IN-SERVICE TRAINING 2012

THE SECOND GENERATION (G2) OF BEST MANAGEMENT PRACTICES (BMPS) FOR CROP PRODUCTION

IRRIGATION TECHNOLOGY

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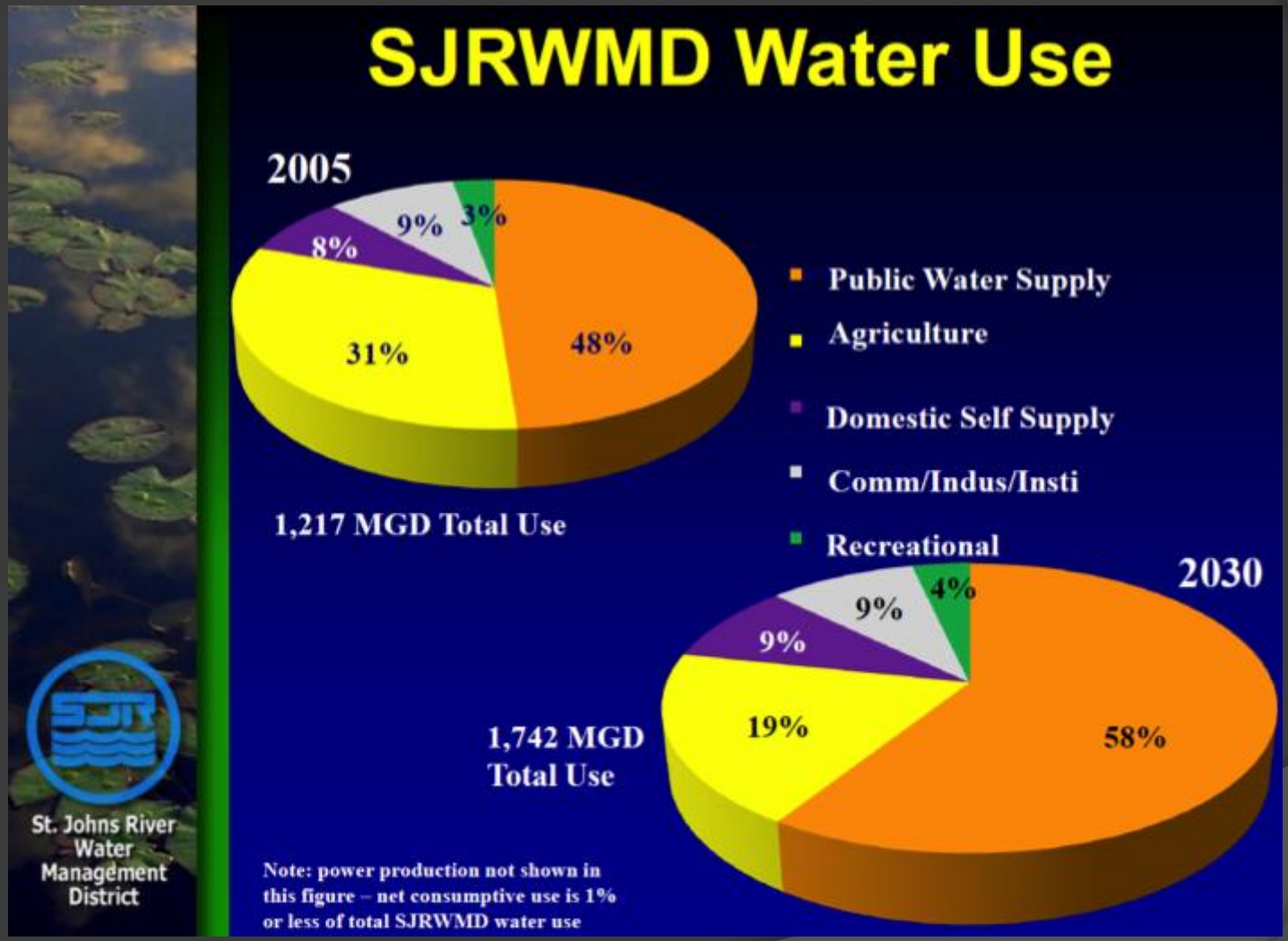
UF UNIVERSITY of FLORIDA IFAS

Objectives

- To promote adoption of efficient irrigation technologies and management practices for irrigation
- To promote the use of information currently available including
  - evapotranspiration network related tools
  - improved irrigation scheduling and monitoring
- Increase public awareness of IFAS irrigation research and extension efforts

Water Conservation



www.sjrwmd.com, Harold A. Wilkening III, Director (Jun 9, 2009)

Irrigation technology

Do we understand our “SOIL – IRRIGATION – PLANT” system to able to recommend the correct irrigation design and management?

Are our growers ready to adopt high technology in our irrigation system?

Irrigation and nutrient management “an example"

