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It’s No Oxymoron
Save Water Without Changing Station Run Times

Mike Baron
Toro Water Management
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Oxymoronic Thesis

- Residential landscape water use is better managed when station run times are left unchanged from month to month and season to season rather than when irrigation schedules are automatically adjusted by sophisticated, multi-variable algorithms and lead the end-user to mis-adjust the controller.

Programming Complexity From Inputting 8 Factors Per Zone

Sprinkler Efficiencies and Average Precip Rates	Precip Rate (in/hr)	Efficiency
Spray Head (default)	1.70	70%
Full Circle Rotor	0.50	80%
Part Circle Rotor	1.00	80%
Mixed Rotors	0.75	80%
Full Circle Impact	0.50	85%
Part Circle Impact	1.00	85%
Mixed Impacts	0.75	85%
Stream Rotors	0.65	75%
Bubbler	2.55	90%
Drip Emitter	1.50	90%
Stream Spray	0.75	70%

Soil Types	Available Water	Infil Rate
Clay	1.40	0.12
Clay Loam	1.95	0.20
Loam	1.80	0.30
Sandy Loam	1.40	0.50
Sandy (default)	1.10	0.70

Crop Coefficient
Cool Season Grass (default)
Warm Season Grass
Combined Grass
Flowers
Trees
Shrubs - High Water
Shrubs - Med Water
Shrubs - Low Water
Mixed - High Water
Mixed - Med Water
Mixed - Low Water
Native Shrubs/Trees
Native Grasses
Custom Plant A
Custom Plant B
Custom Plant C

Root Depth
Cool Season Grass (default)
Warm Season Grass
Combined Grass
Flowers
Trees
Shrubs - High Water
Shrubs - Med Water
Shrubs - Low Water
Mixed - High Water
Mixed - Med Water
Mixed - Low Water
Native Shrubs/Trees
Native Grasses
Custom Plant A
Custom Plant B
Custom Plant C

Slope Factor

Slope Location Factors

Micro Climate Factors

Spacing & Pattern Effects On DU_{LQ} of Spray Nozzles

"More water will be saved by having the spray heads operate at the preferred operating pressure of 30 psi <u>with the proper run times programmed into the controller</u> than by trying to raise the bar for higher uniformity for difficult areas to irrigate.

Brent Q. Mecham, CID, CIC, CLIA, CGIA, Landscape Water Management & Conservation Specialist,
Northern Colorado Water Conservancy District, Berthoud, CO; September 11, 2006

