



**AGRONOMY AND HORTICULTURE**

*Institute of Agriculture and Natural Resources*

# REPLACING HERBICIDES WITH GROUNDCOVERS IN THE VINEYARD

Benjamin A. Loseke

**Special Thanks to:** Dr. Paul Read, Dr. Ellen Papparozzi, Dr. Erin Blankenship, Dr. Chuck Francis, Dr. Brian Wardlow, Steve Gamet, Eric Nelson, Scott Dvorak, Dave Stock and Mike Fritz

# Benefits of using groundcovers in the vineyard

- Reduced herbicide usage
- Reduced erosion
- Increased soil fertility, water holding capacity and structure
- Reduced soil compaction
- Increased Biodiversity
- Regulate vine growth
- Improved air and water quality
- Nitrogen fixation

# Project objectives

- How do 4 different groundcover mixes planted in the alleyways and in rows compete with newly planted vines for water?
- Do groundcovers established simultaneously with vineyard planting have negative effects on vine growth?
- What impact do groundcovers have on vine growth, bud break, fruit quality and wine quality?
- How quickly do the groundcovers establish?
- Can Infrared thermography (IRT) be used to assess grapevine water status using the crop water stress index (CWSI)?
- Will a thermal camera affordable to a grower be sensitive enough to measure water stress?
- Do beneficial insect populations increase as a result?

# BEGINNING OF PROJECT



		Water Source		400'																										ROW
Treatment 1	Western Yarrow, Birdsfoot Trefoil, Dutch Clover	Plant Number																								1				
Treatment 2	Hard Fescue, Sheep Fescue, Sideoats Grama, Buffalograss, Blue Grama	52 51 50 49	48 47 46 45 44 43	42 41 40 39 38 37	36 35 34 33 32 31	30 29 28 27 26 25	24 23 22 21 20 19	18 17 16 15 14 13	12 11 10 9 8 7	6 5 4 3 2 1	1																			
Treatment 3	KY Bluegrass, White Clover, Red Fescue, Hard Fescue, Chewing Fescue, P Rye	54 53 52 51 50 49	48 47 46 45 44 43	42 41 40 39 38 37	36 35 34 33 32 31	30 29 28 27 26 25	24 23 22 21 20 19	18 17 16 15 14 13	12 11 10 9 8 7	6 5 4 3 2 1	2 Block 1																			
Treatment 4	Texoka Buffalograss	54 53 52 51 50 49	48 47 46 45 44 43	42 41 40 39 38 37	36 35 34 33 32 31	30 29 28 27 26 25	24 23 22 21 20 19	18 17 16 15 14 13	12 11 10 9 8 7	6 5 4 3 2 1	3																			
Treatment 5	Weed Free	56 55	54 53 52 51 50 49	48 47 46 45 44 43	42 41 40 39 38 37	36 35 34 33 32 31	30 29 28 27 26 25	24 23 22 21 20 19	18 17 16 15 14 13	12 11 10 9 8 7	6 5 4 3 2 1	4																		
Treatment 6	Control	58 57 56 55	54 53 52 51 50 49	48 47 46 45 44 43	42 41 40 39 38 37	36 35 34 33 32 31	30 29 28 27 26 25	24 23 22 21 20 19	18 17 16 15 14 13	12 11 10 9 8 7	6 5 4 3 2 1	5																		
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# Vineyard establishment









# Irrigation



# Groundcover Planting





# Germination



# Establishment



# Where we didn't plant Groundcovers



# Groundcover Treatments

- Treatment 1 – Roadside Mix (Stock Seed Farms)
- Western Yarrow, Birdsfoot Trefoil, Dutch Clover



# Groundcover Treatments

- Treatment 2 – Custom Native Grass Mix
- Hard Fescue, Sheeps Fescue, Sideoats Grama, Buffalograss, Blue Grama





# Groundcover Treatments

- Treatment 3 – Vineyard/Orchard Mix (Stock Seed Farms)
- KY Bluegrass, White Clover, Red Fescue, Hard Fescue, Chewings Fescue, P Rye



