
- Selected for PTSL and Armillaria (oak root rot) resistance/tolerance
- Semi-dwarfing with superior root-knot nematode resistance
- Waterlogging tolerance

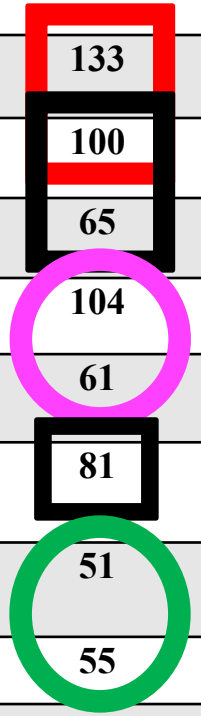
- **Lovell** peach seedling rootstock (named in 1882 for use in the dried fruit industry)
- Once was the standard rootstock with some tolerance to PTSL, but root knot nematode and Armillaria susceptible
- Seed sources limited due to phasing out as a processing peach cultivar
- Very productive rootstock on good sites and traditional orchard spacings were tailored to its vigor

- **Guardian®** peach seedling rootstock
- Joint release of Clemson and USDA-Byron, GA
- Similar to Lovell in production but more vigorous and resistant/tolerant to PTSL and nematodes
- Has replaced Lovell and Halford for replant sites
- Susceptible to Armillaria

CLEMSON
College of AGRICULTURE, FORESTRY AND LIFE SCIENCES

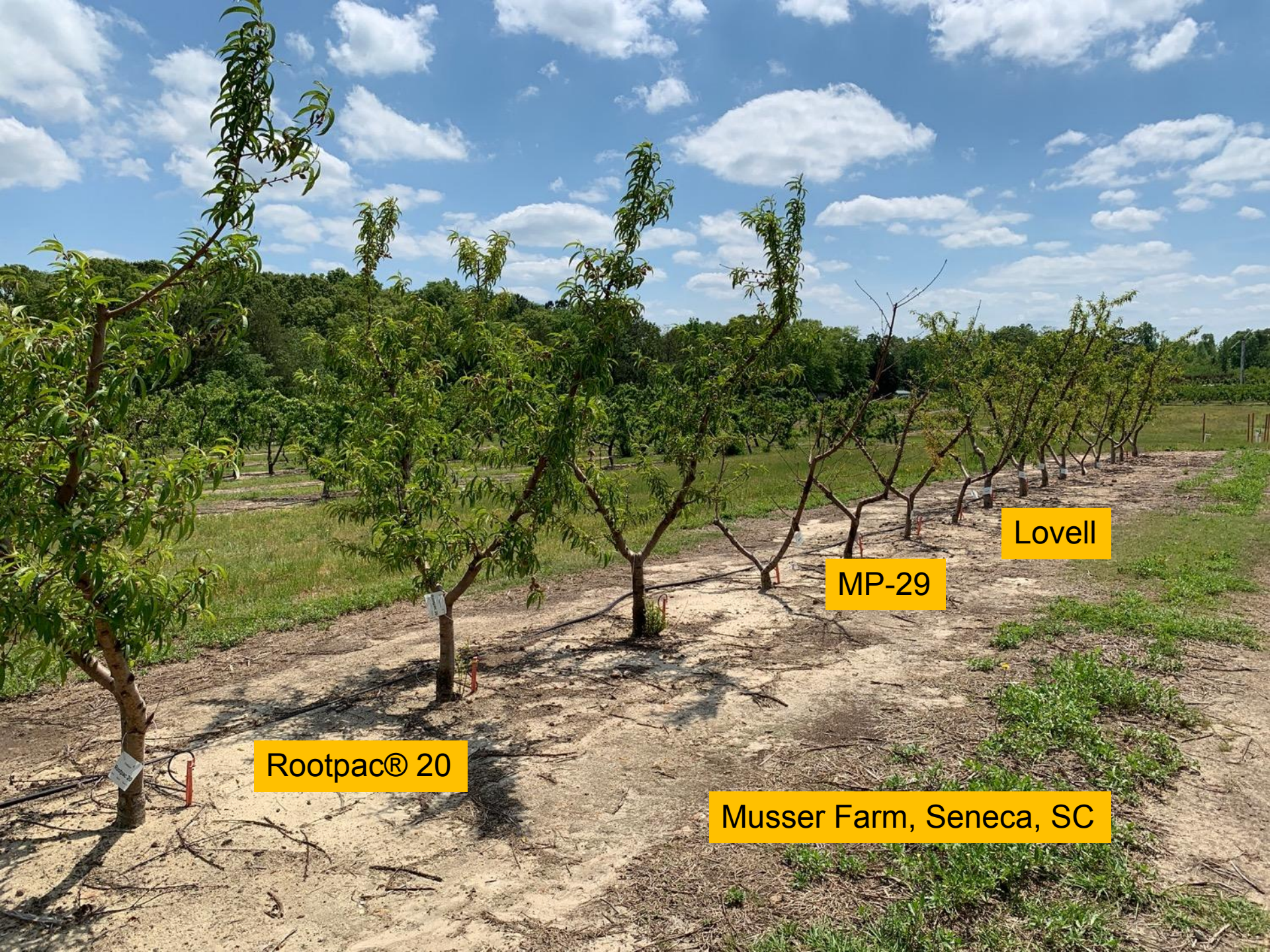
Trunk cross-sectional area in percent of Lovell

