Environmentally sensitive irrigation next to the Everglades Nat. Park

Rafael Muñoz-Carpena, Michael D. Dukes, Herb Bryan

UNIVERSITY OF FLORIDA
Institute of Food and Agricultural Sciences

Objectives

Discussion (water savings, pros and cons and technical aspects) and application of a modern irrigation system based on three cornerstones:

a) high-frequency/low volume
b) soil moisture sensor based
c) automatic operation

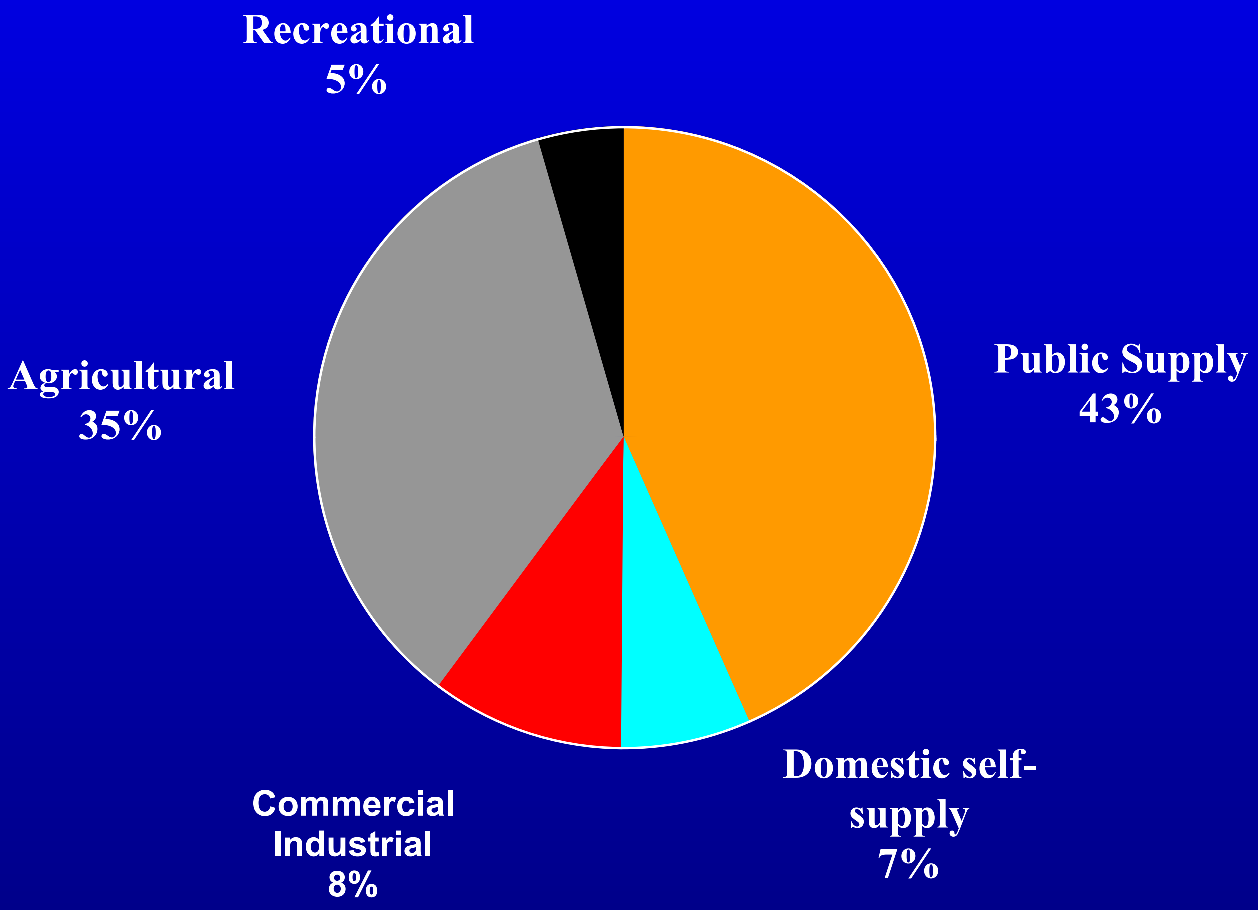
Background:

