

Gizmos and Gadgets

IPM Tools for Turfgrass Management

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Extension Turf Specialist



TH2O “Theta” Soil Moisture Meter

- The TH2O takes accurate soil moisture samples with minimal disturbance.
- By simply inserting the probe into the ground, actual soil moisture percentage readings are given.
- The sensor sends a microwave signal and analyzes a reflected signal to measure the dielectric constant (theta) of the soil.
 - The dielectric reading is then converted to volumetric water content (+/-2% accuracy).



Sprayer for testing on-site

Weed Systems, Inc.
www.weedsystems.com



This may be the best tool you can buy.



TH2O Soil Moisture Meter

- Watering needs can be quickly determined making it easy to remove the guesswork and errors.
- Determine the ideal moisture level for best play and looks.
- After saturation, determine the holding capacity of fairways, greens and tees.
- Spot check the greens and fields on hot days for syringing or for uneven irrigation application.
- After cutting a cup, check the perched water table or root zone.

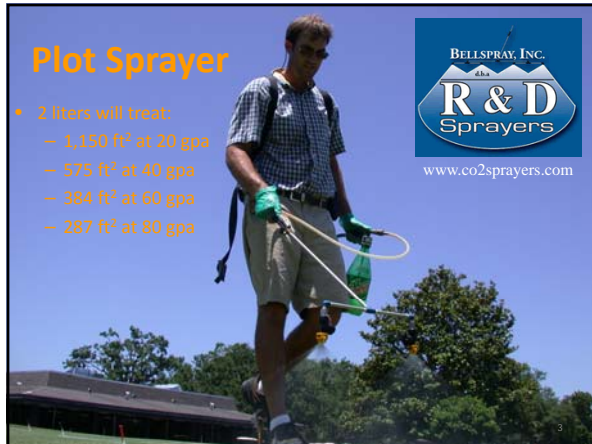


www.dynamax.com



Plot Sprayer

- 2 liters will treat:
 - 1,150 ft² at 20 gpa
 - 575 ft² at 40 gpa
 - 384 ft² at 60 gpa
 - 287 ft² at 80 gpa



www.co2sprayers.com



Application Rates

Product	Rate/oz/M (fb = followed by)	Ozs/Season
Tournament-Ready- pgm I.....	8 fb 2.....	18
Revolution	6 fb 6 fb 6.....	18
Primer Select	4 fb 2.....	14
Magnus Upper Roots	4 fb 4 fb 5.....	12
Cascade Deeper Roots	8 fb 8.....	16
Tournament-Ready- pgm II.....	8 fb 8.....	16



7

Treatments (2004 – 2005)

A. Irrigation Threshold Factor (whole-plots)

- 1) 12% - High
- 2) 10% - Moderately High
- 3) 8% - Moderately Low
- 4) 6% - Low

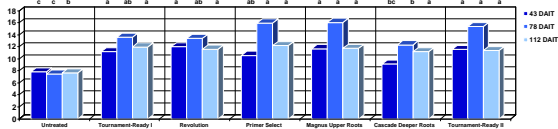


B. Wetting Agent Factor (sub-plots)

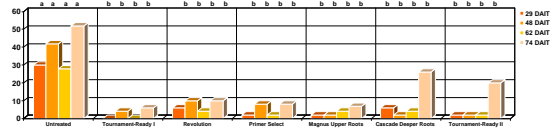
- 1) Revolution™ applied at a rate of 1.91 ml / m² / mo
- 2) Untreated Control

Table 1.

