

**Ground cover, root zone restriction and
rootstock effects on vegetative
growth, crop yield components, and fruit
composition of Cabernet Sauvignon**

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Agenda

- Background/hypothesis
- Vegetative growth data
 - Shoot growth
 - Pruning weights
- Fruit quality
 - Berry weight
 - Malic acid
- Wine quality
 - YAN
 - Color
- Vine water status
- Conclusions

Excessive Vegetative Growth

- **Surplus soil moisture available to vines though the growing season**
- Deep rooting depth, fine textured-high fertility soil
- Warm growing season
- Un-“balanced” vine growth
- Poor fruit exposure
- High vineyard management cost
- High disease pressure

Experimental Design

3 treatment levels

- Under trellis ground cover(UTGC)
 - Herbicide vs. Cover crop - creeping red fescue
- Rootstock
 - 101-14, 420-A, riparia Gloire
- Root Manipulation (RM)
 - No root restriction (NRR) vs. root restriction (RR)

Hypothesis

- Treatments that predictably reduce the rate and duration of vegetative growth will produce fruit with increased wine quality potential.

Objectives

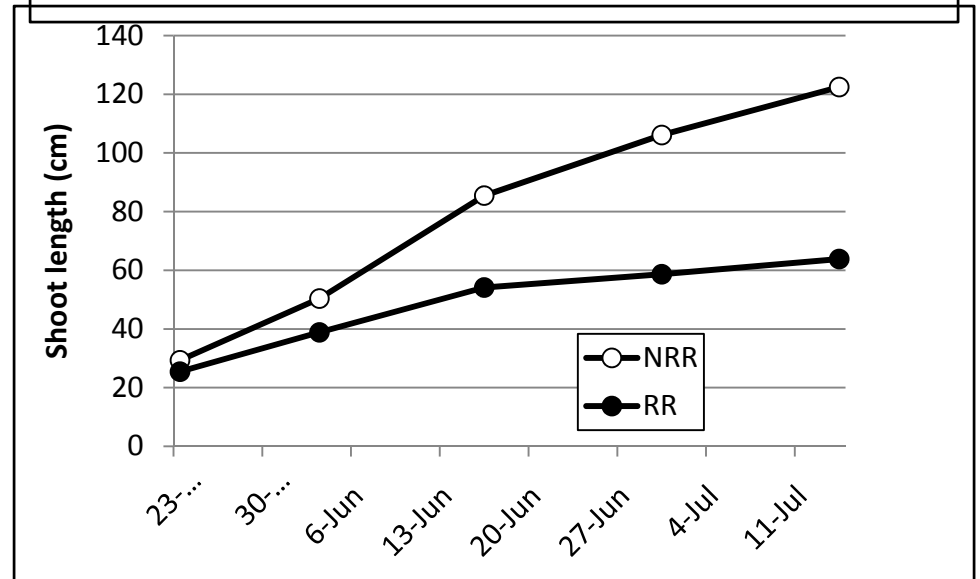
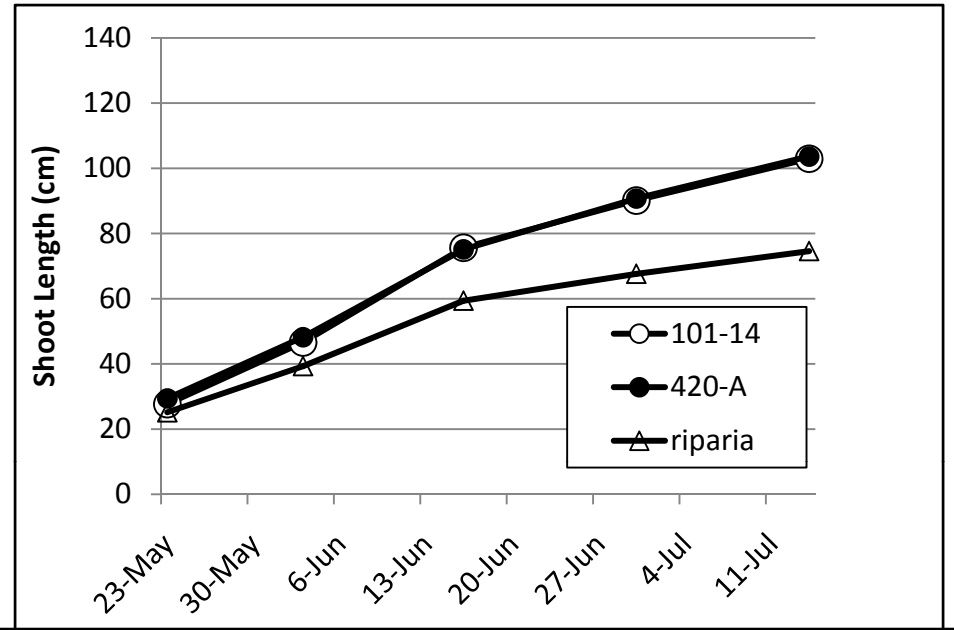
- Evaluate effects of treatments on vegetative growth of vines
- Evaluate how differences in vegetative growth influence fruit quality for wine production

