

Hawk-Eye™ System

Hawk-Eye™ is your translator
24/7/365

Listen to what your crop has to say



Set-up your ALERTS
and listen to it talk.

See it – Measure it – Manage it

The Agricultural Imaging Spectrum

Mon, 01-Aug-2016 2:42 PM
82.9° F -- RH: 60% - DP: 67.6 - ESE @ 11 MPH

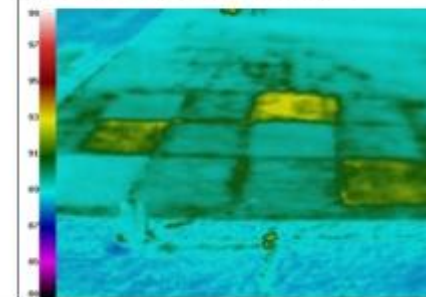
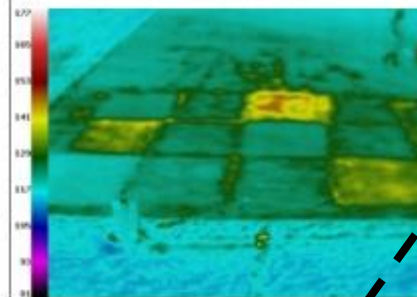
Mon, 01-Aug-2016 2:52 PM
84.4° F -- RH: 61% - DP: 69.4 - SSW @ 5 MPH



Quality

Mon, 01-Aug-2016 2:42 PM
82.9° F -- RH: 60% - DP: 67.6 - ESE @ 11 MPH

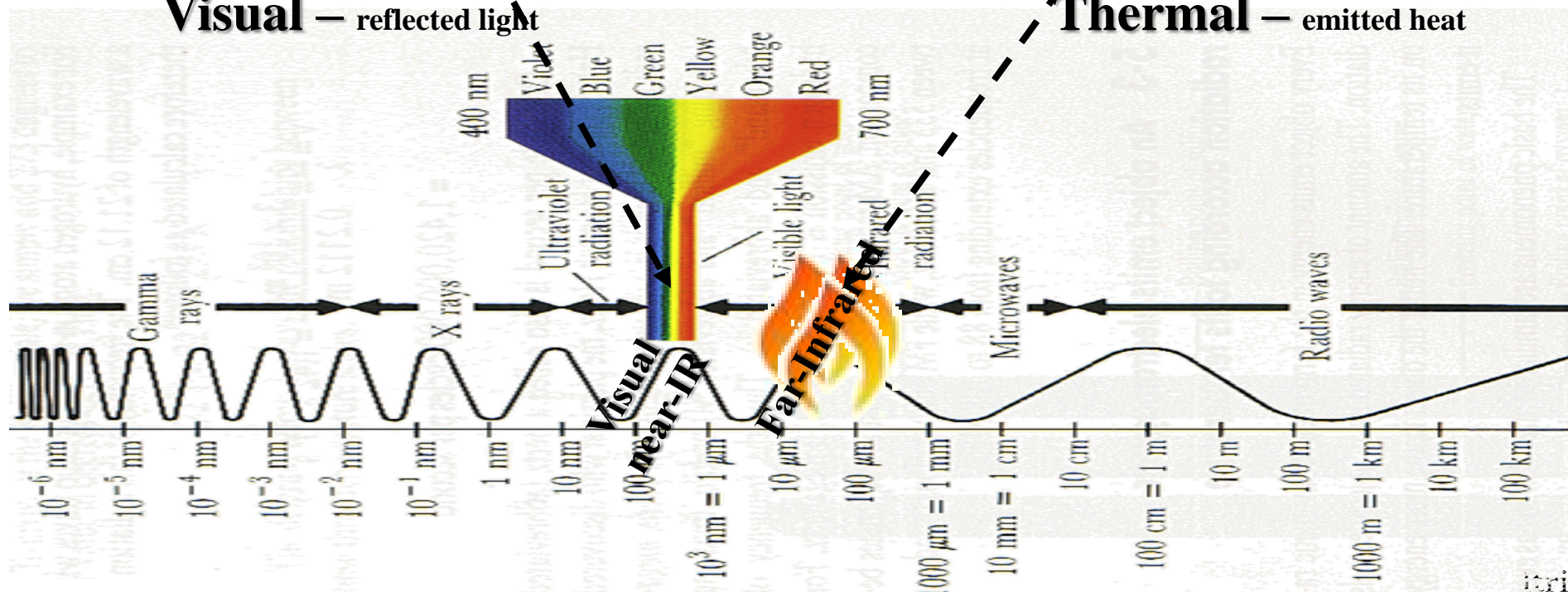
Mon, 01-Aug-2016 2:52 PM
84.4° F -- RH: 61% - DP: 69.4 - SSW @ 5 MPH



