Dynamax

- US Representative for Delta-T Devices, Ltd.
- US Representative for Gill sonic anemometers
- US Representative for ForceA
- Systems Integrator for Campbell Scientific
- A Primary Source for Plant Science Research Equipment
Introducing SapIP Remote Sensor Logger & Agrisensors.NET
All water transpired moves via Sap Flow through the trunk, branches, and stems where it may be measured by sap flow sensors.
Heat balance sensors heat the stem using a heater strip with constant power. Measure the heat loss to the ambient ($Q_r$). The remaining heat is carried by the sap ($Q_f$)*

**HOW?**

- Measure the temperature increase (+) and convert the heat to a flow rate based on the cooling effect of water (Specific Heat = $C_p$).

* Stem Heat Balance Method (S.H.B.)
Agrisensors.NET
Remote Logging Network

Network Server

Application Server
User’s Record Manager

Network Server

Internet Protocol

Gateway

SapIP – Network Loggers
SapIP Advantages

• Data on the spot with wireless mesh radio network
• Remote access from anywhere with Internet
  • Remote Control and Monitoring Status
  • “Real-Time” Data updated in minutes
• Reduce cable cost and travel costs
• Improve data storage capacity and multi-point access
• Logger storage and automatic network storage
• NO user programming required – all systems preconfigured
• Password protected data access
SapIP System Features

Nodes:
- 30,000 Records
- 8 Analog Channels
- 2 Digital Channels
- Heater power
- Excitation

Gateway:
- GSM or LAN Versions
- Power 120 or 220 Volt
- UPS battery backup
- Solar – battery option

Easy Mounting

Comes Complete:
Wiring, grounding, antenna, surge, mounting hardware provided
SapIP Nodes

- Sap Flow or TDP
- Micro-Climate Kit: Weather Parameters, ET
- Soil Moisture Node w/ Soil Moisture Profile
- 2.4 Ghz High Gain - 500 m Range
- 900 Mhz High Gain – 1000 m Range
- SapIP REP Repeater: 700 m hops to SapIP Nodes
SapIP Loggers for Different Purposes

- SAP FLOW
- IR TEMP
- WEATHER
- WIRELESS GATEWAY
- SOIL MOISTURE (4 or 6)
What is a Mesh?

Mesh is like a net, with many points interconnect.
Platform Included

- Customized Dynamax Gateways
- Platform Server Provided
- International Support
- 1-5 yr license available

Completely Developed Cloud Computing Platform!

LAN - anywhere

Cellular MODEM Gateway - GSM
WEB Access Data
Agrisensors.NET

Dynamax Server
Access & Data Security
Control SapIP Devices
Start & Stop Devices
Modify Setup
Download Data
Report Data Integrity
Locate on Satellite Map
Agrisensors Server for SapIP

- Complete logging & control
- User specified graphics
- Download or upload data remotely
- Records configuration changes
- On-Line support services!
Get Status Report from individual SapIP nodes

View Sensors, Channels, and Configuration
Compare ET & Plant Water Use
Daily Sap Flow of Tangerine

Grams or Gallons per Hour
Accumulated Sap Flow of Tangerine
Download Raw Data and Calculated Results

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\(\text{Download Raw Data and Calculated Results}\)
Basic Data Collection

- Sap flow data & actual plant water use
- Accumulated daily total water use
- Weather Data - ETo Plant water use comparisons
- Soil Moisture profiles, 4 or 6 levels
- Weekly irrigation schedule
- Chill Portion, Frost Warnings
- Growing Degree Day
Select the Reports Tab and select the SapIP SITE 1 7/4 TO 7/9 1-6 days shows the quarter hourly sap flow readings. (g/hr). CIMIS data from Fresno State reported below.
Plant Stress Data Analysis

✓ Sap Flow data
✓ Weather data, ETp
✓ Calculate Kc on wet days, Ks on dry days

Two Kinds – Crop Water Stress Index

CWSI = (Etm - Eta)/Etm  (Textbook definition)

Water “Stress Factor”  CWSF = Ks/Kc

So if Stress Factor = 0.75

Transpiration is 75 % of maximum T

New terminology, but simple for sap flow
Ratio of Sap Flow / ET0 = Stress Factor

Kc = 1.0 to 1.05

Note that the 28th and the 30th are low ET days. Cooler weather are not normally days to set Kc for July.
Ks after stress induced – 7 days before shaking

10 hrs @ Aug 5
7 hrs @ Aug 8

ET Accumulated (mm)/Day
Average 5.8 mm /day

235 Gallons applied; 305 gallons used, water reserve depletion 70 gal.
Sap Flow Ks is highly correlated to Stem Water Potential

Sap Flow Stress Coefficient vs. Stem Water Potential

$K_s = \frac{SF \text{ (mm)}}{ETo \text{ (mm)}}$

Almonds - FSU

$y = 0.508x + 1.59$
$R^2 = 0.84$

$y = 0.441x + 1.29$
$R^2 = 0.96$
Simple Data Presentation

• Plant water use curves, hourly water use
• Total daily water use - extrapolated to whole plants
• Stress Factor bar chart
• Growers need only decide how much plant stress can be tolerated before irrigating
• Growers also know about how much water should be applied
• Water can be conserved if irrigation schedule is reduced and Stress Factor remains at 1.0
Use SapIP Direct-Connect Dashboard
To collect data directly from the SapIP Node

Attach Windows PC to the USB port of the SapIP to control, and monitor.

Used for stand-alone operation as well.

Retrieves data and exports raw results to Excel, Agrisensors, or local charts.
SapIP Benefits

- Using the plant to determine crop water use and stress levels
- Irrigation scheduling using “Stress Factor”
- Water conservation
- Monitor sap flow, soil moisture, and weather, all through one network
- Agrisensors.NET data graphs and charts
SapIP Applications

• Irrigation Scheduling
• Works on - Almond, Grape, Citrus, Pecan, Peach, Plum, Pistachio, Corn, Cotton, Soybean, Sunflower, Walnut, and many more crops and trees
• Stress management
• Scalable to cover large areas
• Water balances
• Soil moisture or weather station networks
• Phytoremediation and Water Balances
• Drought tolerance evaluation
IRT – IR Leaf Temp System

- Wireless IR Temperature
- Leaf temperature
- Plant stress measurement
- Irrigation scheduling
- For center pivot or other irrigation systems
- Uses low-cost Zigbee coordinators
- Developed with USDA-ARS
Dynamax IRT Sensors

- Measure IR temperature +/- 0.5 C
- 10 degree Field of View
- Leaf temperature relates to plant stress
- Wireless, Analogue, & SDI versions
- Compare to CWSI or other Stress Model
- Excellent for use with drip or center pivot irrigation systems
- For use on crops where sap flow will not work, or on moving platforms
XBIB Coordinator

- XBIB Coordinator connected to PC
- “IRT Watcher” Software
- Will handle up to (10) IRT Sensors or Repeaters
- 300 to 500 meter “Line of Sight”
- Use Repeaters to add distance, 500 meters
- Up to (25) IRT possible with Repeaters
IRT-SALH Data Loggers

- Monitors up to (25) IRT
- Stress Accumulator Software
- ZB Link Transmitter
- Memory for 65,000 records
- SD Card Slot for Data
- WiFi for data collection, 20-50 ft
- Webpage data access, Mapping for locations
Thanks!
Any questions?
admin@dynamax.com
800-896-7108
www.dynamax.com