Volumetric Soil Water Content



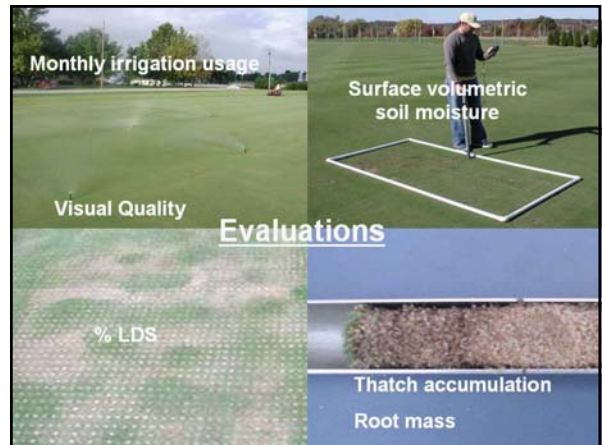
% Hydrophobicity



Means with the same letter on the same rating date are not significantly different.

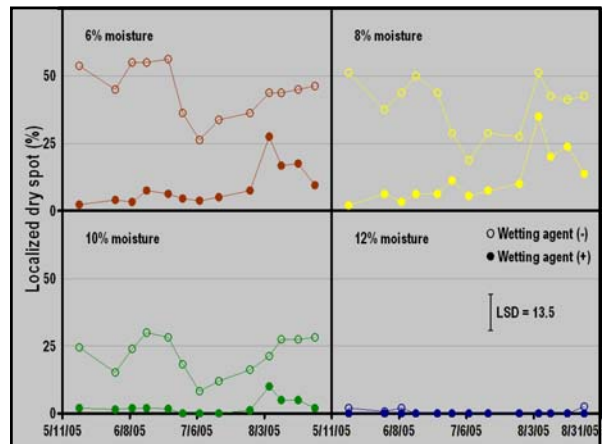


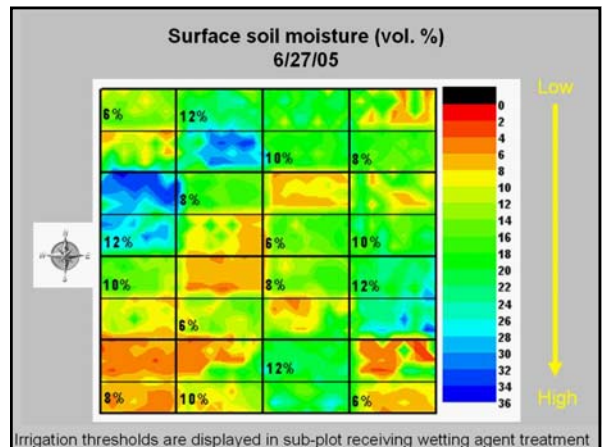
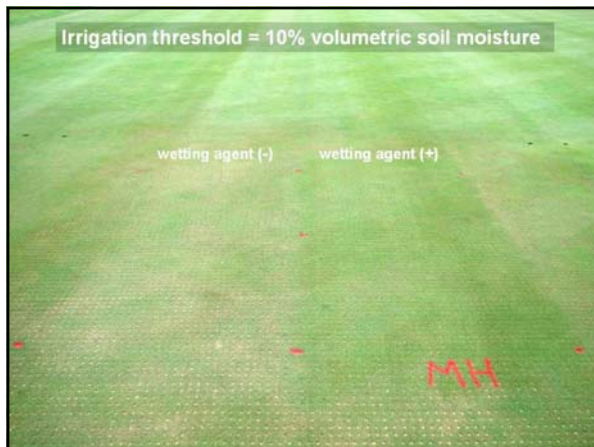
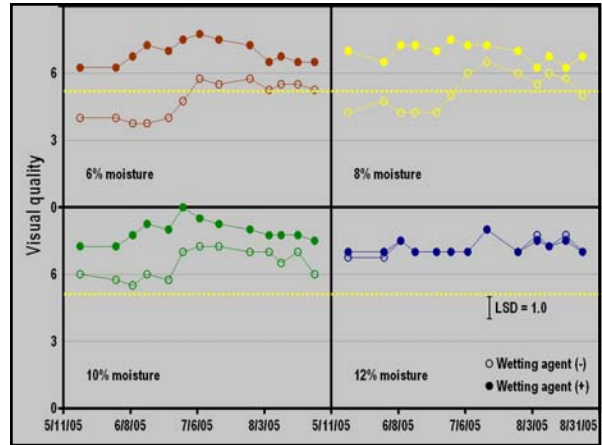
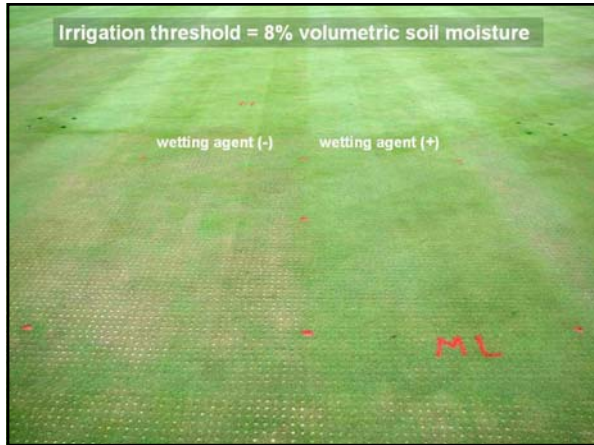
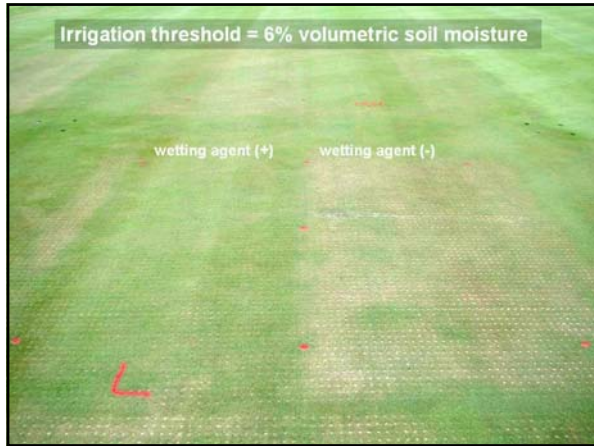
8