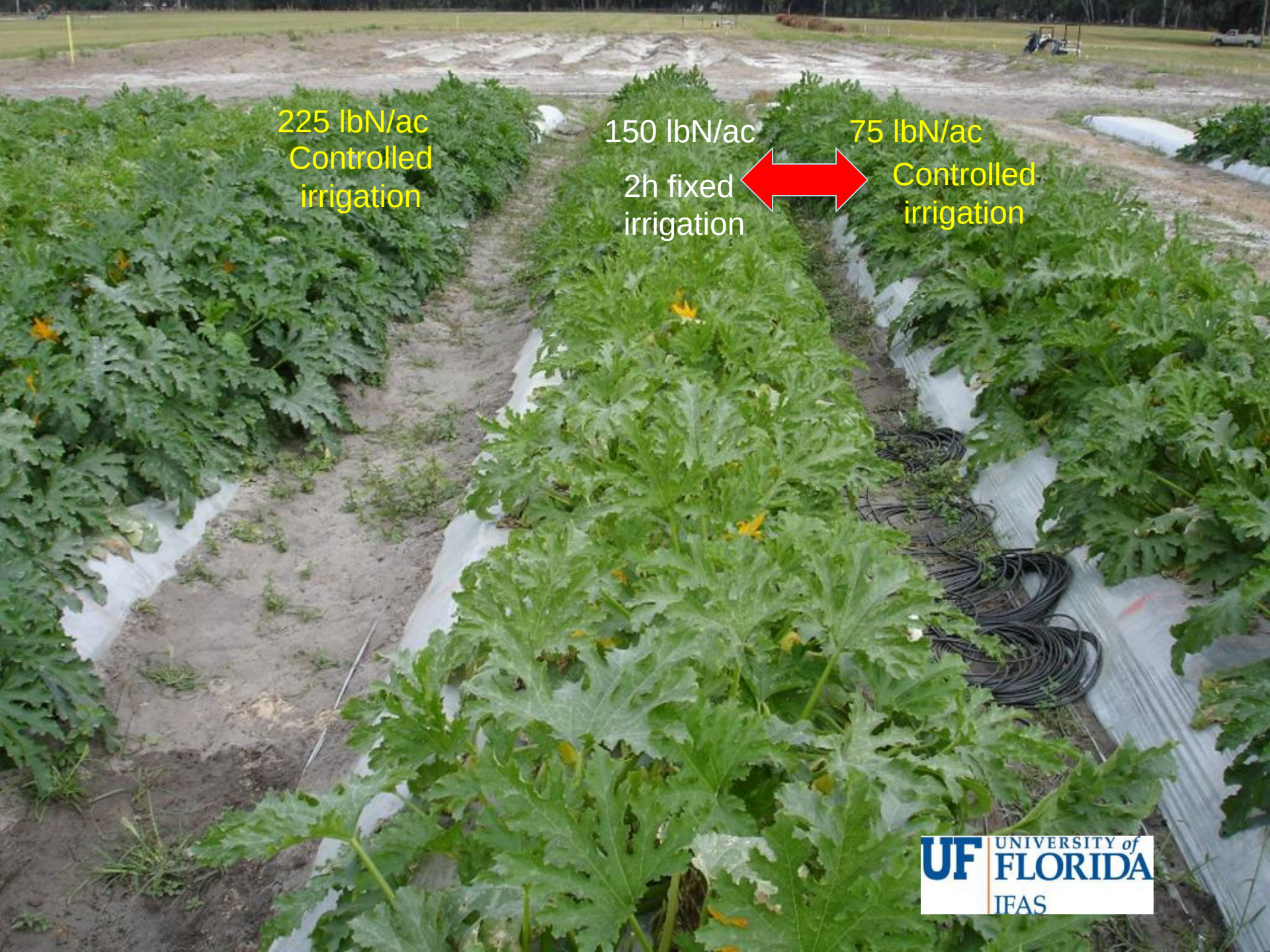


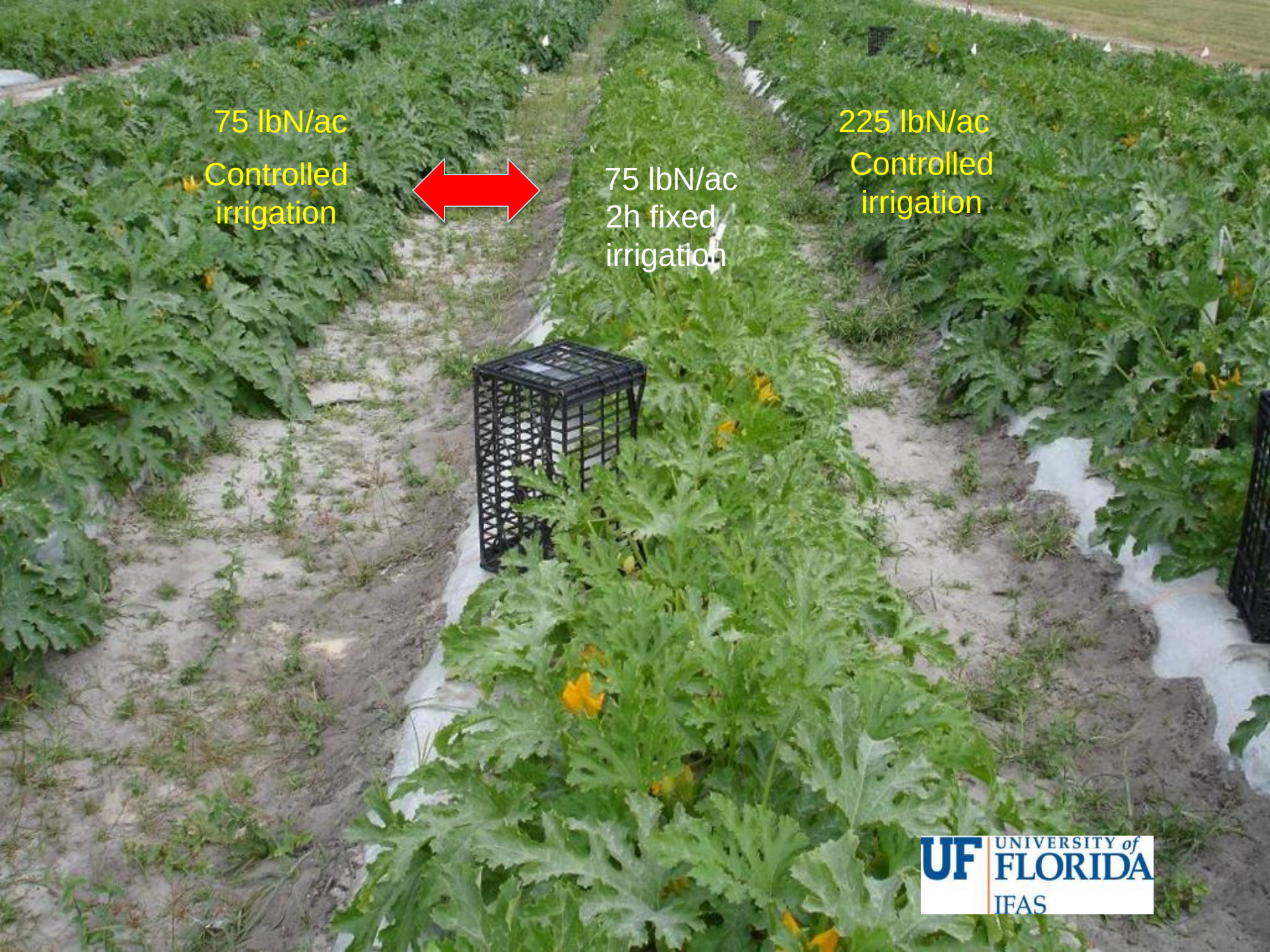


Water management and vegetable production

- Two irrigation strategies
  - Fixed irrigation – 2 hours continuously
    Equivalent to 79.6 gal/100ft/day
    At the end of the season applied 16.2 in or 5,970 gal/100ft
  - Controlled irrigation – TARGET WAS TO WET THE TOP 12-16" OF SOIL
  - 5 possible irrigation windows controlled
  - by soil moisture sensors set at soil field capacity
    Equivalent to 33.2 gal/100ft/day
    At the end of the season applied 6.7in or 2,492 gal/100ft
- N-rates of 75, 150 and 225 lb/ac
  weekly fertigation with calcium nitrate

