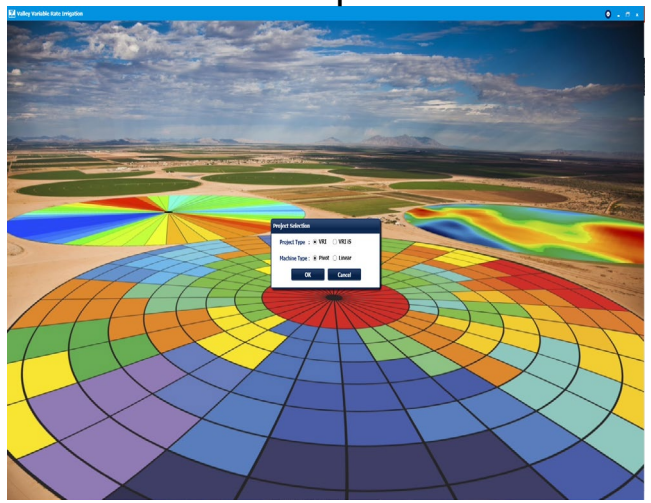
Evaluating Variable Rate Irrigation for Vegetable Production in South Florida

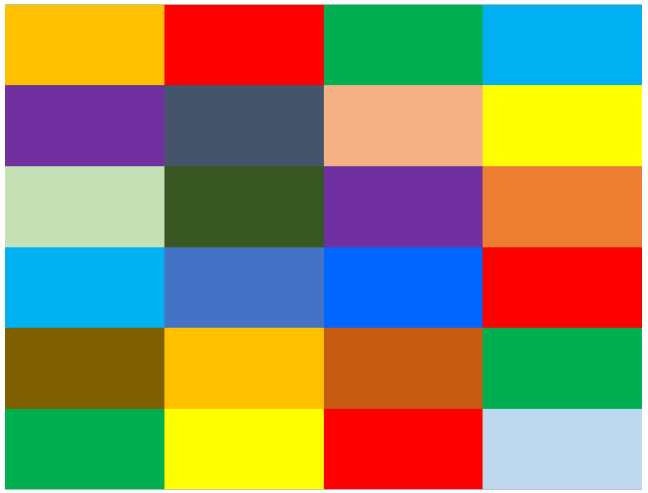
Haimanote Bayabil, Ph.D.
Assistant Professor
Agricultural & Biological Engineering Dept.
Tropical Research & Education Center
University of Florida
hbayabil@ufl.edu | 786-217-9253

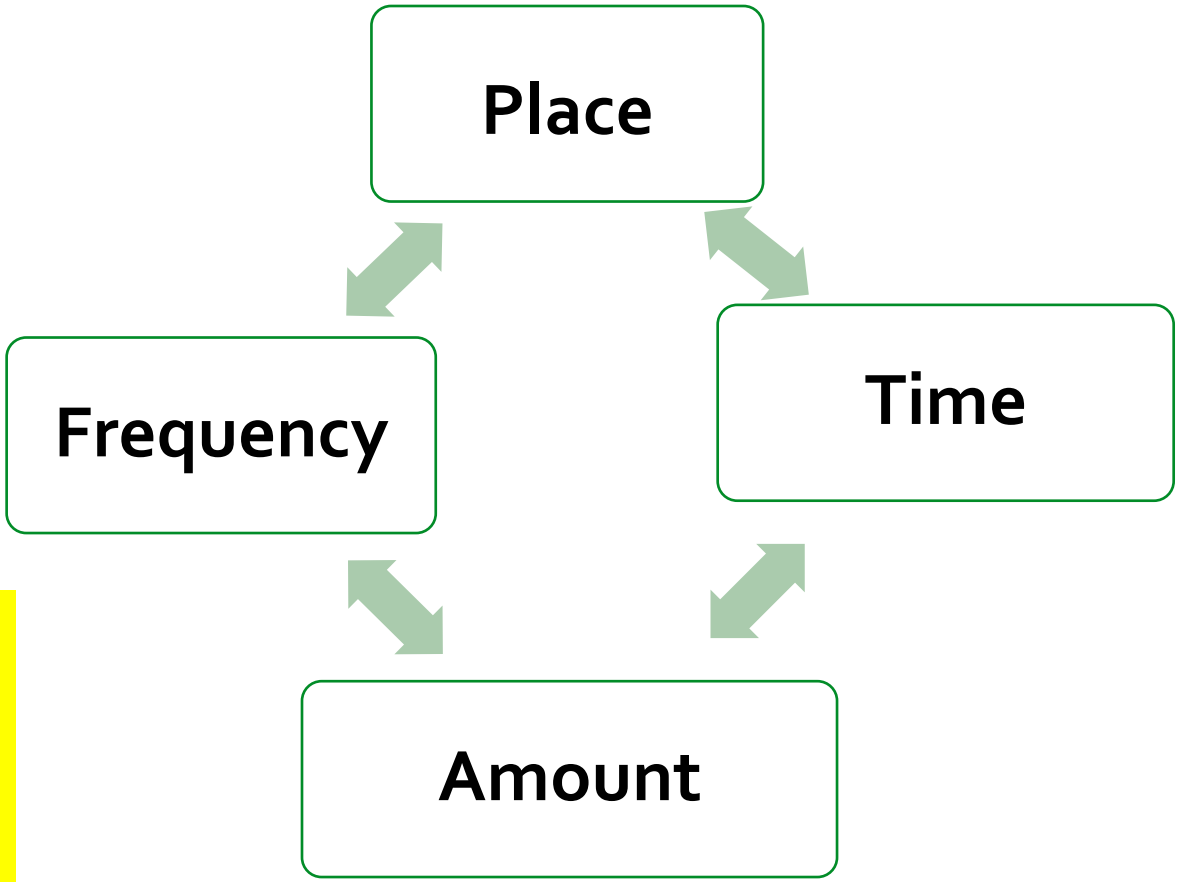
What is Variable Rate Irrigation (VRI)?