2008

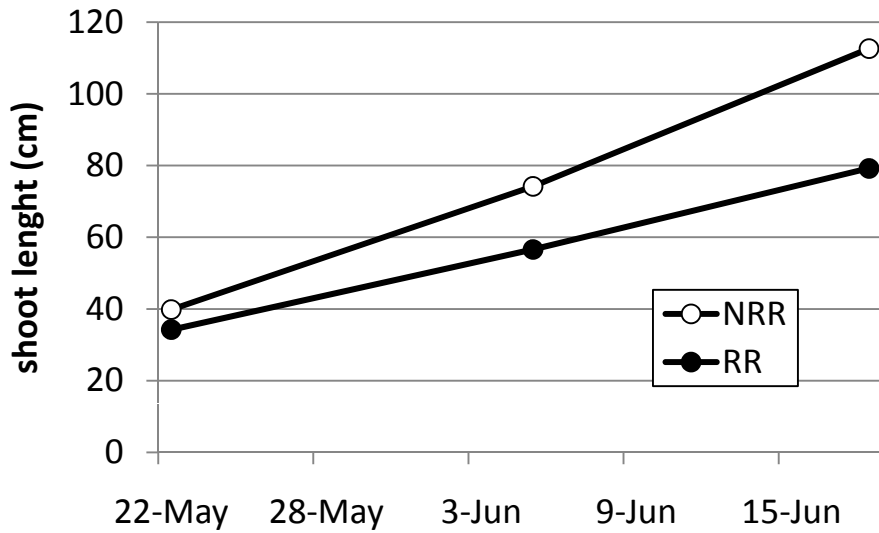
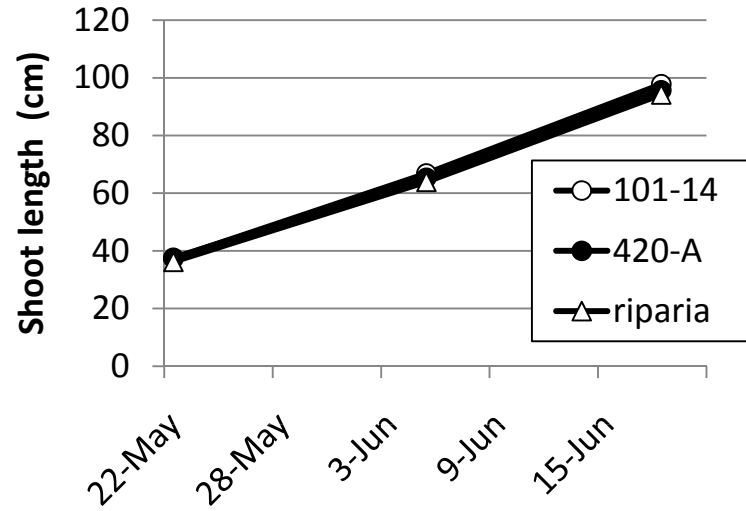
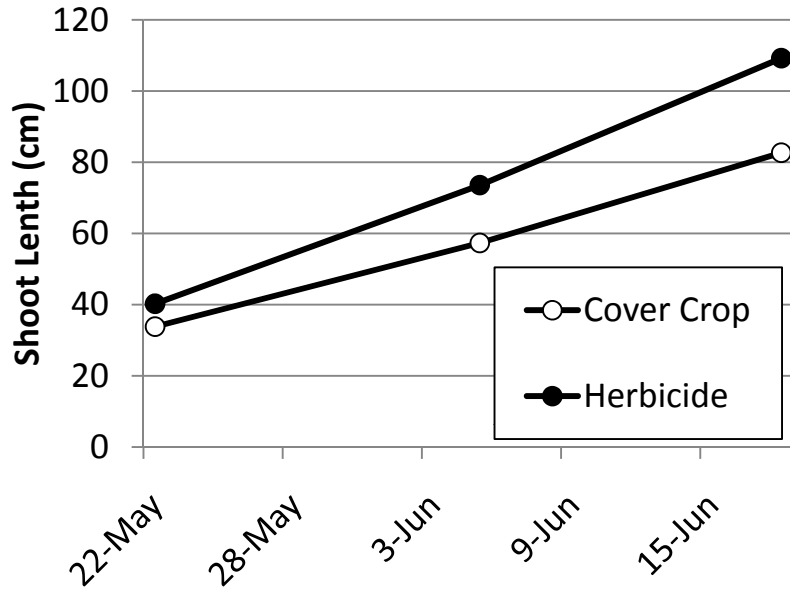
UTGC n/a