# Groundcover Treatments

- Treatment 4
- Texoka Buffalograss



# Groundcover Treatments

- Control
- Natural Vegetation + Weed Free Strip Beneath Vines

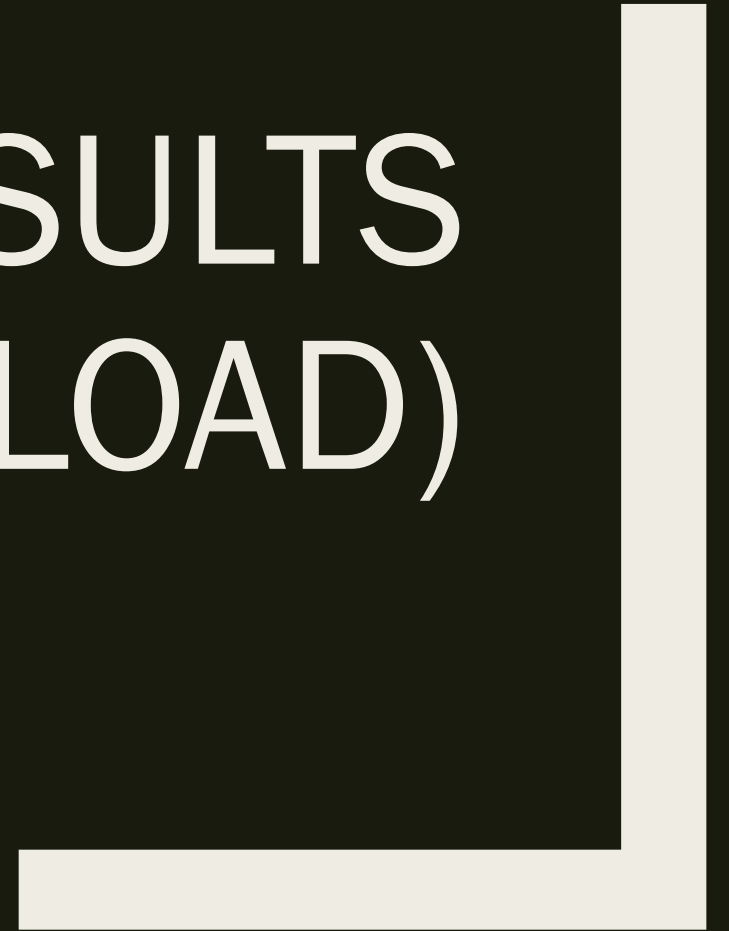


# Data Collected – 2014, 2015, 2016

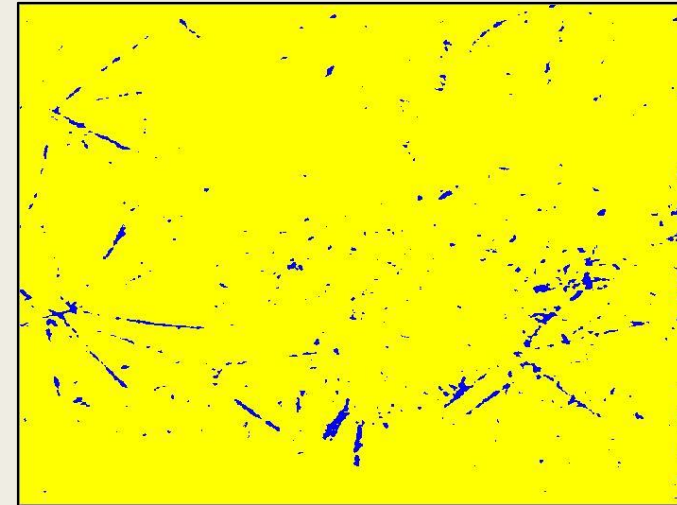
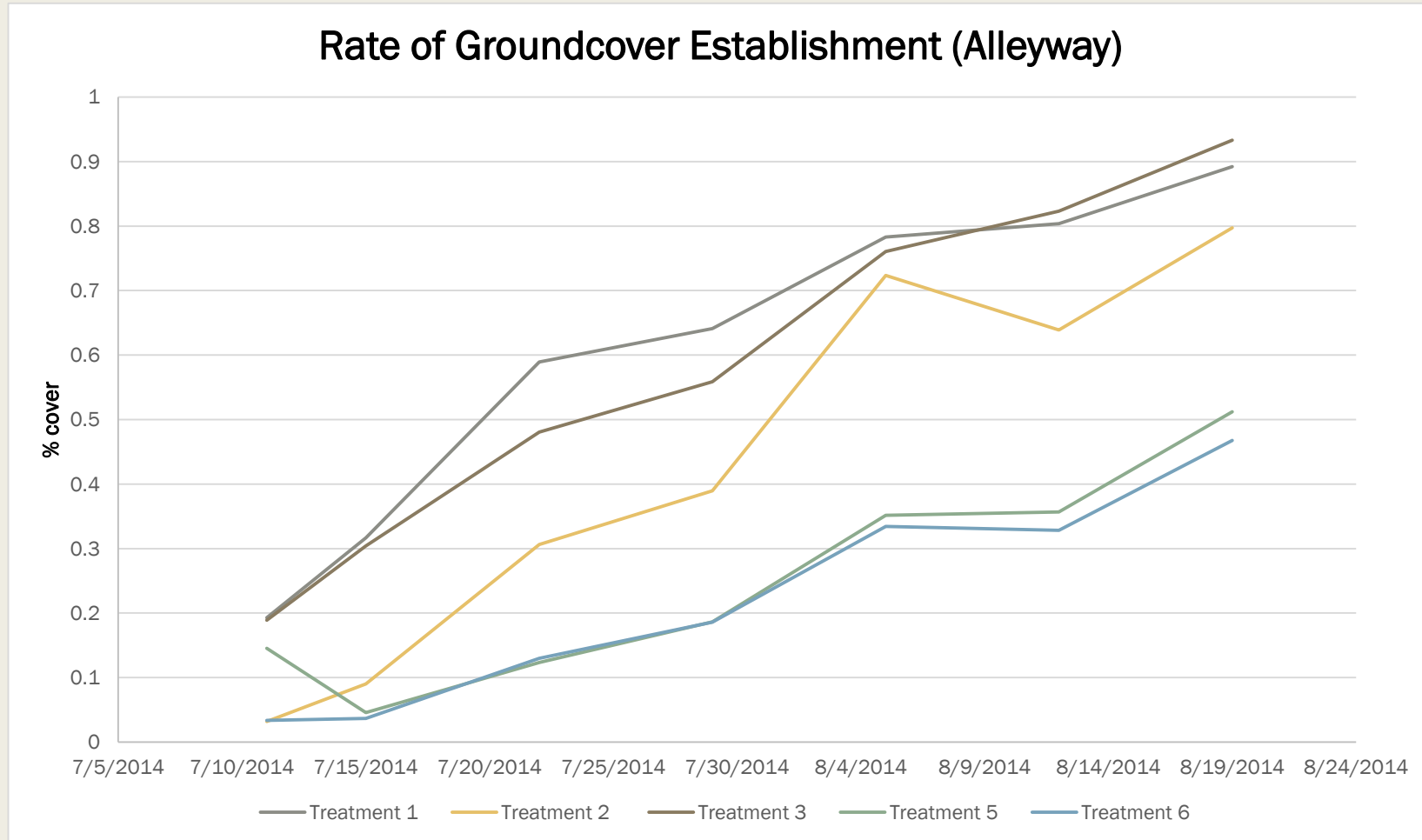
- Soil Samples (all years)
- Groundcover Rate of Establishment (2014)
- Vine Length (2014)
- Pruning Weights (2015 & 2016)
- Leaf Water Potential, i.e. Plant Water Status (2015, 2016)
- Crop Water Stress Index (2015, 2016)
  - Leaf temperature
  - Irradiance
  - Ambient air temperature
  - Wind speed
  - Relative humidity
- Bud Break (2016)
- Harvest Data (2016)



