VRDI

Variable Rate Drip Irrigation

The next generation of drip irrigation

Vineyard conference, Katzrin 2.2017

Dr. Itamar Nadav, Netafim R&D

NETAFIM™

Uniform application

- Applying the same rate (amount) across the field
- Over/under applications
- Low application efficiency (high costs)

Variable rate application

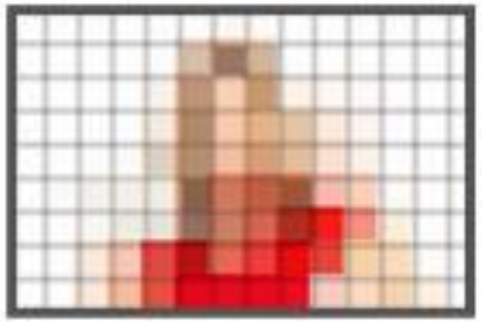
- Applying different rates (amounts) across the field
- Adequate application for each zone
- high application efficiency (lower costs)

VARIABLE RATE APPLICATIONS

- Fertilizers
- Pesticides
- Herbicides
- Tillage
- Seedling
- Irrigation

Management zones

WHAT'S IN THE PICTURE?



Lesson of the day: **higher resolution is better!**

OBJECTIVES

- VRDI aims to eliminate/reduce spatial variability
- Variability in yield
- Variability in quality

Causes for variability:

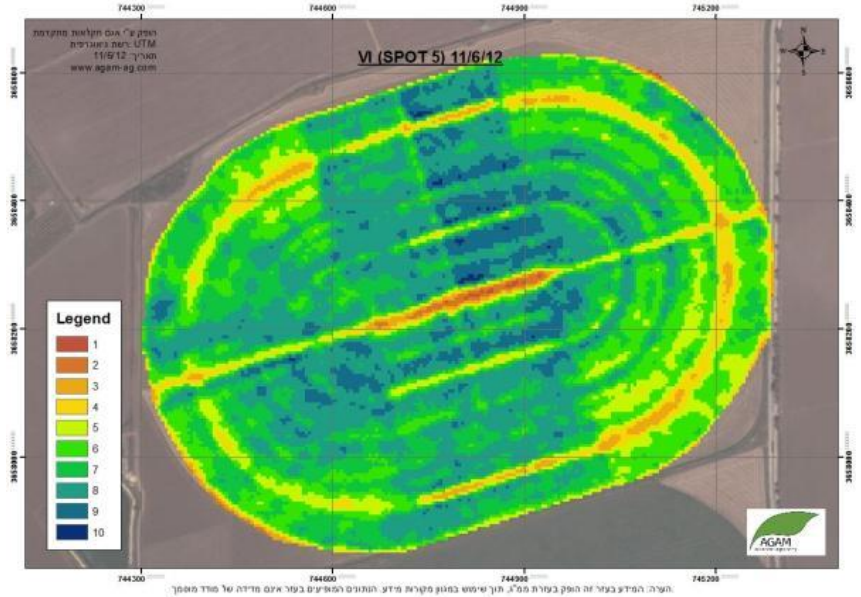
- Sloped plots
- Different types of soils
- Soil depth
- other

TARGET CROPS

- Perennial crops
- Vineyards
- Citrus
- Almonds
- Avocado
- ……

MEASURING VARIABILITY

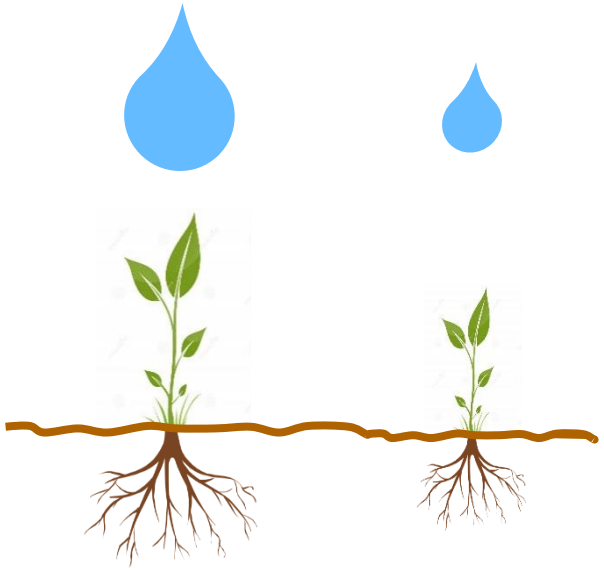
- Yield map
- Remote sensing (NDVI)
- Soil texture (VERIS)
- Proxy sensors



DIFFERENT APPROACHES FOR VRI

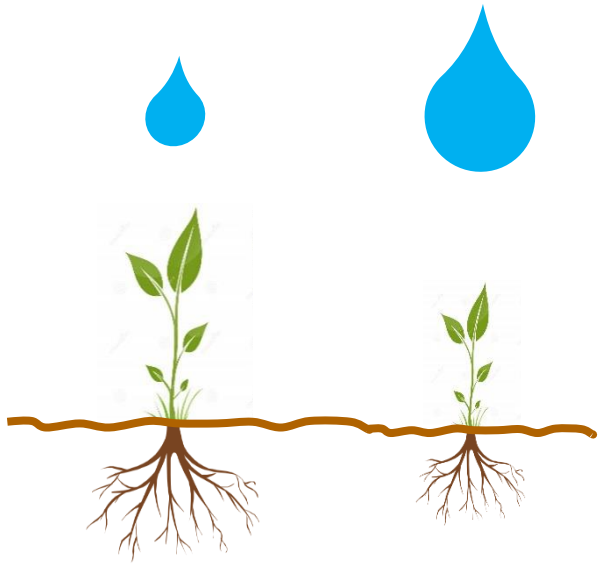
The capitalistic approach

(increase variability)



The socialistic approach

(reduce variability)

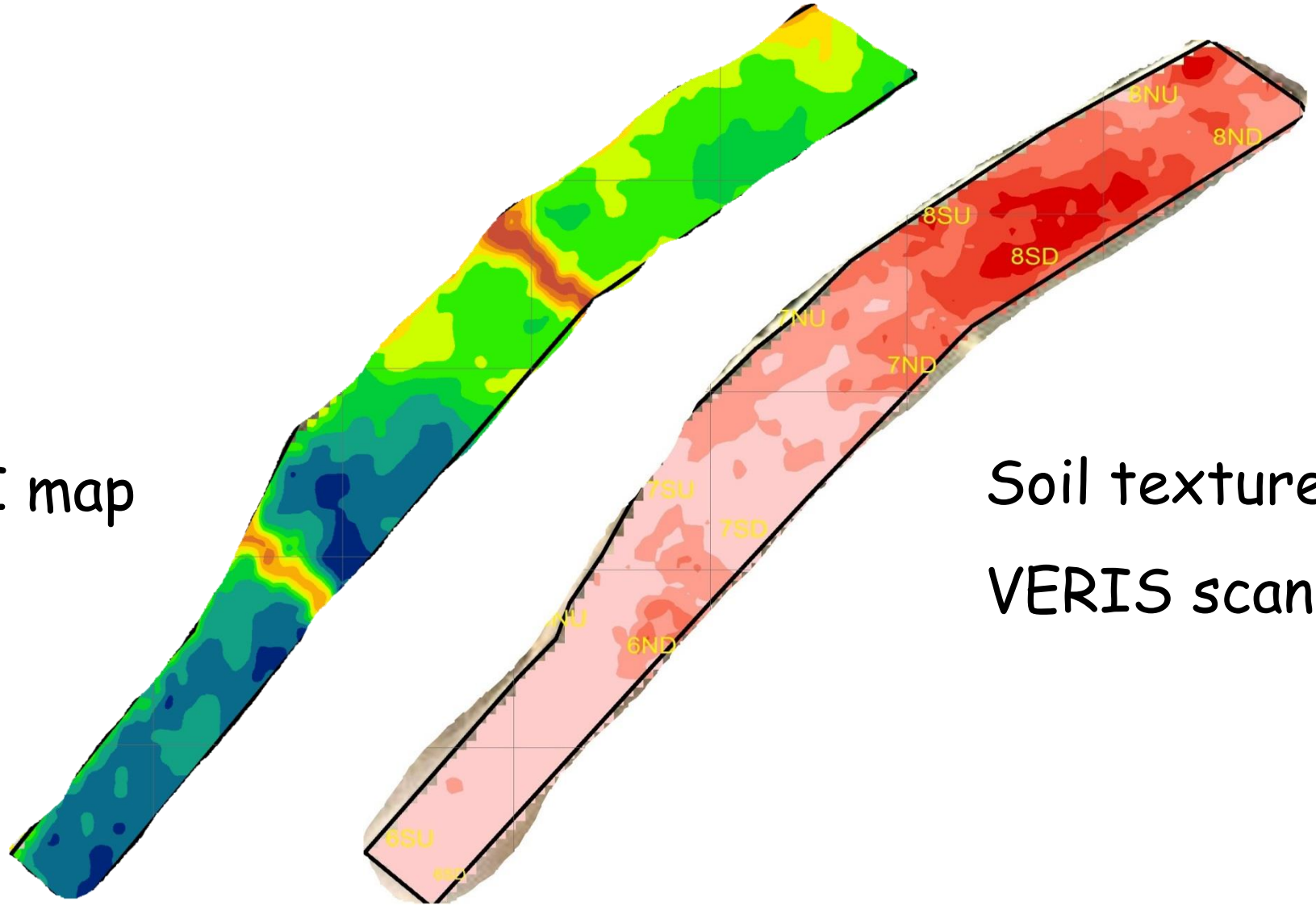


CASE STUDY: VINEYARD

- 2006 Shiraz variety vineyard.
- 3.6 hectare.
- Variable vegetation, yield and quality in the same plot.