Irrigation water use, uniformity and efficiency in Florida

Irrigation Requirements

- Irrigation required for maximum yield
- Low available soil water
  - Frequent irrigation ideal but may be wasteful and inconvenient
  - Soil moisture initiated irrigation should be efficient
  - Optimum settings (soil moisture levels) required for each crop at various growth stages

Groundwater Use In Florida



Groundwater Use Trend

Estimated

Irrigation Efficiency & Uniformity

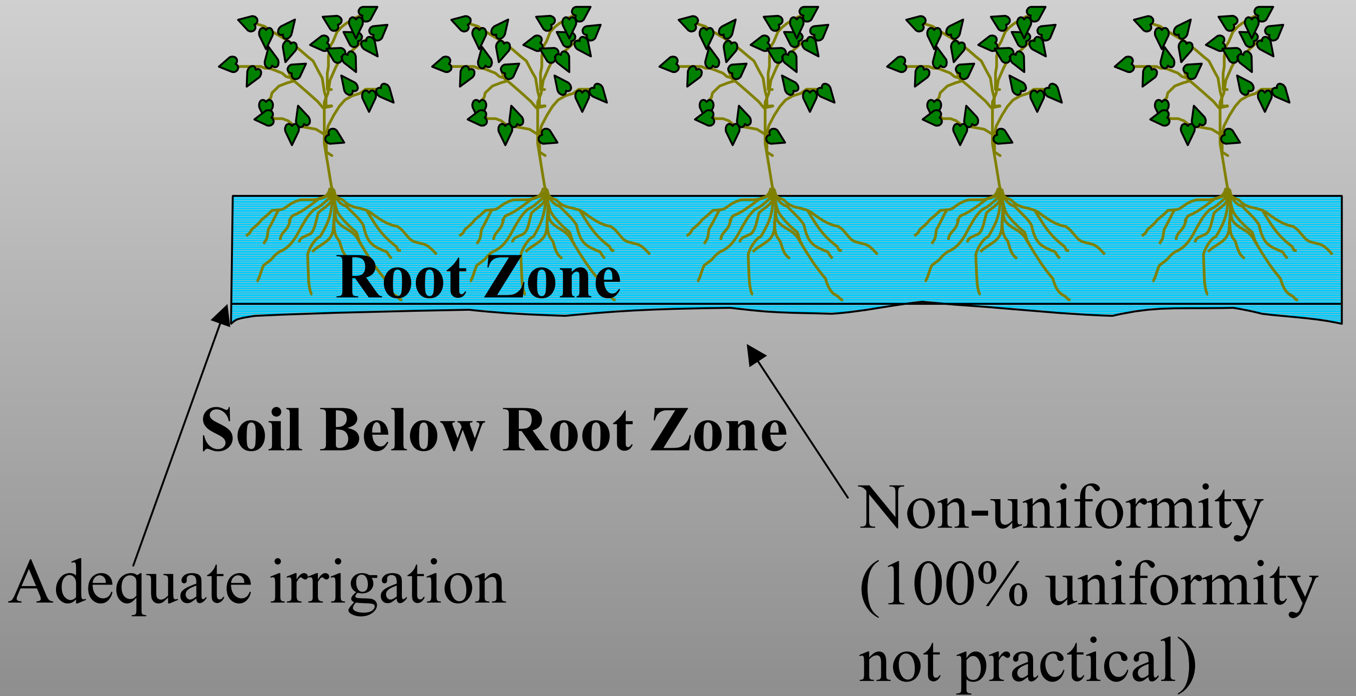
- What is irrigation system efficiency?

