Department of Horticulture | Oregon Wine Research Institute

Applied Viticulture Research to Address Climate Change

Dr. Patty Skinkis
Professor & Viticulture Extension Specialist

Mathew Lange,
Graduate Research Assistant
Jeremy Schuster,
Graduate Research Assistant

April 26, 2022 – OWRI Grape Day, Corvallis, OR

Oregon State University

How changing climate impacts the wine industry…

Vineyard
yield, fruit composition

Vine growth
Water use
Fruit ripening

Winery
nutrients, fermentation

Condition of fruit dictates amendments, process, wine style

Sales
Price and market

Marketability depends on final product

Climate Change Adapatation

- How will management practices need to change?
- Adapation: Which cultivars and/or rootstocks should be used?
- Requires time and investment

Soil Moisture Project (2020-2022)

Rootstock Project (2020-2022)

Seasonal Dynamics of Soil Moisture and Vine Growth

2020-2022

oregon wine BOARD

ERATH FAMILY FOUNDATION

Project Objectives

1. Characterize seasonal soil moisture among soil types common to the Willamette Valley
2. Determine vine growth, water status, and berry development responses to weather and soil moisture conditions
3. Understand vineyard floor management impacts on different soil types

Experimental Design

- 1 vineyard → Newberg, OR
- Pinot noir grafted to 101-14
- Planted 2008
- Spacing – 6.5’ x 5’
- 3 soil types – *silt loam/silty clay loam*

Soil Series	Parent Material
Dupee	Sedimentary
Saum	Volcanic
Woodburn-Willamette	Glacial deposits

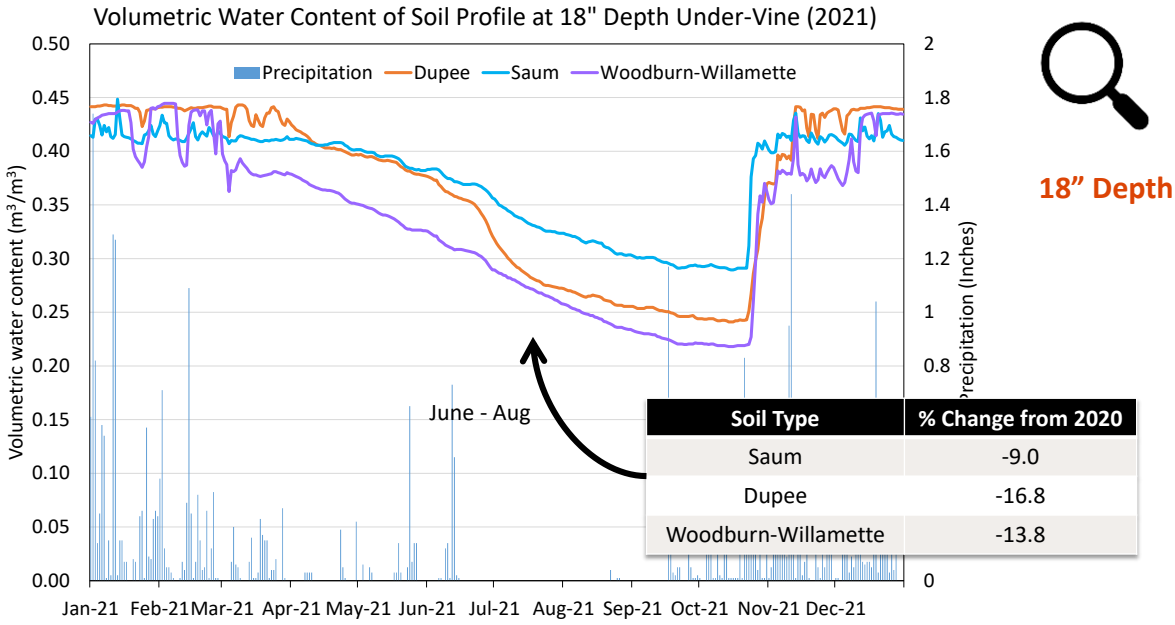
Soil Monitoring

- Continuous:
  - Volumetric soil water content
  - Soil temperature
  - Electrical conductivity (EC)
- January 2020 – present

Location	Depth
Under-vine	18”, 36”
Alleyway	18”, 36”