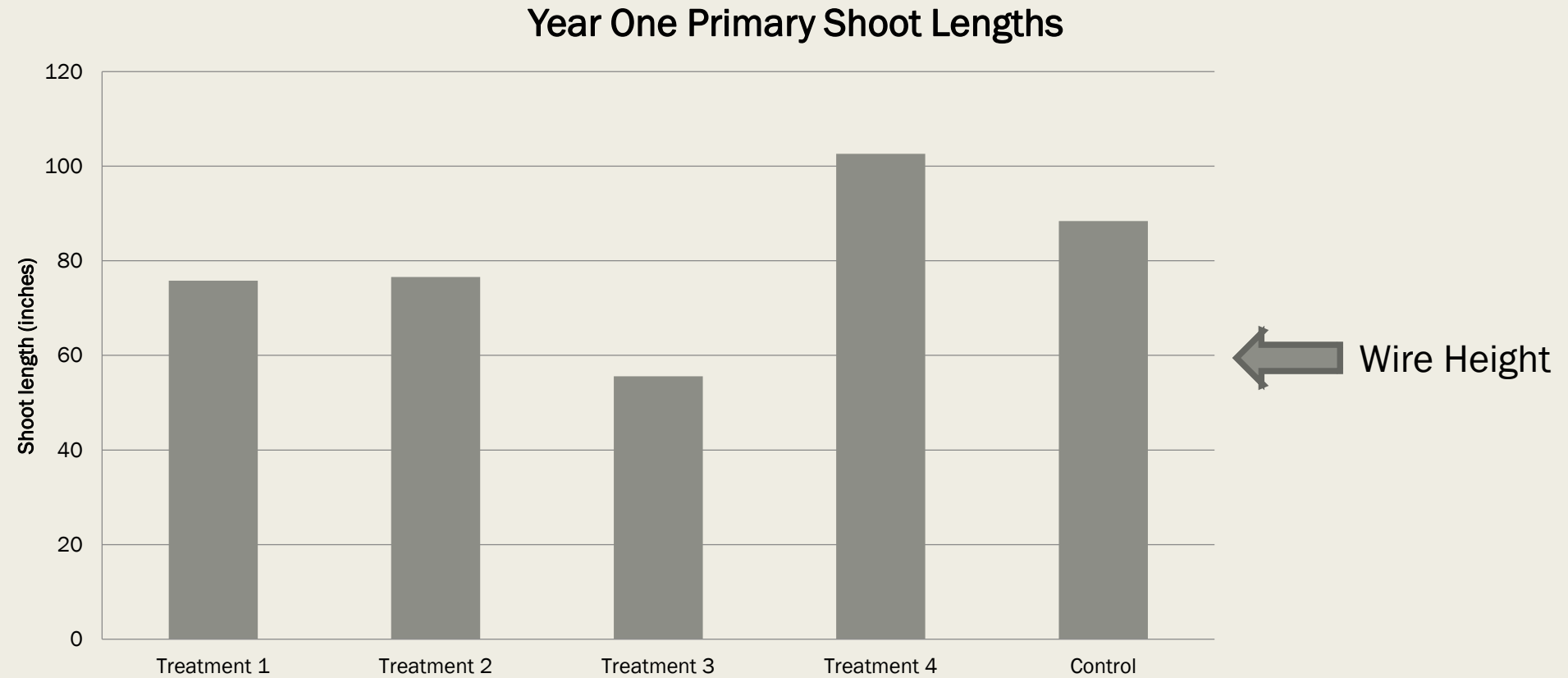
# RESULTS (DATA OVERLOAD)



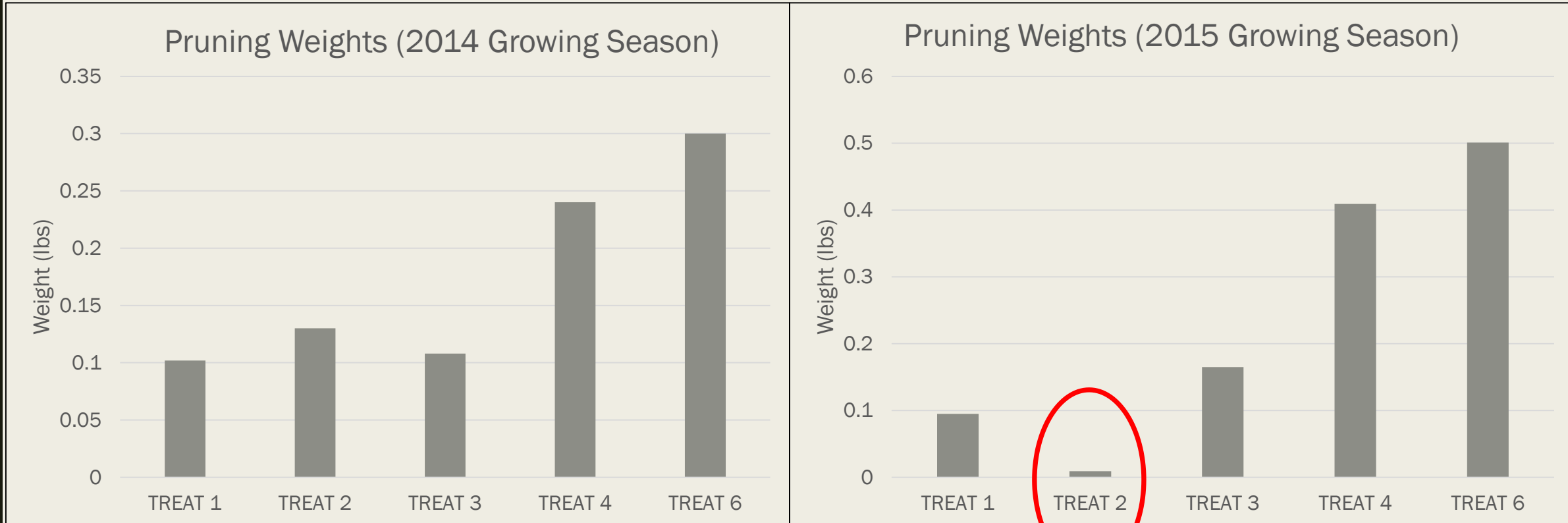
# Rate of GC establishment (2014)