Rootstock	North Carolina	South Carolina	Georgia	Alabama	State
Cultivar	(% Lovell)	(% Lovell)	(% Lovell)	(% Lovell)	mean (%)
Guardian®	122	130	143	137	133
Lovell	100	100	100	100	100
MP-29	68	63	75	52	65
Rootpac® 20	--	108	112	91	104
Rootpac® 40	--	51	64	69	61
Controller™ 6	73	73	95	81	81
Controller™ 7	35	50	38	79	51
Controller™ 8	45	56	35	85	55




Guardian®
Lovell
Musser Farm, Seneca SC

Controller™ 7 vs Guardian®
Musser Farm, Seneca, SC


Lovell
MP-29
Rootpac® 20
Musser Farm, Seneca, SC

Cumulative new root suckers

Rootstock	South Carolina	Georgia	Alabama	Root suckers
Guardian®	7	16	15	13
Lovell	4	6	10	7
MP-29	2	1	2	
Rootpac® 20	22	20	31	24
Rootpac® 40	5	1	3	
Controller™ 6	0	0	1	0
Controller™ 7	0	0	2	1
Controller™ 8	0	0	1	0

CLEMS
College of AGRICULT
FORESTRY AND LIFE SC

Rootpac® 40 with bacterial spot infection -- Musser Farm

Three-year cumulative yields in percent of Lovell

Rootstock	North Carolina	South Carolina	Georgia	Alabama	State
Cultivar	(% Lovell)	(% Lovell)	(% Lovell)	(% Lovell)	mean (%)
Guardian®	123	141	586	119	128 *
Lovell	100	100	100	100	100
MP-29	77	56	291	60	64 *
Rootpac® 20	16	110	174	92	101 **
Rootpac® 40	2	24	22	23	23 ***
Controller™ 6	80	61	87	48	69
Controller™ 7	13	39	9	35	37 **
Controller™ 8	33	54	13	54	54 **
			*no GA	**no GA/NC	***no NC