Ratio between water beneficially used and water pumped for crop production

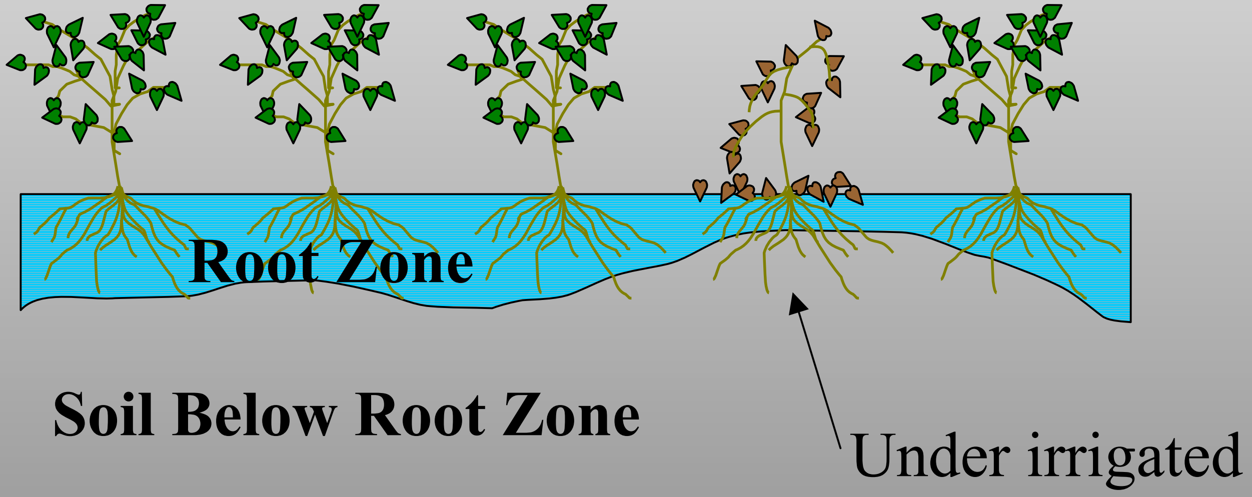
- And uniformity?