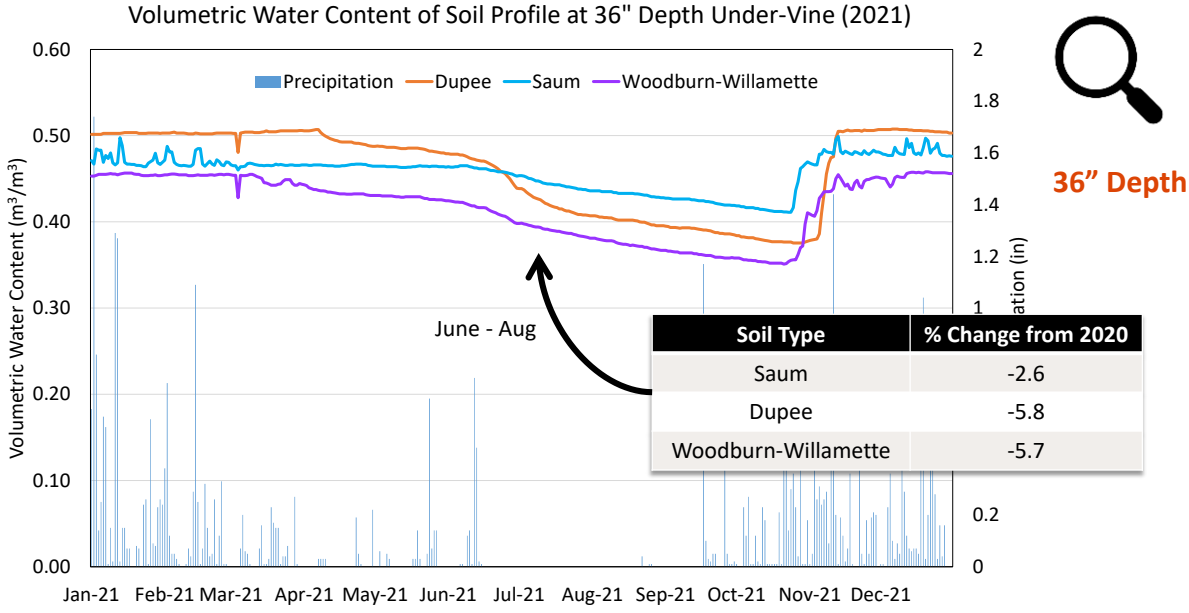
Vine Measures

- Shoot growth
- Leaf area
- Yield
- Pruning weight
- Vine nutrient status
- Leaf water potential
- Leaf gas exchange
- Berry development curve
- Fruit ripeness and “quality” parameters



18" Depth

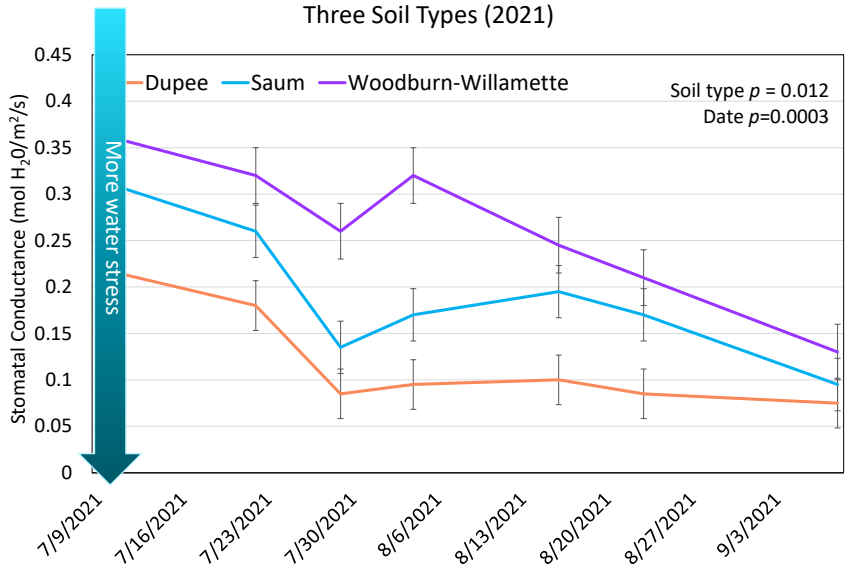
Soil Type	% Change from 2020
Saum	-9.0
Dupee	-16.8
Woodburn-Willamette	-13.8



