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## Abstract

- Saline-sodic soils are a serious problem for grapevines in the San Joaquin Valley (SJV). Alleviation of salt-related problems is of crucial importance to increase soil health. For this purpose, the soil can be treated with calcium-based soil amendments.
- The objective of this study is to monitor the response of the soil physics, grapevine physiology, and fruit composition to different dosages and forms of  $\text{CaSO}_4$  (anhydrite,  $\text{CaSO}_4$  & gypsum  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) in synergy with organic matter (biosolids). The experiment has been performed for two years, 2020 & 2021, in a Merlot vineyard located in a sodic soil of the Bakersfield area. The experimental design is a completely randomized block design with six treatments replicated four times and broadcasted in winter 2020 (2.5 t/ac Gypsum, 5.1 t/ac Gypsum, 10.2 t/ac Gypsum, 5.1 t/ac Anhydrite, and 5.1 t/ac Gypsum + biosolids, and Control with no application) after a first season of measurements to ensure no prior differences across treatments.
- The response of vineyard to treatments was monitored by comparing effects of treatments on the soil and the plants through a comprehensive set of proximal and remotely sensed measurements. The results from the study will help the SJV growers to get the best reclamation practices for their vineyards.

## Scope

- Develop scientific knowledge about the response of grapevine to soil reclamation by calcium-based soil amendments in a sodic soil of Southern SJV of California.
- Develop guidelines for SJV growers about optimum doses and forms of  $\text{CaSO}_4$  for effective management of salt stress and soil health.

## Methodology

Table 1. Scheme of applied treatments

$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ – doses experiment	$\text{CaSO}_4$ - form experiment
Control, with no gypsum application	Control, with no gypsum application
Gypsum at 2.5 t/acre	Gypsum at 5.1 t/acre
Gypsum at 5.1 t/acre	Gypsum at 5.1t/acre + 2 t/acre compost
Gypsum at 10.2 t/acre	Anhydrite at 5.1 t/acre

## Materials & Methods

### Soil physical-chemical measurements:

- Soil samples were taken twice a year to measure chemical measurements including total dissolved solids, pH, EC, SAR.
- Physical measurements twice a year such as bulk density, particle density, infiltration rate, soil porosity etc.