Source: Zotarelli et al 2008. Scientia Horticulturae


225 lbN/ac
Controlled
irrigation
150 lbN/ac
2h fixed
irrigation
75 lbN/ac
Controlled
irrigation
UF UNIVERSITY of FLORIDA
IFAS


75 lbN/ac
Controlled irrigation
75 lbN/ac
2h fixed irrigation
225 lbN/ac
Controlled irrigation
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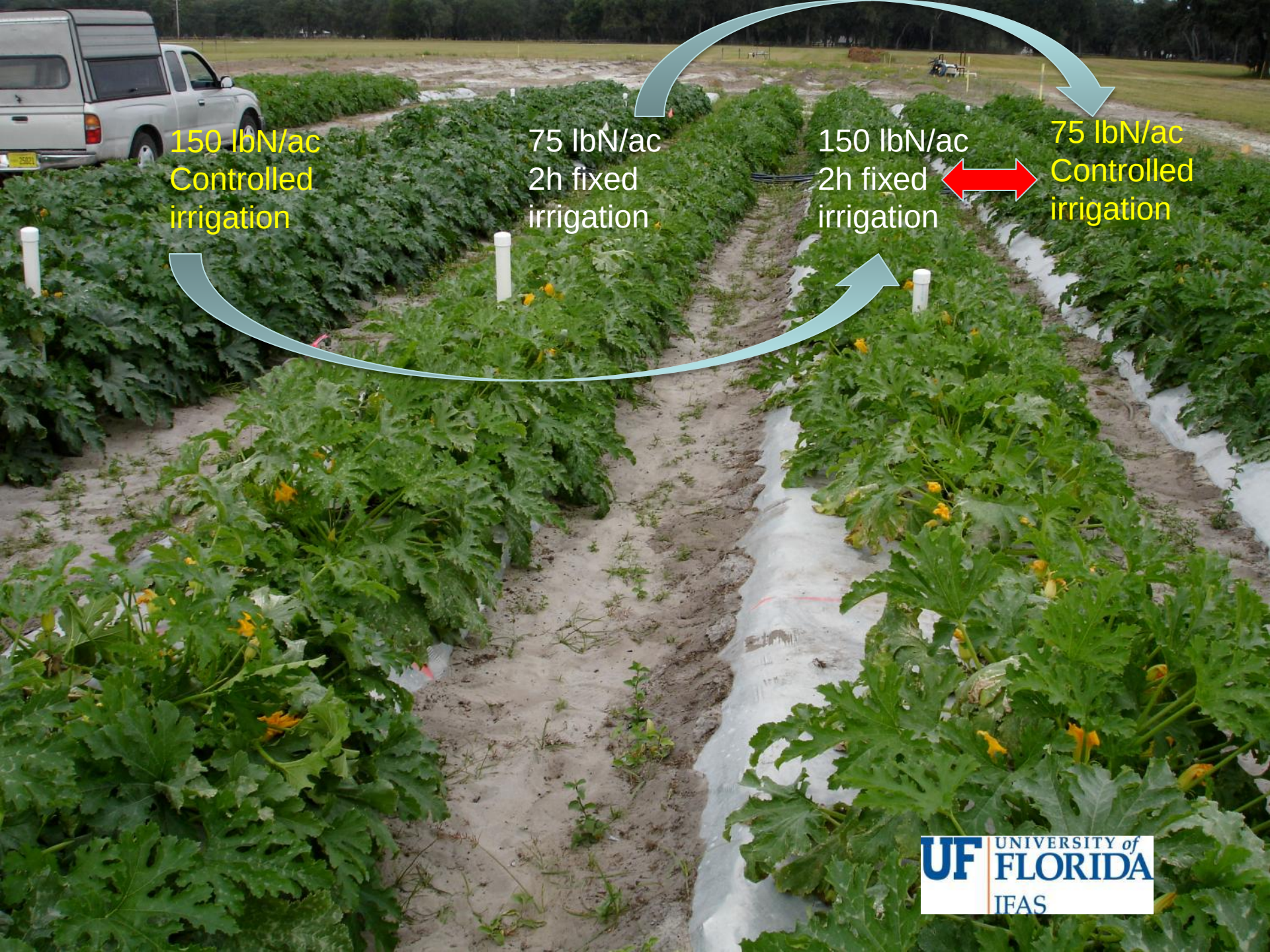