Center pivot



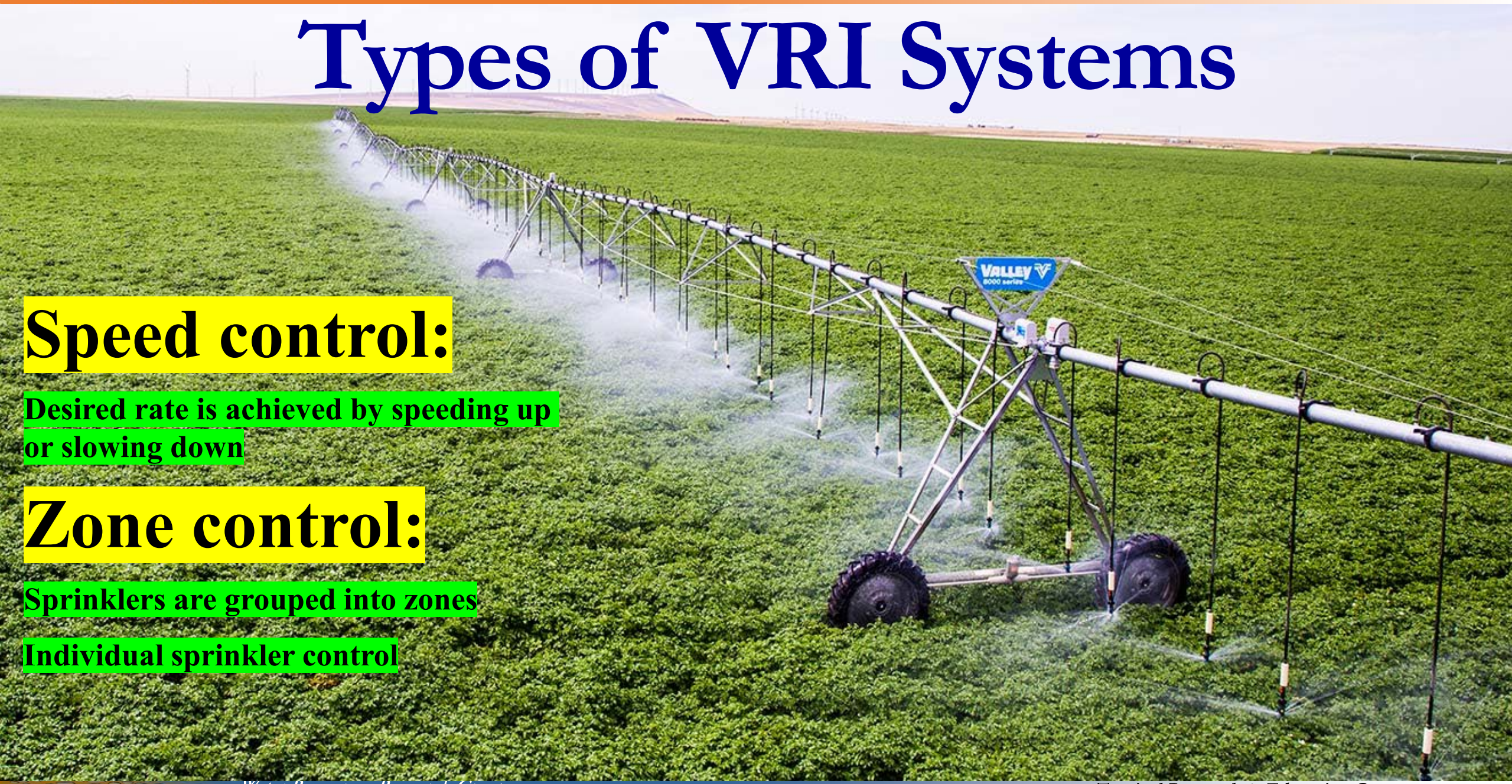
Linear move





- **Allows applying different rates of water**
- **Relies on GPS/GIS**
- **Zones consist one or more sprinklers**