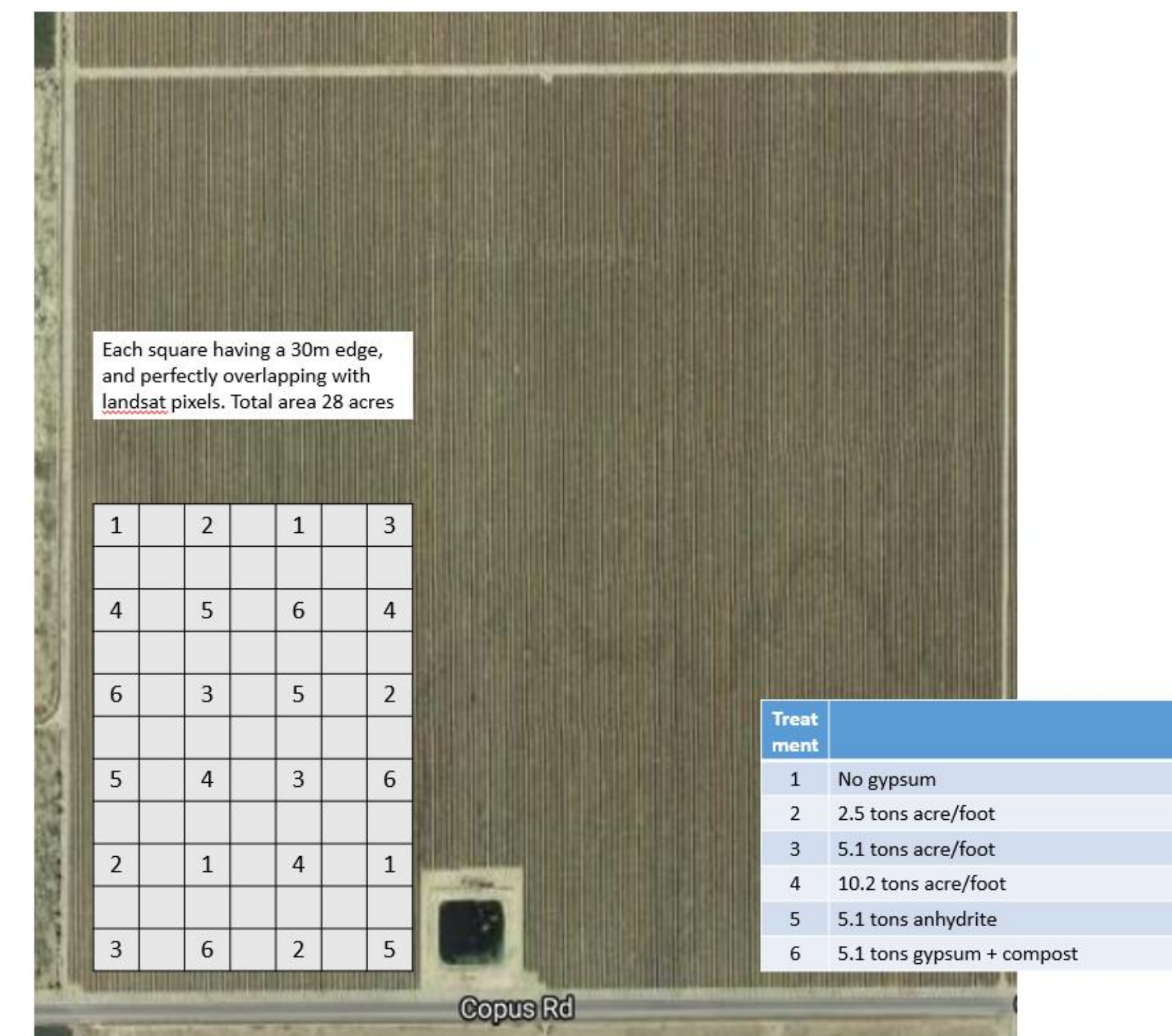


Fig.1: Map of experimental design. Each square is 30x30m, overlaps with Landsat 8 pixels. Total area is 17 acres.

### Plant measurements:

- Plant water status was assessed by taking stem water potential measurements and leaf gas exchange measurements.
- Photosynthetic carbon isotope discrimination and yield components were assessed at time of harvest.
- Total Soluble Solids (TSS), juice pH and titratable acidity (TA) were measured from one hundred random grape berries collected weekly from veraison to harvest. Grape skin flavonoids were measured through HPLC.

### Landsat8 imagery:

Satellite images were taken from Landsat 8 to find the correlation with in-field measurements, measured contemporary.



Fig. 2 (left): field measurements.  
Fig. 3 (right) effect of sodicity on plant and soil