150 lbN/ac
Controlled
irrigation
75 lbN/ac
2h fixed
irrigation
150 lbN/ac
2h fixed
irrigation
75 lbN/ac
Controlled
irrigation
UF
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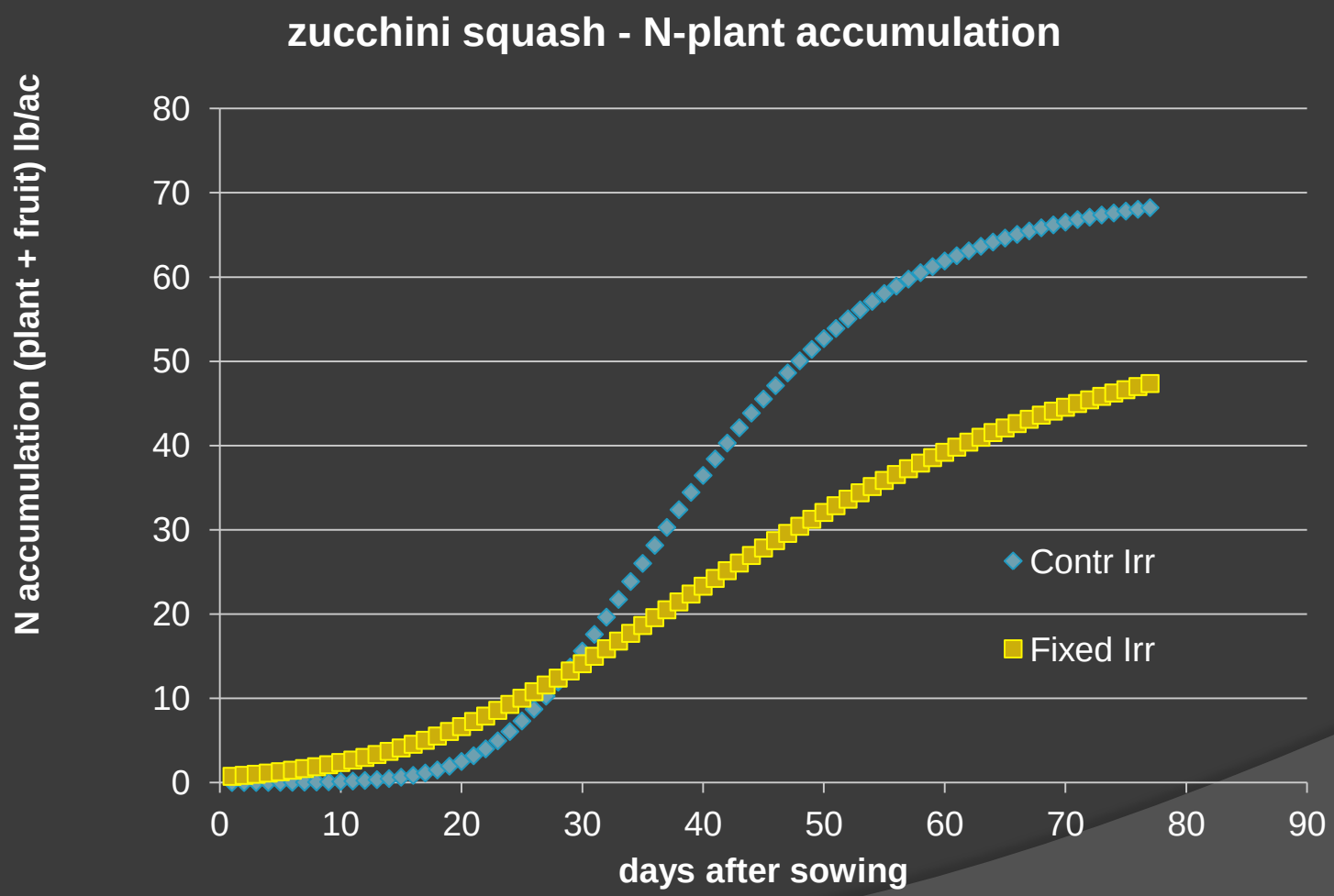
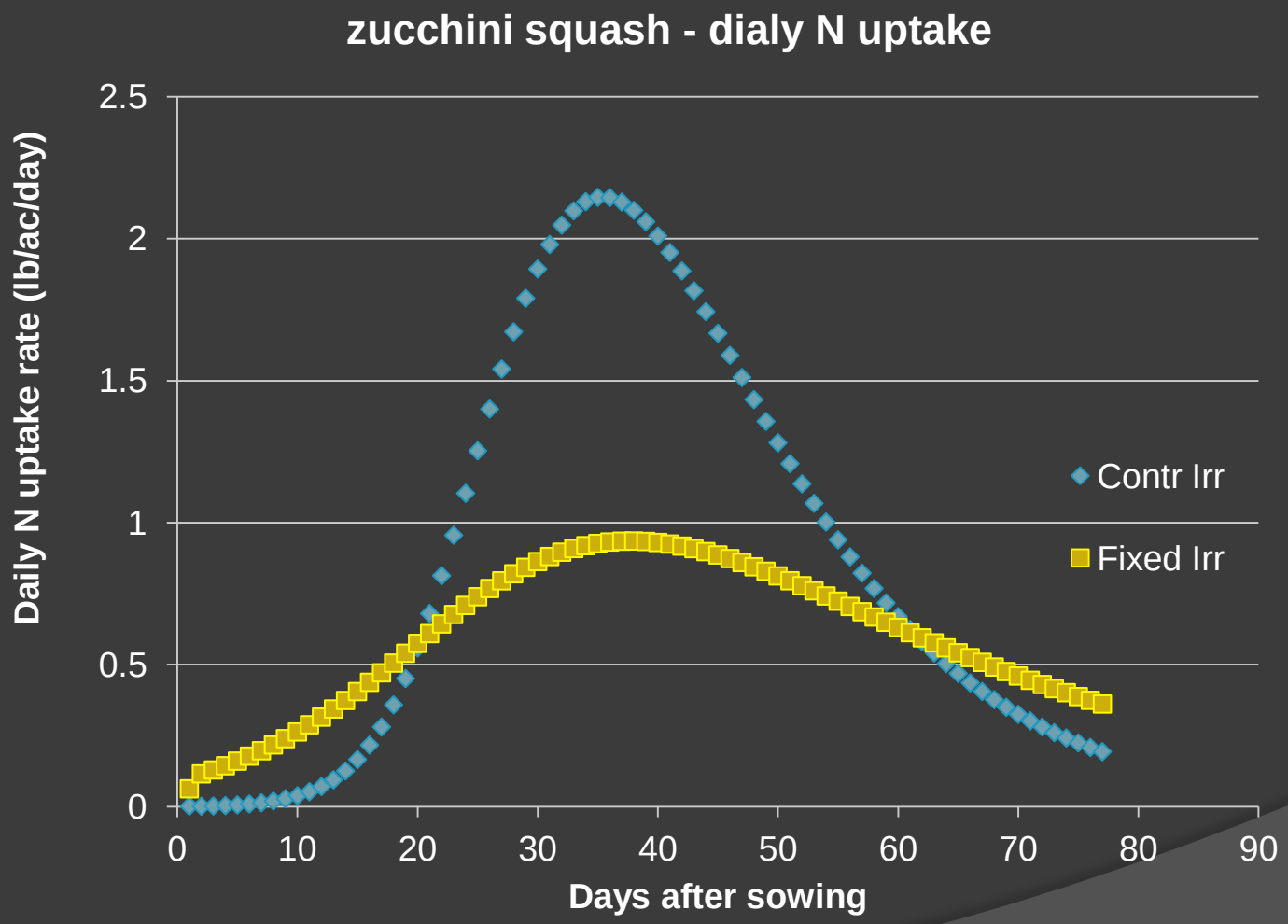
Zucchini plant N accumulation