Types of VRI Systems



Speed control:

Desired rate is achieved by speeding up or slowing down

Zone control:

Sprinklers are grouped into zones

Individual sprinkler control

Types of VRI Prescription Maps

Static map

- One prescription map is mostly used
- Developed based on variables that does not change frequently
  - Soil texture/depth differences
  - Slope/ elevation gradient
  - Cropped vs non-cropped fields
  - Water bodies

Dynamic map

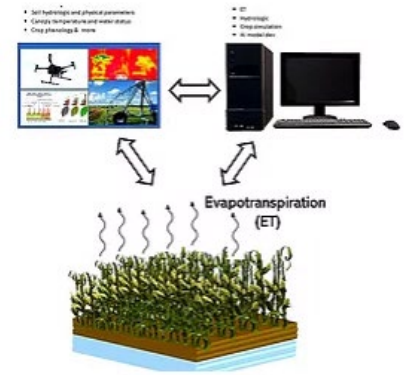
- Prescription map is updated frequently
- Developed based on variables that change frequently
  - Soil moisture readings
  - Seasonal adjustments based on crop growth stage

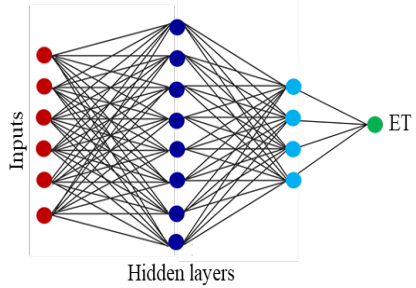
Potential Benefits of VRI

- Water conservation
- Reduction in nutrient losses due to leaching and/or runoff
- Maximize yield and/or improve quality
- **South Florida**: shallow and highly permeable gravelly soils - hydrologically connected with the surficial Biscayne aquifer

***Disadvantage**: Cost

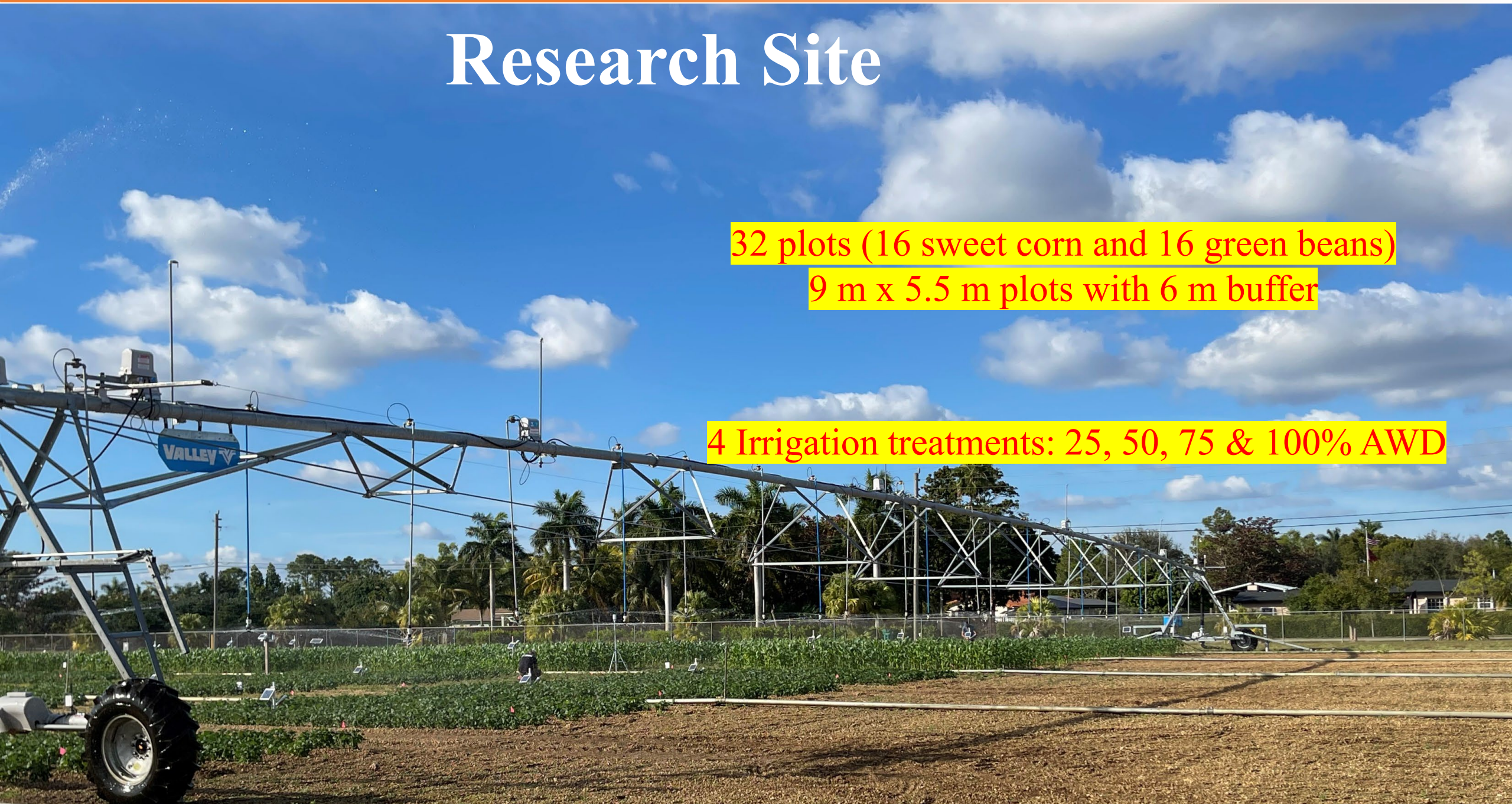
Modeling Evapotranspiration at Plot and Field Scales