Rootstock	NRR	RR	average
101-14	2.6	1.4	2.0 a
420-A	2.5	1.3	1.9 a
riparia	1.9	0.9	1.4 b

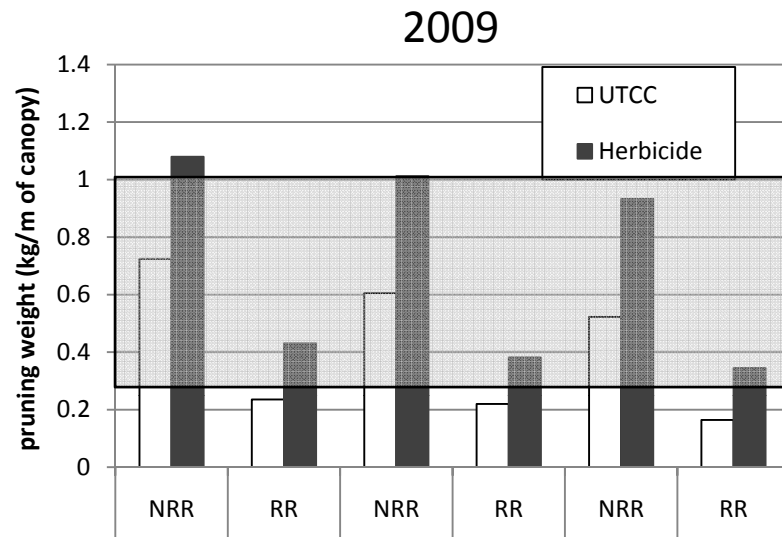
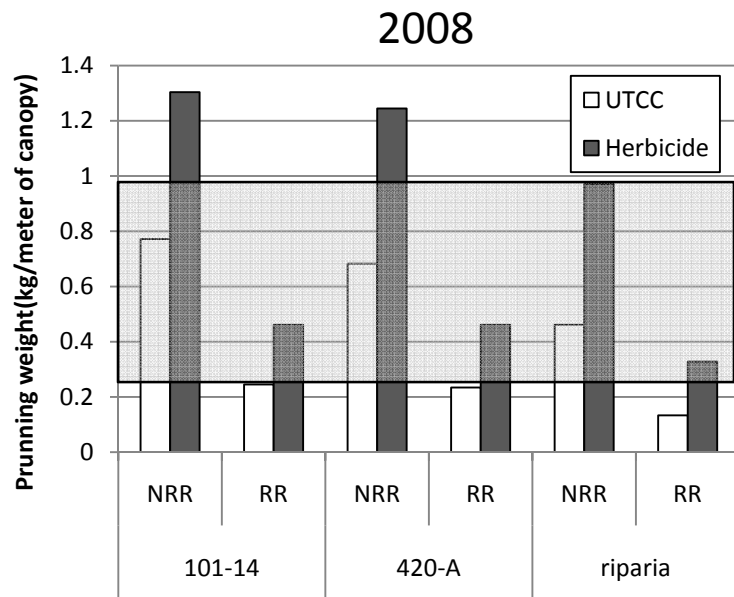
Effect	p-value
Rootstock	< 0.0001
RM	< 0.0001
Rootstock X RM	0.0381