# Shoot Lengths (2014)



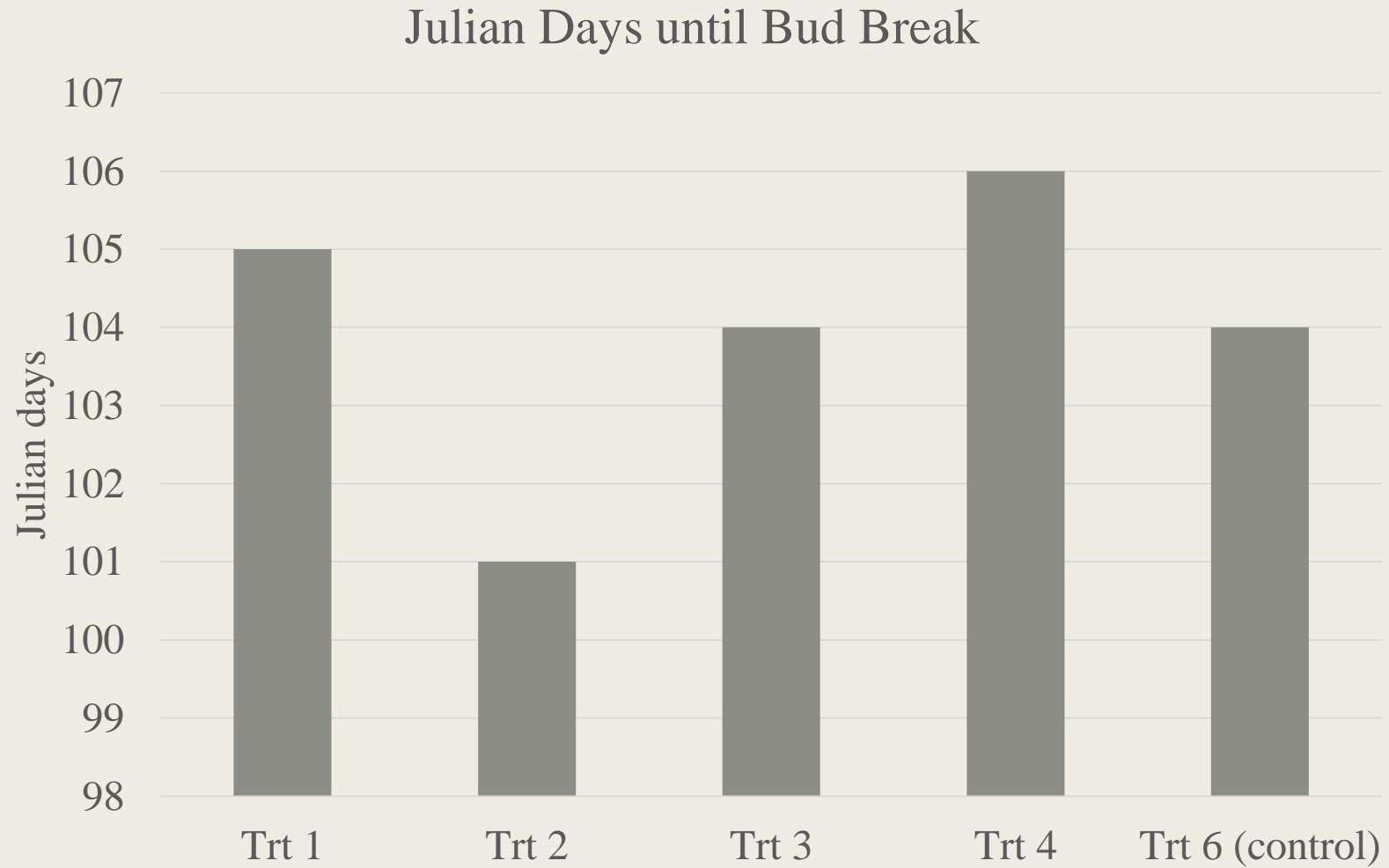
# Pruning weights 2014 & 2015



???