USDA NIFA

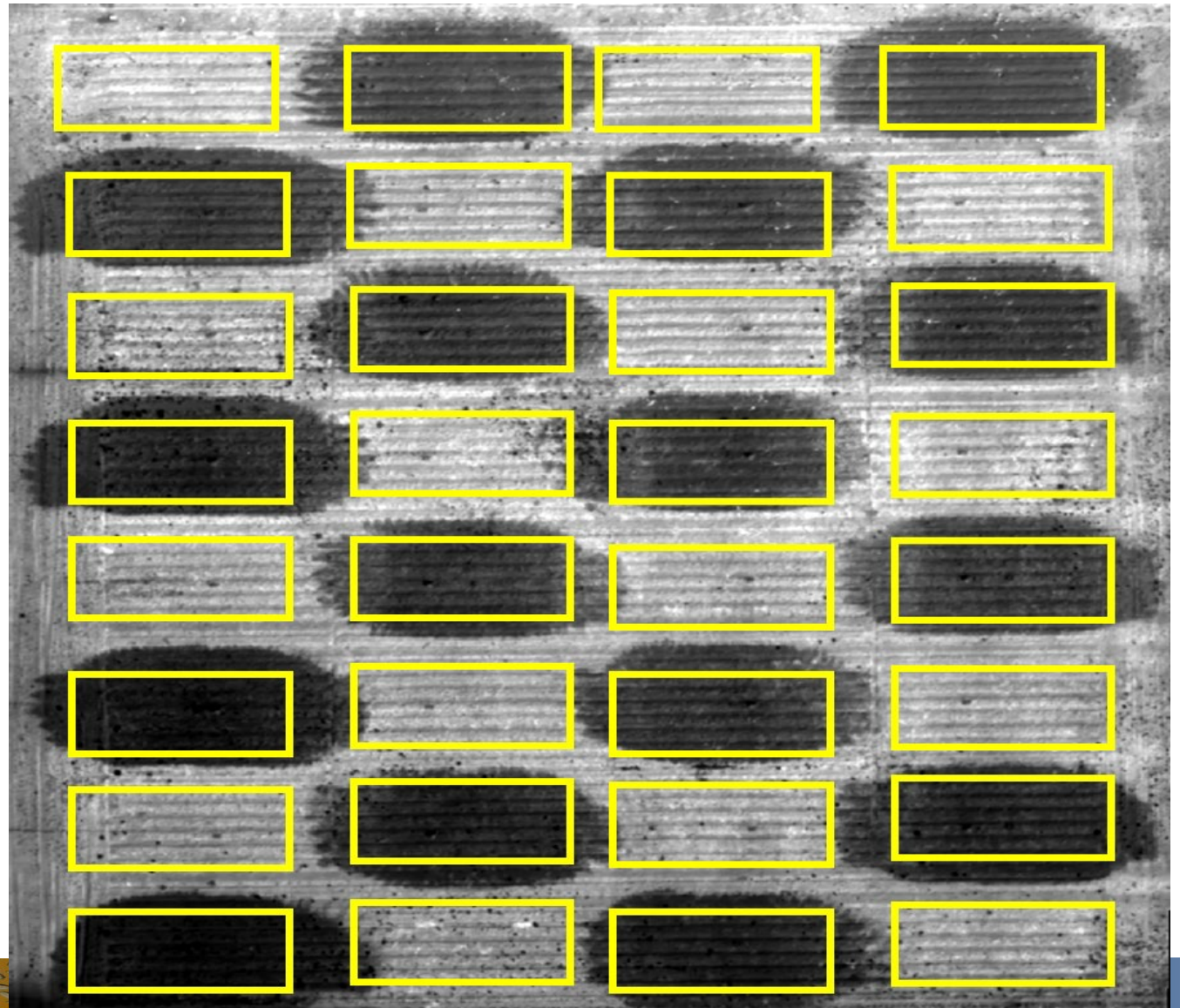
Research Site

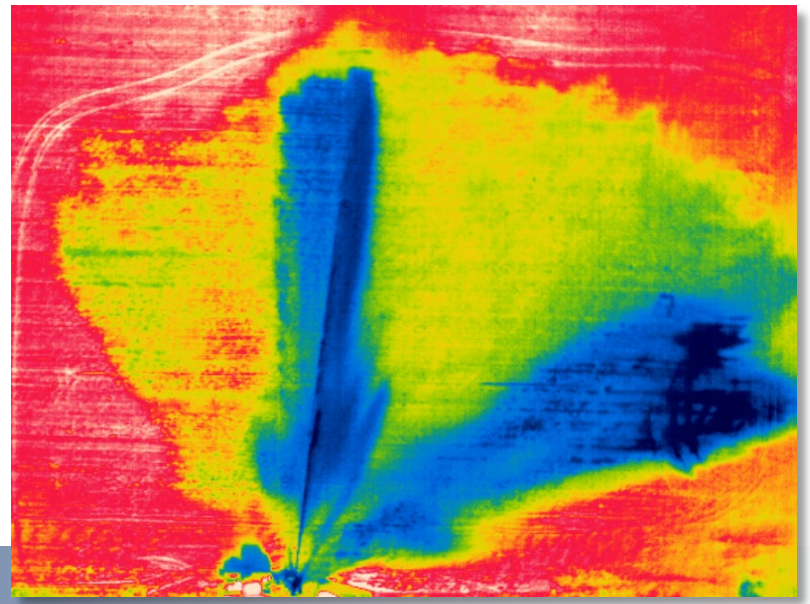


32 plots (16 sweet corn and 16 green beans)
9 m x 5.5 m plots with 6 m buffer