2009

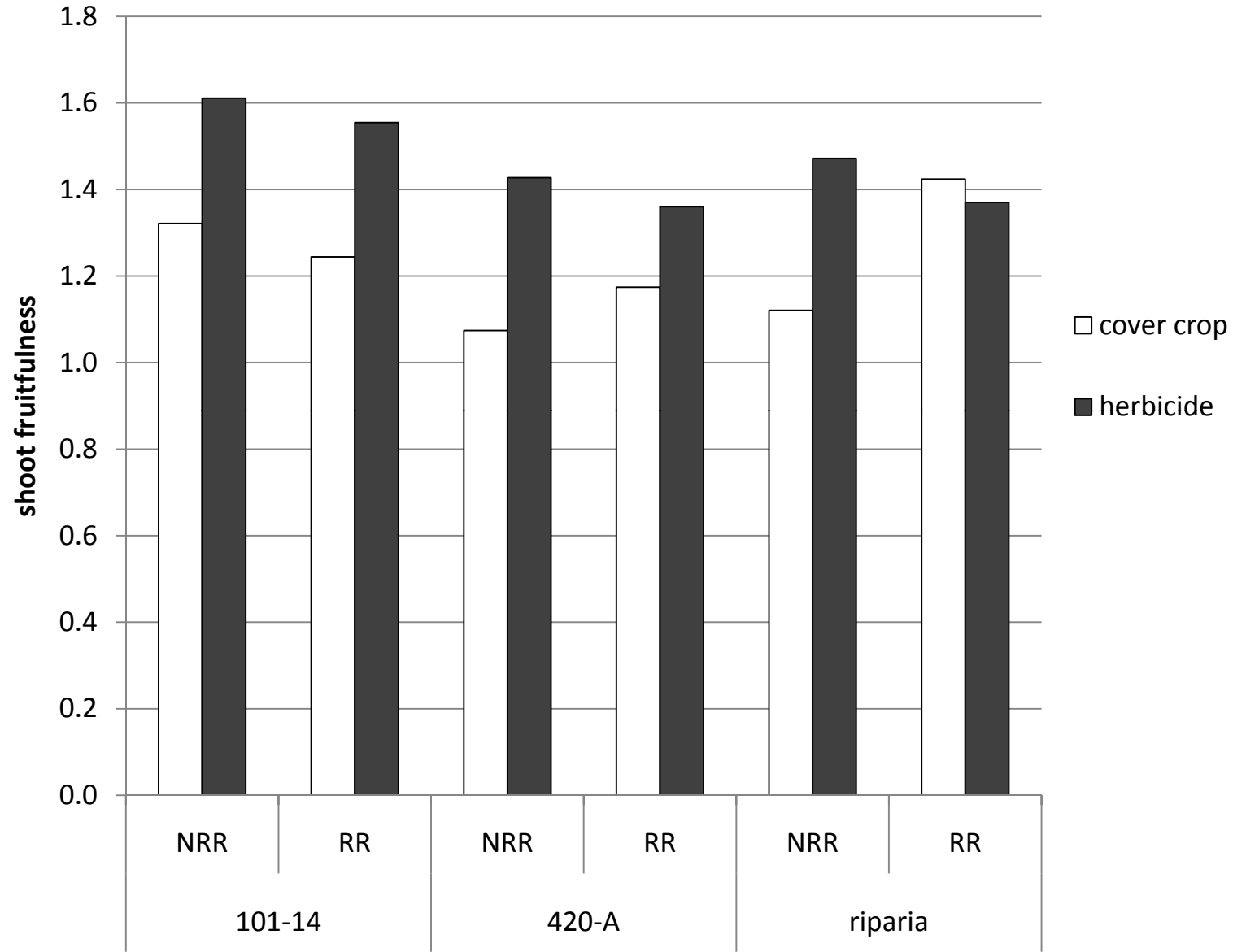


Effect	P-value
UTGC	<0.0001
Rootstock	ns
UTGC X Rootstock	ns
RM	<0.0001
UTGC X RM	<0.0001
UTGC X Rootstock X RM	ns



Effect	2008	2009
	P- Value	
UTGC	<0.0001	<0.0001
Rootstock	0.0064	0.035
Rootstock X UTGC	ns	ns
RM	<0.0001	<0.0001
RM X UTGC	<0.0001	<0.0001
RM X Rootstock X UTGC	0.0009	ns

2009



Components of yield

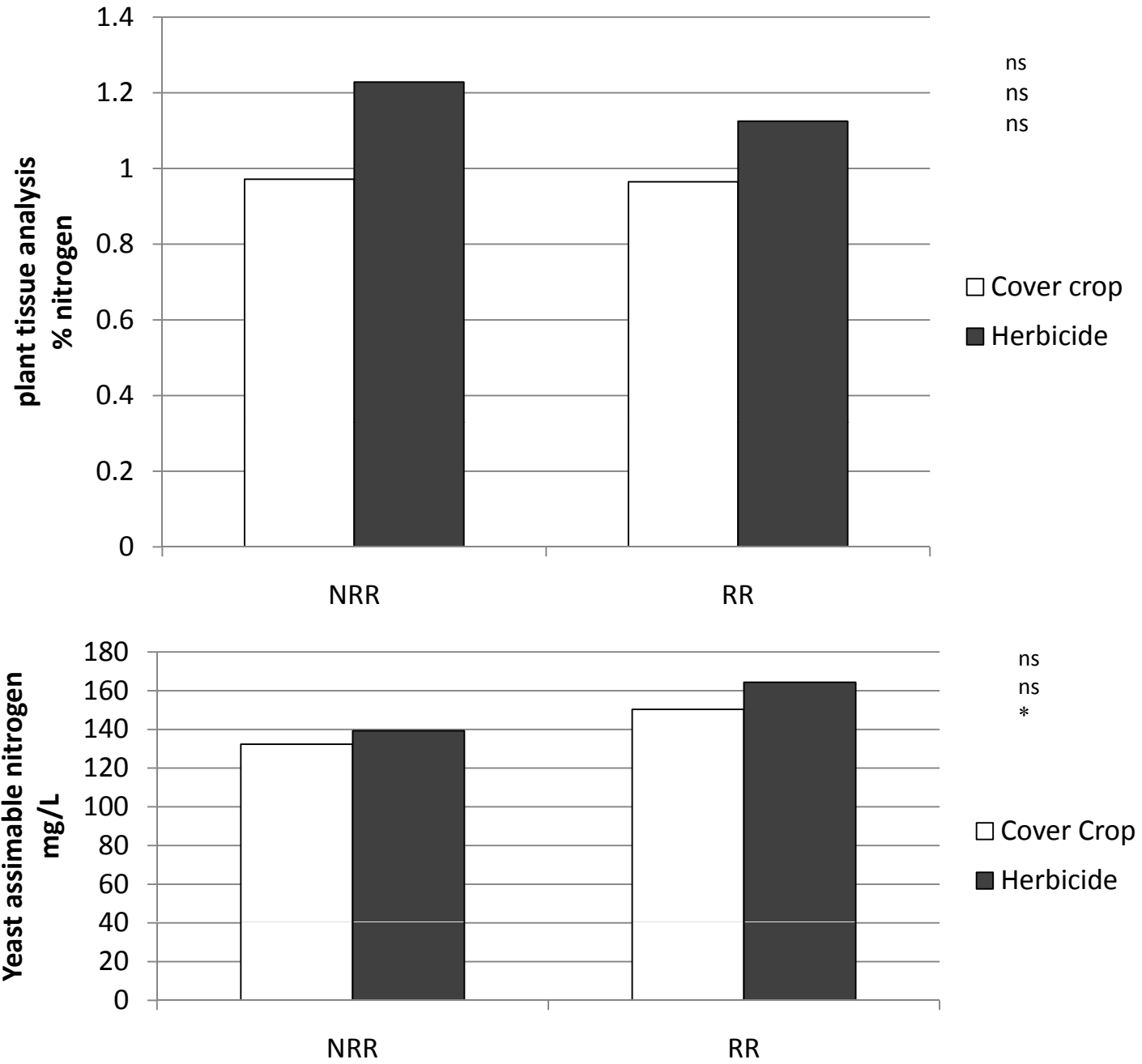
Treatment	Vine yeild (kg)		Clusters per vine		Cluster weight (g)		Berry weight (g)		Berries per cluster	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Herbicide	2.8	2.9	15	21	182	139	1.4	1.5	132	95
UTCC	1.6	1.8	14	20	108	91	1.3	1.4	85	64
101-14	1.8 a	2.1 a	14	20	127 a	102 a	1.3	1.4 a	98	73 a
420-A	2.2 a	2.2 a	15	20	142 ab	109 a	1.3	1.4 a	107	77 a
riparia	2.6 b	2.7 b	14	20	164 b	132 b	1.3	1.5 b	120	88 b
NRR	3.3	2.9	20	24	166	118	1.4	1.5	118	77
RR	1.1	1.8	9	17	124	112	1.2	1.4	99	82
Effect	p-values									
UTGC	0.0006	<0.0001	ns	ns	<0.0001	<0.0001	0.0078	0.0074	<0.0001	<0.0001
Rootstock	0.0205	0.0086	ns	ns	0.0487	0.0045	ns	0.0026	ns	0.0252
Rootstock X UTGC	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
RM	<0.0001	0.0006	<0.0001	<0.0001	0.0002	ns	0.0001	0.0003	0.002	ns
RM X UTGC	<0.0001	<0.0001	ns	0.0019	ns	ns	ns	ns	ns	ns
RM X Rootstock X UTGC	<0.0001	<0.0001	ns	ns	<0.0001	ns	ns	ns	0.0004	ns