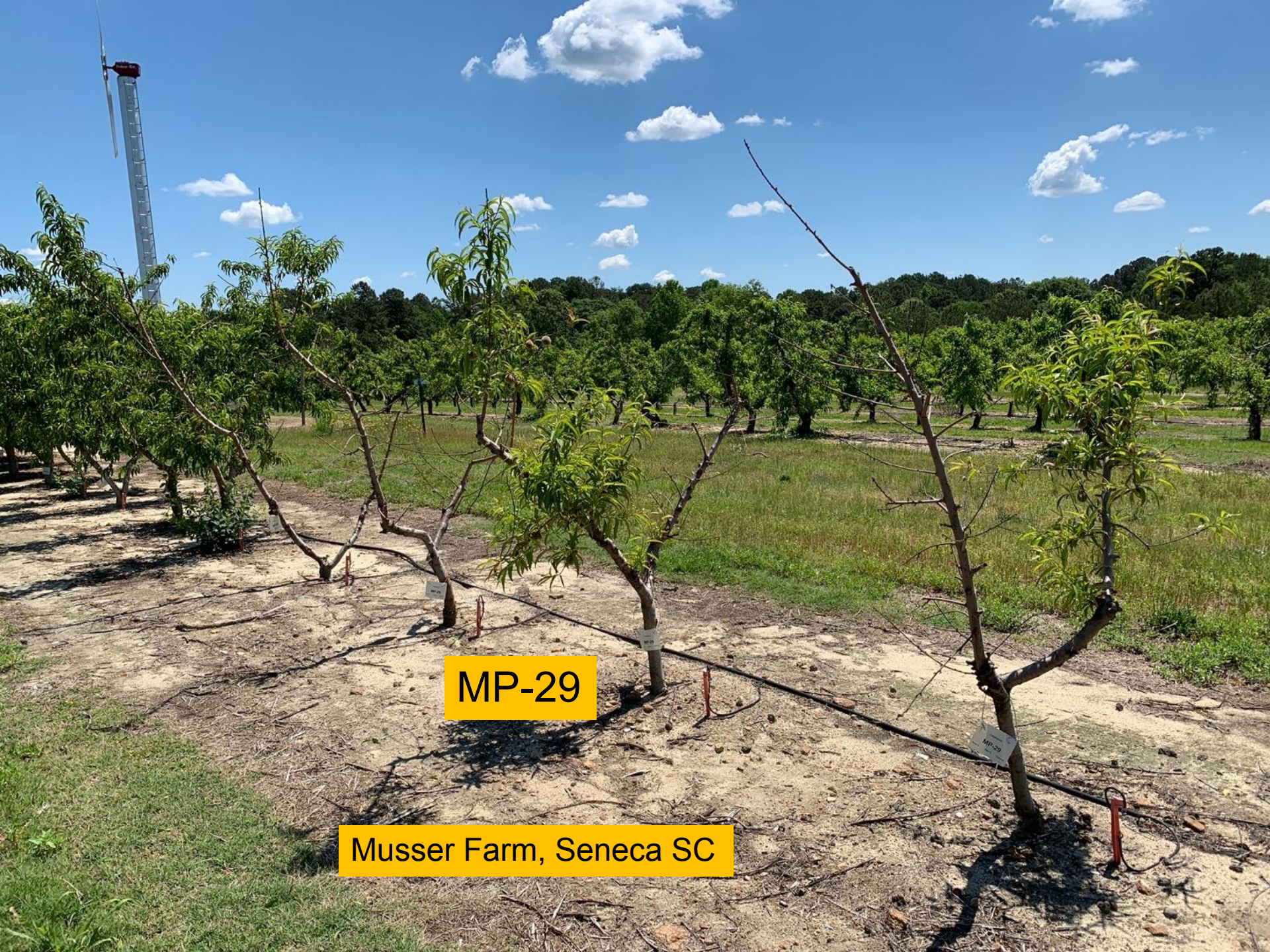
Average 3-year fruit weight

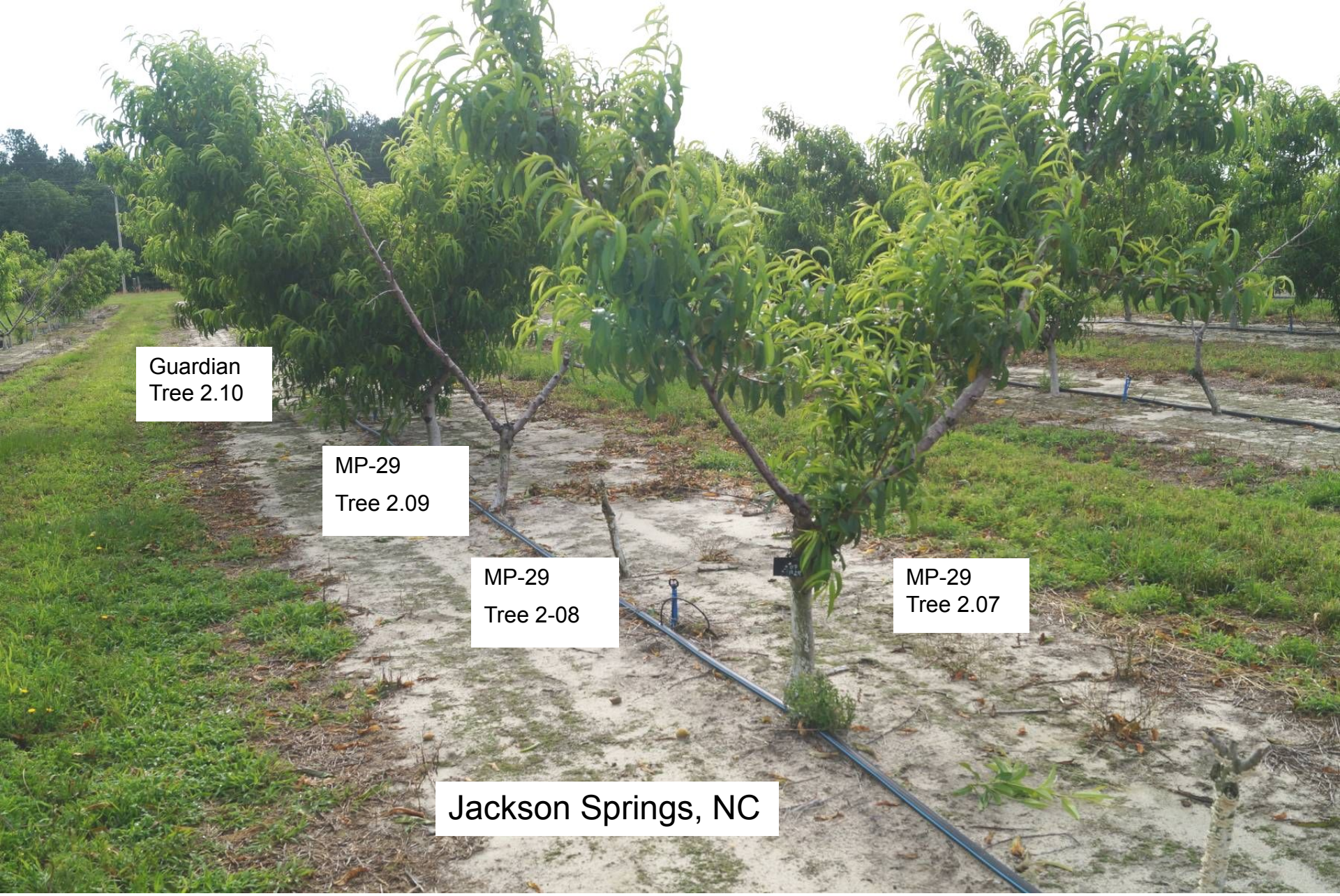
Rootstock	North Carolina	South Carolina	Alabama	Rootstock mean
Cultivar	(g)	(g)	(g)	(g)
Guardian®	264	247	225	245
Lovell	265	268	264	266
MP-29	247	255	219	240
Rootpac® 20	--			238
Rootpac® 40	--	249	290	270
Controller™ 6	266	267	310	281
Controller™ 7	203	249	292	248
Controller™ 8	245	269	250	255
Mean fruit wt. (g)	248	256	260	