4 Irrigation treatments: 25, 50, 75 & 100% AWD

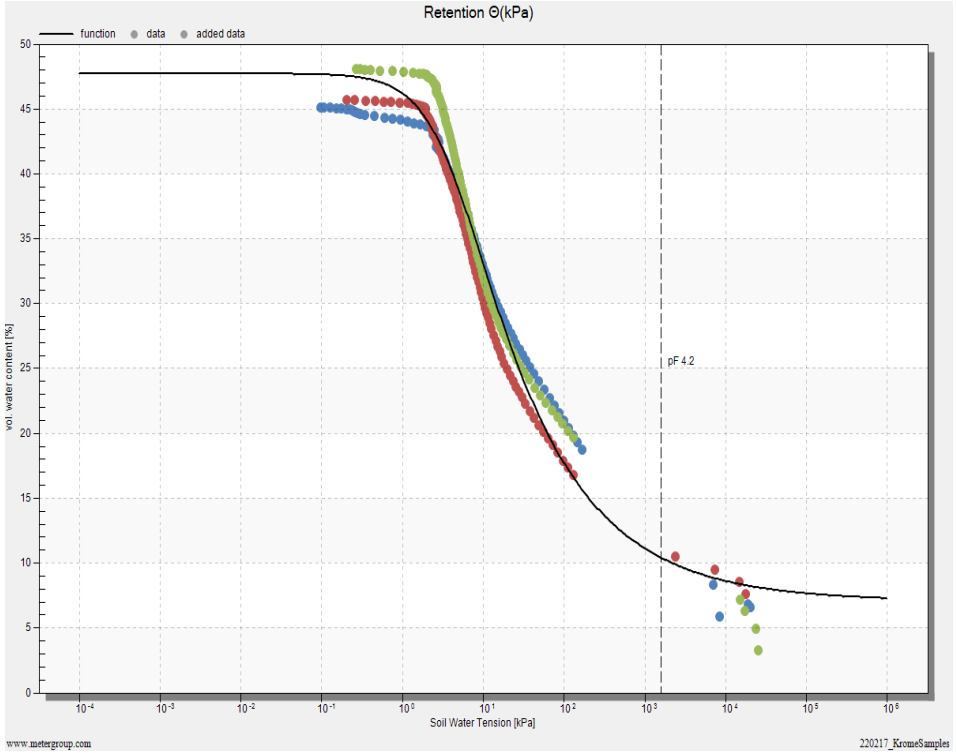
VRI Application Uniformity



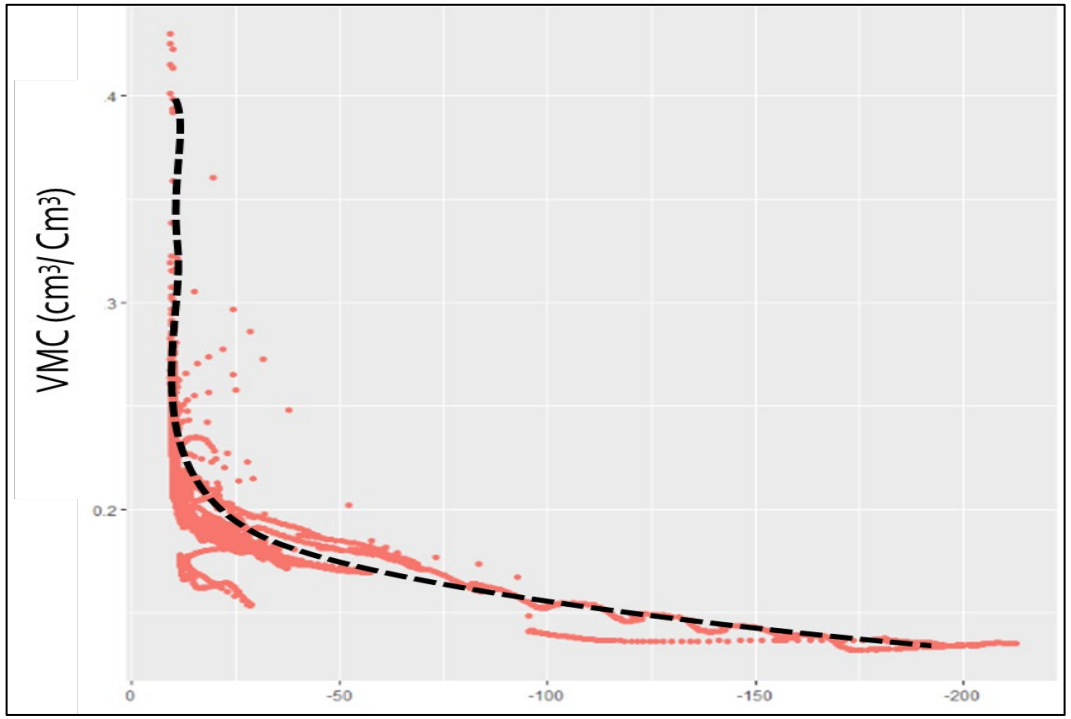


Soil Moisture Characteristics

Lab (disturbed soil)