VINEYARD VARIABILITY

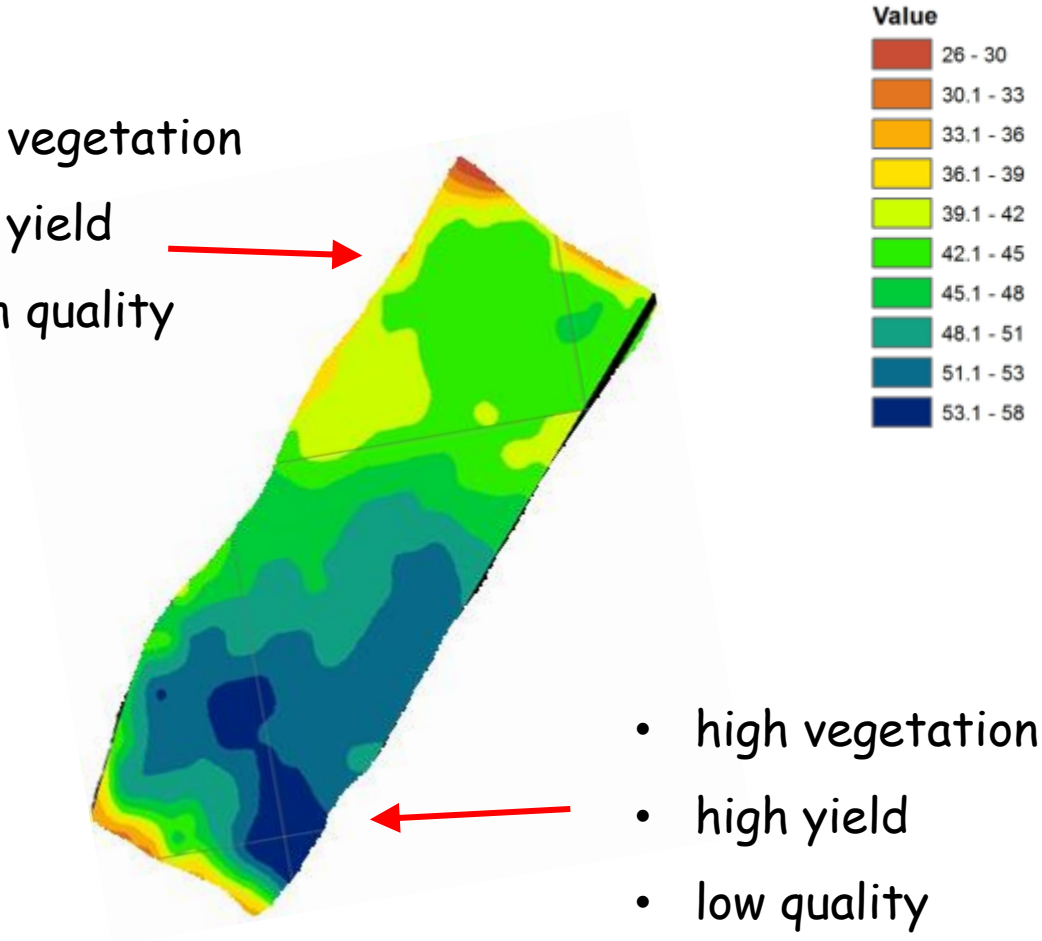
NDVI map



Soil texture by VERIS scanning

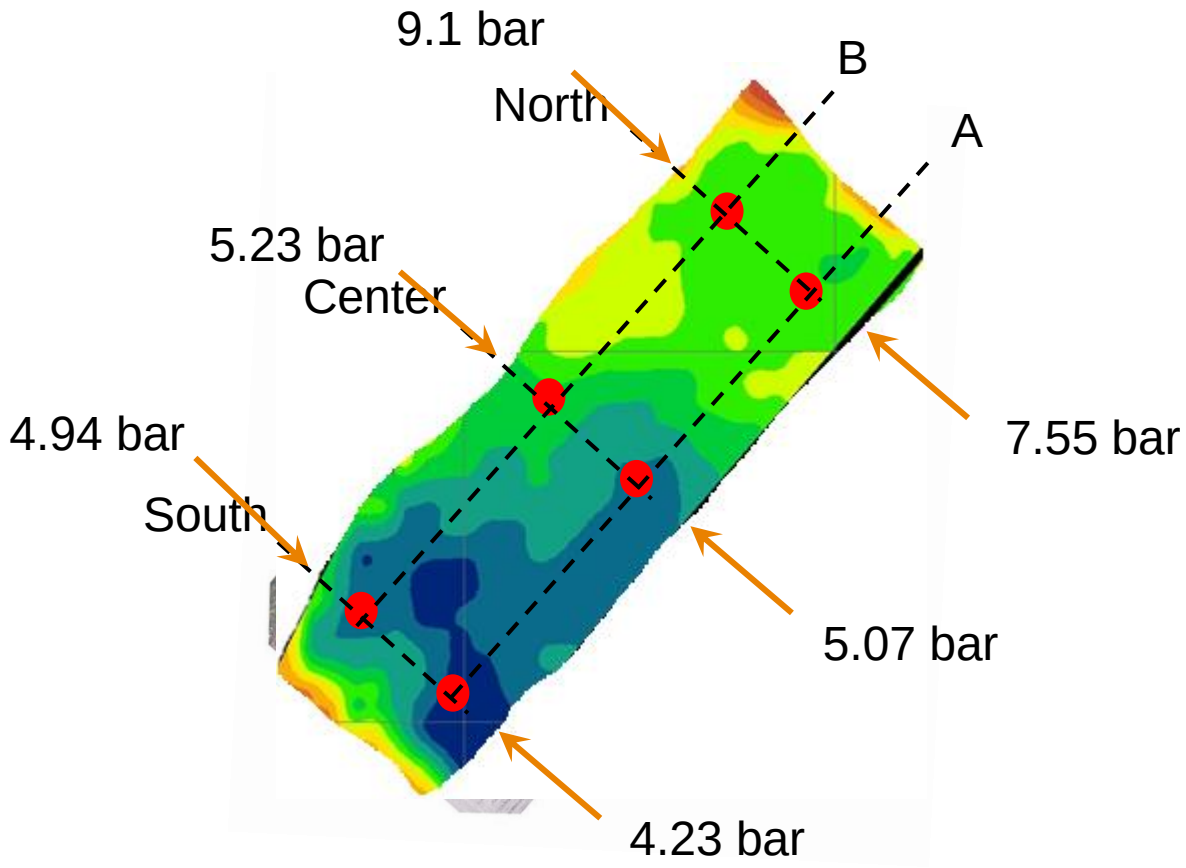
CASE STUDY: VINEYARD

- 2006 Shiraz variety vineyard.
- 1.2 hectare.
- Variable vegetation, yield and quality in the same plot.