Zucchini daily N uptake



Irrigation vs. N-fertilization on zucchini

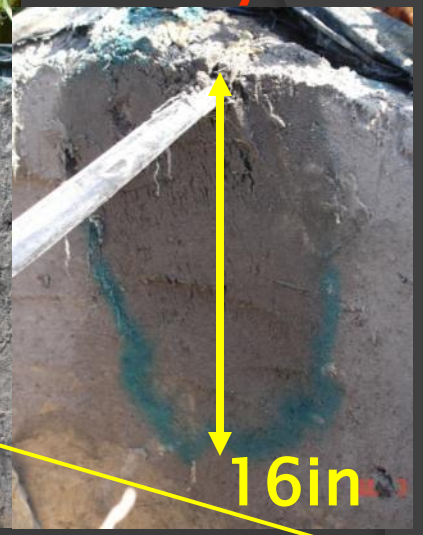
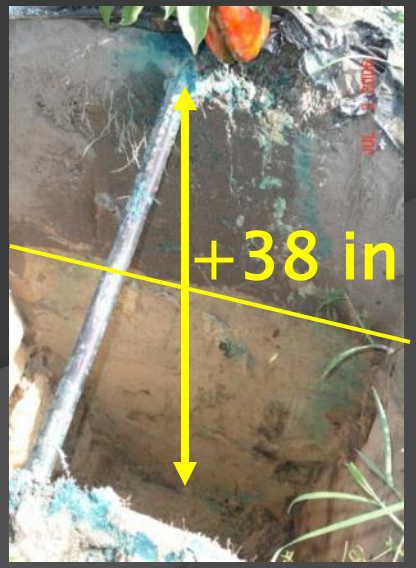
	75 lbN/ac	150 lbN/ac	225 lbN/ac	Average
	Zucchini marketable yield (lb/ac)			
Controlled irrigation – up to 5 irrig. windows/day	22,389	25,422	26,135	**24,649 A**
Fixed irrigation of 2h/day	15,525	19,535	19,891	**18,316 B**
Average	**19,955 B**	**22,478 A**	**23,013 A**	

† Means within columns/lines followed by the same lowercase letters are not significantly different ($P \leq 0.05$) according to Duncan's multiple range test.

Irrigation vs. N-fertilization on zucchini

	75 lbN/ac	150 lbN/ac	225 lbN/ac	Average
	Zucchini marketable yield (lb/ac)			
Controlled irrigation – up to 5 irrig. windows/day	22,389	25,422	26,135	**24,649 A** 100%
Fixed irrigation of 2h/day	15,525	19,535	19,891	**18,316 B** 74%
Average	**19,955 B** 84%	**22,478 A** 100%	**23,013 A** 102%	

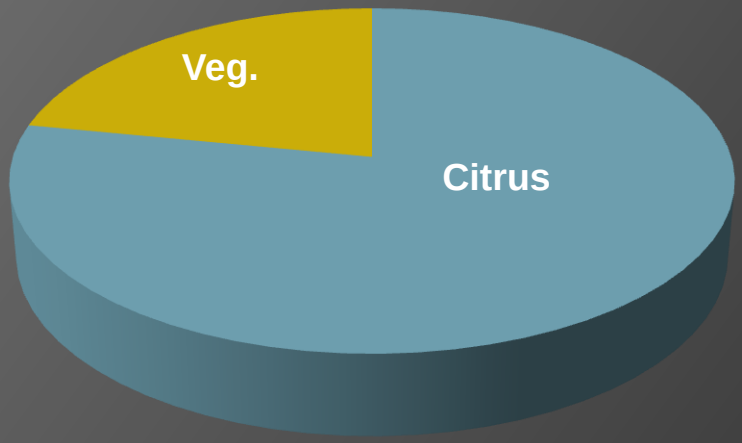
Effect of irrigation on solute displacement (injecting dye in fertigation lines)

	24 hrs	3 days	7 days
soil sensor based irrigation			
fixed time irrigation schedule			

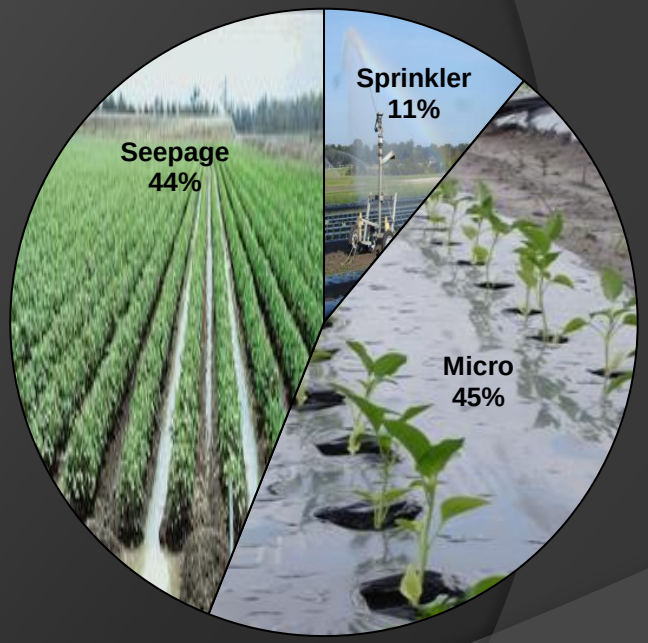
Keeping
water and nutrients
in the plant root zone