Stress

Visual — reflected light

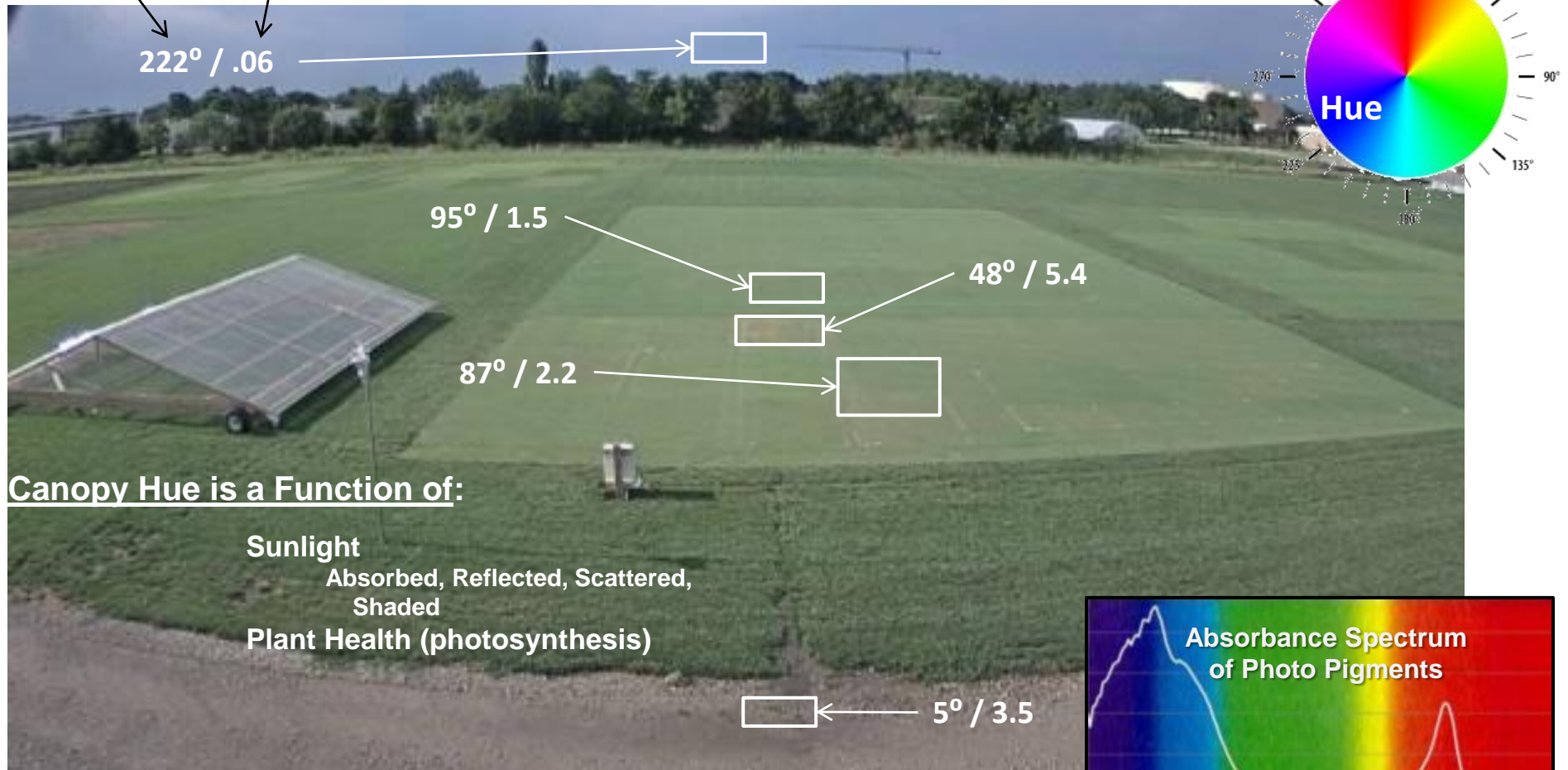
Thermal — emitted heat



Hue° / Color Measurement

Std Deviation of the Hue° is an objective measure of Quality (Plant Canopy Density & Homogeneity)

Hue degree / Std Deviation of the Hue°



Canopy Temperature

Area Average / Std Dev

Canopy Temperature is a Function of:

Air Temperature, Humidity, Wind
Sunlight

Absorbed, Reflected, Scattered, Shaded

Plant Health (photosynthesis and respiration)

Plant Water Status

96° F / 1.5

85° F / 1.5

Canopy Temperature is a Function of:

Air Temperature, Humidity, Wind

Plant Health (respiration)