## Results

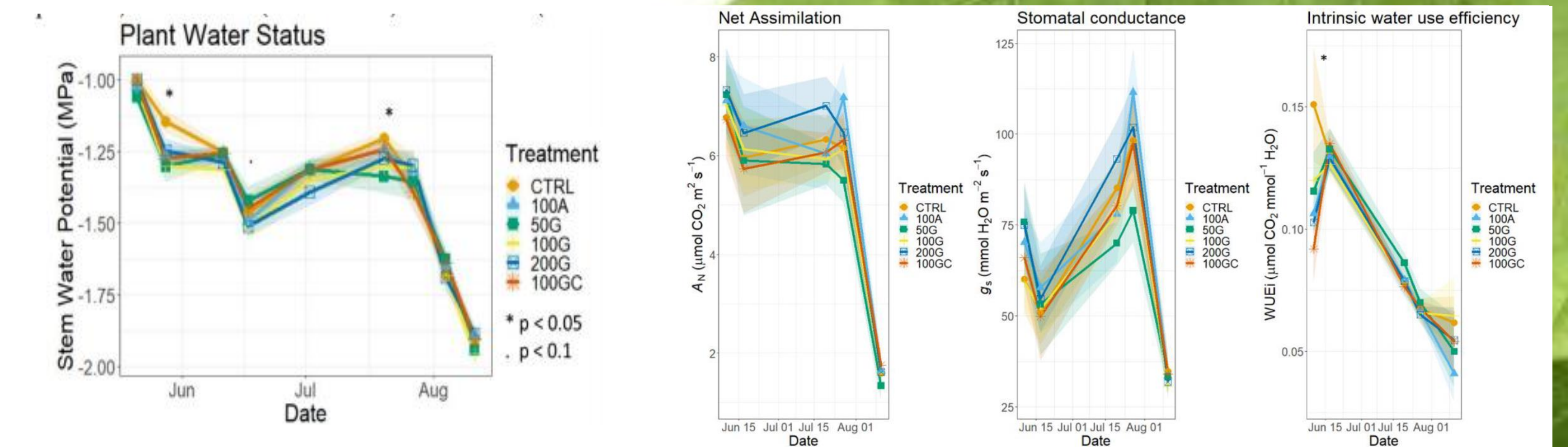


Fig.4. Trends of  $\psi_{stem}$ ,  $A_n$ ,  $g_s$ , and WUE during first season after treatment application. No major significant differences appear.

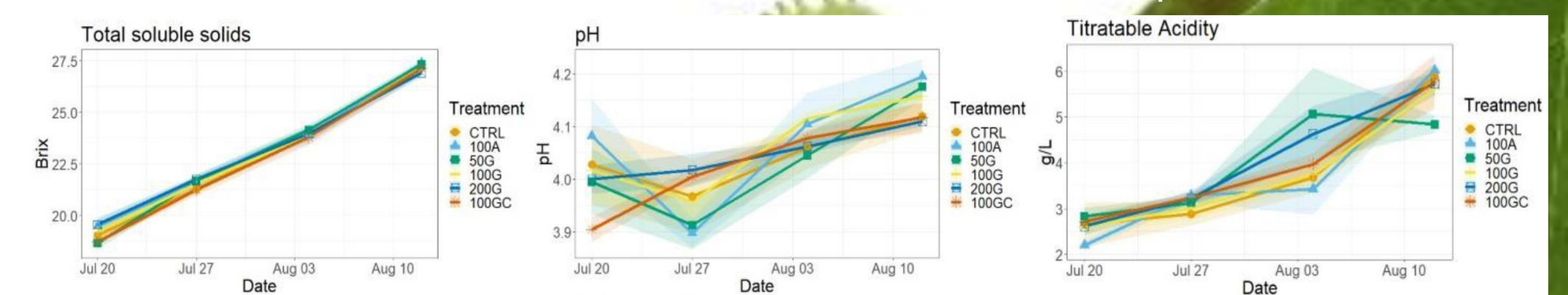


Fig.5. Trends of Total Soluble Solids, pH and Titratable acidity in grape juice, 2020 season