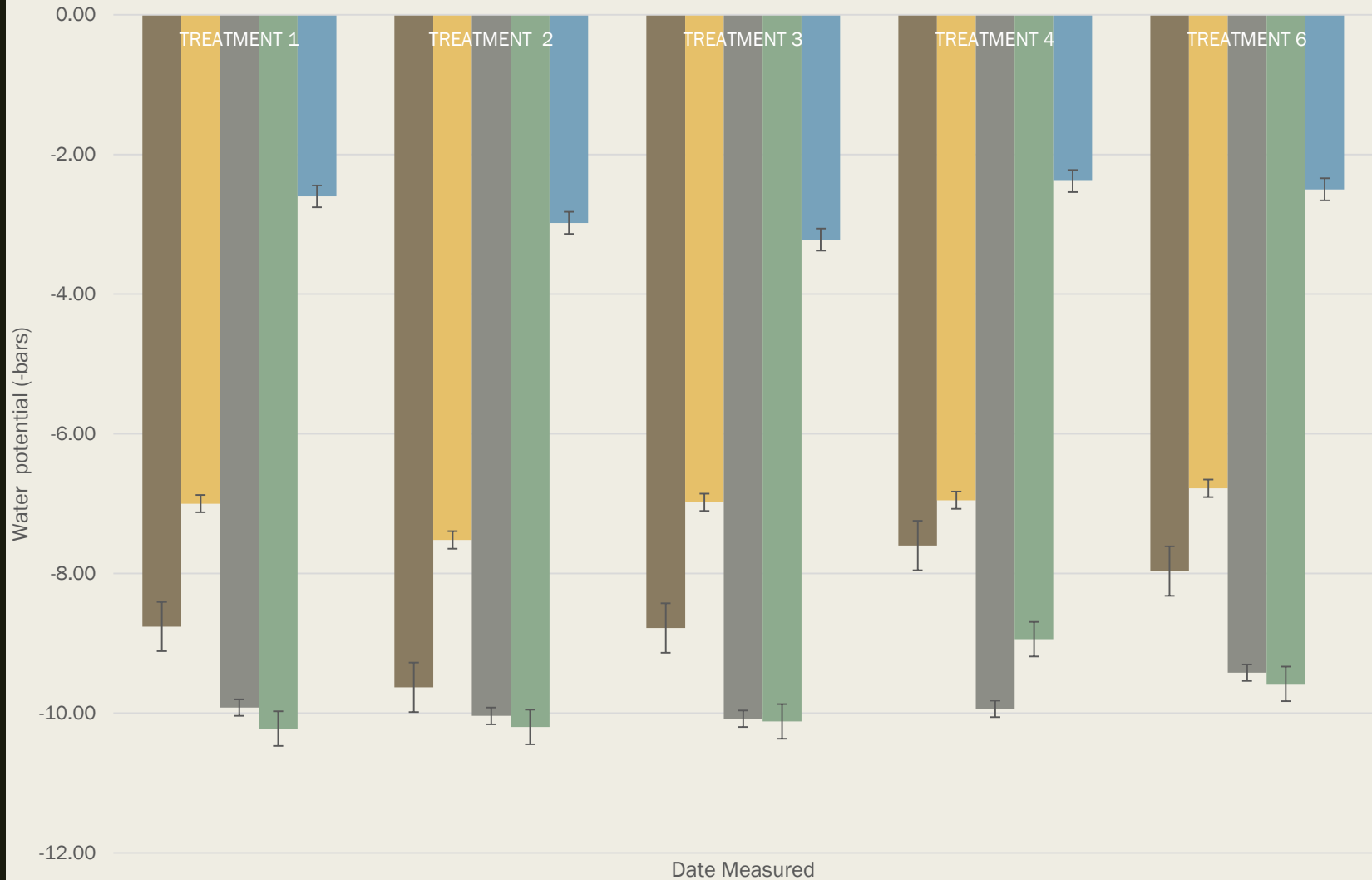


# Date of Bud Break (2016)



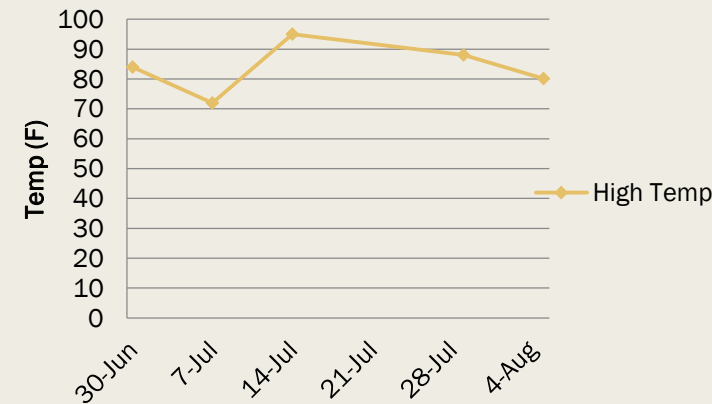
# Water Competition Summer 2015

Mean Leaf Water Potential of all Reps on Each Collection Date



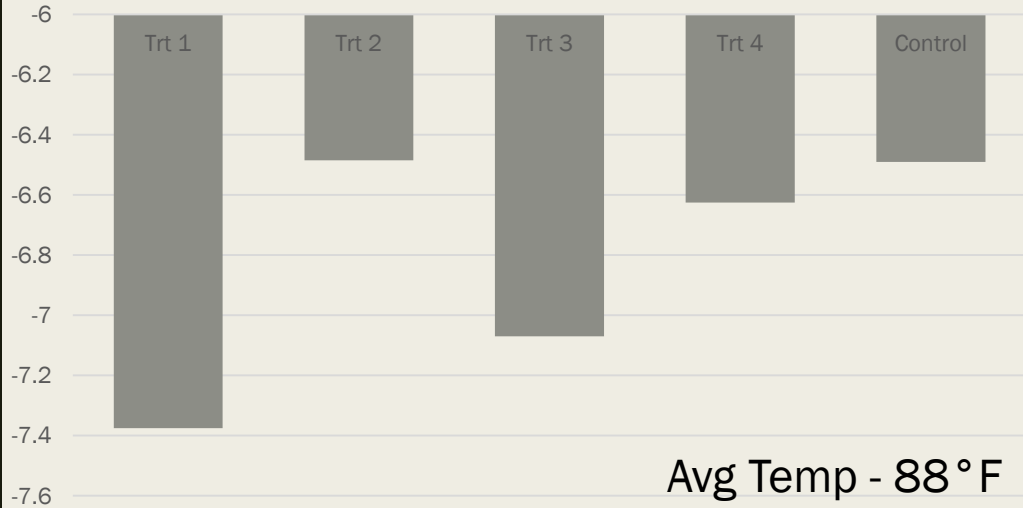
- 30-Jun
- 7-Jul
- 17-Jul
- 29-Jul
- 5-Aug