PRE-VDRI RESULTS

SWP- mid season



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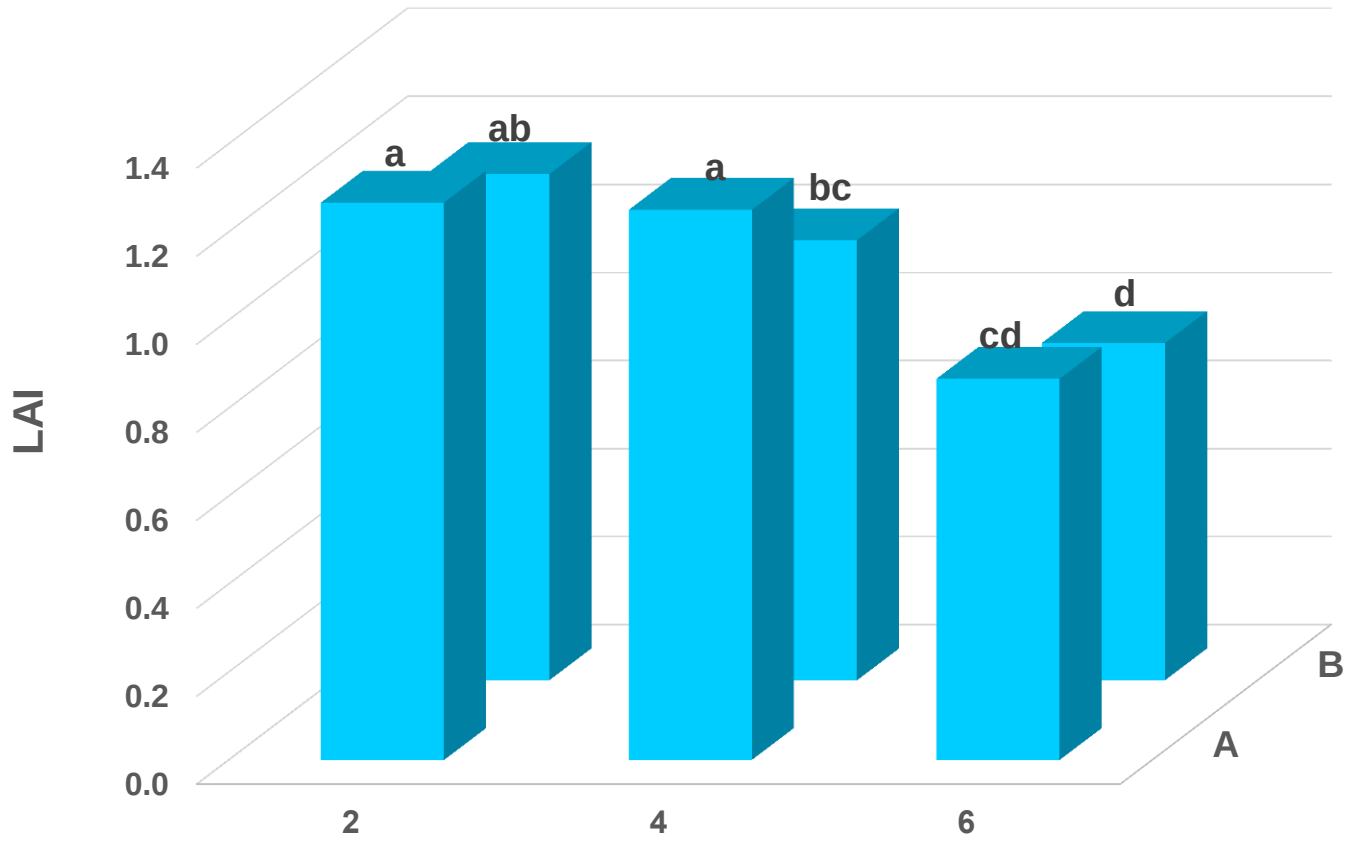
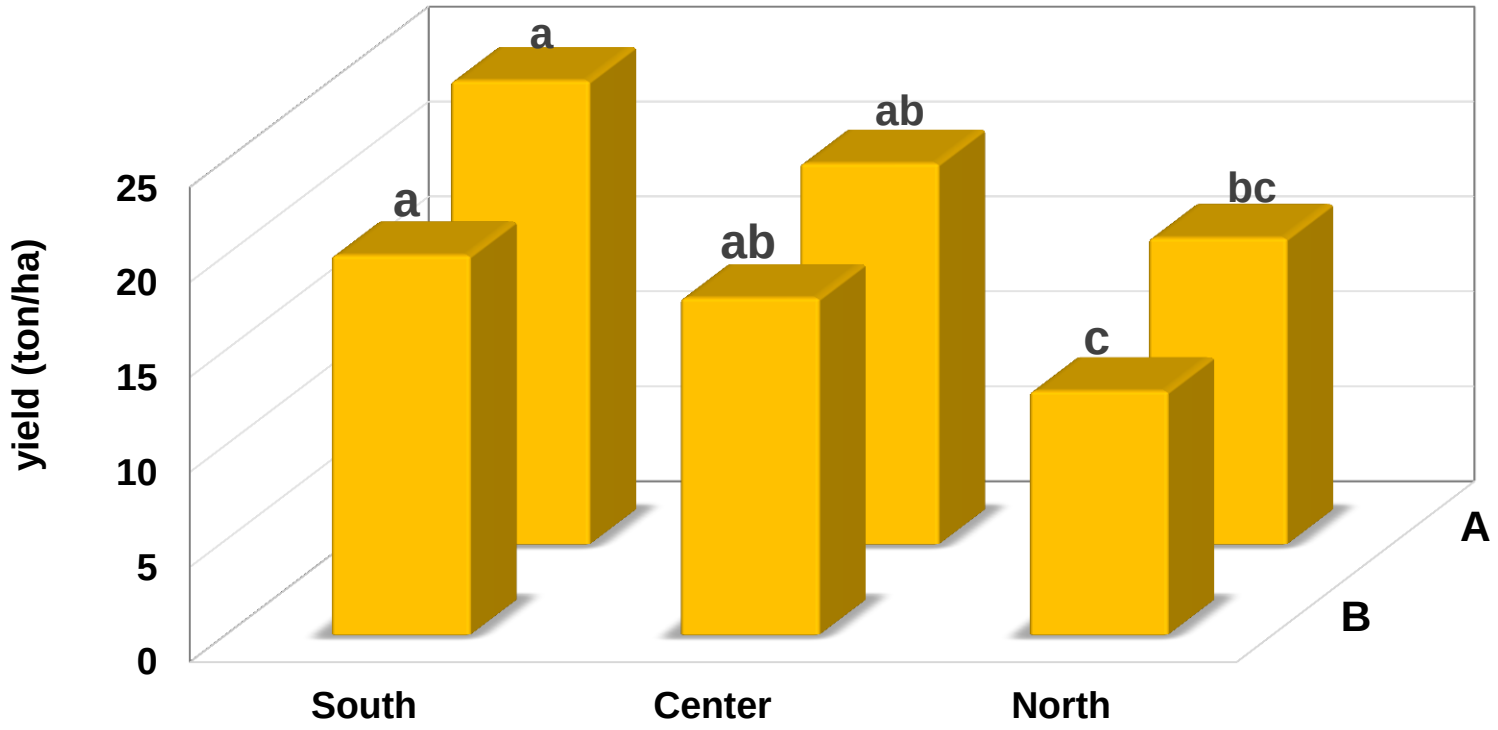
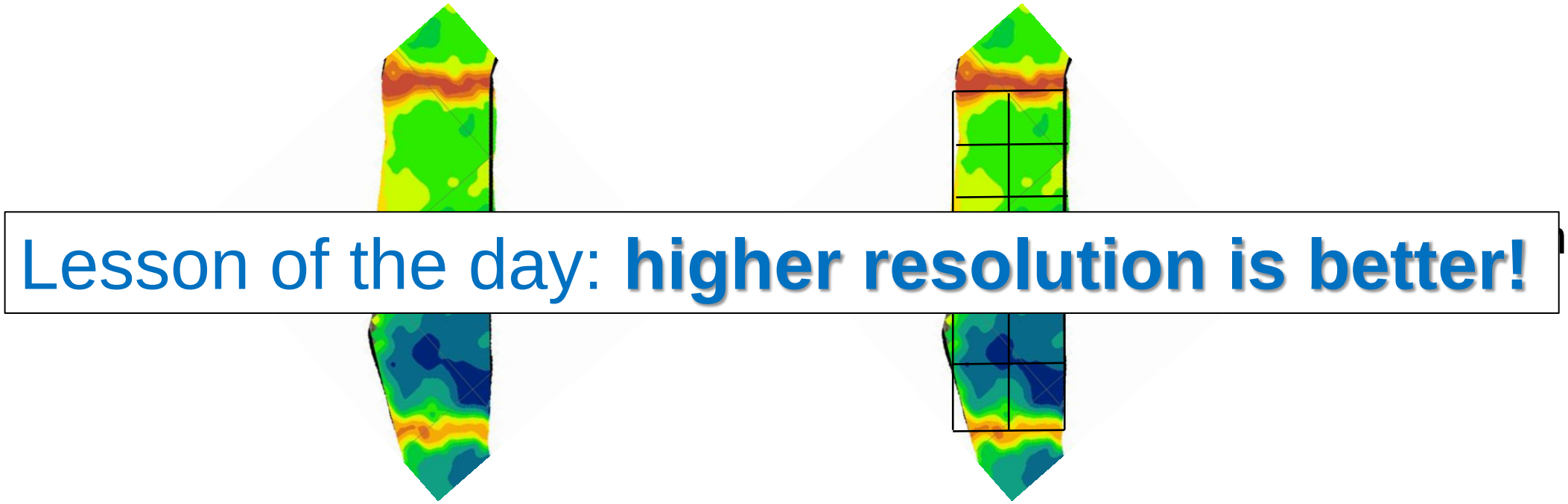