Research Goal

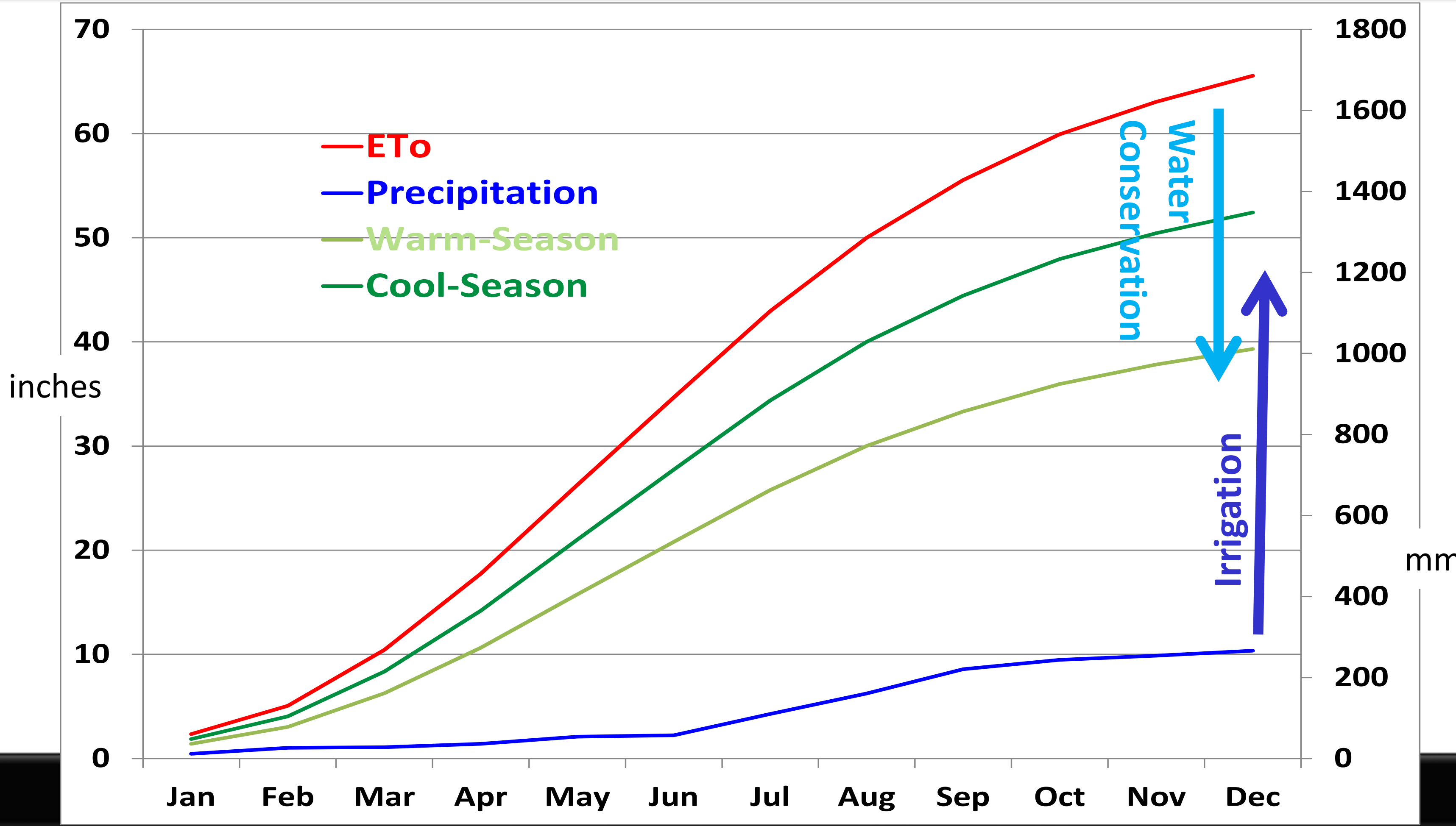
To Evaluate the Water Conservation Potential of a Sensor Controlled Turf Irrigation System Compared to Other Scheduling Technologies

Cooperative Extension Service
Department of Extension Plant Sciences, MSC 3AE
College of Agricultural, Consumer, and Environmental Sciences
P. O. Box 30003
Las Cruces, NM 88003-8003
Phone: (575) 646 5280
Fax: (575) 646 8085

Bernd Leinauer, Professor, leinauer@nmsu.edu
Matteo Serena, Ph.D., mserena@nmsu.edu
Extension Plant Sciences Department
New Mexico State University

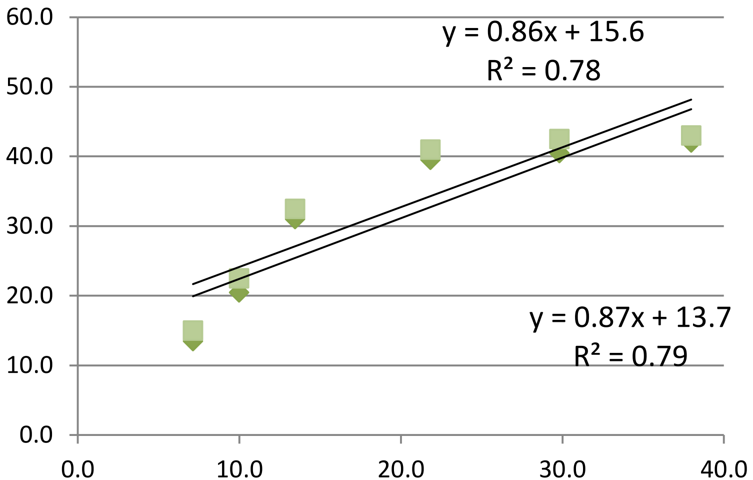
Products Tested Over 2-Year Period
New Mexico State University