36" Depth

Soil Type	% Change from 2020
Saum	-2.6
Dupee	-5.8
Woodburn-Willamette	-5.7

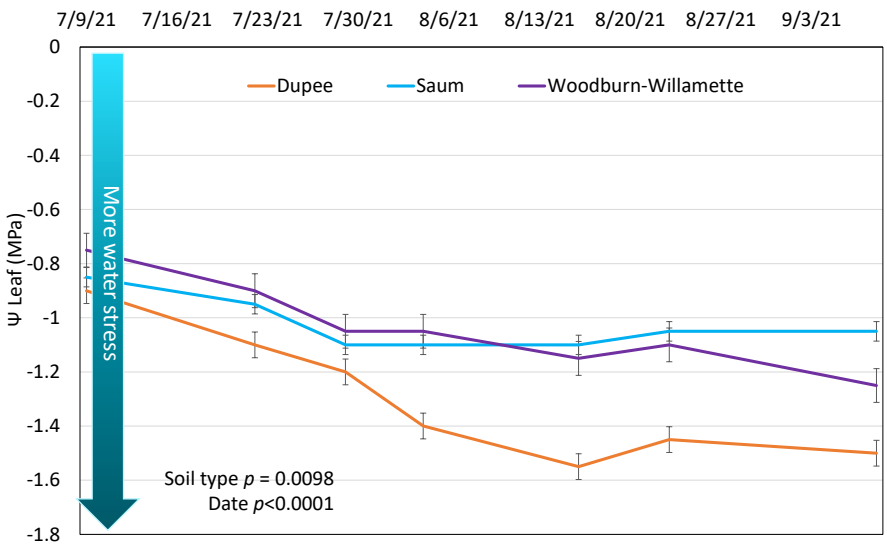
Leaf Stomatal Conductance of Pinot noir Growing in Three Soil Types (2021)



Woodburn-Willamette had highest
- Stomatal conductance
- Photoassimilation
- Leaf water potential

Dupee had lowest
- Stomatal conductance
- Photoassimilation
- Leaf water potential

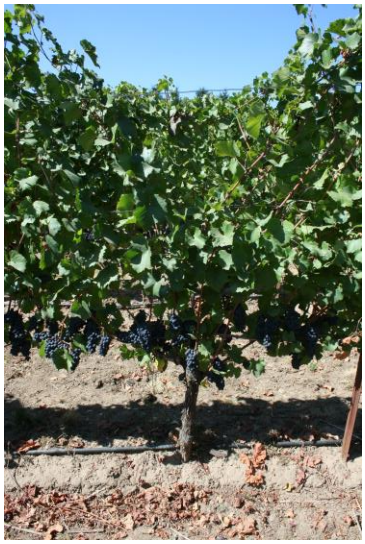
Leaf Water Potential of Pinot noir Growing in Three Soil Types (2021)



Woodburn-Willamette had highest
- Stomatal conductance
- Photoassimilation
- Leaf water potential

Dupee had lowest
- Stomatal conductance
- Photoassimilation
- Leaf water potential

Vine Growth Response – *Vigor & Yield*



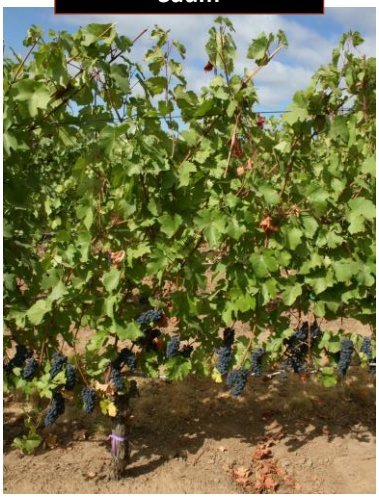
- Woodburn-Willamette = largest vines

Soil Type	Pruning weight (lb/ft)	Cane weight (g)	Yield (lb/ft)
Dupee	0.35 b	49 b	1.08 b
Saum	0.29 b	46 b	0.99 b
Woodburn Willamette	0.58 a	78 a	1.29 a
p	0.010	0.005	0.0028

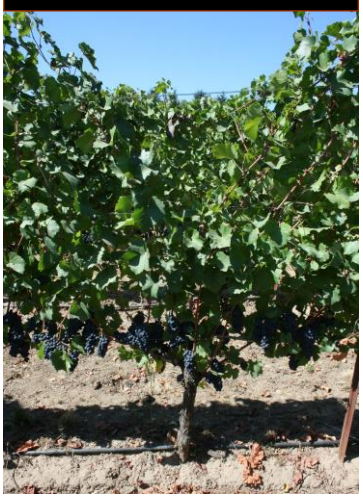
- Lower soil moisture yet less water stress in WW may be due to larger water demand or deeper roots