Level to which all plants in the field receive a similar amount of water

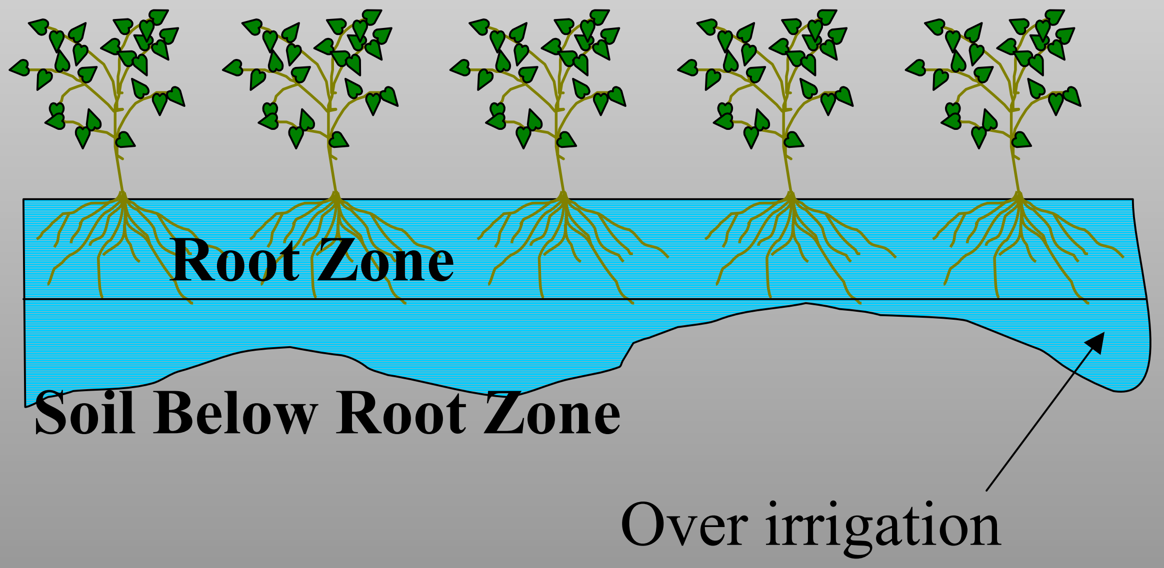
Uniform -- Efficient



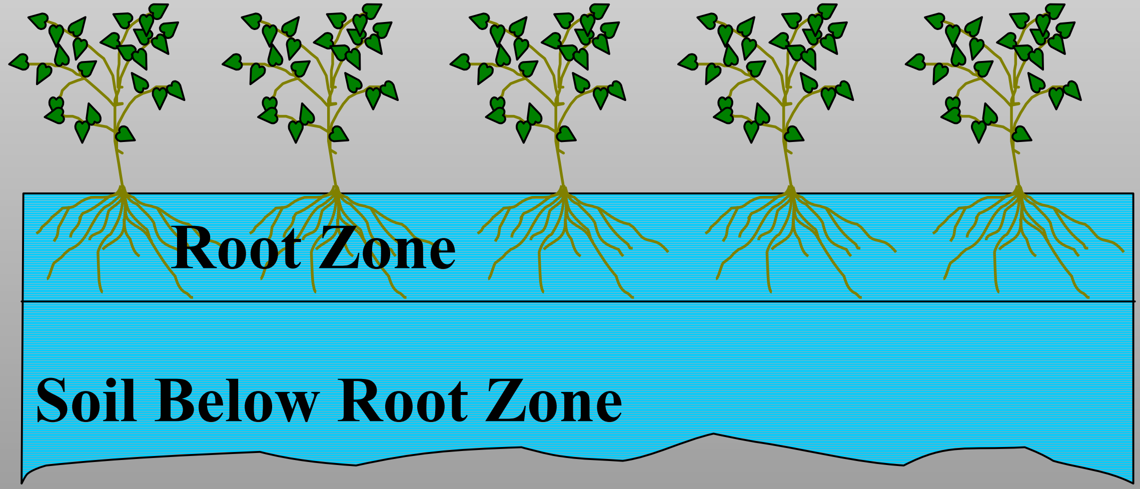
Non-uniform -- Inefficient



Non-uniform -- Inefficient



Uniform -- Inefficient

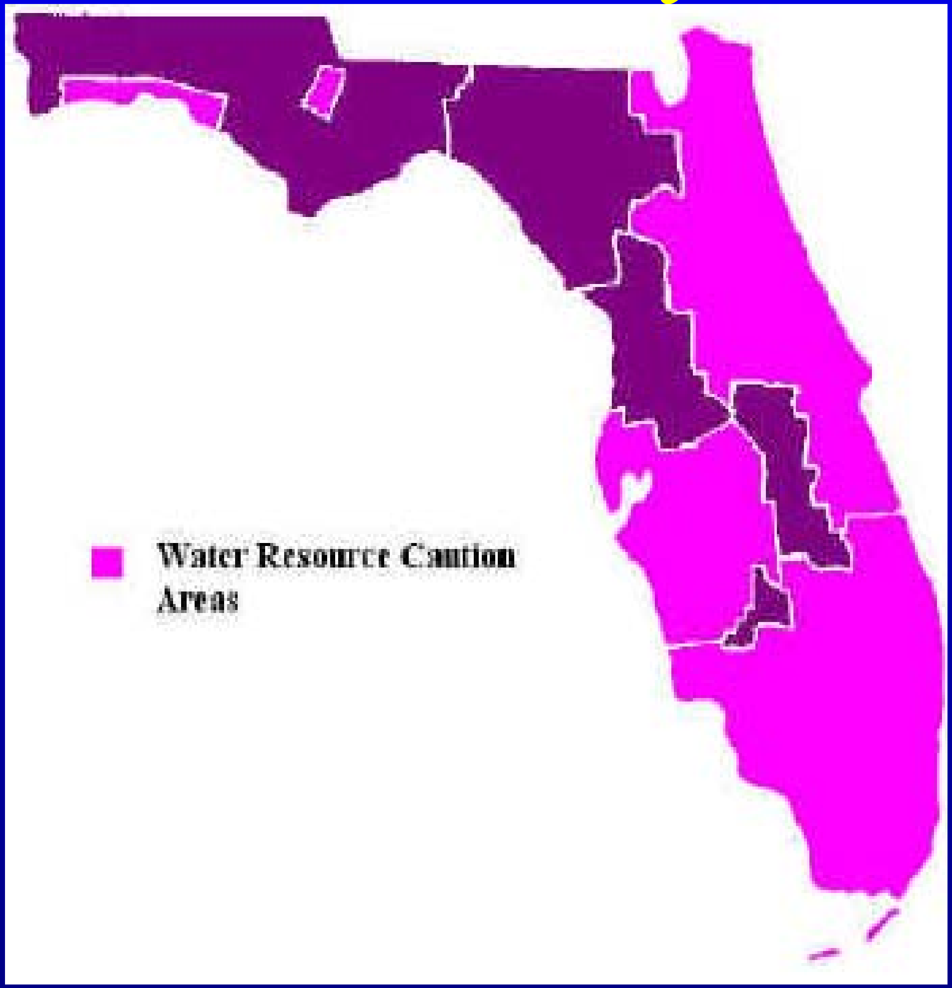


Irrigation Efficiency

- 100% efficiency often not practical
- Agriculture 50-90%
- Typical residential efficiency poorly documented 15-50%

Why Worry About Efficiency?

- Wasted water
- Increased water bills
- Increased demand on the resource



Types of Automatic Irrigation

- Time based
- Time based/sensor lock out
- Weather station based
- Timed/sensor initiated
- Soil moisture controlled

Research and extension work in South Miami Dade, FL

Environmentally sensitive irrigation next to the Everglades Nat. Park

- Testing of soil moisture monitoring devices for irrigation management in different crop commodities and soils.
- Demonstration project to assess the feasibility of automatic irrigation based on soil moisture sensoring in a commercial tomato field.
- A comprehensive survey to ~500 commercial agriculture water users (ornamentals, vegetables, fruits and golf/landscape) was conducted to identify historical improvements, current practices, motivations and possible introduction of additional water conservation techniques.

Optimized irrigation (to closely match crop needs) avoids the potential for excess soil water drainage and leaching of agri-chemicals in the soil in this environmentally sensitive area

UNIVERSITY OF FLORIDA
Institute of Food and Agricultural Sciences

Demonstration Project in S. Florida - Miami

- 1.5 acr. experimental plot inside a farmer's 40 acre commercial tomato field
- Sandy soil, tomatoes on beds with dual drip irrigation lines.
- 7 irrigation treatments:
  - 4 soil moisture based automatic irrigation (2 sensor types x 2 moisture set points 10 cbar & 15 cbar)
  - 2 time based, high frequency/low volume (100% and 150% water needs)
  - 1 traditional low frequency/high volume farmer's manual irrigation with portable pump

QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.