Vegetable & Citrus Irrigation in Florida

Planted Acreage 1998-2006

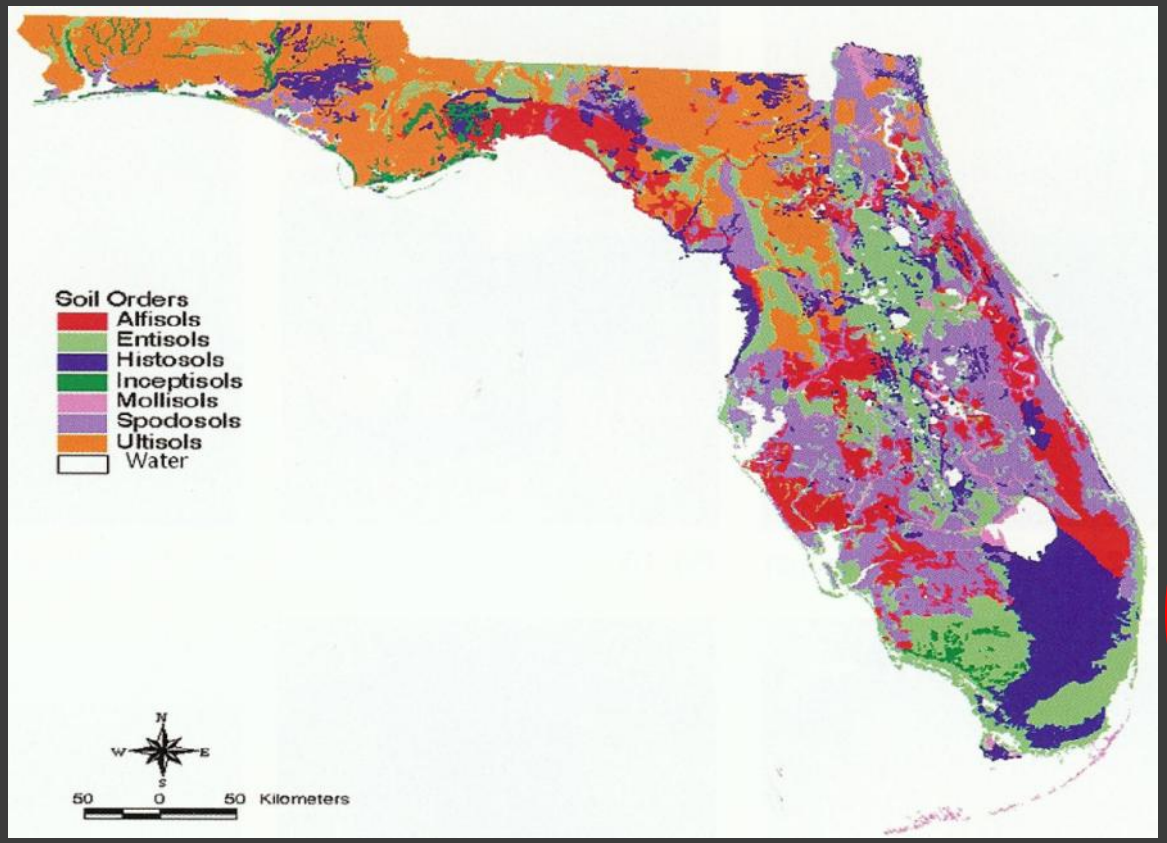


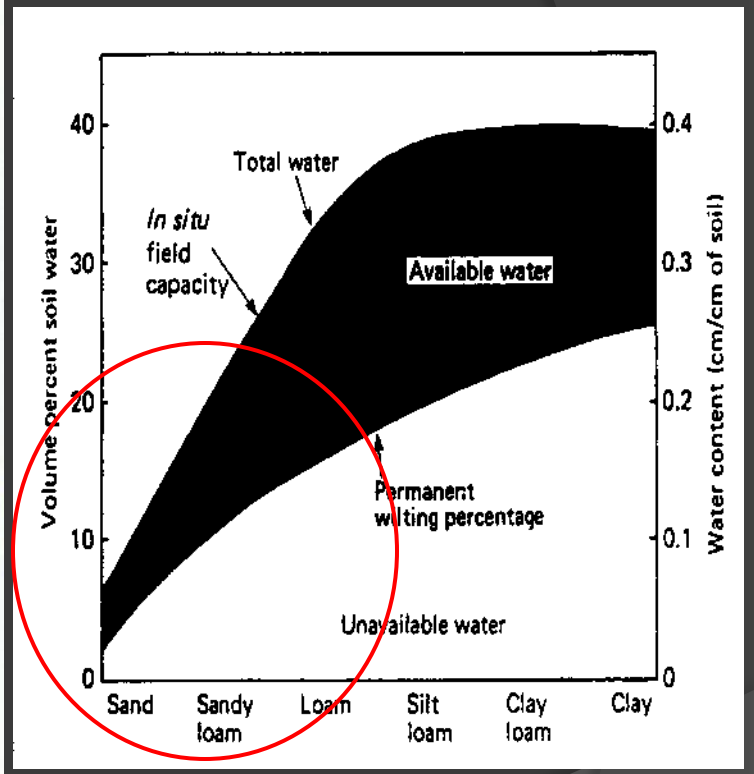
Percentage of total irrigated land in Florida by irrigation delivery method (2004)



Average of total of 207,700 acres planted with vegetable crops and 739,500 acres with citrus in Florida between 1998 and 2006 (NASS/USDA, 2008)