Treatment	Brix		pH		TA (g/L)	
	2008	2009	2008	2009	2008	2009
Herbicide	22	23	3.3	3.4	6.0	6.8
UTCC	24	23	3.4	3.4	4.6	6.6
101-14	23	23	3.4	3.4	5.3	6.3
420-A	23	23	3.3	3.3	5.0	6.9
riparia	23	23	3.3	3.4	5.5	6.8
NRR	23	23	3.3	3.3	5.4	7.4
RR	23	23	3.4	3.4	5.2	6.0
Effect	p-value					
UTGC	0.0023	ns	0.015	ns	0.0162	ns
Rootstock	ns	ns	ns	ns	ns	ns
Rootstock X UTGC	ns	ns	ns	ns	ns	ns
RM	0.001	0.0044	0.035	0.0109	ns	0.0009
RM X UTGC	ns	ns	0.0353	0.0003	ns	ns
RM X Rootstock X UTGC	ns	ns	ns	ns	ns	ns

Wine Pre –fermentation chemistry

Treatment	Brix	pH	TA (g/L)	Malates (g/L)	YAN (mg/L)
Herbicide	23	3.8	4.0	3.4	152
UTCC	23	3.7	4.0	3.4	141
NRR	23	3.7	4.3	3.9	136
RR	23	3.7	3.7	3.0	157
Effect	p-values				
UTGC	ns	0.0082	ns	ns	ns
RM	ns	ns	0.0065	0.0048	0.0509
UTGC X RM	0.0035	ns	ns	0.018	ns