Plant Water Status

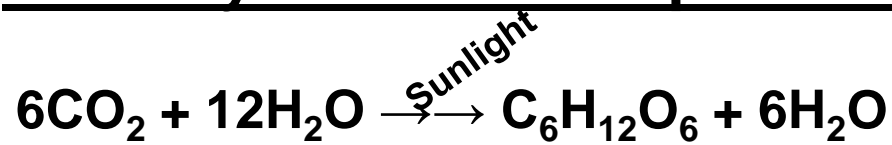
Soil Moisture

Root Respiration

Soil Moisture

Root Respiration

Photosynthesis/Transpiration



Respiration



Canopy Temperature is
an objective measure of
Health & Stress & Water Status

Latent Heat of Vaporization

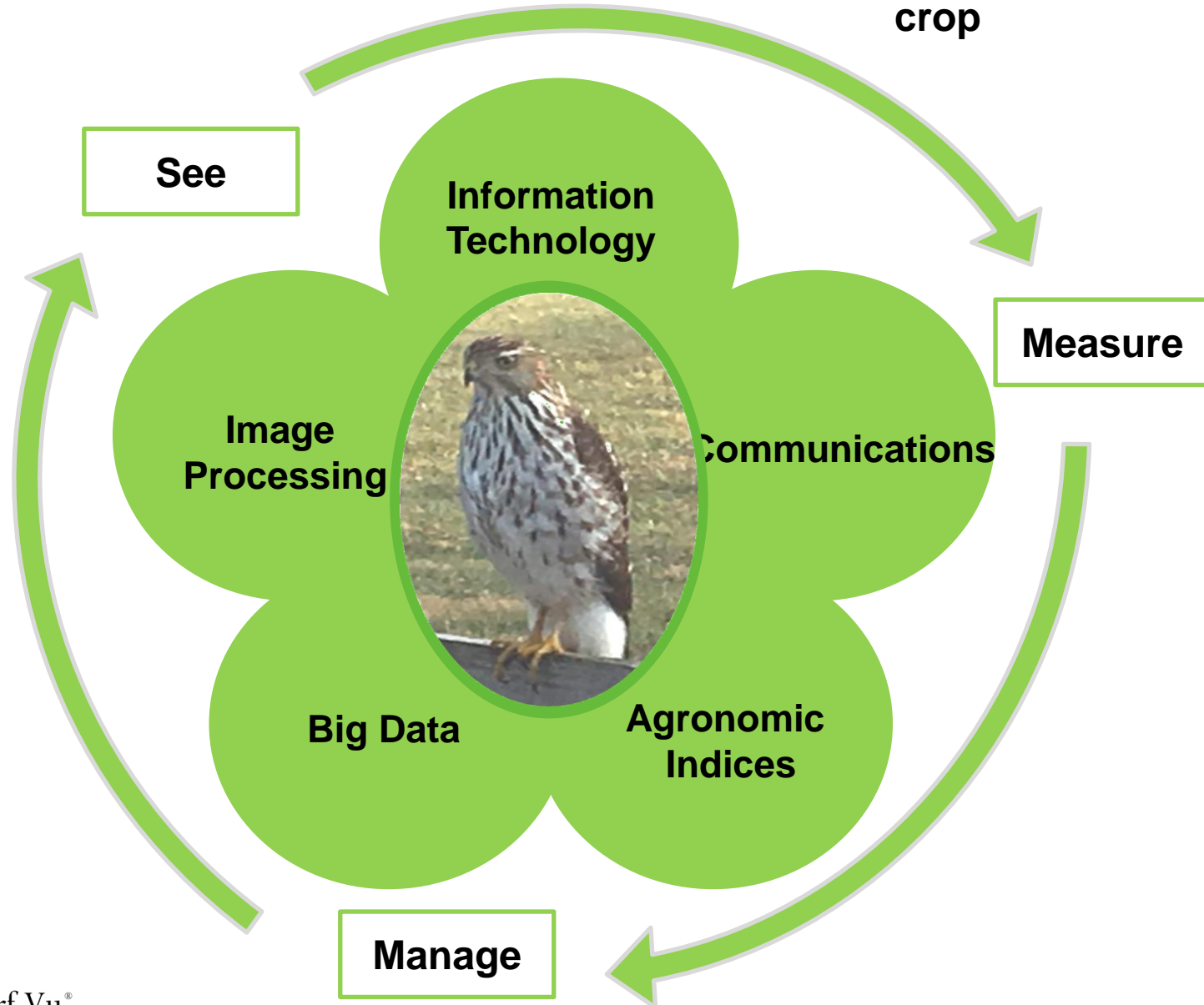
Cooling during Transpiration

Water Vapor & Heat Released during Respiration

There are no boundaries when enthusiasm and excitement are applied to the task at hand.

Hawk-Eye™ System of Systems

Enables a real-time conversation with the
crop 24/7/365



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Hawk-Eye™ Thermal and Visual Image Data

**Persistently, 24/7,
Autonomously**

Pattern Recognition for:
Early ID of disease, pest,
and water pressures
drainage

Alerts to:
Loss of turf vigor
High canopy temperatures
High Stress events

Indices to Guide:
Irrigation
Player Safety
Using Fans
Grow Lights
Turf Heating



**Set it up.
Durable and WeatherProof**

**It is autonomously
measuring in real-time:
canopy color/stddev &
temp/stddev)
local weather.**

Calculating indices

**Tell it what you want to
know.**

**It alerts you when the
conditions you wanted
to know about occurs.**

Listen to the crop talk.