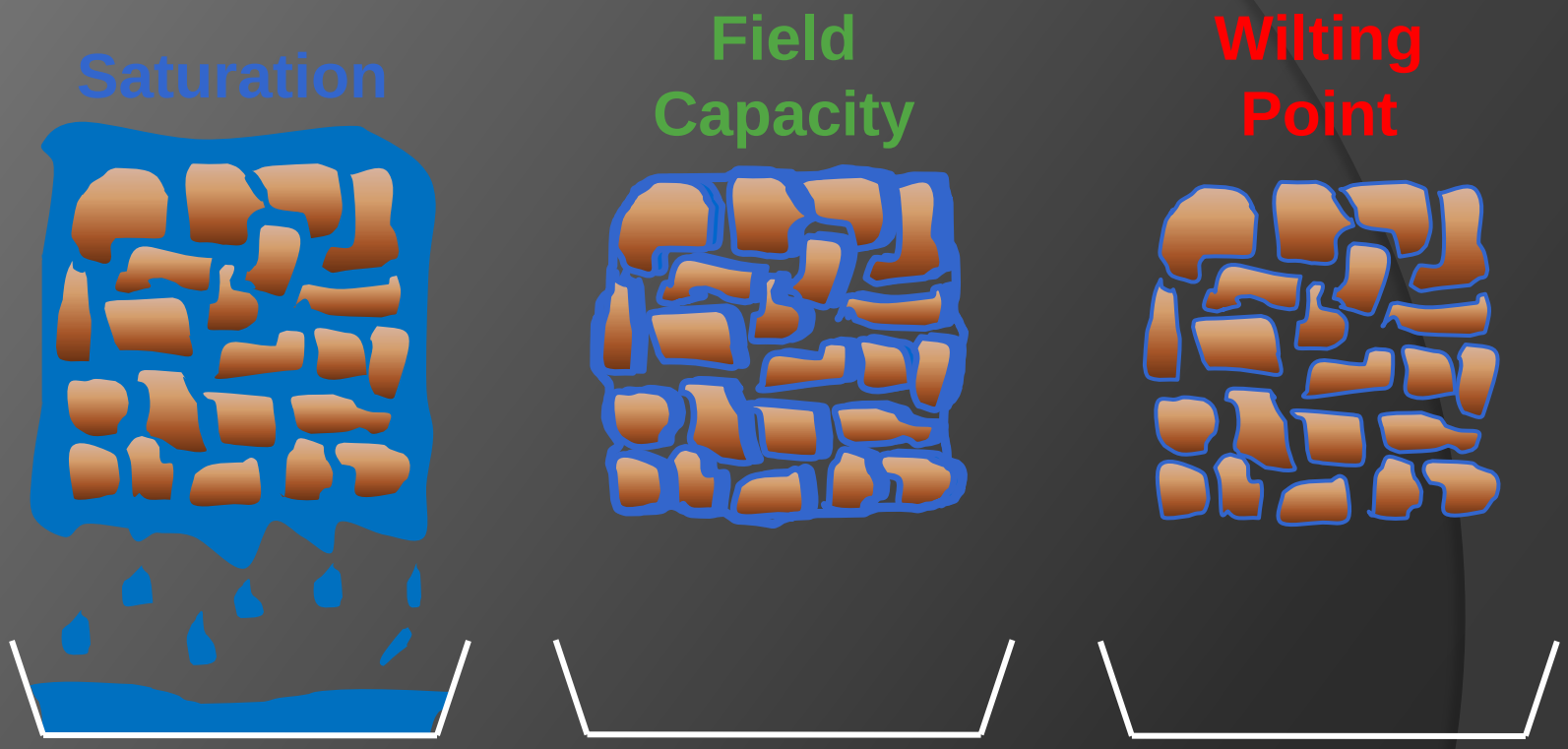
Effect of soil texture and soil tension on soil water availability





Kramer and Boyer (1995)

Actual soil moisture on sandy soils



VWC > 30%
VWC > 0.3 m^3/m^3

-1 cbar
-0.001 MPa

VWC approx. 12%
VWC > 0.12 m^3/m^3

-10 cbar
-0.01 MPa

VWC approx. 6%
VWC > 0.06 m^3/m^3

-1500 cbar
-1.5 MPa

What can we do to improve water use efficiency of irrigation systems in Florida?

Seepage

Microirrigation

Sprinkler

General guidelines:

- Proper irrigation design
- Determine and record operation values and water consumption
- Check system uniformity
- Irrigation system maintenance (documented maintenance)
- Record flow rate, pressure delivered by the pump, energy consumption, etc.

Resources: Mobile Irrigation Lab (MIL) – free of charge, provide irrigation systems evaluation with recommendation with system upgrades, irrigation scheduling, maintenance items. Contact local NRCS District Conservationist.

Irrigation technology, what is currently available?

- MICROIRRIGATION
- Advantages:
- Deliver water right to the plant;
- Frequent, small applications;
- Low volume required;
- Don’t wet the entire soil surface or volume;
- Perfect match with plasticulture (additional soil water conservation, up to 30%)
- Proper timing

- WHAT CAN BE DONE TO IMPROVE IT?
- Improve irrigation scheduling based on ET information

Vegetable Irrigation Scheduler

Please enter the specifications of your irrigation system and click [Create Schedule] to create a 2-week irrigation schedule.

Planting	Irrigation System	Scheduling
Between-Row: 6 ft (1 - 10) Planting Date: 01/18 mm/dd Crop: Tomato	Rate: 30 gals/100ftRow/hr (1 - 45) System Efficiency: 95 % (50 - 100)	FAWN Station: Citra ET: 0.0862″ Kc: 0.75

Create Schedule

Irrigation Schedule

Irrigate 0 hours and 51 minutes a day.

Bookmark your specifications

Click link to my specifications to save your specifications in the URL, then add-to-favorites/bookmark the page for later use.

About / Help

For help or more information about the scheduler, contact:

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Office: (239) 658-3400

Thanks to the South Florida Water Management District for funding this research.

Also see: Competition For Water Resources.

Irrigation technology, what is currently available?

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- WHAT CAN BE DONE TO IMPROVE IT?
- Improve irrigation scheduling based on ET information
- Soil moisture monitoring technology