Dupee

Saum



Woodburn-Willamette



%N Leaf Blade 2.07 1.92 2.35

Berry Ripeness by Soil Type

Soil Type	TSS (Brix)	pH	TA (g/L)	Sugar/ berry (g)
Dupee	23.9 ab	3.22	7.3	0.20
Saum	24.8 a	3.40	6.0	0.21
Woodburn-Willamette	23.2 b	3.24	7.3	0.20
p	0.0122	ns	ns	ns

- Saum
  - most advanced TSS
- Woodburn-Willamette
  - Highest fruit YAN
  - Highest leaf blade N at véraison

Summary – *2 Years*

- Soil moisture at depth is sufficient for growth and ripening, even in dry season
- Soil impacts vine growth and N status
  - N cycling of soils
  - Soil depth
- Soil impacts vine water status
  - Water holding capacity
  - Vine root depth
  - Vine size

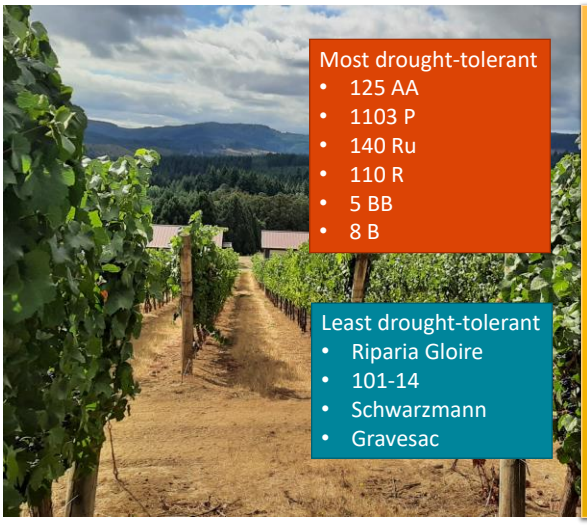
Mature Pinot noir x Rootstock Project

2019-2022

oregon wine BOARD

ERATH FAMILY FOUNDATION

Rootstock Research – *OSU Woodhall Vineyard*



Most drought-tolerant
- 125 AA
- 1103 P
- 140 Ru
- 110 R
- 5 BB
- 8 B

Least drought-tolerant
- Riparia Gloire
- 101-14
- Schwarzmann
- Gravesac

101-14
1103P
110R
125AA
140R
161-49
1616
3309C
420A
44-53
5BB
5CTE
8BTE
99R
BOER
GRAV
own-rooted
Riparia Gloire
Schwarzmann
SO4

Pinot noir x
19 Rootstocks +
Own-rooted

- Planted 1997
- Randomized complete block design
- 5 reps
- Spacing 7’ x 4’
- Dry farmed

Objectives

1. Determine phenological advancement, vine growth, and fruit productivity
2. Determine rootstock impact on fruit composition
3. Quantify vine water stress response of key rootstocks (new 2021)