## High Temp

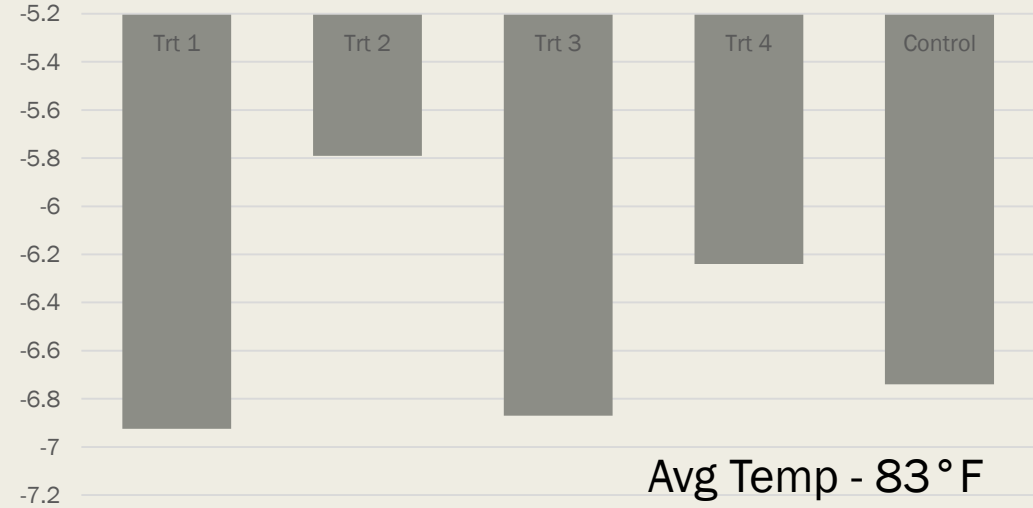


# Water Competition Summer 2016

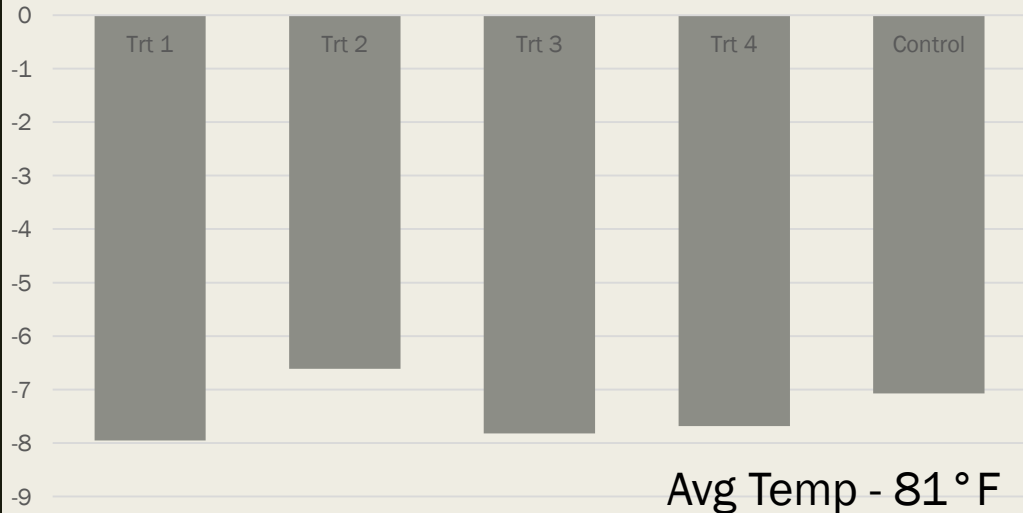
Mean Leaf Water Potential 07/06/2016



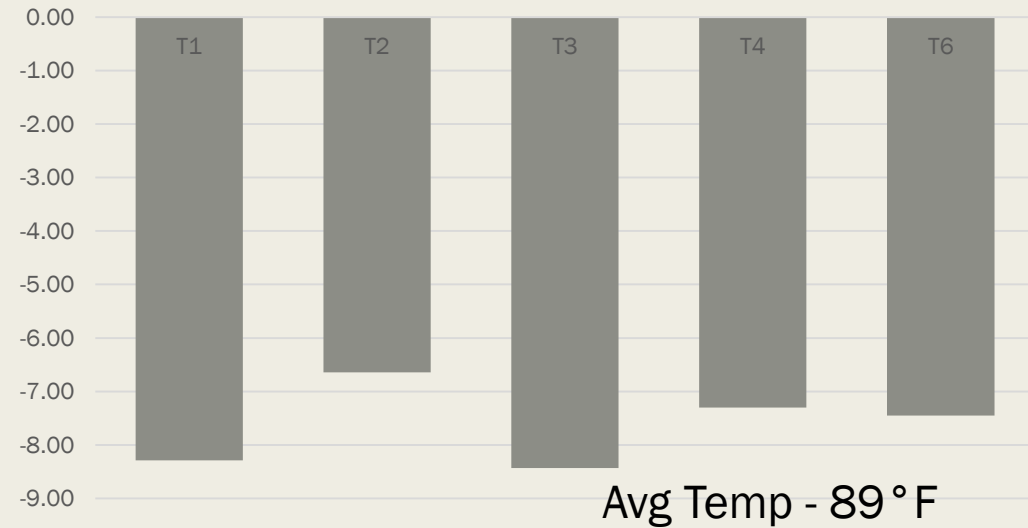
Mean Leaf Water Potential 07/12/2016