~ 200 g = 3 inch fruit

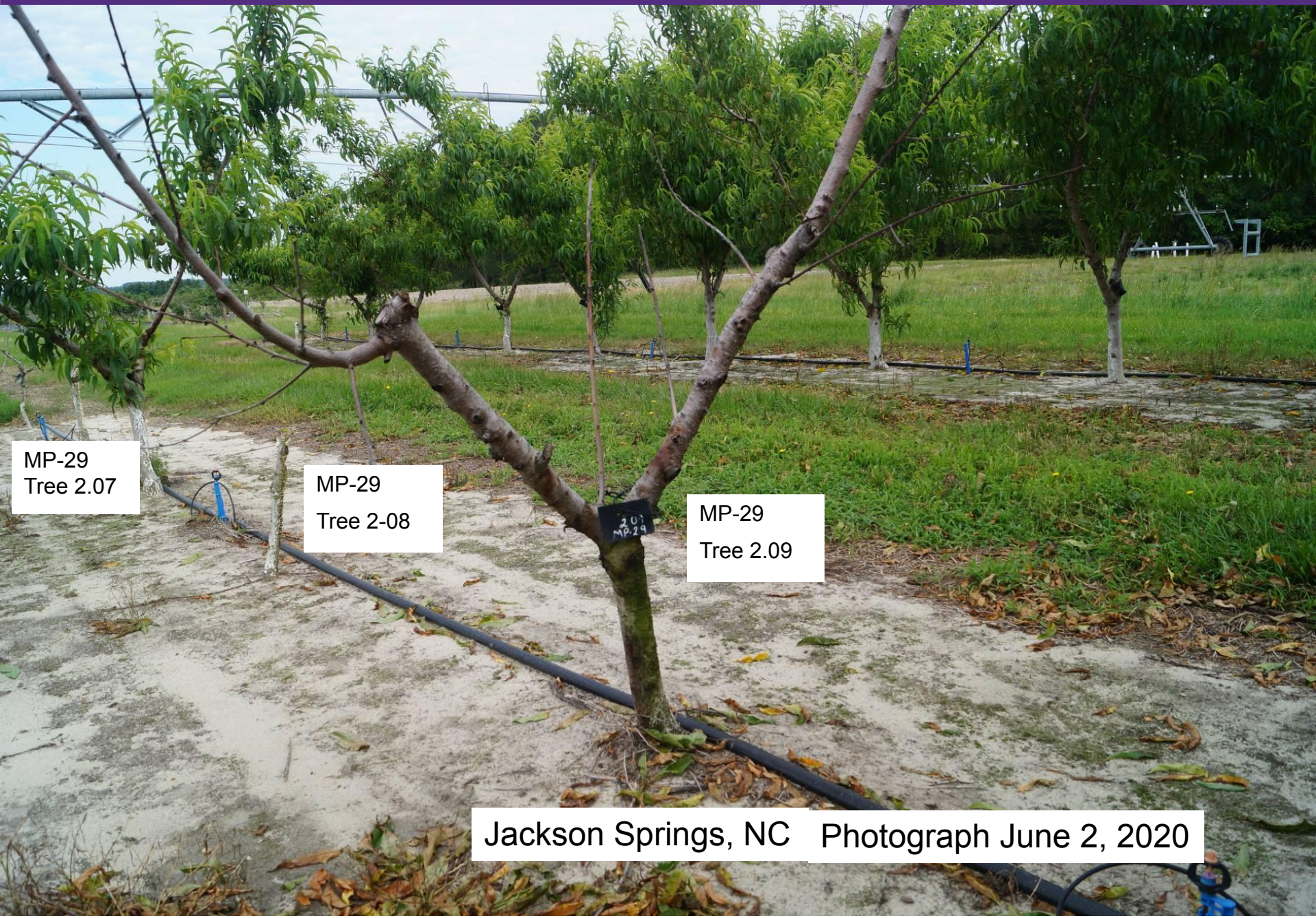
Five-year tree survival in percent

Rootstock	North Carolina	South Carolina	Georgia	Alabama	State
Cultivar	(%)	(%)	(%)	(%)	(%)
Guardian®	95	100	100	100	99
Lovell	55	100	100	100	89
MP-29	62	90	75	100	82
Rootpac® 20	0	96	50	100	62
Rootpac® 40	0	81	20	81	46
Controller™ 6	70	95	100	100	91
Controller™ 7	35	95	63	95	72
Controller™ 8	50	100	88	95	83
Mean survival %	46	95	75	96	