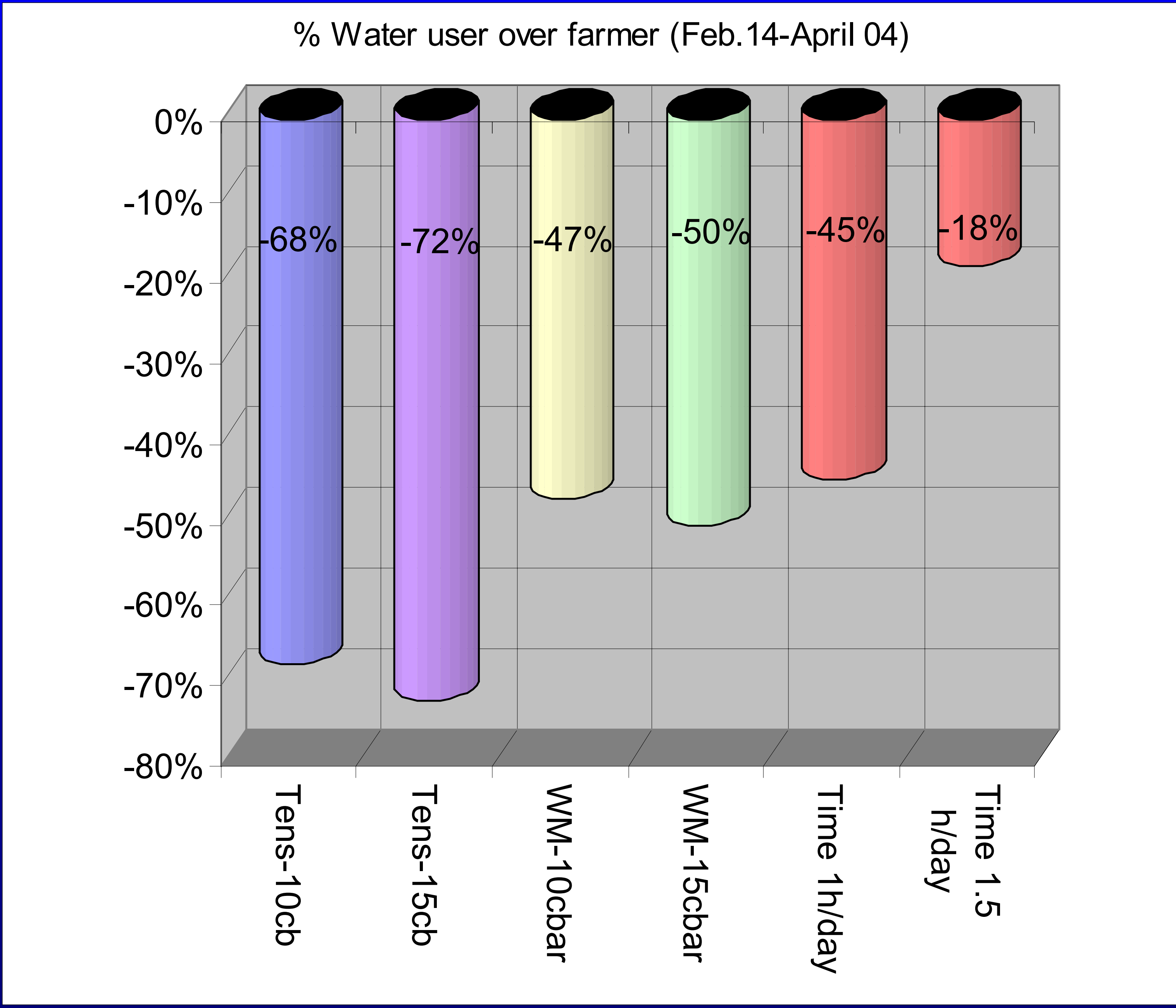
Irrigation design

Tape:T-TAPETSX 508-12-450 (double drip lines)
Internal diameter=0.625
Drip spacing=12 in
Nominal flow=0.450 gpm/100'
Nominal pressure=8 psi

Max needs=2800 g-ac-d
Each plot= 0.083 acre
Max needs/plot=233 gal/d
Time to irrigate = 50 min/plot-day
No. of irrigations/day=5
Time/irrigation=12 min/plot

Pump: 1HP, well tank 35-50psi

Preliminary results



- All treatments used significantly less water than traditional irrigation in farmer's field
- Switching tensiometer blocks conserved the most water (-70%)
- Moisture set point for the sandy soil, from 10 cbar to 15 cbar, conserved an additional 16% in tensiometers and 7% in Watermark
- High frequency/low volume (no sensor) treatments also conserved water since deep percolation associated to large volume application is reduced significantly