Mean Leaf Water Potential 08/01/2016

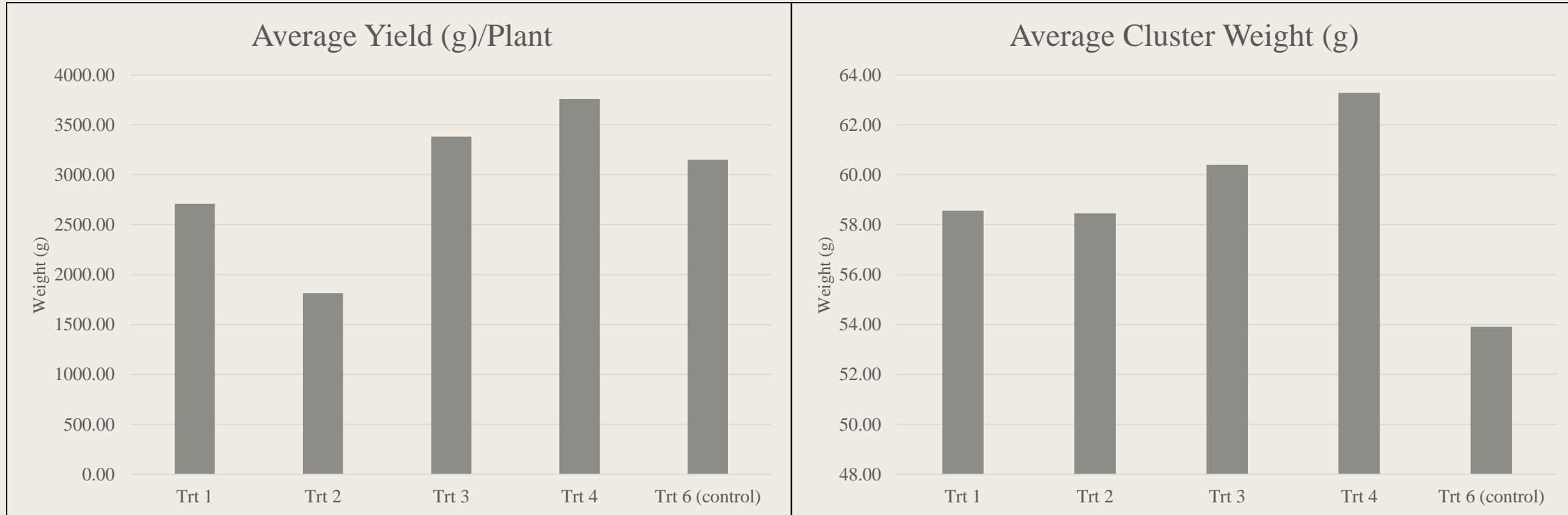


Mean Leaf Water Potential 08/10/2016



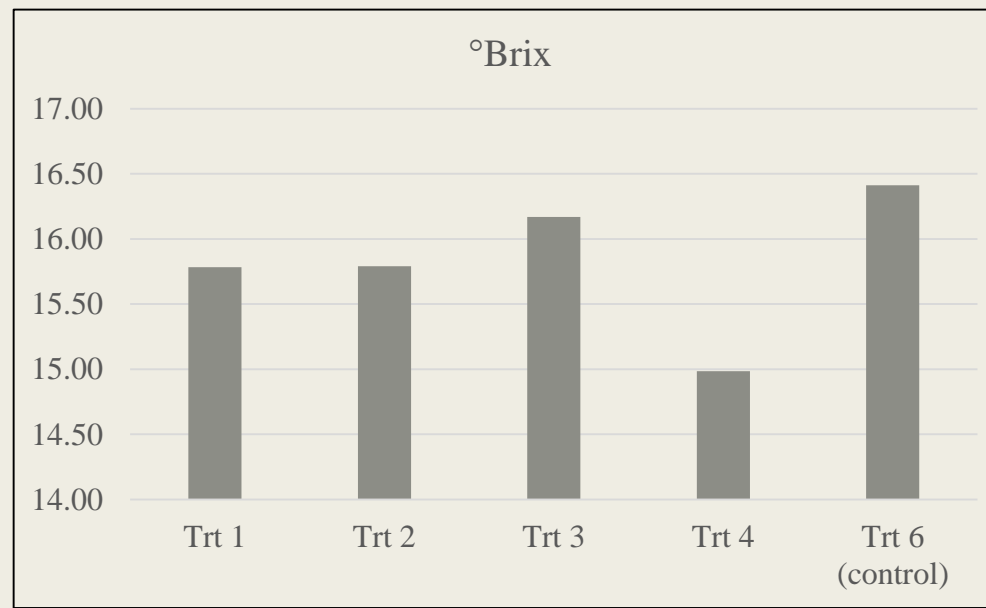
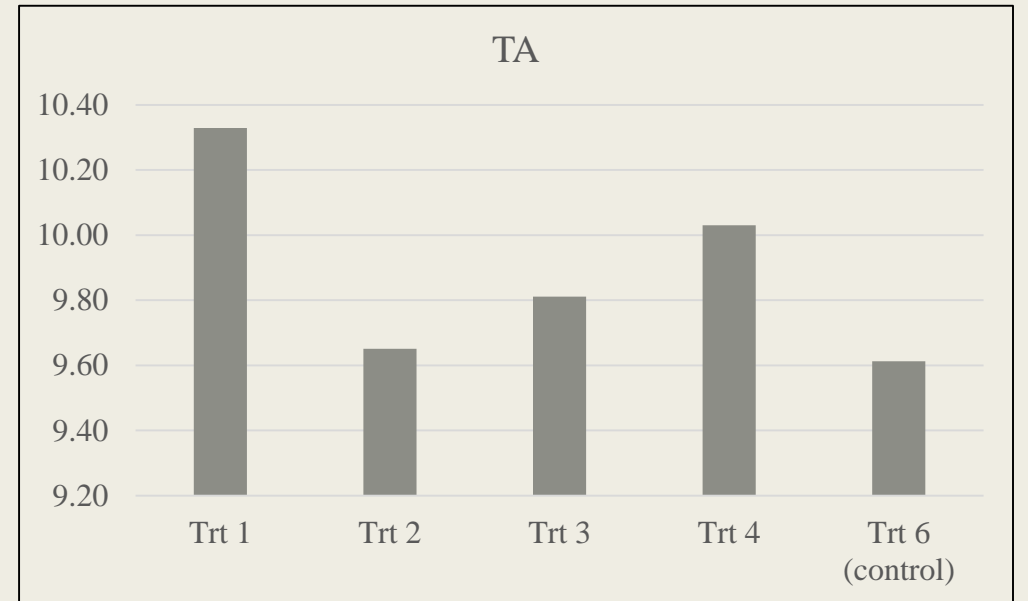
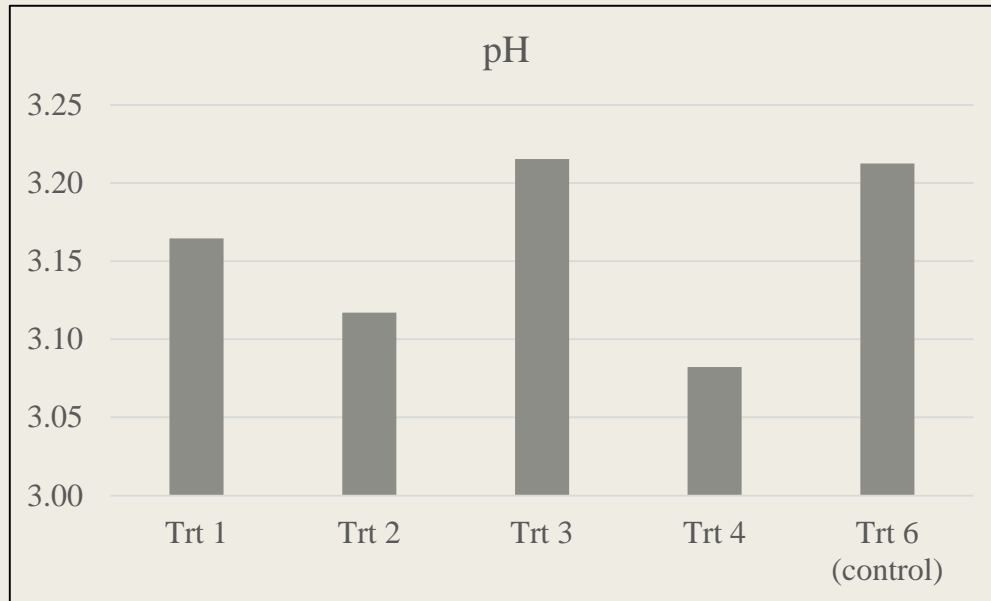