PRE-VDRI RESULTS



THE PROBLEM: VARIABILITY

The solution: VRDI



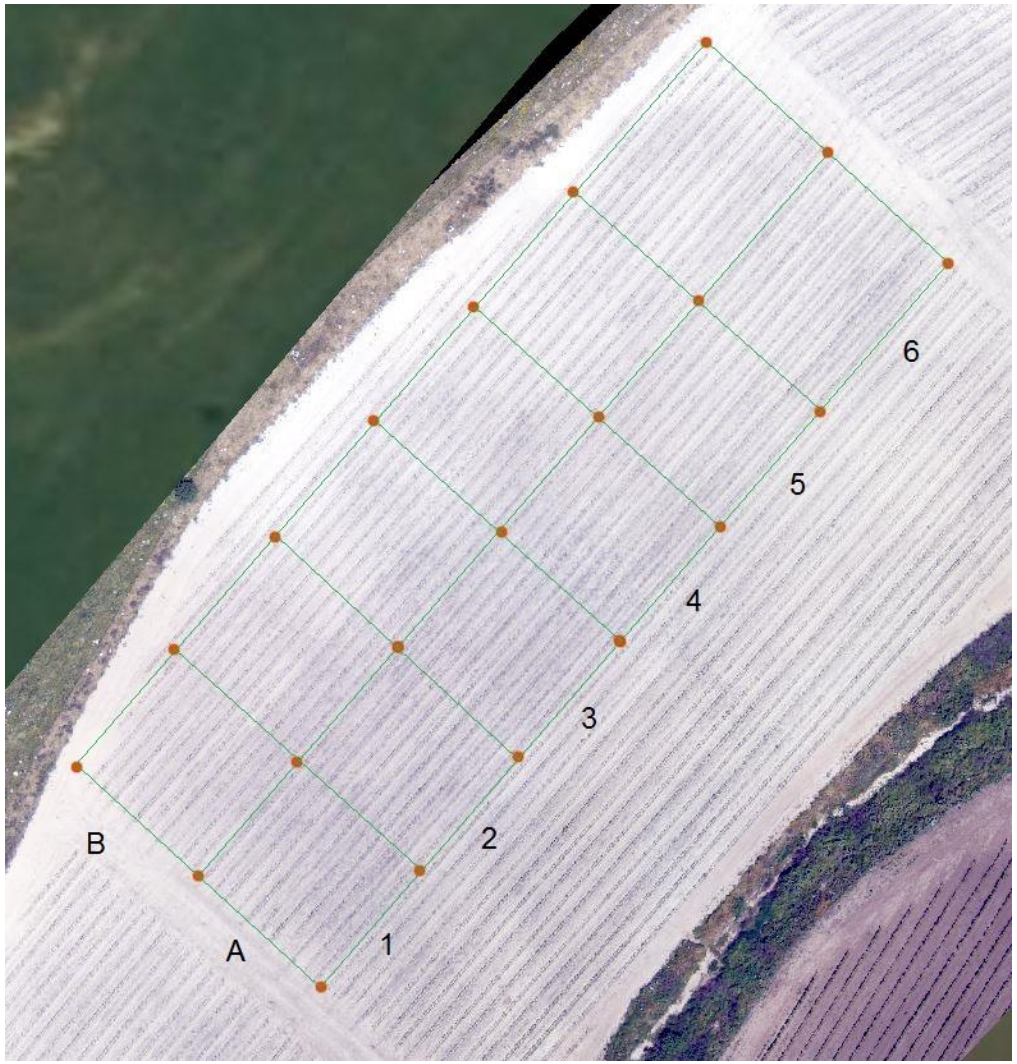
Lesson of the day: **higher resolution is better!**

1 irrigation zone

12 irrigation zones

VRDI SUB PLOTS

- Dividing the plot into 12 sub irrigation zones (A1…A6; B1…B6).
- Each subplot can be irrigated separately.
- Each irrigation subplots is irrigated to achieve goal yield and quality.



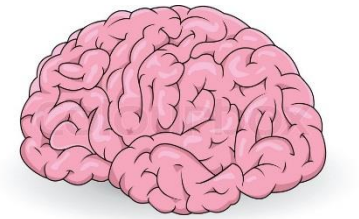
SYSTEM HEAD


Controllers
A1-A6 valves and water meter
B1-B6 valves and water meter
Solar panel charged battery

SYSTEM INSTALLATION

- Left: system head is levels with ground surface
- Right: no sign for the installation…