By exploiting the Internet of Things the Hawk-Eye™ System enables plants to talk to managers, help target labor and actuate irrigation.

jim etro http://itricorp.com/docs/Hawk-Eye_System-an_Introduction.pdf

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Use WhatsApp outside USA

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Hawk-Eye™ Systems

Images and Data

Actionable Indices

Delivered to you in Real-Time



24/7 every 10 minutes - Internet and Cell network

Desktop and Mobile

Semi-Permanent &/or Mobile

- Thermal camera
- Visual camera
- Communications (WIFI & Internet)
- Pan/Tilt Option

Durable and Weather Proof

Real-Time Image and Weather Data

Data Archive w/Search Tools

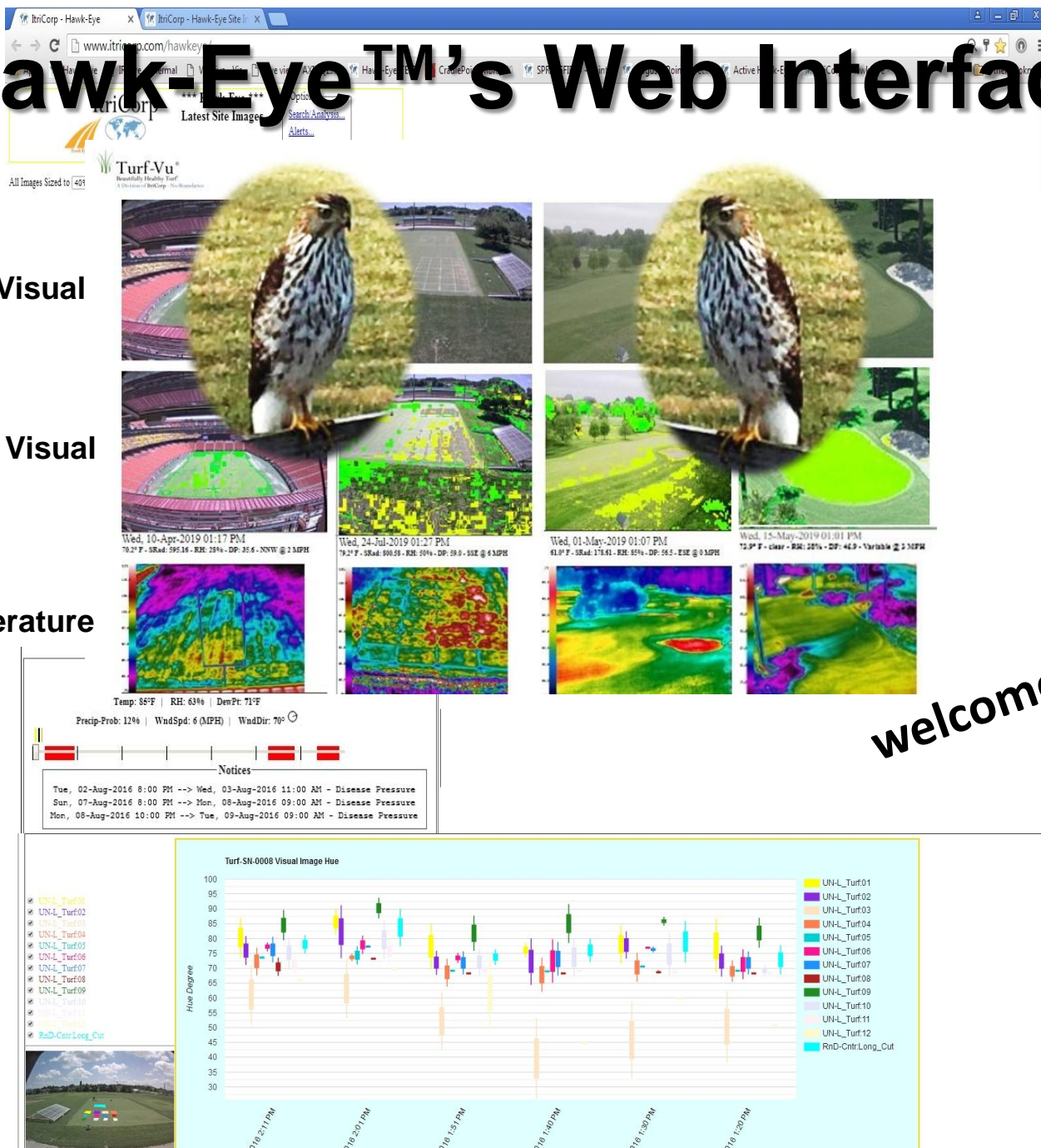
Hawk-Eye™'s Web Interface

24/7/365

Visual

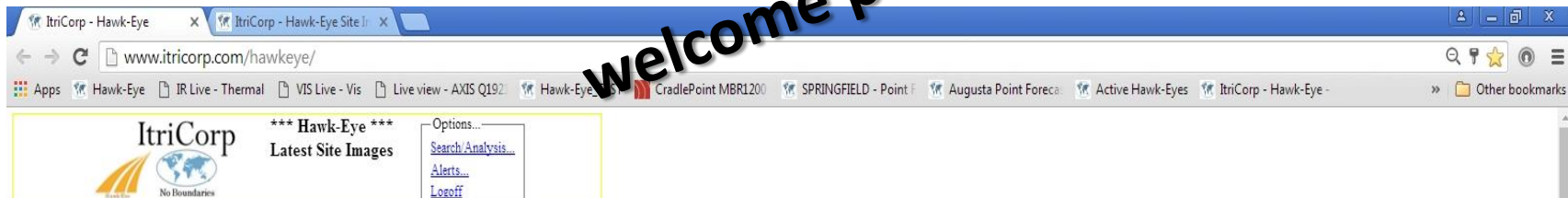