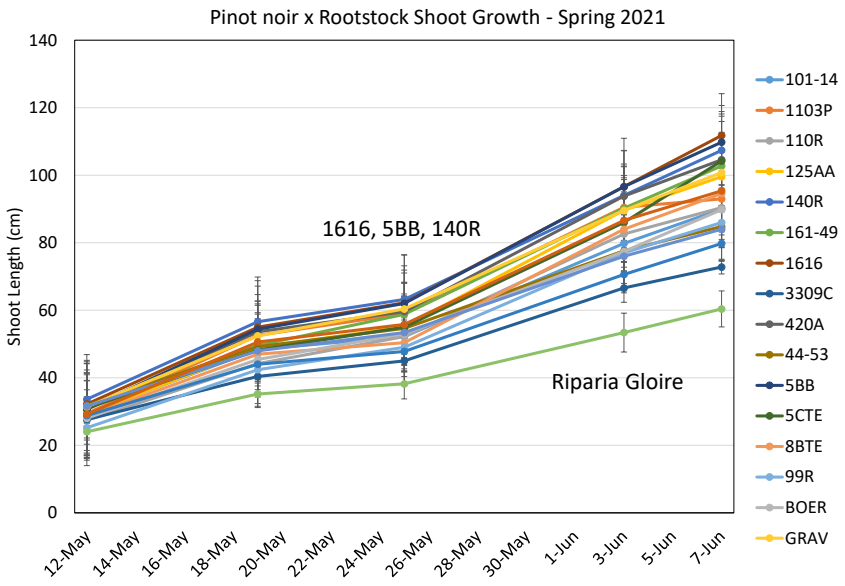
Under dry-farmed conditions
2019-2022

Vine Growth Measures
Fruitfulness
Shoot growth
Leaf area
Yield
Pruning weight

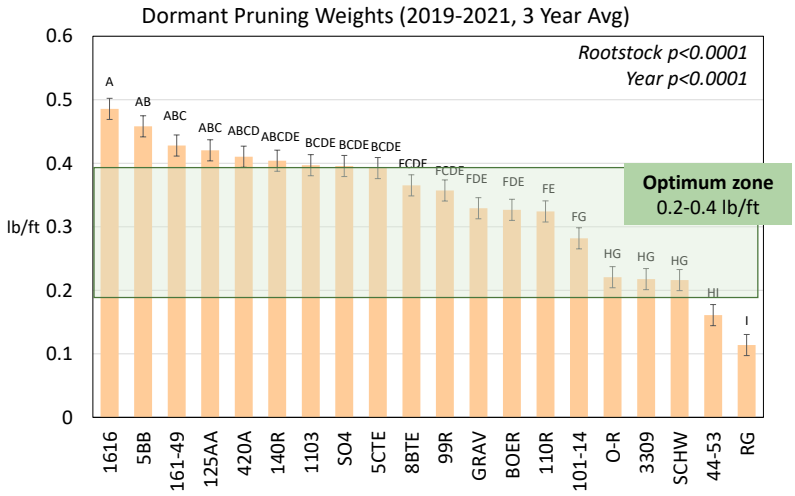
Fruit Composition
TSS, pH, TA
YAN
Total anthocyanin
Total phenolics
Total tannins

Results – *Vine growth & productivity*

- Phenology
  - no differences at bud break or bloom
- Shoot length *(at bloom)*
  - **Lowest**: Riparia Gloire, Schwarzmann, Boerner
  - **Highest**: 110R, 99R, 140R, 1616, 161-49
- Leaf area
  - Visible differences by mid-season
- Fruitfulness
  - no difference by rootstock