THE VRDI SYSTEM COMPONENTS

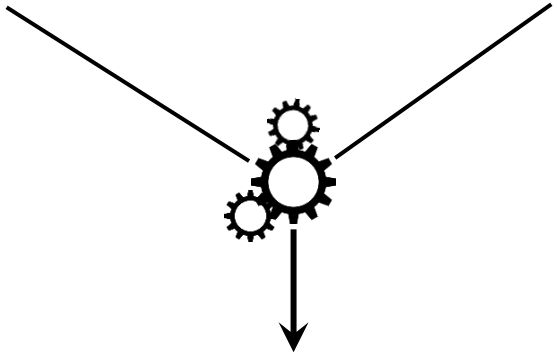


Software

- Remote sensing
- Algorithm
- DSS

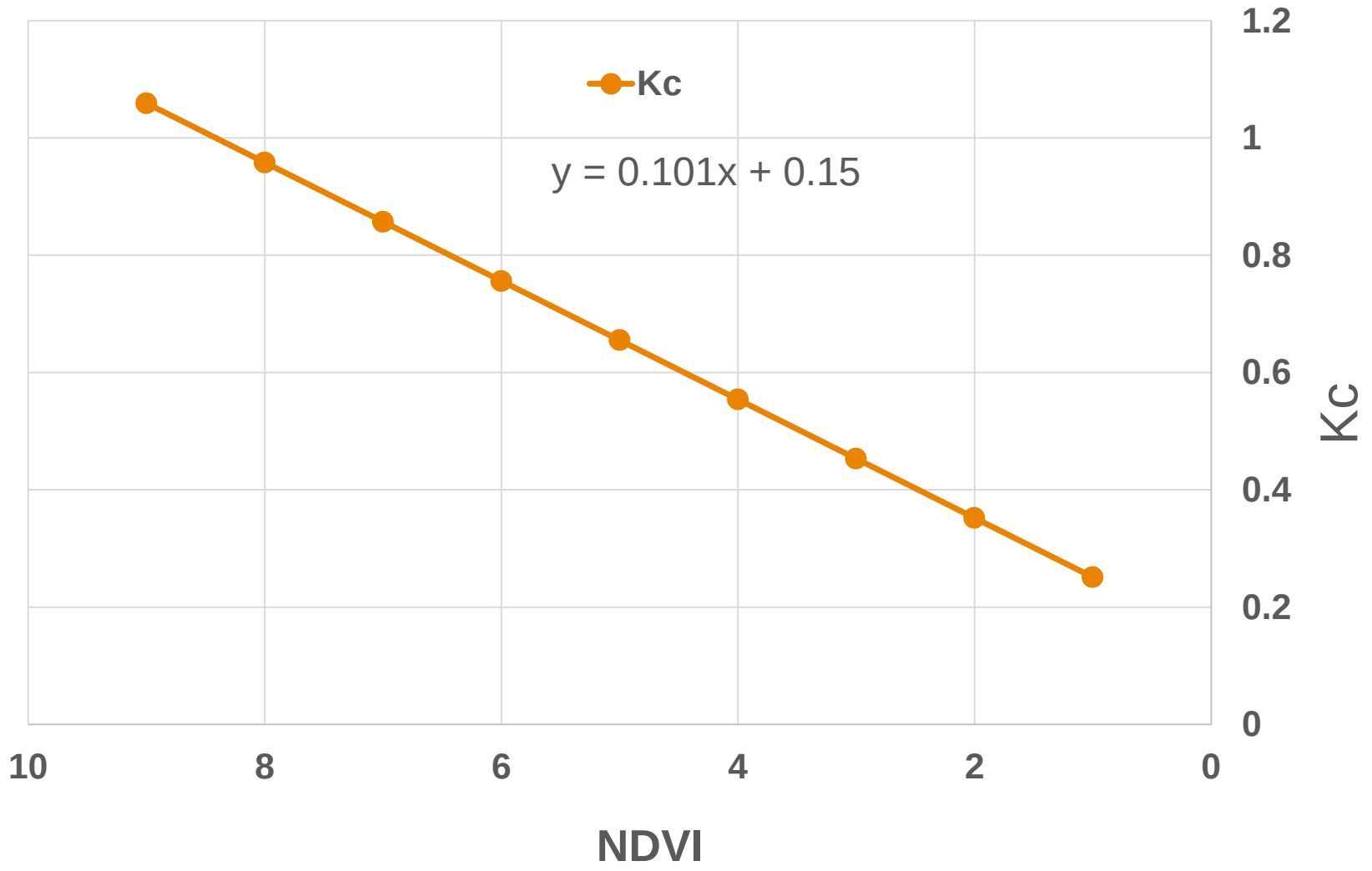
Hardware

- Driplines
- Valves
- Controllers



Variable rate irrigation according to the spatial variability in the field

KC-NDVI MODELS



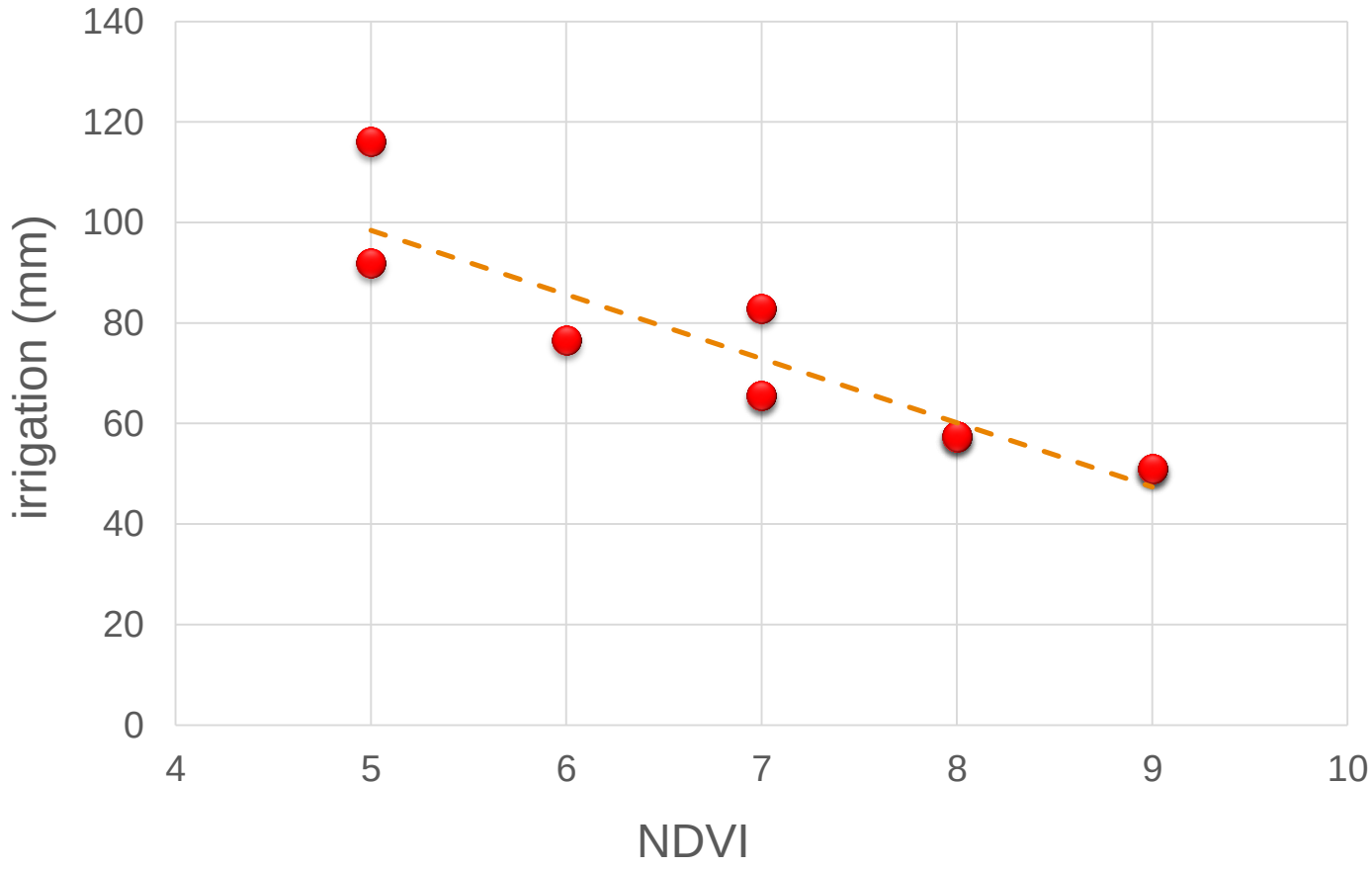
PIXELS IRRIGATION MODEL

- Kc=0.15+(NDVI*1.01*0.1)
- ETc = ETo x Kc
- Irrigation per pixel: ETc x Stress factor (0.2-0.5)

- Compensated irrigation: ETc x Stress factor (0.2-0.5) x $\frac{Ref.\ NDVI}{Pixcel_i\ NDVI}$ $\left[\frac{5}{2}\right] \times 1$
- Early irrigation at low NDVI zones

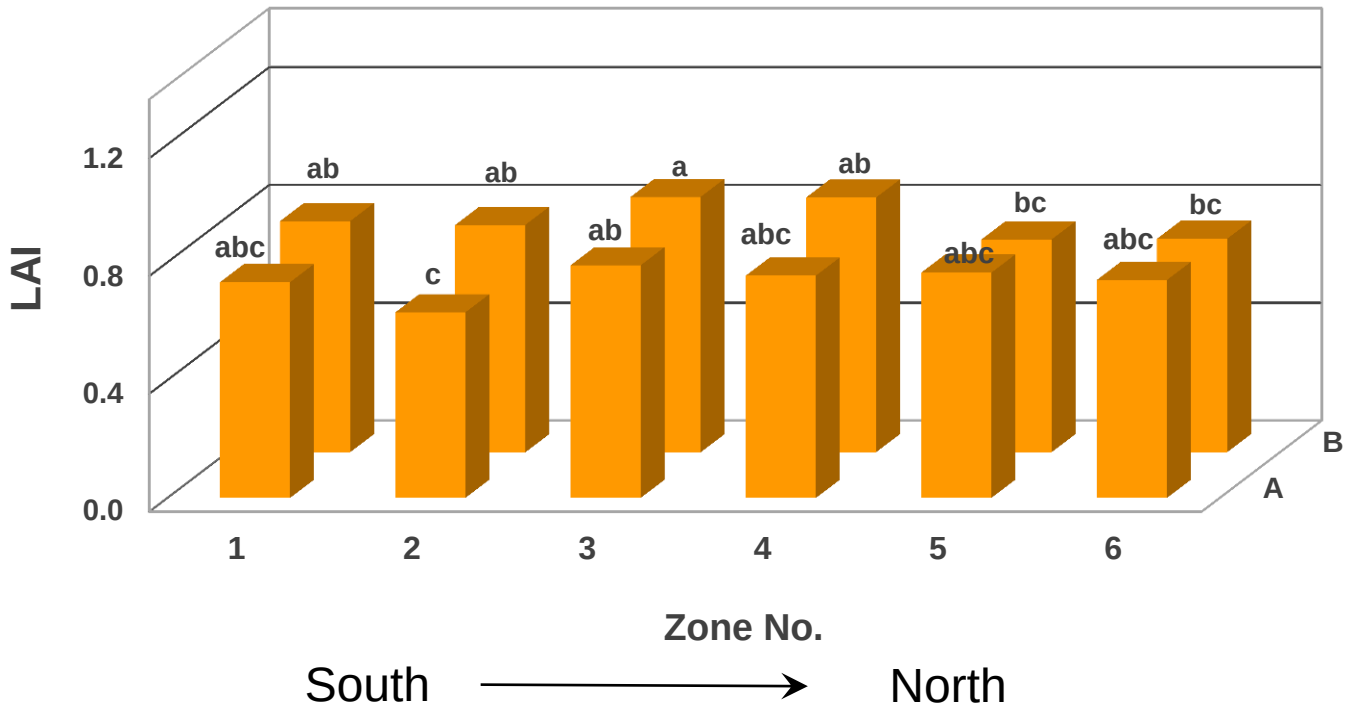
NDVI VS. IRRIGATION (2015)

Larger plants (high NDVI) get less water than smaller plants (low NDVI)