Really Cool Research at the University of Arkansas

Dr. Doug Karcher







Field Scout TDR 300




FIELDSCOUT
The All-New Field Scout TDR 300. More Rugged Design and Field Ready!



- Based on proven time-domain measurement technology, these portable units accurately measure soil moisture across the full range of soil moisture conditions.
 - Probes are 1.5", 3", 4.8", or 8" to suit your desired depth measurement.
 - Install PVC access tubes and take readings deeper in the soil profile.
 - \$1,069.00 (+ rods) from Spectrum Technologies.

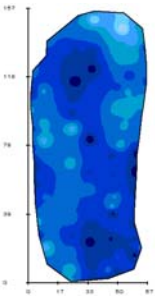
Turf-Tec Digital Moisture Sensor



- Adjustable foot allows you to determine moisture at the 1", 2", 3" or 4" depths.
- Designed to work in all soil types and salinity ranges.
- The Turf-Tec Digital Moisture Sensor uses a newly designed electrical conductivity sensing circuit that gives quick and reliable readings of soil moisture.


www.turf-tec.com
\$600.00


Spatial Variability




Your Field Name Tam 1024 No.1a
File Upload Name TDR Practice Moisture 10-24 1.txt
Sensor Model TDR 300
Sensor Type Soil Moisture

Color Legend		Count
29.7	to 31.5	VWC 1
31.5	to 33.3	VWC 2
33.3	to 35.0	VWC 4
35.0	to 36.8	VWC 22
36.8	to 38.6	VWC 26
38.6	to 40.3	VWC 23
40.3	to 42.1	VWC 23
42.1	to 43.9	VWC 9

Field Scout SC-900 Soil Compaction Meter

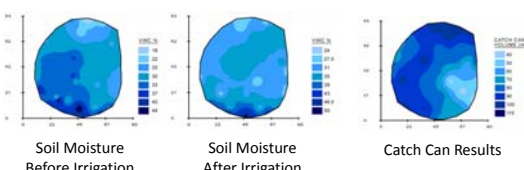
- Soil compaction meters (penetrometers) are used to determine the density of soil and other material.
- Compaction data is recorded and displayed, at one inch intervals, in PSI or kPa.