Enhanced Visual

Temperature



welcome page

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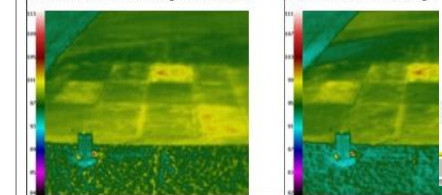
All Images Sized to 40% of original - Refresh Latest Images - Layout: Site

Site Time at Fetch: Tue, 02-Aug-2016 1:28 PM

Tue, 02-Aug-2016 1:25 PM
83.7° F -- RH: 69% - DP: 72.3 - ENZ @ 6 MPH THH: 163



Tue, 02-Aug-2016 1:15 PM
83.8° F -- RH: 69% - DP: 72.5 - NE @ 9



Forecast: Location View Graphical View Table View

Location: 2 Miles NE Lincoln NE



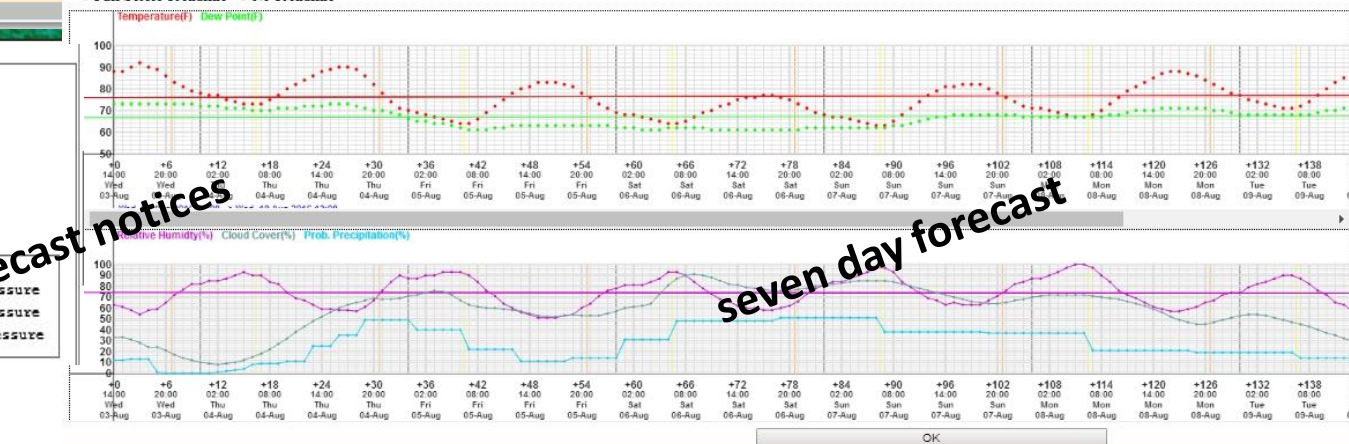
weather RADAR

Forecast
Tue, 02-Aug-2016 14:00
Temp: 87 | RH: 59 | WndSpd: 7 | WndDir: 70

Notices
8pm, Tue, 02-Aug-2016 --> 11am, Wed, 03-Aug-2016: Disease Pressure
8pm, Sun, 07-Aug-2016 --> 9am, Mon, 08-Aug-2016: Disease Pressure
10pm, Mon, 08-Aug-2016 --> 9am, Tue, 09-Aug-2016: Disease Pressure