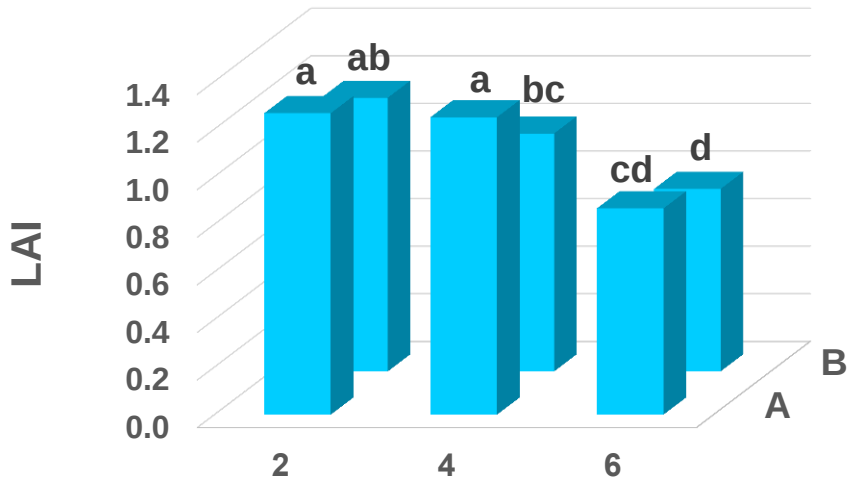
PHYSIOLOGICAL MEASUREMENTS- LAI

VRDI (2016)