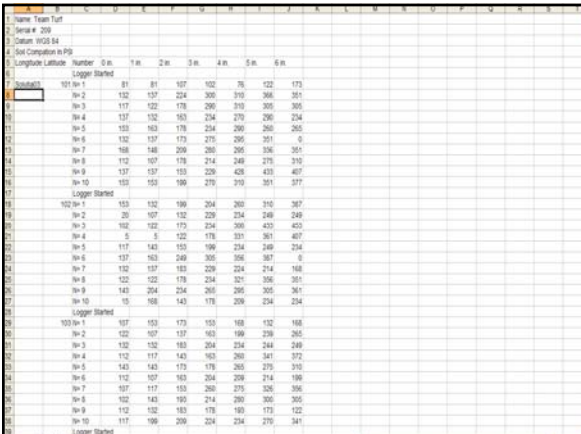
Application Slide: Comparison of soil moisture map before and after irrigation of a putting green. Third chart is map of catch can volumes collected during irrigation. Catch can locations the same as SM measurement locations.

Irrigation Audit

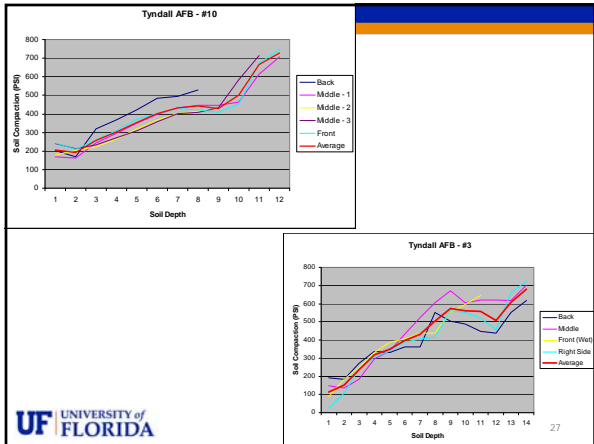
SpecMaps & TDR 300

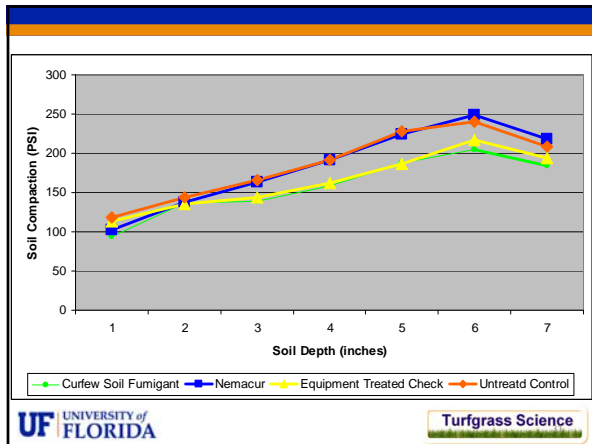


Audit Type	DU ₁₀	DU ₂₀	RTM ₁₀	RTM ₂₀
CC	64.0	80.2	1.6	1.2
TDR1	81.5	86.7	1.2	1.1
TDR2	83.1	88.5	1.2	1.1



The spreadsheet shows columns for Longitude Latitude, Number, and depth intervals (0 in, 1 in, 2 in, 3 in, 4 in, 5 in, 6 in). It lists data for 100 sensor locations (Sen-1 to Sen-100) and includes 'Logger Started' and 'Logger Stopped' markers.








UF UNIVERSITY of FLORIDA

Turfgrass Science

Field Scout® TruFirm (Turf Firmness Meter)

- Measures the relationship between the compaction of the soil and the moisture level.