MP-29
Musser Farm, Seneca SC



MP-29 2.07 photo taken June 2, 2020 by David Ritchie



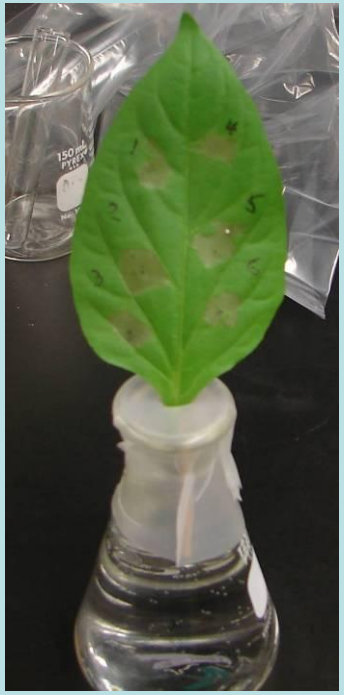
Trees in background to the right are border row cv. Cresthaven on Guardian, Photo Dave Ritchie


Photograph June 2, 2020
Guardian
Tree 2.10
MP-29
Tree 2.09
Jackson Springs, NC

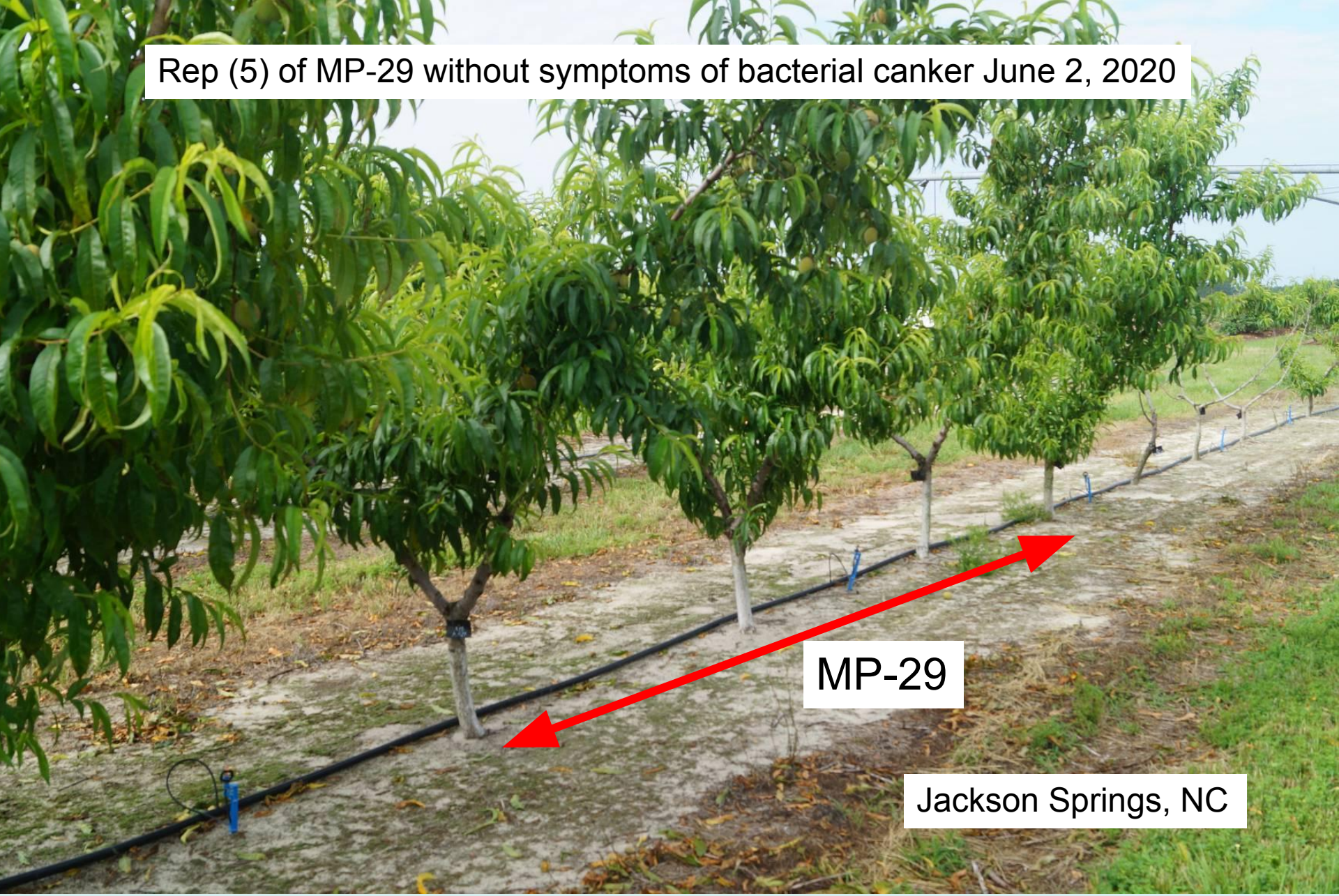
MP-29 tree 2.09 sample collected 3/12/2020
Pictures 3/16/2020 (David Ritchie)