South → North

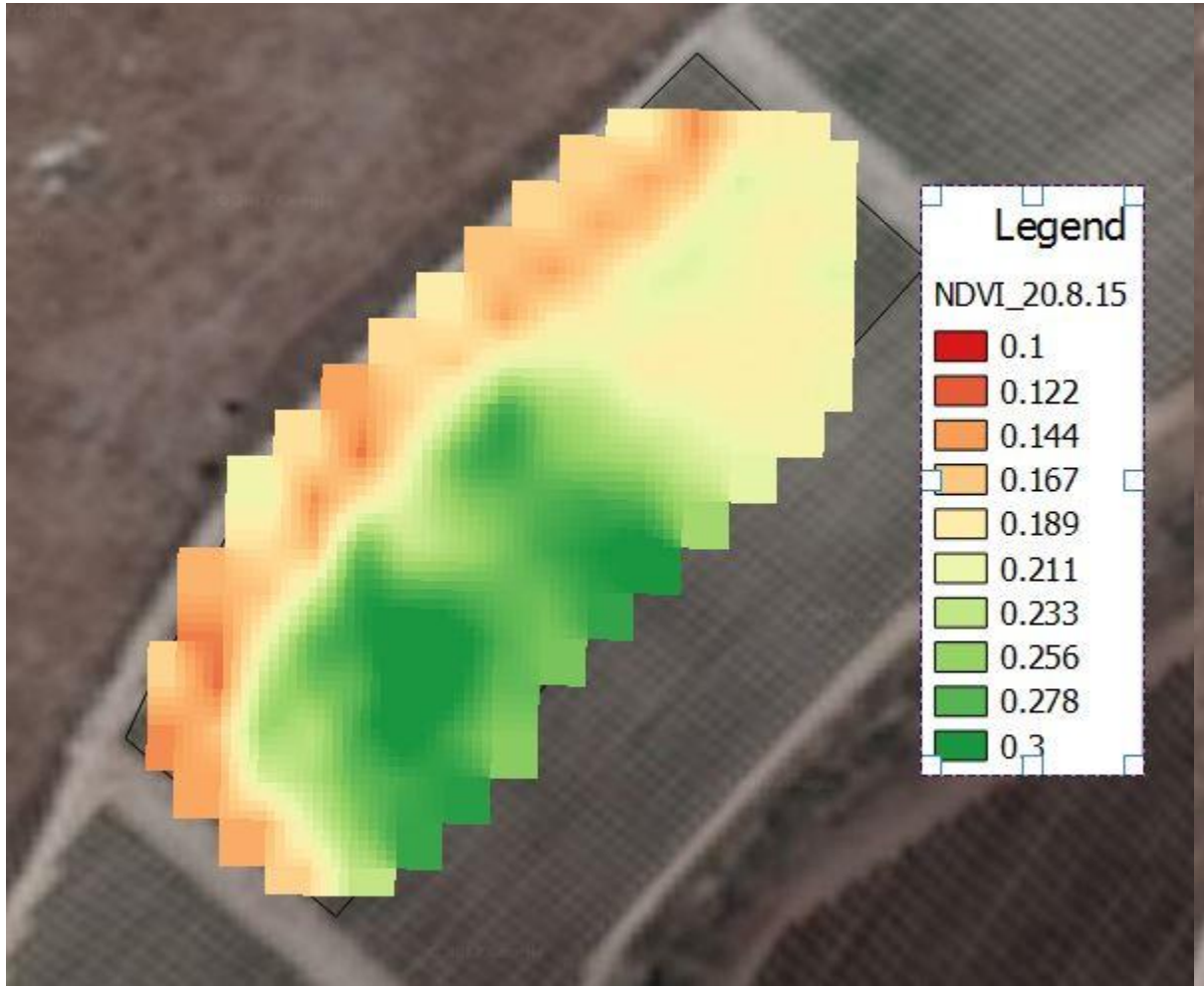
2014

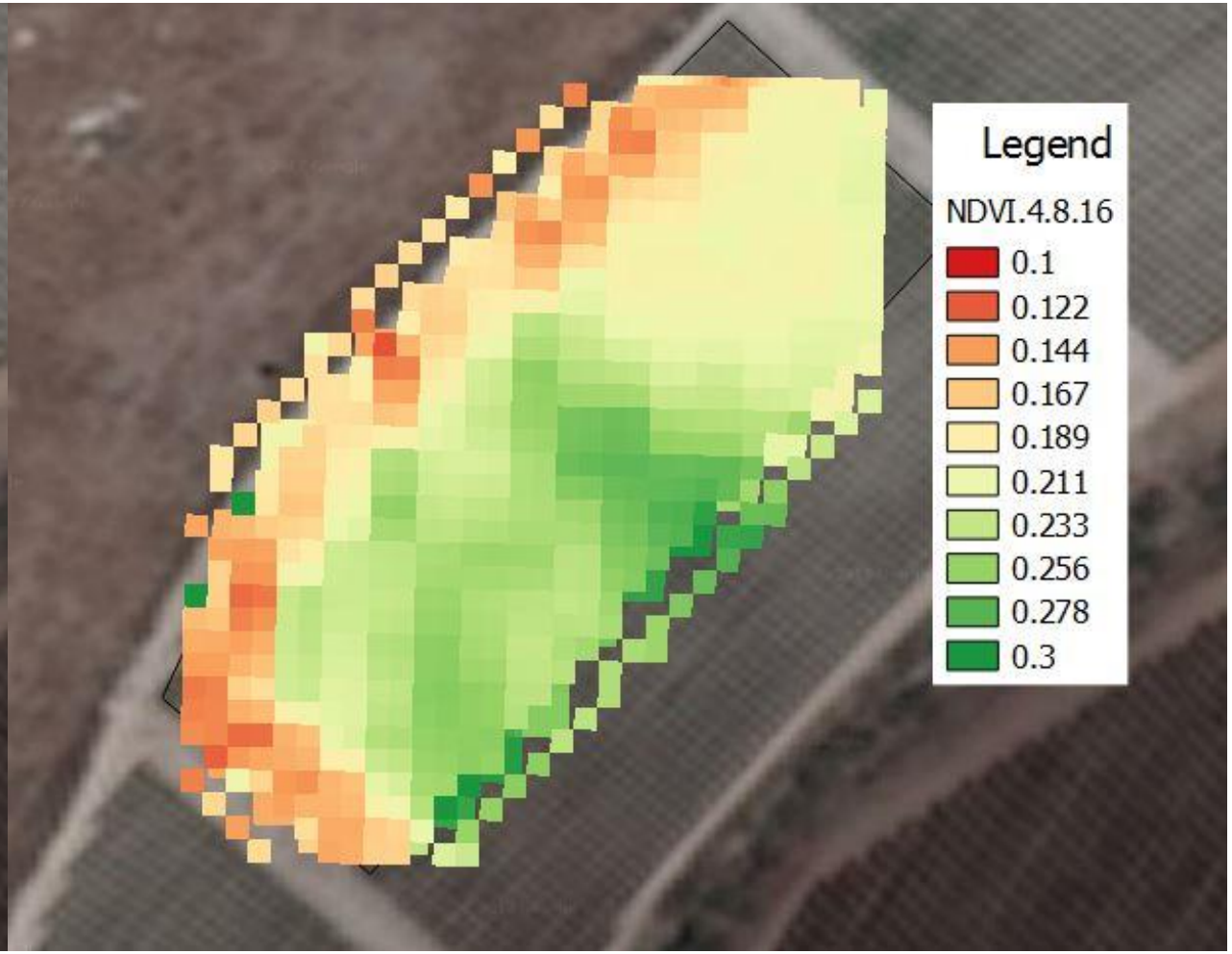


South → North

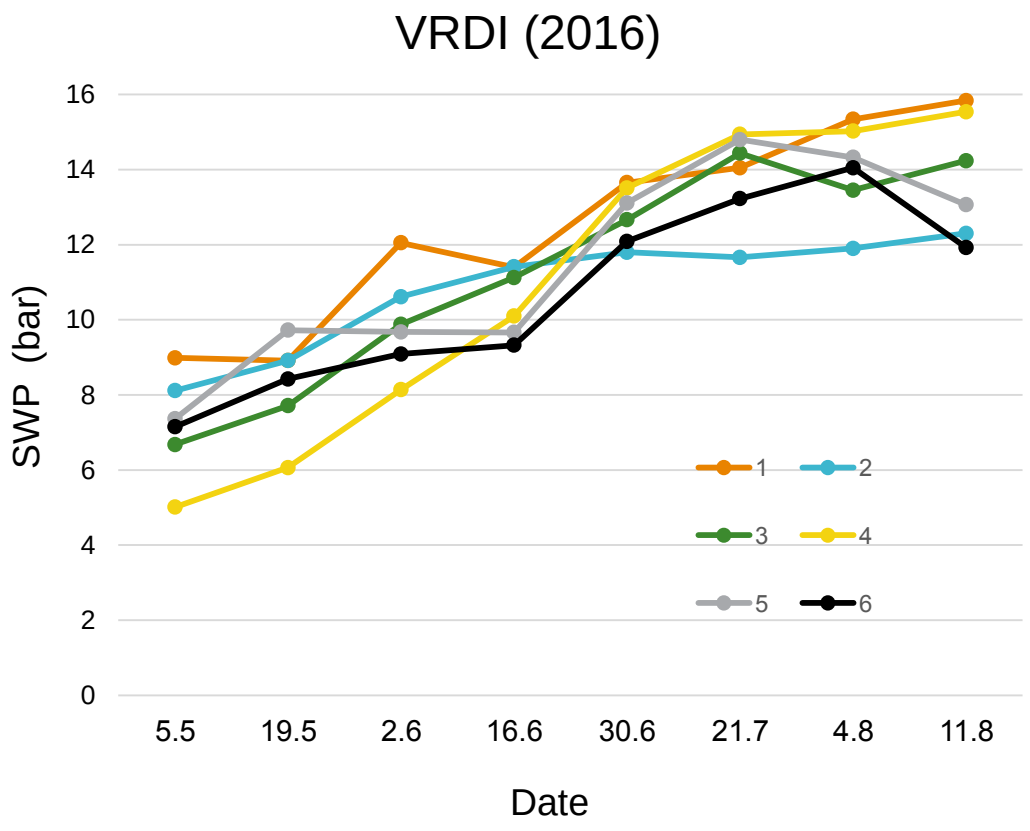
One zone

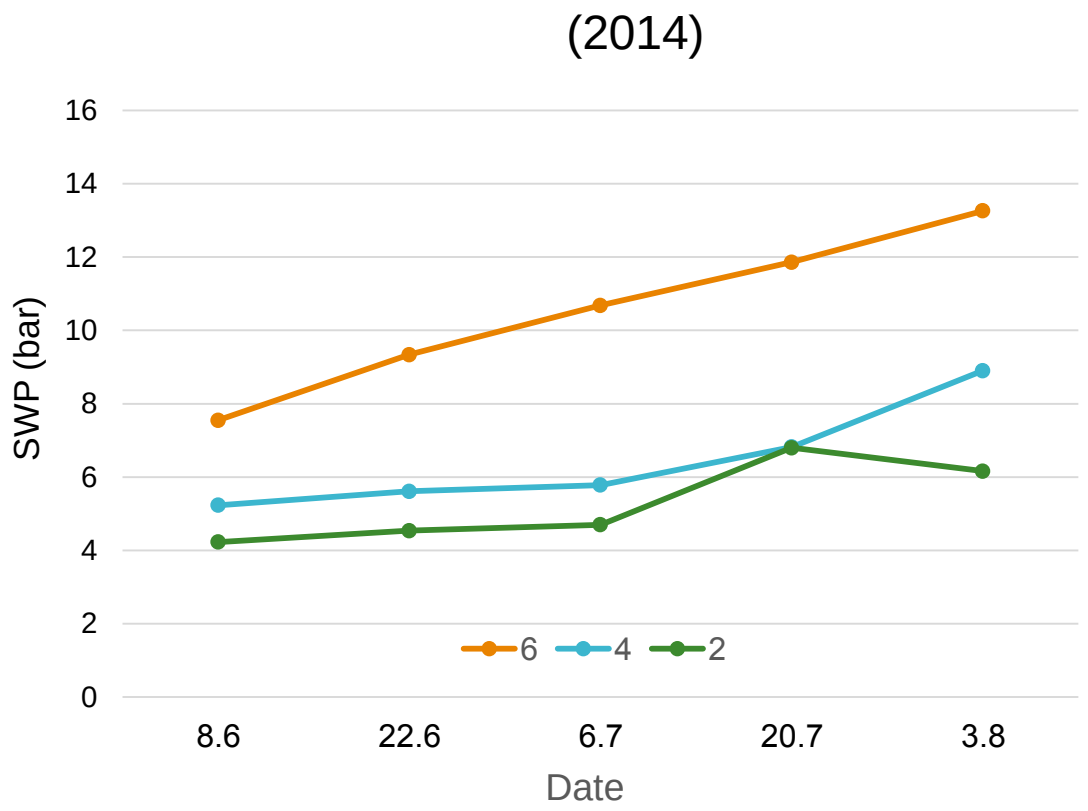
VRDI





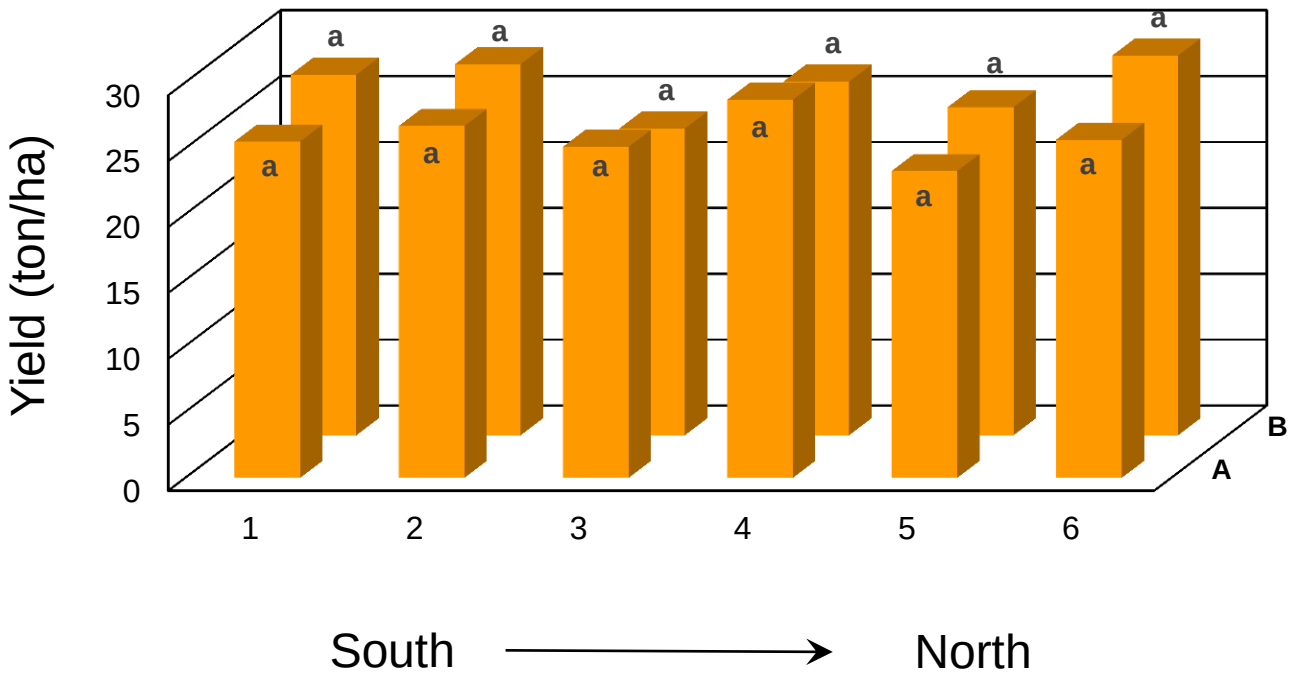
PHYSIOLOGICAL MEASUREMENTS- WATER POTENTIAL





YIELD RESULTS

VRDI (2016)