2009



Post-fermentation color analysis

Treatment	A ₂₈₀	A ₃₂₀	A ₄₂₀	A ₅₂₀	Color density (A)	Hue (A)
Herbicide	29	11	3	4	6	0.65
UTCC	33	12	3	5	8	0.69
NRR	28	11	3	4	7	0.69
RR	33	12	3	5	8	0.65
Effect	p-values					
UTGC	ns	ns	ns	0.0463	0.05	ns
RM	ns	ns	ns	0.0287	0.03	0.05
UTGC x RM	ns	ns	ns	ns	ns	ns

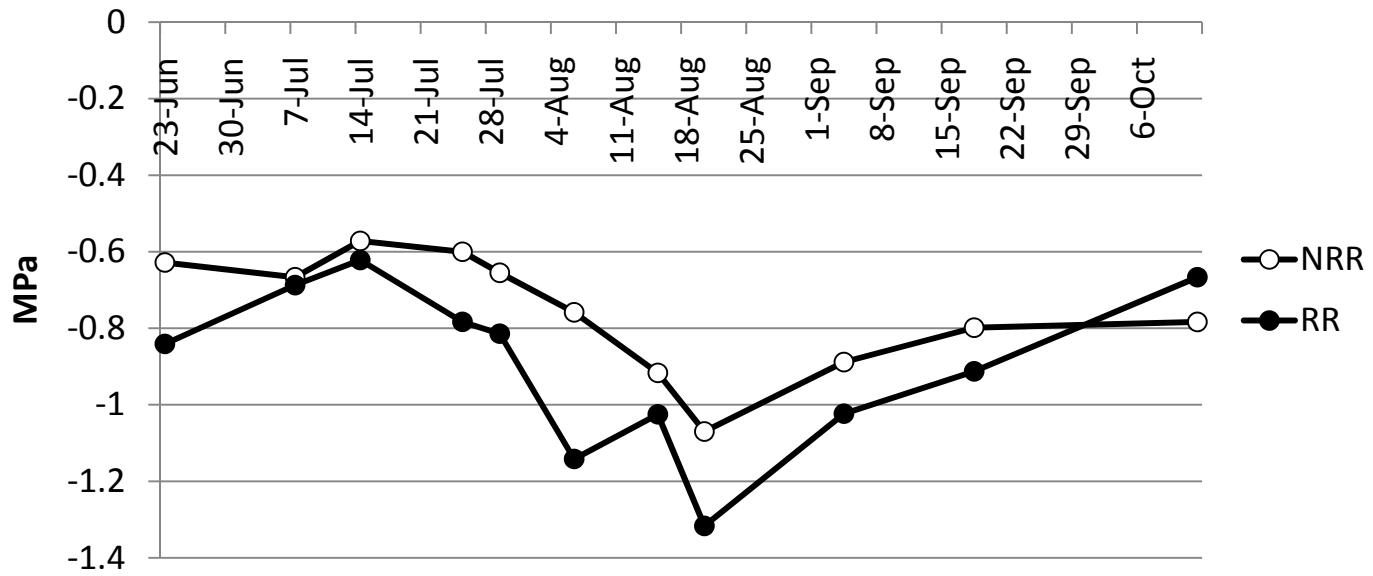
Water potential (ψ)

- Tension is caused by leaf transpiration and conducted throughout the plant to the root surface where water is drawn out of the soil, like tension pulled on a rope
- More negative value – more water stress