Twig canker from tree budded on MP-29 (tree 2.09). Tree expressing bacterial canker symptoms

Bacteria isolated from the twig canker. Flurosence under UV-light is a characteristic of P*seudomonas syringae* species including *P.s. syrinage.*



Bacterial strains elicited HR in non-host indicative of the strains being pathogens.


Rep (5) of MP-29 without symptoms of bacterial canker June 2, 2020
MP-29
Jackson Springs, NC

Relative yield efficiency and productivity across all locations

Rootstock	A =Yield (% of Lovell)	B =TCSA (% of Lovell)	A/B =Efficiency Coefficient (vs. Lovell)	A/B x Survival (Productivity index)
Guardian®	128	133	0.96	0.95
Lovell	100	100	1.00	0.89
MP-29	64	65	0.98	0.80
Rootpac® 20	101	104	0.97	0.60
Rootpac® 40	23	61	0.38	0.17
Controller™ 6	69	81	0.85	0.77
Controller™ 7	37	51	0.73	0.53
Controller™ 8	54	55	0.98	0.81

Results and key points from the 2017 NC-140 peach rootstock trial after 5 years in 4 southeastern states

- Dwarfing rootstocks were 51-65% in size compared to Lovell after 5 years
- Controller™ 6 was intermediate in size -- 81% of Lovell
- Dwarfing rootstocks were 38-49% in size compared to Guardian® after 5 years
- Vigor of Agromillora rootstocks Rootpac® 20 (greater) and Rootpac® 40 (lesser) were opposite of that reported in European trials
- Rootpac® 40 and MP-29 had trees die from bacterial canker
- Yields and yield efficiency were correlated with tree vigor except for Rootpac® 40 and Controller™ 7, where both had lower yields
- Productivity was highest on Guardian due to vigor and some sites having PTSL but MP-29 would be a better choice if Armillaria root rot is present

Acknowledgements:

- Musser Fruit Research Center Staff
- Dave Ouellette
- Technical staffs at Auburn, Georgia, NCSU and USDA
- NIFA/USDA; SC Expt. Station

Thank you!