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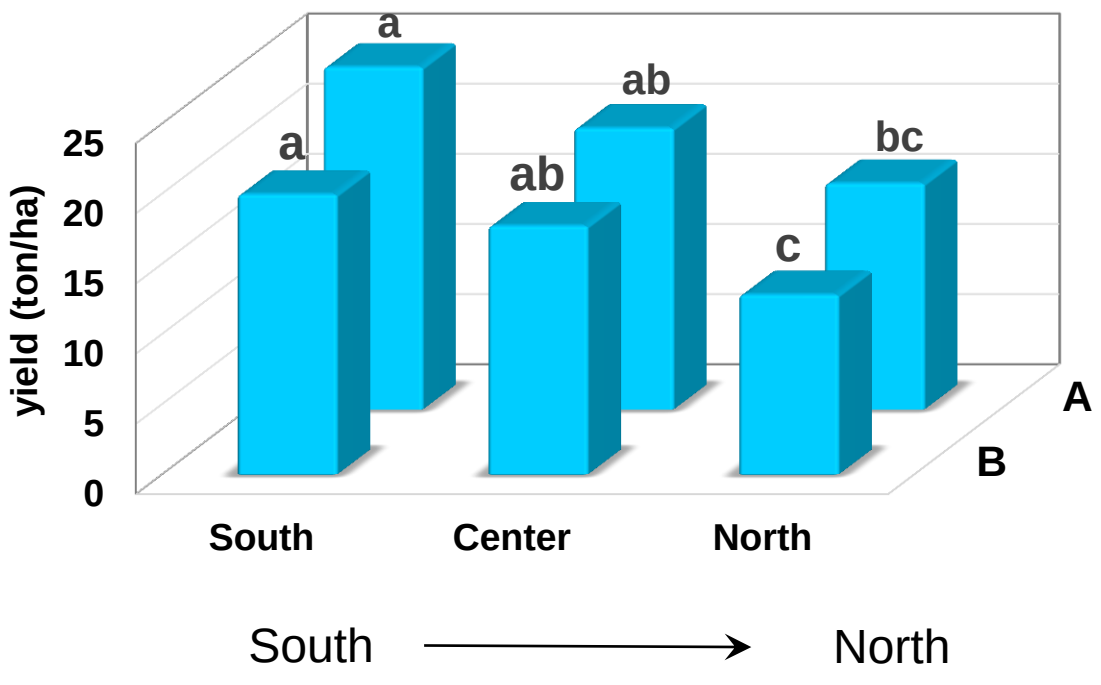
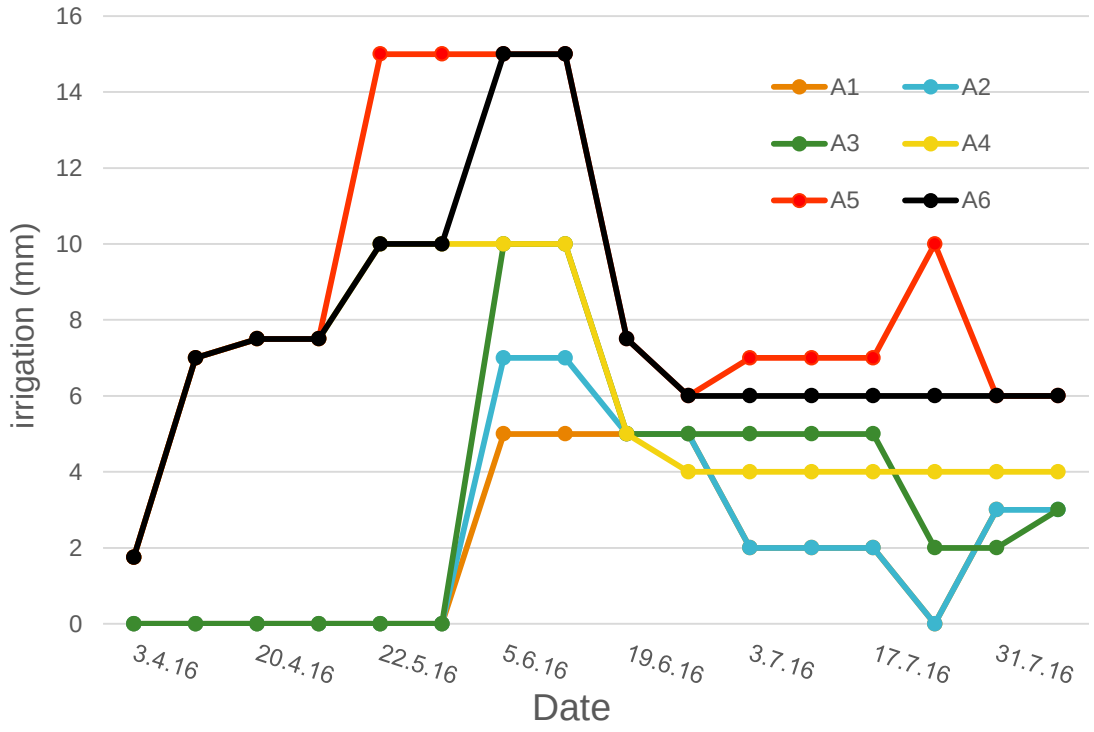
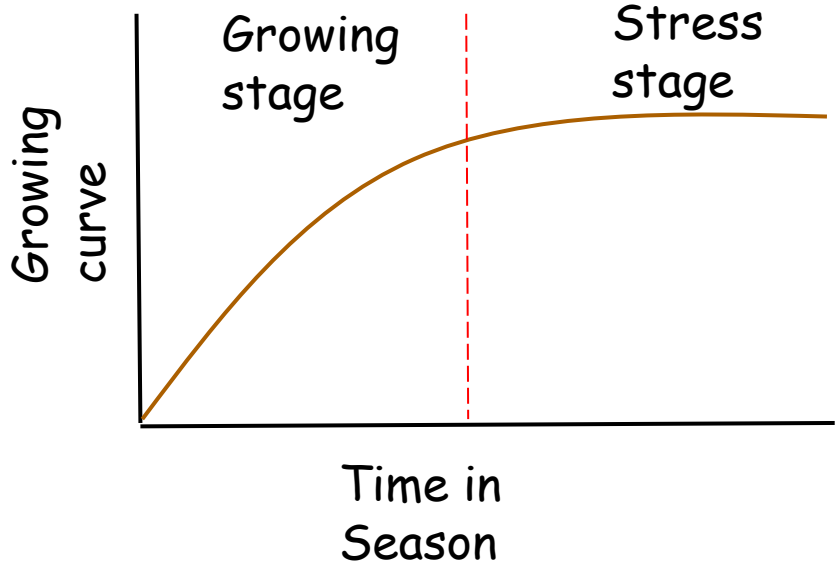
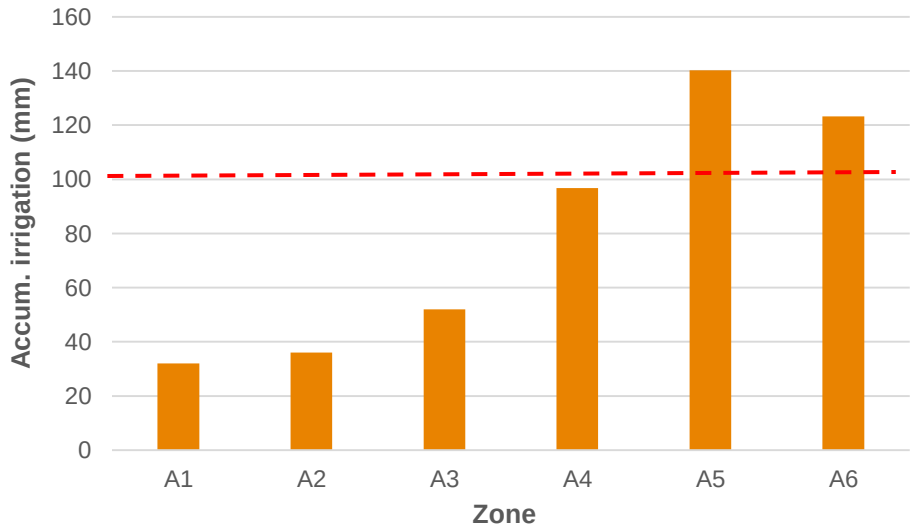


IRRIGATION SCHEDULING







E. & J. GALLO

- Livingston Ranch, CA.
- 23 acres
- 96 irrigation pixels
- Highly variable

NEXT STEPS

- 40 acres of VRDI in almonds (wonderful, ABC)
- Additional 200 acres of VRDI in vineyard (E&J Gallo)
- 5 acre of VRDI in Greece
- VRDI in other crops and regions (Australia, South Africa)
- System improvements, optimization and cost reduction

Thank you!

Questions?