Forecast: Location View Graphical View Table View

Full Series Trendline No Trendline



seven day forecast

Forecast & Notifications

Weather - Current RADAR and Full Forecast Display

Tue, 02-Aug-2016 1:00 PM

Temp: 85°F | RH: 63% | DewPt: 71°F

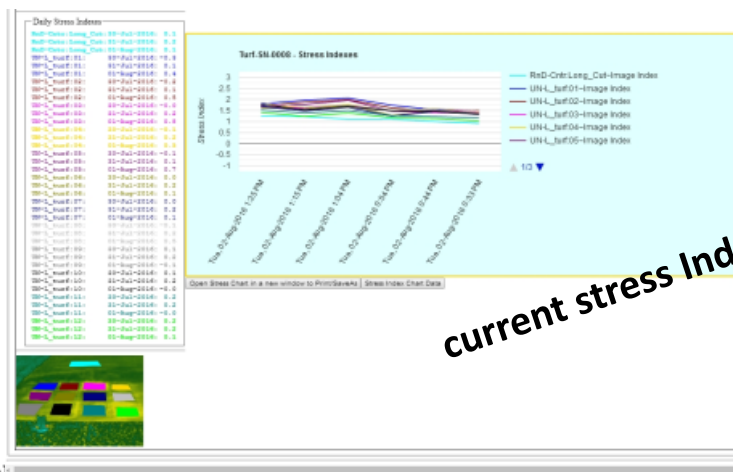
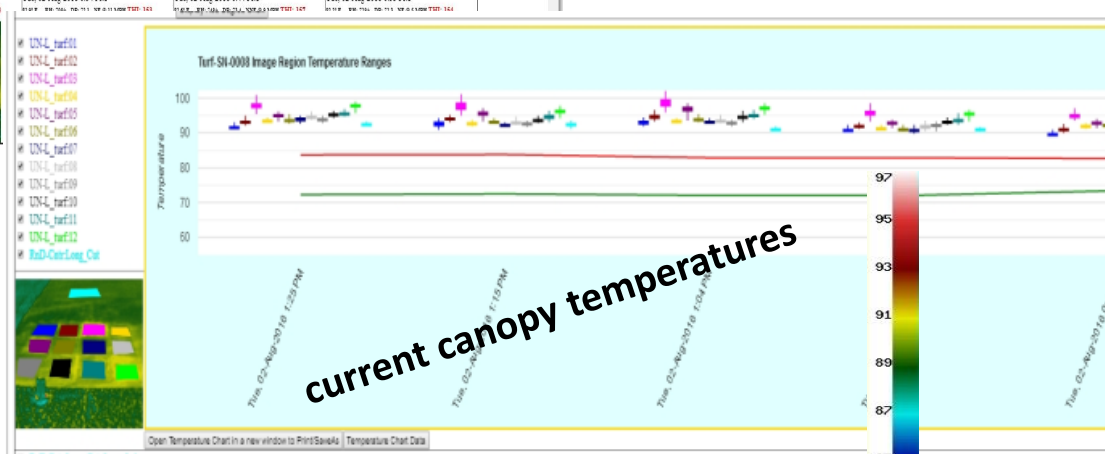
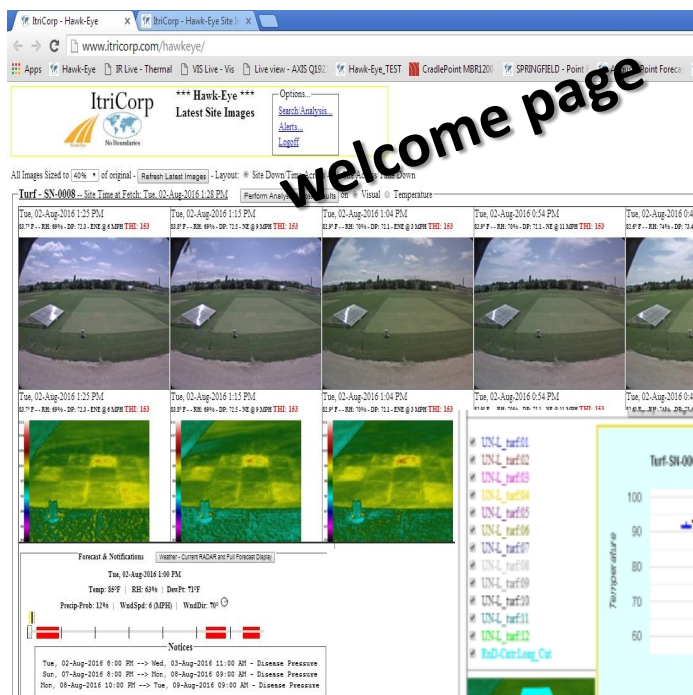
Precip-Prob: 12% | WndSpd: 6 (MPH) | WndDir: 70°

Notices

Tue, 02-Aug-2016 8:00 PM --> Wed, 03-Aug-2016 11:00 AM - Disease Pressure
Sun, 07-Aug-2016 8:00 PM --> Mon, 08-Aug-2016 09:00 AM - Disease Pressure
Mon, 08-Aug-2016 10:00 PM --> Tue, 09-Aug-2016 11:00 AM - Disease Pressure

disease pressure, seven day forecast notices

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current stress Indexes

current canopy temperatures

current quality Indexes

Alerts ^{24/7/365}

welcome page

setting Alerts

The screenshot shows the ItriCorp Hawk-Eye website interface. At the top, there's a navigation bar with 'ItriCorp - Hawk-Eye' and 'ItriCorp - Hawk-Eye Site'. The main content area displays '*** Hawk-Eye *** Latest Site Images' and a sidebar with 'Options...' including 'Search/Analysis...', 'Alerts...', and 'Logout'. Below this, there's a section for 'Turf - SN-0008' with a 'Site Time at Fetch: Tue, 02-Aug-2016 1:28 PM'. The main content area shows '*** Hawk-Eye - Site Notifications ***' with a table of site notifications. A smartphone is overlaid on the bottom right, displaying a heatmap overlay on a golf course image. An arrow points from the 'Alerts...' link in the sidebar to the smartphone screen.