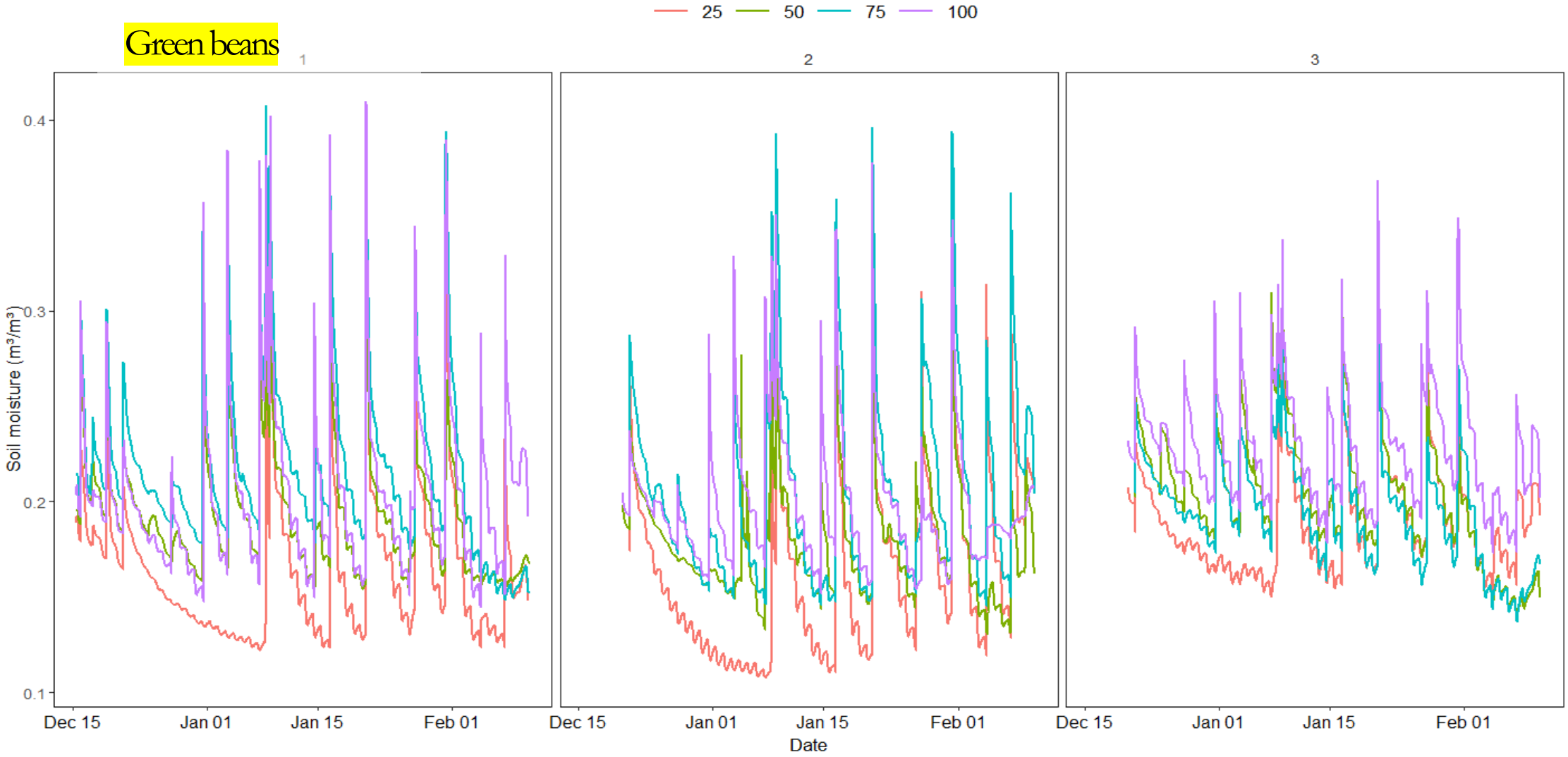


Field conditions

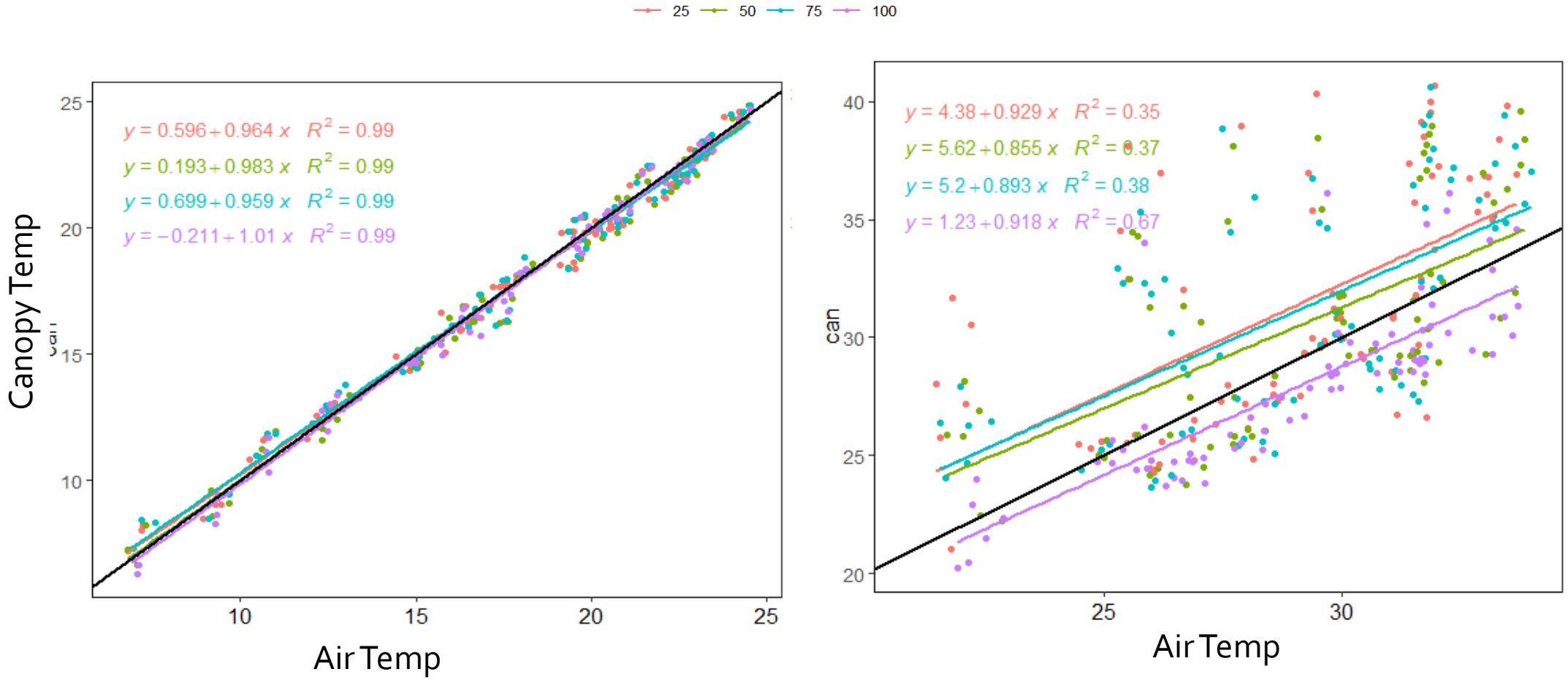


Krome soil: Very gravelly with 51% coarse and 49% loam fractions

Rootzone Soil Moisture: Volumetric



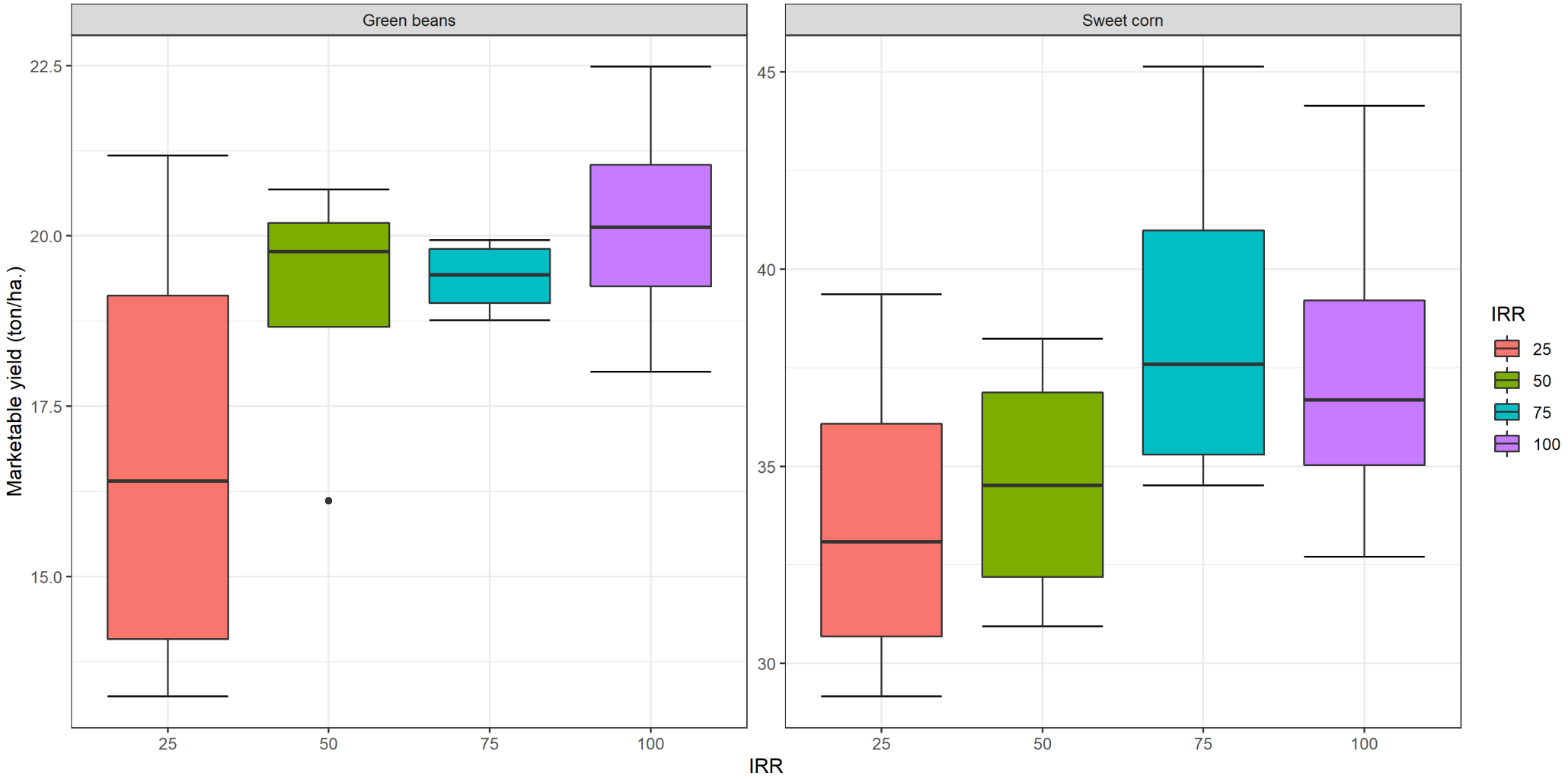
Canopy Temperature



On av. 2-3 °c difference

Yield Responses

2020/2021



Differences were not statistically significant

Tradeoffs: Water conservation Vs. Yield

Crop	IRR Rate	Irrigation (mm)	Yield (ton/ha)	Yield Gap (ton/ha)	Water saving (m^3/ha)
Green beans	25	21.0	102.61	(20.6)	629
	50	41.9	116.54	(6.7)	419
	75	62.9	118.41	(4.8)	210
	100	**83.8**	**123.25**		
Sweet corn	25	26.2	205.64	(23.7)	739
	50	50.8	210.97	(18.3)	493
	75	75.5	236.31	7.0	246
	100	**100.1**	**229.29**		

2020/2021

Summary

- VRI has shown great potential for water conservation from vegetable production in South Florida
- Benefits could also include improved nutrient management and reduction of nutrient leaching
- Initial cost could be an issue and adoption rates of VRI are likely to remain low

Thank you!

USDA NIFA

Award # 2020-67021-31965

UF IFAS UNIVERSITY of FLORIDA

Tropical Research & Education Center

UF IFAS UNIVERSITY of FLORIDA

UF IFAS Research UNIVERSITY of FLORIDA