# Harvest Results (2016)



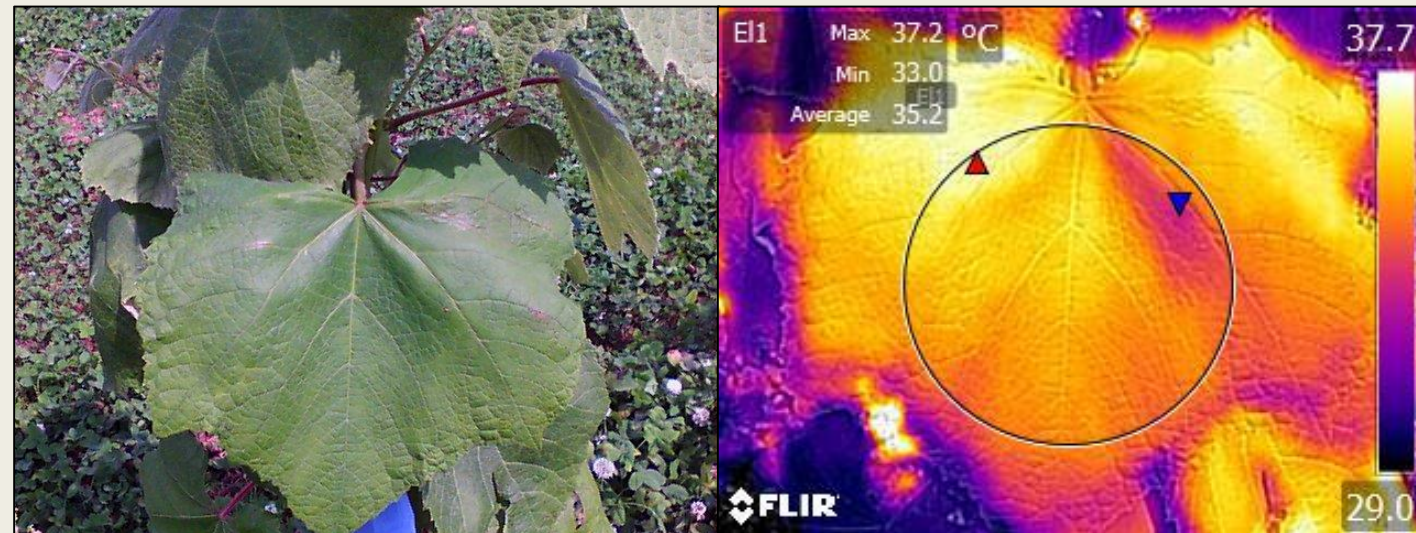
Harvest Caveat: Estimated 50% Crop Loss from Herbicide Drift

# Harvest Results (2016)

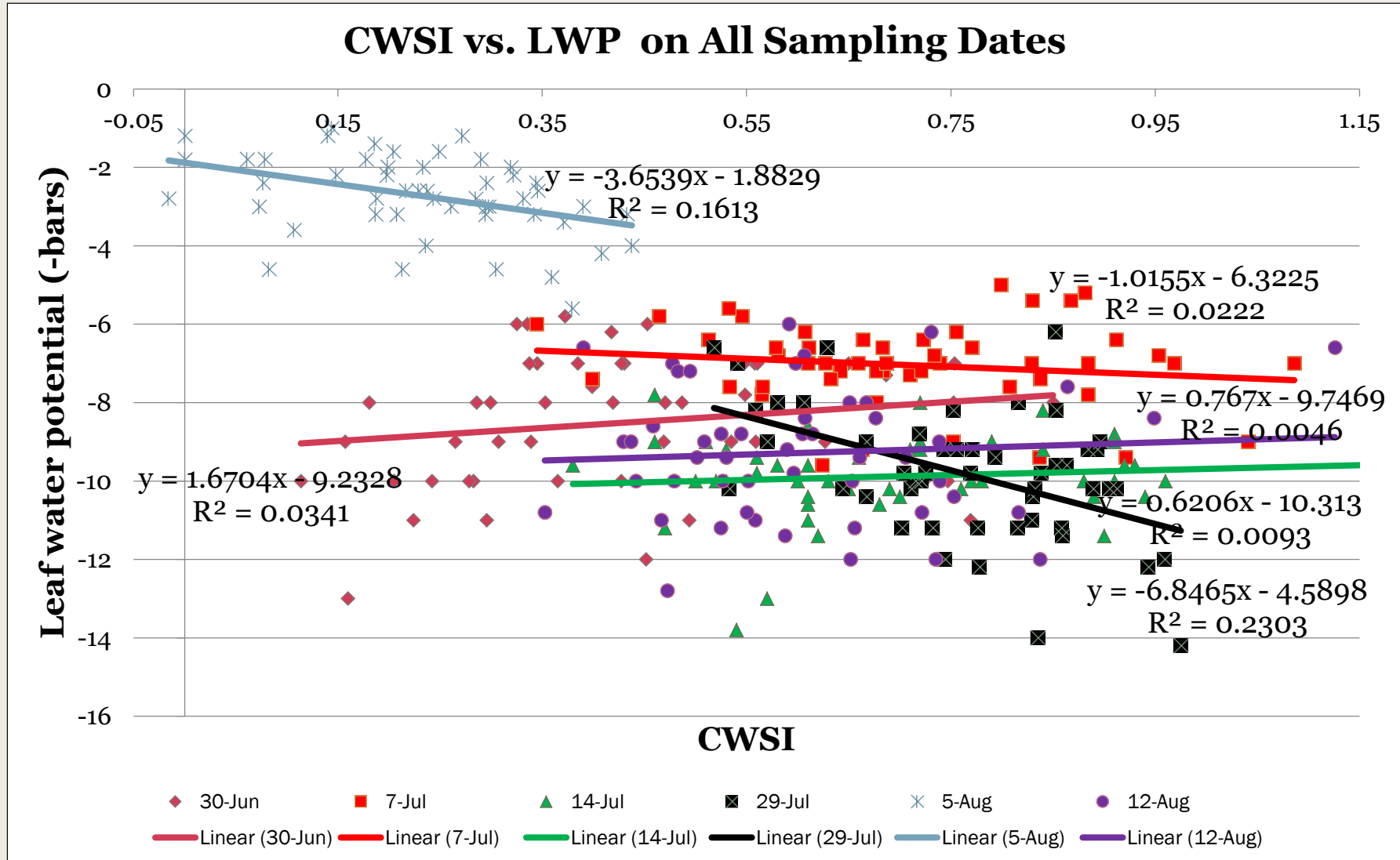


# Infrared Thermography

- Idea: as plants begin to become water stressed their leaf temperature will increase as stomata close and transpiration slows
- Thermal cameras are able to detect this change
- Using the leaf temperature we can plug the values into the crop water stress index (CWSI) for a standard water stress level between 0 and 1



# LWP and CWSI Correlation







<https://www.youtube.com/watch?v=bqpAk30HDe4>



# Preliminary\* Recommendations

- Results suggest planting groundcovers in year 2 after vines have had one year to establish
- Groundcovers should be taken care of as if they provided economic value to the vineyard (i.e. irrigation, fertilization, etc.)
- Native grass groundcovers appear to stress the vines the most
- **Final Recommendation: TO ENHANCE VINEYARD SUSTAINABILITY, PLANT SOMETHING!**

# Questions