Turfgrass Irrigation Requirement Las Cruces, NM (2005 – 2009)



Lab Test To Validate Moisture Sensing Technology

Test #	Water salinity (dS m^{-1})	Regression	R^2	P value
1	0.0	X= -5.90 + (0.76* Y)	0.85	<0.001
2	0.7	X= -3.75 + (0.77 * Y)	0.89	<0.001
3	2.0	X= -9.04 + (0.91 * Y)	0.78	<0.001
4	4.0	X= -11.14 + (0.65 * Y)	0.90	<0.001



X = gravimetric soil moisture; Y = sensor reading

- **Track moisture changes accurately**
- **Not affected by salinity up to 4dS/m**

Field Study

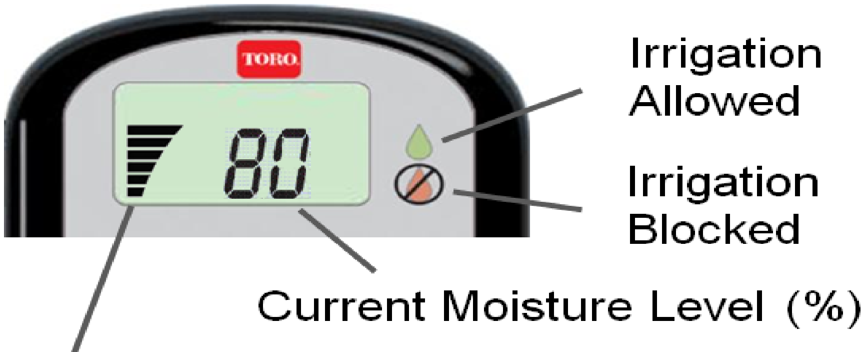
- Two grasses: Bermudagrass (*Cynodon dactylon*) tall fescue (*Festuca arundinacea*)
- Sprinkler Irrigation, Toro® Precision™ Series Sprays Turfguard sensors at 5 and 20 cm (°T, %VWC ECb)

Irrigation Treatments

Four different irrigation scheduling systems:

1. Precision™ soil sensors
2. Climate Logic weather sensing system
3. Constant run time (Homeowner)
4. Historic weekly ET