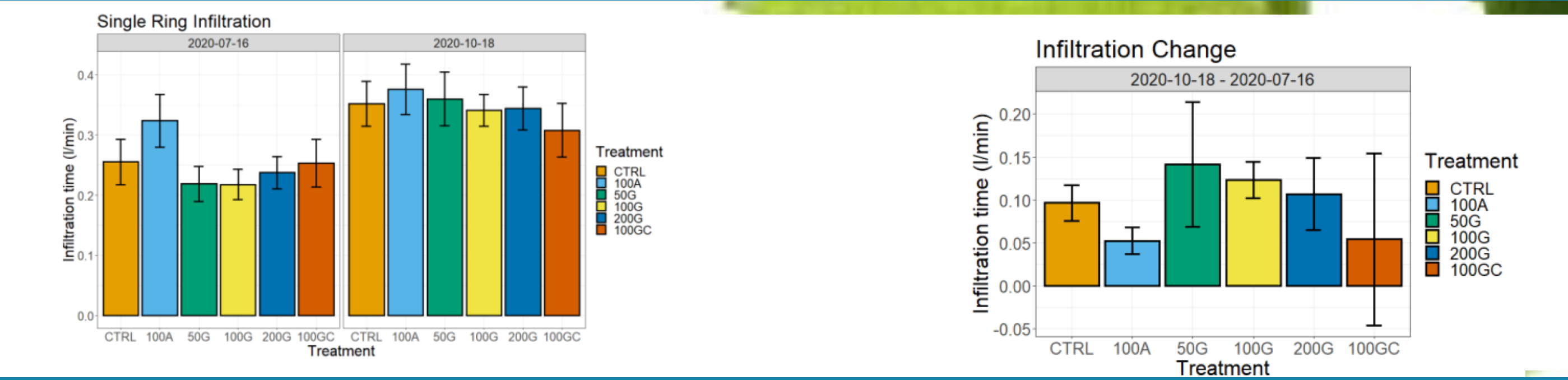


Fig.6. Single ring Infiltration in 2020

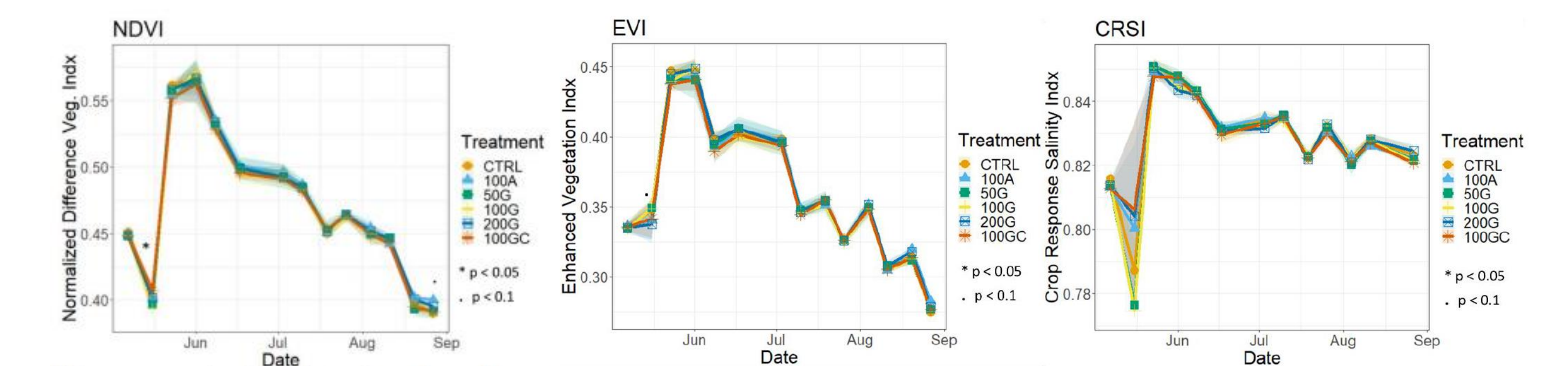


Fig.7. NDVI, Normalized Difference Vegetation Index, EVI, Enhanced Vegetation Index & CRSI, Crop Response to Salinity Index in 2020 from Landsat8

## Conclusion

Biweekly measurements of stem water potential and leaf gas-exchange showed moderate to severe water stress but did not evidence significant differences across treatments in plant water status, carbon assimilation, stomatal conductance, or water use efficiency. Treatments had similar values in grape soluble solids, pH, titratable acidity, or the anthocyanin profile. Yield was higher in the 10.2 t/ac gypsum and the 5.1 t/ac gypsum + compost. For vegetation indices measured from Landsat 8, the Normalized Difference Vegetation Index decreased during the season with canopy becoming older.

We expect more differences across treatments to manifest in year two as the reaction of soil amendments in the soil is a slow process.