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Turfgrass Science

SC-900 Soil Compaction Meter

\$1,795.00 from
Spectrum Technologies, Inc.

www.specmeters.com



Field Scout® TruFirm (Turf Firmness Meter)


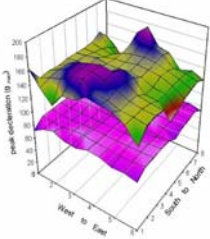
- The mass is dropped from a consistent height and the maximum turf penetration value is recorded and correlated to the surface firmness — the lower the penetration value, the firmer the turf.




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Turfgrass Science

Clegg Impact Soil Tester— H-4196A

www.humboldtmg.com
~ \$3,500.00

Field Scout® TruFirm (Turf Firmness Meter)

- Common applications for TruFirm include:
 - Golf course greens for better playing conditions and fewer ball marks.
 - Fairway landing areas for longer drives.
 - Green approach areas for chip and run play.
 - Bunker sands for moisture retention and greater ball control.



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Turfgrass Science



Field Scout® TruFirm (Turf Firmness Meter)

**\$749 - \$899 from
Spectrum Technologies, Inc.**
www.specmeters.com

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Field Scout® Direct Soil EC probe

- Protocol for in-office EC measurements (most accurate method):
 - Obtain a representative soil sample, about 50cc (about 2 oz) in a small cup.
 - Add ***your irrigation water*** while stirring until the soil surface glistens.
 - Don't add too much water.
 - If the water can be poured off, you've added too much and you will need to start over or add dry soil.
 - Stick the probe into the soil so the electrodes are completely immersed in the soil.
 - Read the meter and convert the meter reading.
 - Record the converted value for future reference.

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Field Scout® Direct Soil EC probe

- The unit permits instant, accurate measurement of salts in soil as well as water or nutrient solutions.
 - Use this portable EC meter and probe to measure soil salinity right on the spot, without conducting tedious soil sampling and soil preparation.
 - Available for \$379.00 - \$465.00 from Spectrum Technologies, Inc. (www.specmeters.com)




UF UNIVERSITY of FLORIDA **Turfgrass Science**

Field Scout® Direct Soil EC probe

- Protocol for in-field EC measurements:
 - Saturate the area of the green to be evaluated with irrigation water.
 - The soil must be saturated to obtain an accurate reading.
 - Stick the probe into the soil so the electrodes are completely immersed in the soil.
 - Read the meter and convert the meter reading.
 - Record the converted value for future reference.

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Field Scout® Direct Soil EC probe



EC (dS/m) = (meter reading X 2.7) + 0.8

Meter	Extract EC	Meter	Extract EC	Meter	Extract EC
0.1	1.1	1.1	3.8	2.1	6.5
0.2	1.3	1.2	4.0	2.2	6.7
0.3	1.6	1.3	4.3	2.3	7.0
0.4	1.9	1.4	4.6	2.4	7.3
0.5	2.2	1.5	4.9	2.5	7.6
0.6	2.4	1.6	5.1	2.6	7.8
0.7	2.7	1.7	5.4	2.7	8.1
0.8	3.0	1.8	5.7	2.8	8.4
0.9	3.2	1.9	5.9	2.9	8.6
1.0	3.5	2.0	6.2	3.0	8.9

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Digital Thermometer & Bead Thermocouple

- One can easily monitor canopy temperatures using relatively inexpensive equipment.
 - Digital thermometer (Extech 421502, Grainger #4PC60: \$178.00)
 - Bead thermocouple (Fluke, Grainger #1T322: \$46.60).
- To determine the canopy temperature, thread the bead into the turf in an area between the base of the foliage and the thatch layer.
- Take measurements during the hottest part of the day allowing a few moments for the unit to equilibrate.