Sensors Used to Measure Soil Moisture Content

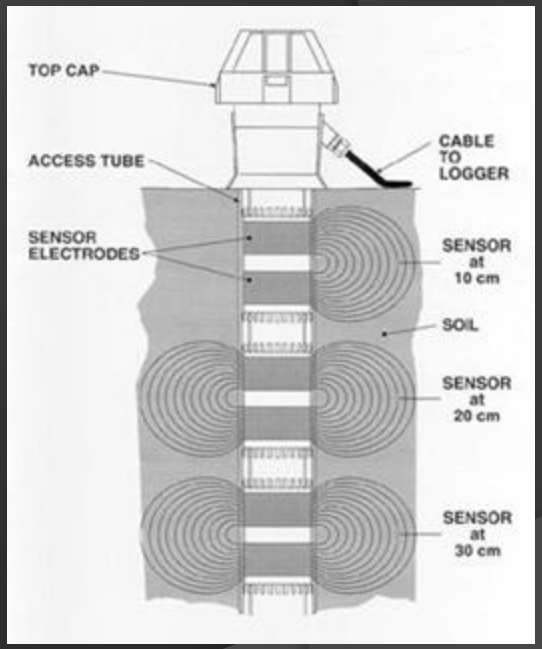
Tensiometers

Granular Matrix

TDR

Radio Telemetry

Capacitance Sensors



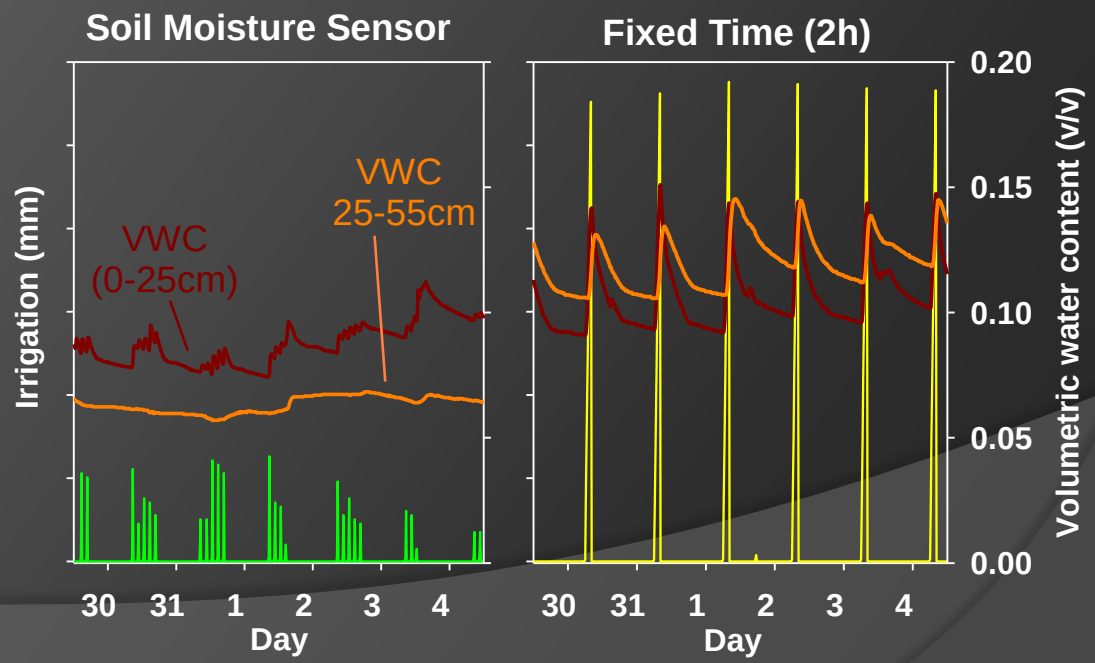
Potential Use of Irrigation Technologies in Florida

- Vegetable Crops – shallow root zone, high valued crops, water conservation – sensor-based systems
  - drip irrigation –high potential for acceptance due to control systems used.
  - Seepage irrigation –potential for use limited to monitoring only since system control is coarse.
- Citrus – Perennial, deeply rooted
  - Microsprinkler irrigation – systems becoming automated to reduce labor requirements and improved water and nutrient use efficiencies.

ADDITIONAL ADVANTAGE IF COUPLED WITH WIRELESS COMMUNICATION

Sensor Based Irrigation Control

- **Types:**
- **On-demand irrigation**
- **Bypass irrigation**

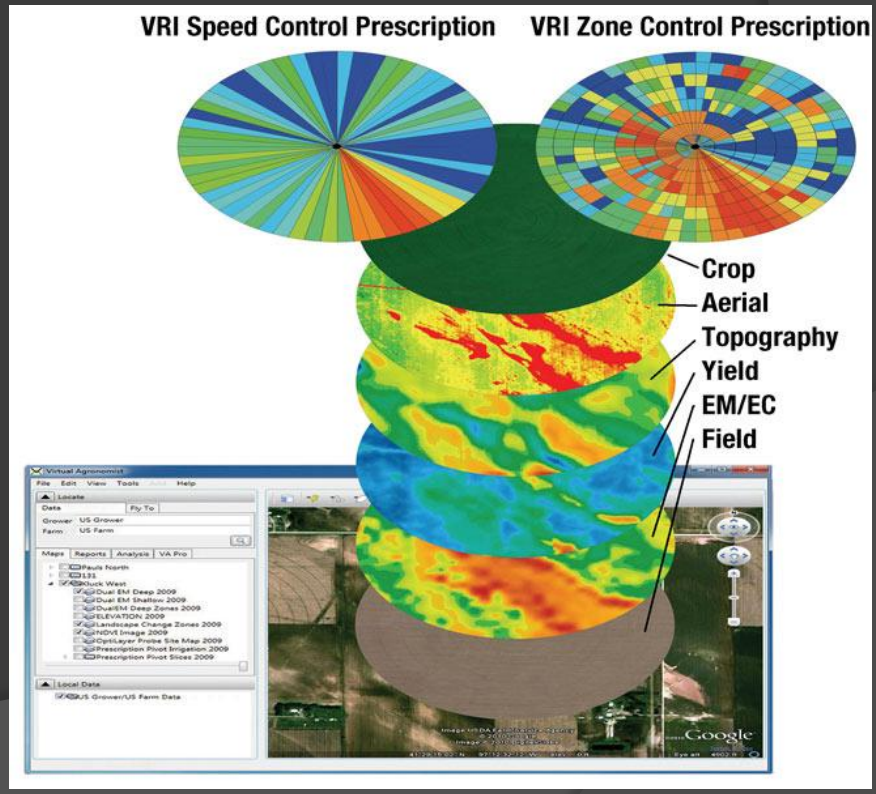


Variable Rate Irrigation – Center Pivot Irrigation

matching field variability with an equally variable irrigation application applying irrigation water based on specific water needs of individual management zones, rather than applying a uniform rate across an entire field

Speed Control
Uses an irrigation prescription defined by specific field conditions

Zone Control
Individual sprinkler or span control allows up to 30 different possible VRI Zones along the center pivot



Final considerations

- ✓ Combination of irrigation and fertilization
- ✓ On-field technology
- ✓ On-line technology
- ✓ Adaptation and creativity
- ✓ Extension & education

What are the barriers and incentives for BMP-irrigation implementation?

Economic investment

- ✓ Lack of information about the system, correct management and maintenance
- ✓ High-quality water

Incentives

- ✓ Cost-Share Programs for Water Conservation – qualified growers are expected to contribute a portion of total project cost
- ✓ Water Conservation Programs administered by USDA: e.g. Environmental Quality Incentives Program (EQIP)
- ✓ State and Regional Water Conservation Programs: e.g. BMP Cost-Share Program (FDASC); FARMS Program (SWFWMD); Water Protection and Sustainability Cost-Share Program (SJRWMD)