Receiver Design

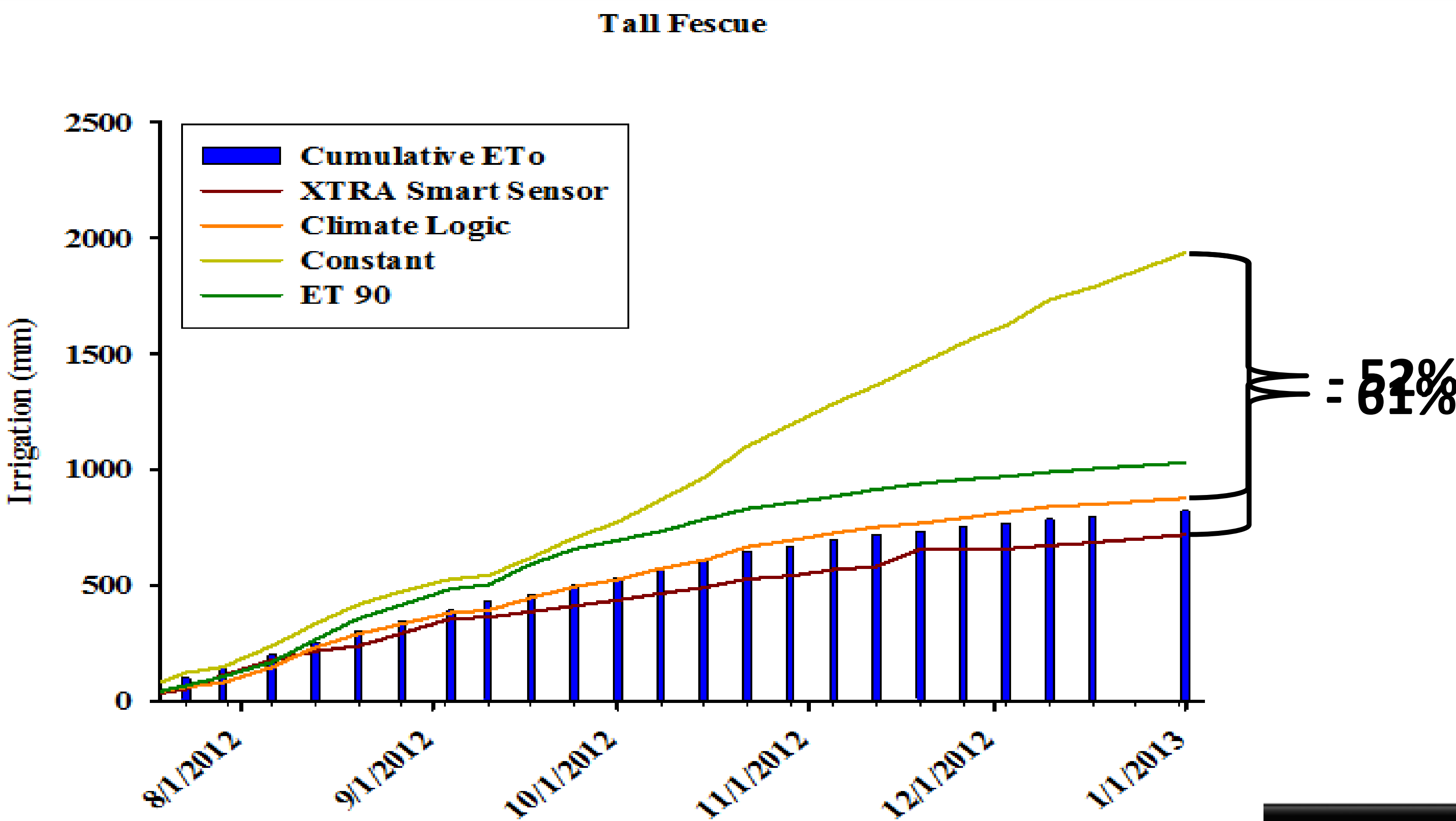


- Indicates signal strength with
- Indicates battery strength with

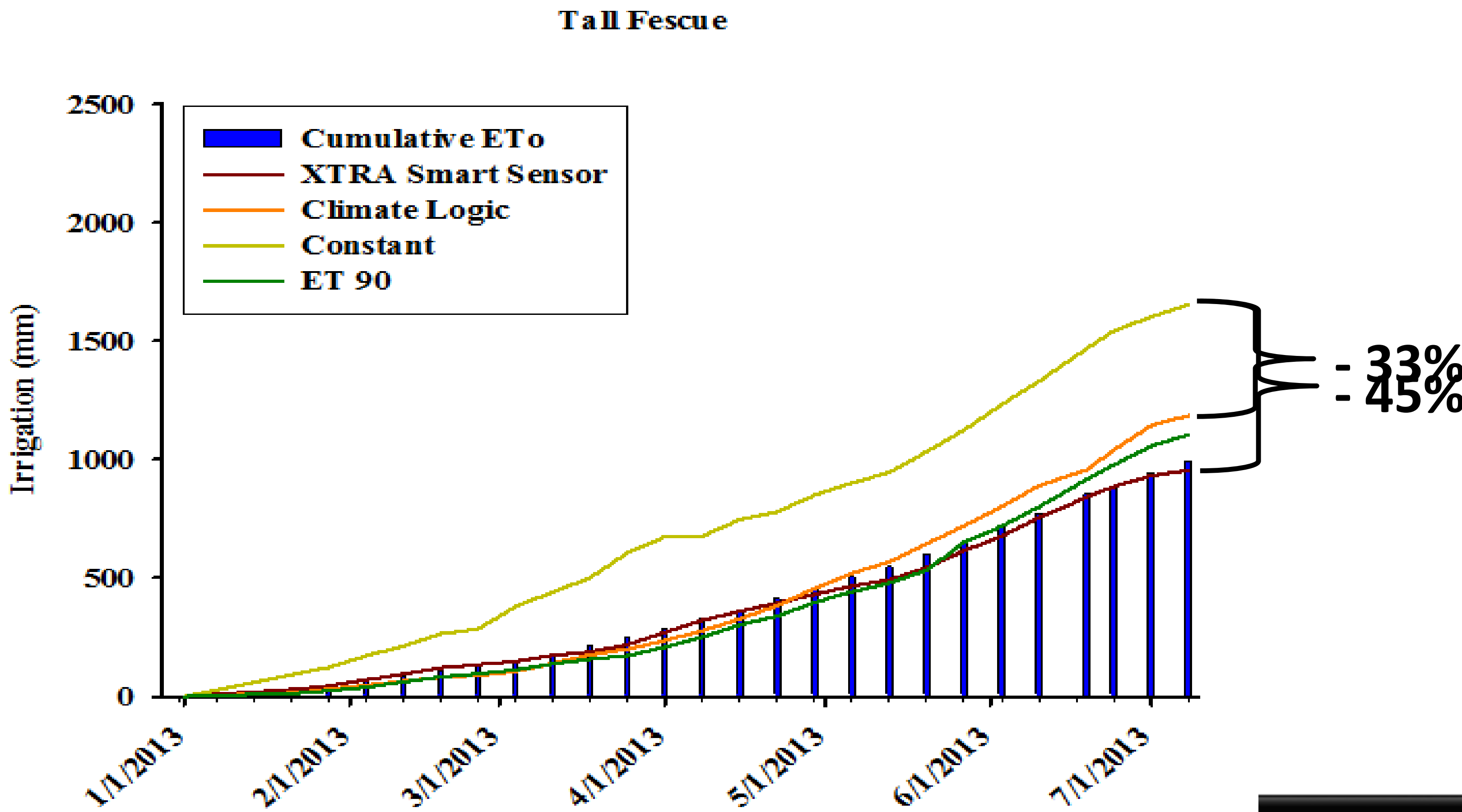
Data Collection

- Turf quality assessment
- Water consumption (flow meters)
- Soil moisture

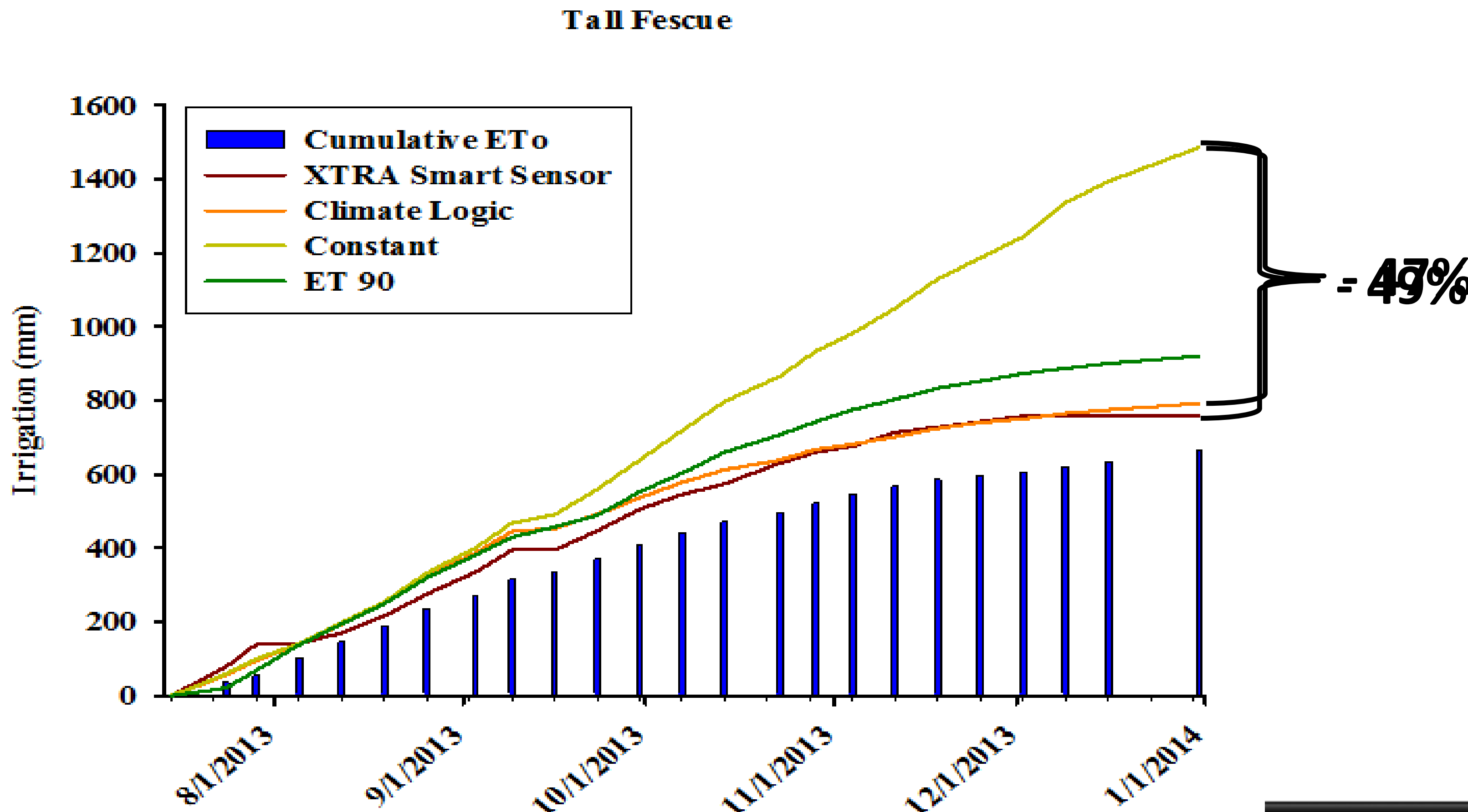
Results: August – December 2012



Results: January – July 2013



Results: August – December 2013



Summary – Water Savings

Period	Tall fescue	Bermudagrass
July – Dec 2012	61%	46%
Jan – Jun 2013	42%	38%
July – Dec 2013	49%	40%

Water Use By Each Of the Four Treatments

- Tall fescue plots irrigated by a daily constant run time received the most water
- Next, the 90% ETo treatment
- Water consumption for the Climate Logic treatment followed ETo closely
- The PSS treatment resulted in the least amount of water applied.
  - A significant rain event during the first week of September, caused irrigation to be withheld on PSS scheduled plots for about 10 days following the rain event

Implications For Residential Irrigation Scheduling & Control

Moisture Sensors

- Measure moisture content directly, in the soil, vs. a calculated ET
- Manage the interval between watering events rather than adjusting station run times
- During heat waves, avoid increased run times which can produce runoff
- After rain events, will delay resumption of automatic irrigation
  - Gains in significance as average annual rainfall increases

– Does not provide for consistent, repeated irrigation events

THANK YOU !

QUESTIONS??

Mike Baron
951-785-3721
mike.baron@toro.com