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Canopy Temperature

- Select a minimum of three greens where you will do the bulk of your turf canopy monitoring.
 - Your best bet is usually to choose those greens that have failed in the past during hot weather.
- Begin turf canopy temperature monitoring when maximum air temperatures for the day reach 85 °F.
 - Monitor and record turf canopy temperatures every day that the maximum air temperatures reaches 85 °F or higher.



www.paceturf.org

Turfgrass Science

Low Mowing Fatigue

- Our observations have shown that raising the height of cut from 115/1000^{ths} to 130/1000^{ths} lowered canopy temperatures by as much as 30 °F.



www.grainger.com

Turfgrass Science

Canopy Temperature

- To measure turf canopy temperatures, make measurements during the hottest part of the day (usually around 2:00 pm).
 - Place the bead in the area between the base of the foliage and the top of the thatch layer.
 - Allow a few moments for the thermometer to equilibrate, and for the reading to remain stable.
 - Record the readings in a hardbound notebook, with a ballpoint pen, so that your records remain legible for years to come.
- Begin preventive cooling programs (syringing, fans or blowers if necessary) when turf canopy temperatures reach 100 °F for poa, or 105 °F for bentgrass.



www.paceturf.org

Turfgrass Science



Infrared Thermometer

- Useful for measuring surface temperatures.
- Can be purchased from www.instrumart.com
 - Raytek Raynger ST20, \$169.00




45




Light Meters

- Quantum sensors measure light energy at the specific wavelengths plants actually use for photosynthesis.
- All quantum meters here measure Photosynthetic Photon Flux (PPF) as $\mu\text{mol m}^{-2} \text{s}^{-1}$ for Photosynthetically Active Radiation (PAR) in the range of 400 to 700 nm.
- \$199.00



Item 3419F Shown

www.specmeters.com




Li-Cor LI-250 Light Meter

- This Quantum Light Meter provides direct digital readout of 15 second averages.
- Measures μmol , lux k lux or watts/m²
- ~ \$670.00



www.forestry-suppliers.com

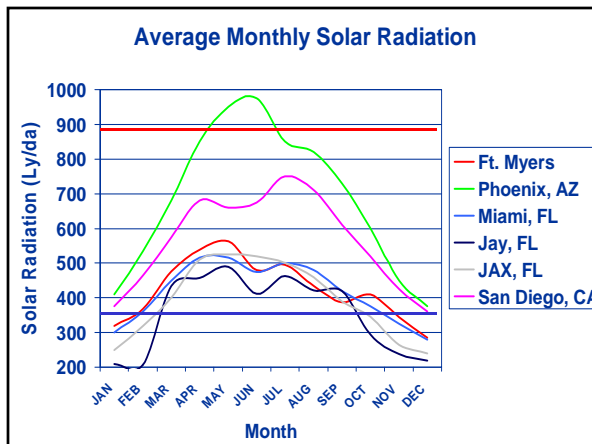
Research @ UF

Brian Glenn, J. Bryan Unruh, Jason Kruse




Simple, one button operation



LightScout DLI 100 Light Meter

- Compare light between locations
- Displays light intensity levels every 4 seconds for 24 hours
- Measure PAR light (Photosynthetically Active Radiation)
- Meter runs for 24 hours and calculates your Daily Light Integral (DLI)
- Packaged in sets of 3 light meters, or individually



Simple way to monitor shaded or full sun golf greens

www.specmeters.com
 \$59/each; \$169/three

IPM Scope

- The IPM Scope combines a digital camera, precision optics and LED lighting into a powerful handheld microscope and imaging software package.
 - Zoom in on fine details of plant disease symptoms, or insects.
- \$349.00 - \$795.00

www.specmeters.com
www.turf-tec.com



IPM Scope shown with optional Photo Microscope to view 3D images

IPM Scope CAM2

- Digital microscope helps you view images in the field without connection to a PC.
 - Transfer images via SD Card or USB cable to PC.



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www.specmeters.com
\$445.00

Turfgrass Science

www.gatorturf.com
<http://edis.ifas.ufl.edu>

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