Trigger On	Criteria	Value	Value Period	Notify
Air Temperature	Greater than or Equal To	88.00	10.00 min	2604505169@v

Trigger On	Criteria	Value	Value Period	Notify
Stress Index	Greater Than	1.50	30.00 min	2604505169@v

SN-0008 UN-L_turf

Air Temperature 52 is \leq to 55
This value has held over 60.00 Minutes

Area: UN-L_turf Area: nr15-green

Average Canopy Temperature 95.27 is \geq to 95.00
This value has held over 60.00 Minutes (6 readings)

Area: UN-L_turf Area: nr15-left

Stress Index 1.53 is \geq to 1.50
This value has held over 30.00 Minutes (3 readings)

Area: UN-L_turf Area: nr15-green

Min Canopy Temperature 89.12 is \leq to 90.00
This value has held over 10.00 Minutes (1 reading)

Archive

ItriCorp - Hawk-Eye x **ItriCorp - Hawk-Eye Site I** x

www.itricorp.com/hawkeye/

Apps Hawk-Eye IR Live - Thermal VIS Live - Vis Live view - AXIS Q1

ItriCorp ***** Hawk-Eye ***** **Latest Site Images** Options... Search/Analy Alerts... Logoff

All Images Sized to 40% of original - Refresh Latest Images - Layout: Site Down Time Across

Turf - SN-0008 - Site 1 at Fetch: Tue, 02-Aug-2016 1:28 PM Perform Analysis Across

Tue, 02-Aug-2016 1:25 PM 83.7° F -- RH: 69% - DP: 71.3 - ENE @ 6 MPH THI: 163

Tue, 02-Aug-2016 1:15 PM 83.9° F -- RH: 69% - DP: 71.5 - NE @ 9 MPH THI: 163

ItriCorp ***** Hawk-Eye - Site Image Search *****

Search Criteria

Site Selection

Site	Min Date-Time	Max Date-Time	Timezone
Ag - Dena-2011	Mon, 03-Aug-2015 4:19 PM	Tue, 02-Aug-2016 2:07 PM	US Central
Ag - SN-0004	Sat, 18-Jul-2015 06:27 AM	Tue, 02-Aug-2016 2:07 PM	US Central
Turf - SN-0008	Tue, 11-Aug-2015 3:55 PM	Tue, 02-Aug-2016 2:06 PM	US Central

Image Selection (Date Time is relative to the Site timezone)

Image Type: Temperature Visual

Date Range: Min: Tue, 11-Aug-2015 - Max: Tue, 02-Aug-2016

On Between Through

01-Aug-2016 and 02-Aug-2016

Time Range:

Closest (after) or Between

1:30 AM 2:01 and 2:47 AM 2:04

His from Solar Noon

His. (-) < Solar Noon > (+) His.

Weather Selection

Temperature (F) at or between and

Sky: clear mostly clear partly cloudy mostly cloudy overcast obscured

Relative Humidity (%) at or between and

Dew Point (F) at or between and

TH-Index at or between and - Positive Dew Indicator

Wind Speed (MPH) at or between and

Wind Direction North East South West Variable

Search - Result Layout: Time Across Time Down

All Images Sized to 40% of original

Turf - SN-0008 - Site Time at Fetch: Tue, 02-Aug-2016 2:11 PM Perform Analysis Across Results on Temperature Visual