2008

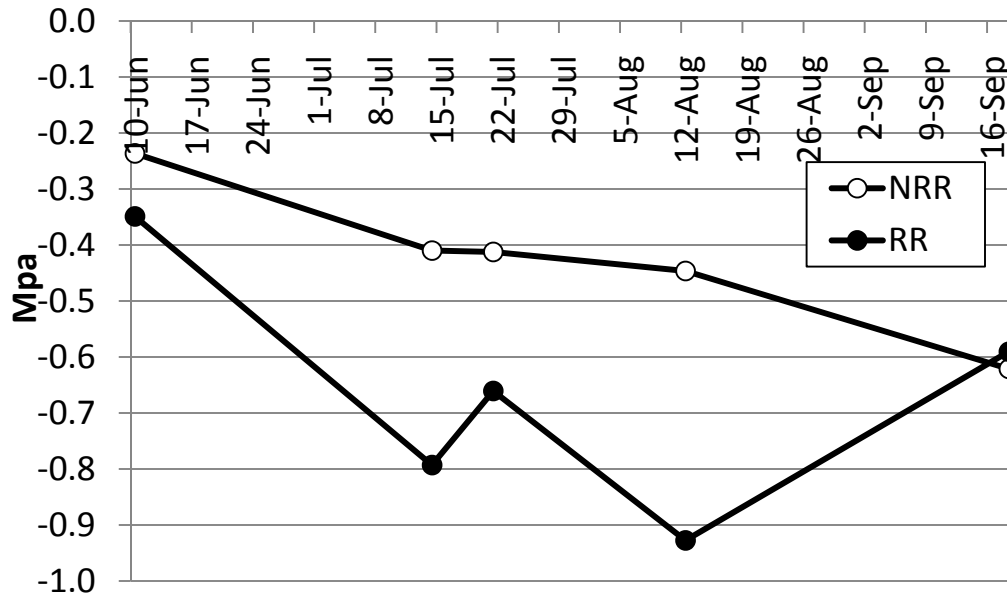
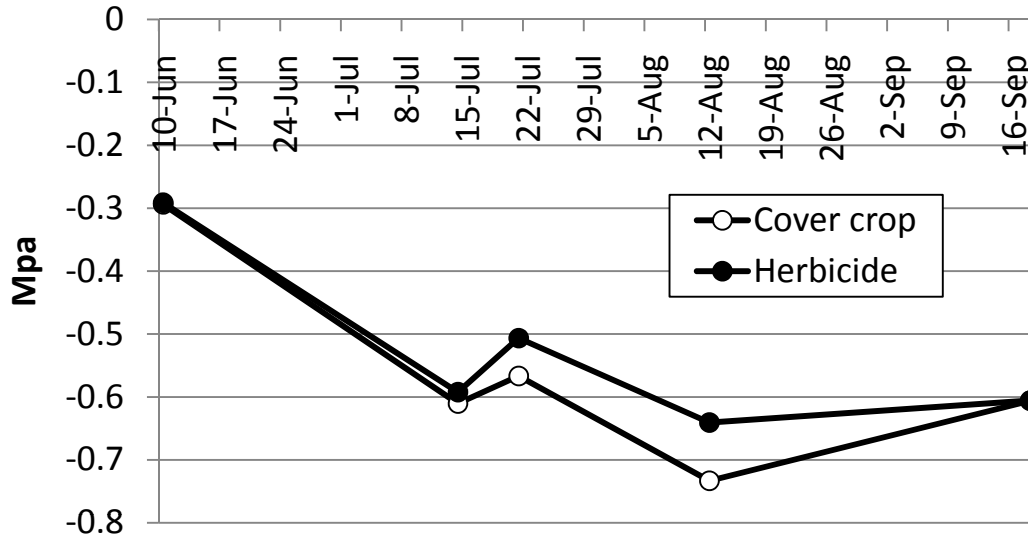
2008

Ψ_{leaf}



2009

Ψ_{stem}



Results

- Cover crop
 - Reduce vegetative growth
 - Reduce crop level
 - Reduce fruitfulness
 - Increase color
- Rootstock (riparia)
 - Reduce vegetative growth
 - Increase crop level

Results

- Root restriction
 - Reduce vegetative growth
 - Reduce crop level
 - Increase color
 - Decrease malic acid

Viticulture

- Less vegetative growth
 - Low input canopy management
 - Less disease pressure
- Crop level
- Winter hardiness
- Nutrient management over time
- Treatment function - duration

Wine quality

- Berry weight
- Acidity
- Color