Results – *Dormant Pruning Weight*

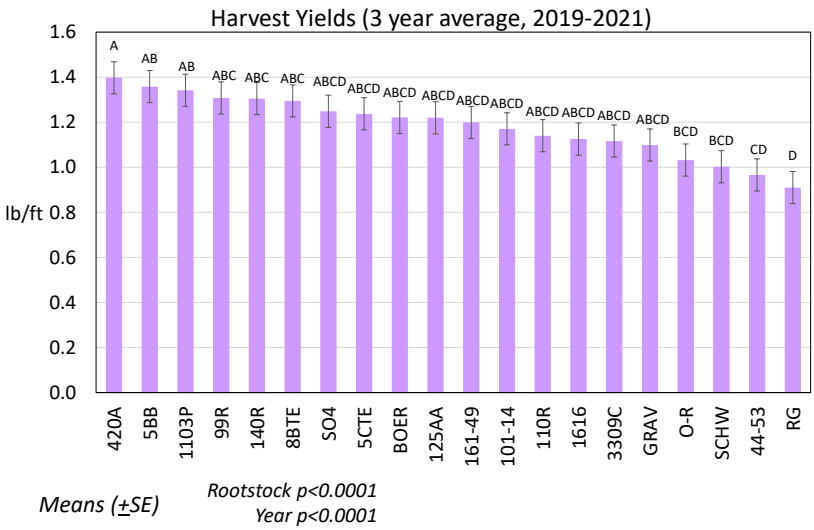


Above optimum PW (High Vigor)
1616
5 BB
161-49
125AA

Below optimum PW (Weak Vines)
44-53
Riparia Gloire

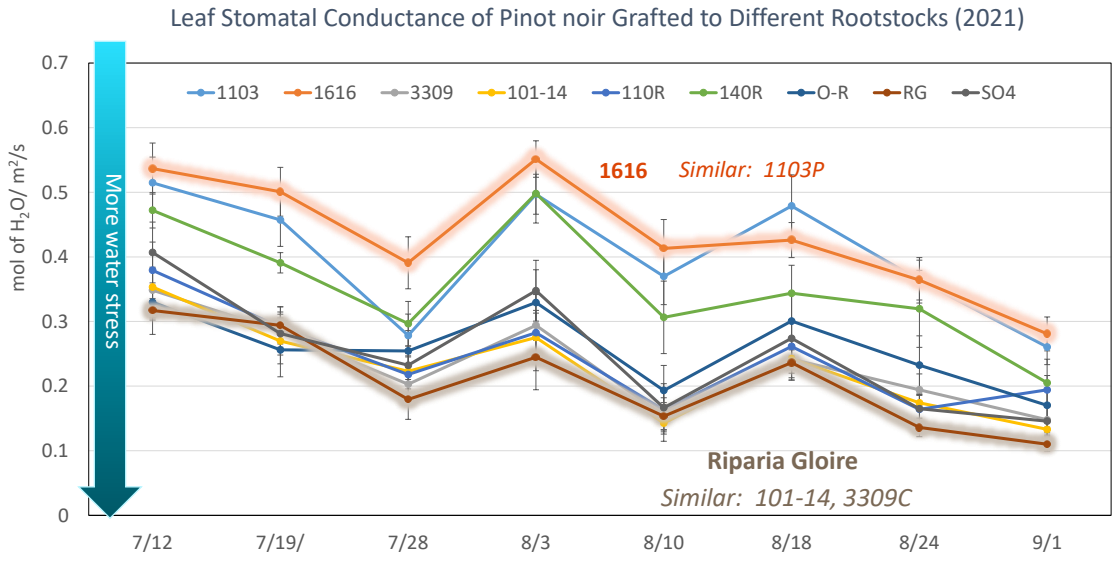
Means (±SE),

Results – *Harvest Yields*

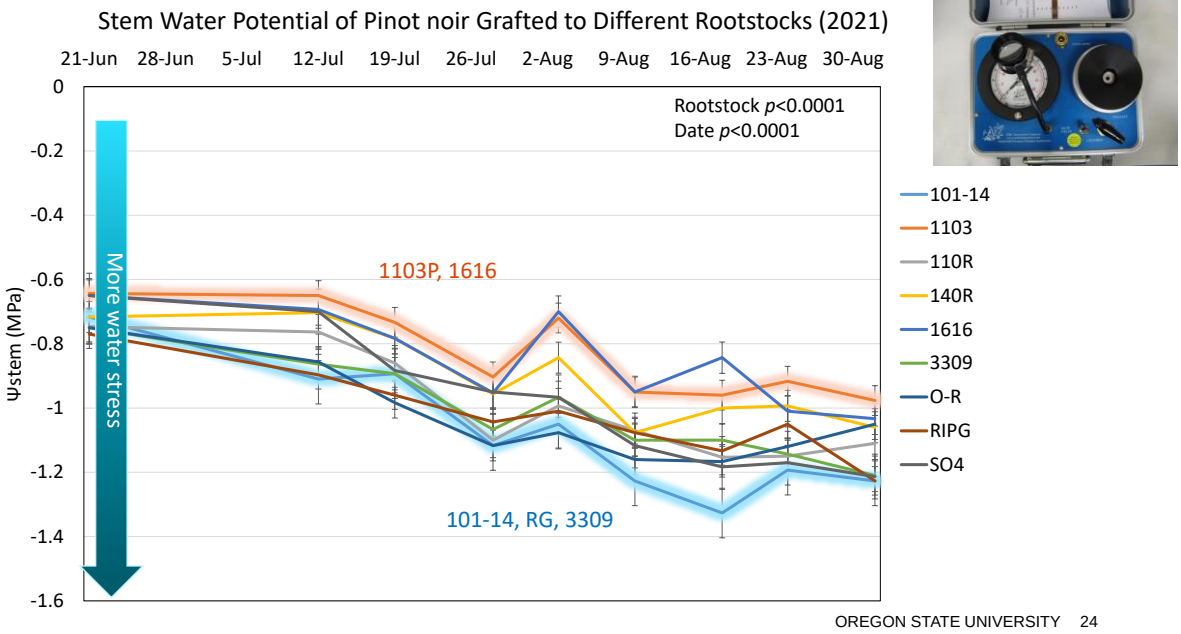


Means (±SE)

Rootstock p<0.0001
Year p<0.0001



Rootstock *p*<0.0001
Date *p*<0.0001



Rootstock Project Summary

- Greatest impact is on vine growth and yield
  - Likely related to N tissue status
  - Vine water stress response short and long-term
- Limited impact on fruit ripeness or phenolics
- Mature vines are balancing growth and yield

Considerations for Climate Change in Oregon

- Rootstocks have potential to improve canopy size, yields
  - Current devigorating rootstocks may become limiting
- Soils may provide adequate moisture if
  - Proper soil care/vegetation management
  - Adequate soil depth

Oregon State University

Questions?

Patty Skinkis, PhD
Dept of Horticulture
Oregon Wine Research Institute
patricia.skinkis@oregonstate.edu
owri.oregonstate.edu