Mon, 01-Aug-2016 1:30 PM 81.7° F -- RH: 64% - DP: 69.1 - ENE @ 17 MPH

Mon, 01-Aug-2016 1:40 PM 81.7° F -- RH: 64% - DP: 69.1 - SSE @ 10 MPH

Tue, 02-Aug-2016 1:35 PM 84.7° F -- RH: 70% - DP: 73.9 - SSE @ 11 MPH THI: 165

Tue, 02-Aug-2016 1:45 PM 84.7° F -- RH: 69% - DP: 73.8 - SSE @ 13 MPH THI: 164

Mon, 01-Aug-2016 1:30 PM 81.7° F -- RH: 64% - DP: 69.1 - ENE @ 17 MPH

Mon, 01-Aug-2016 1:40 PM 81.7° F -- RH: 64% - DP: 69.1 - SSE @ 10 MPH

Tue, 02-Aug-2016 1:35 PM 84.7° F -- RH: 70% - DP: 73.9 - SSE @ 11 MPH THI: 165

Tue, 02-Aug-2016 1:45 PM 84.7° F -- RH: 69% - DP: 73.8 - SSE @ 13 MPH THI: 164

Time Series

Mon, 01-Aug-2016 1:30 PM 81.7° F -- RH: 64% - DP: 69.1 - ENE @ 17 MPH

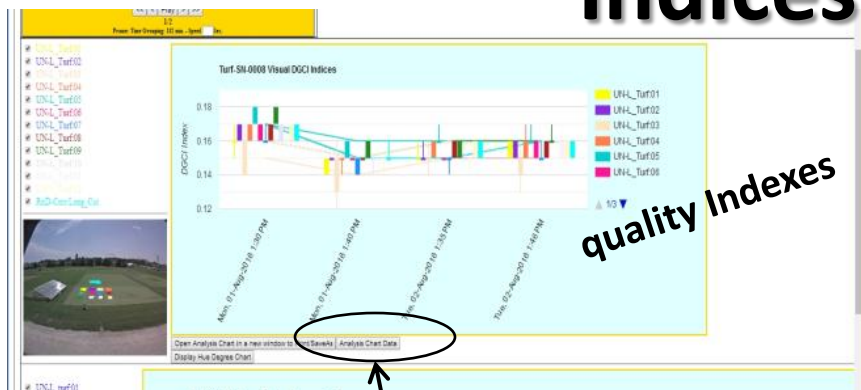
Mon, 01-Aug-2016 1:40 PM 81.7° F -- RH: 64% - DP: 69.1 - SSE @ 10 MPH

Time Lapse Movie

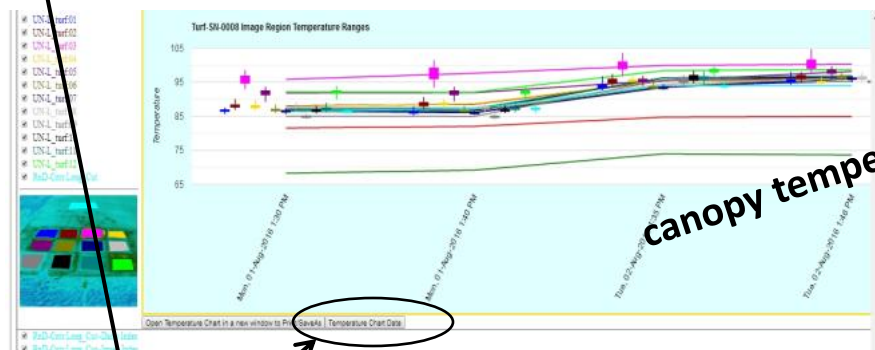
Indices and Data

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Indices and Data

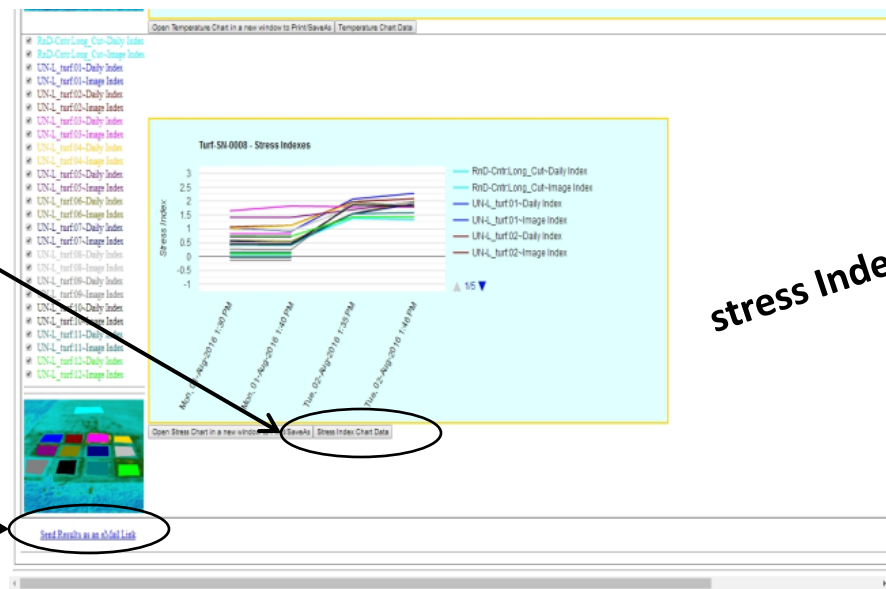


quality indexes



canopy temperatures

Work with spreadsheets



stress indexes

e-mail a collaborator

Send Results as an e-Mail Link

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Hawk-Eye™ Systems

Tool for Precision Application of

Labor

Materials & Pesticides & Herbicides

Water Save/Avoid using more or less than needed

**Real-Time Alerts & Notifications for Critical
Decision Making and Equipment Triggers**

**Environmental
Stewardship
&
Business
Sustainability**

Hawk-Eye™ Systems



Set-up your ALERTS
and listen to it talk.

Jim Etro

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703-489-8507

See it – Measure it – Manage it