Applied Thermography (@ Sports Fields)

Autonomously distill **tons of data** from multiple sites everywhere that you need to know about,

into **actionable information**

And solve the labor shortages and budget squeezes by making using the tool that makes money back!

Jim Etro

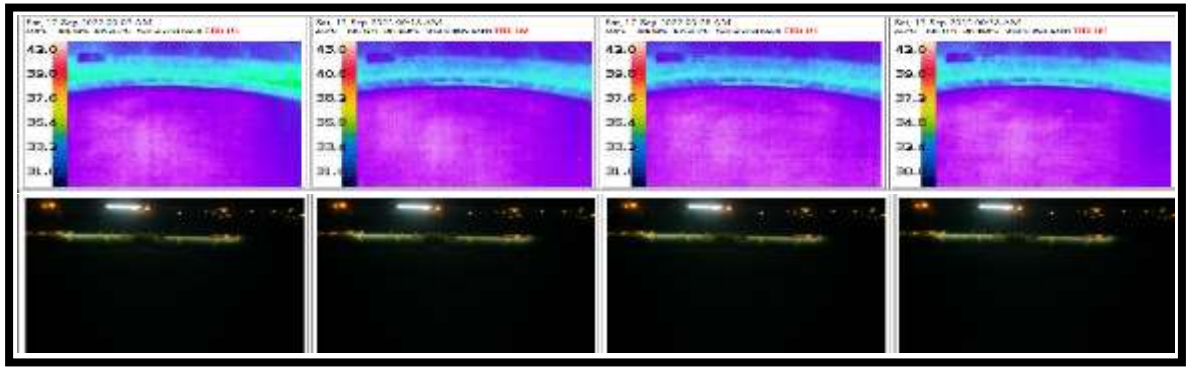
j.etro@turf-vu.com

+1 703 489 8507 on WhatsApp

Turf-Vu

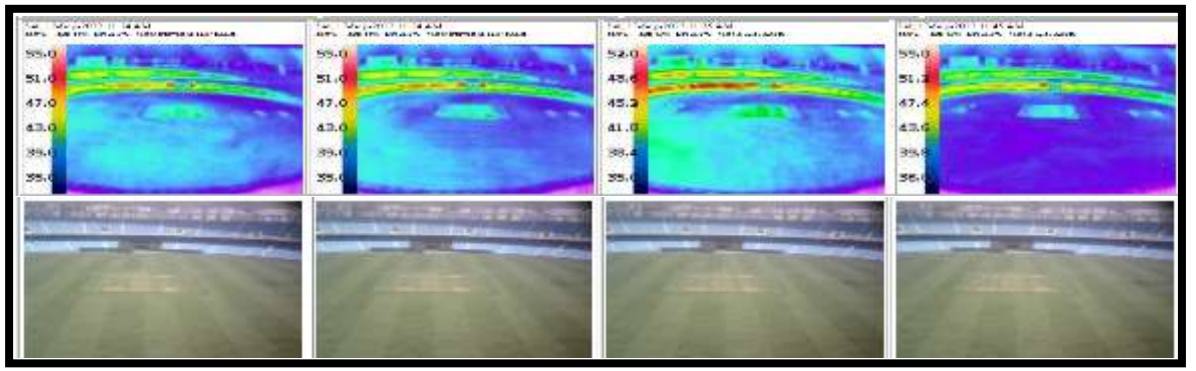
a Division of ItriCorp

See and Measure the Grass



All Night

and



All Day

Green Color
7 day Trend

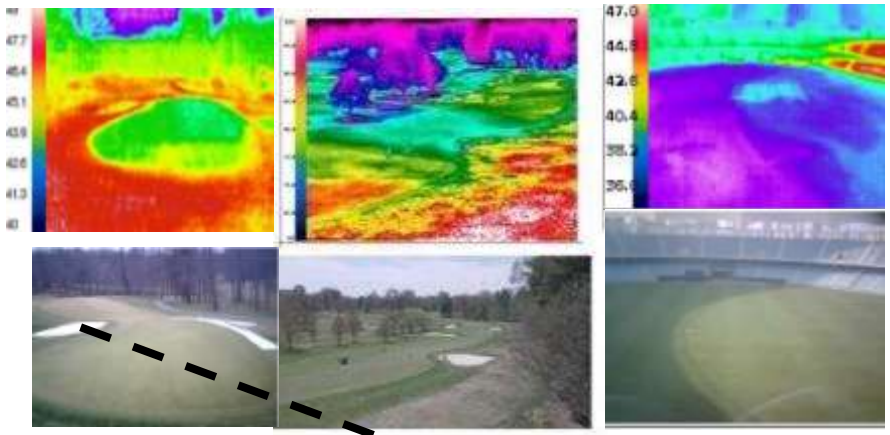
Daily Stress
7 day Trend

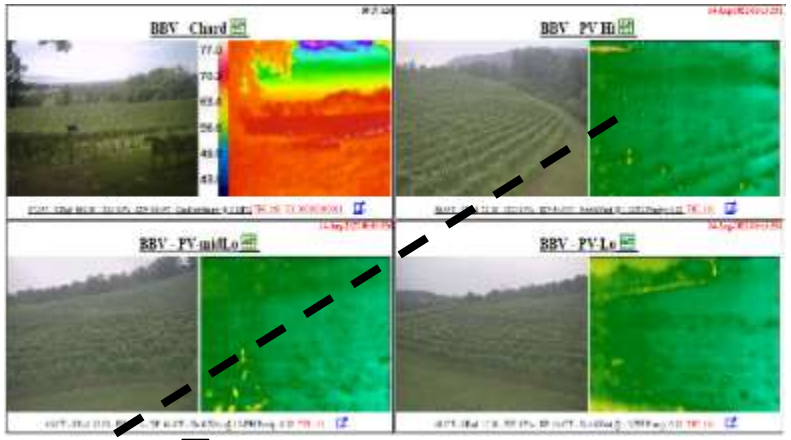
Uniformity of Green Color
7 day Trend

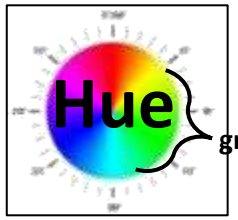
Nightly Recovery
7 day Trend

Turf-Vu

The Turfgrass Imaging Spectrum







green, 40° - 160°

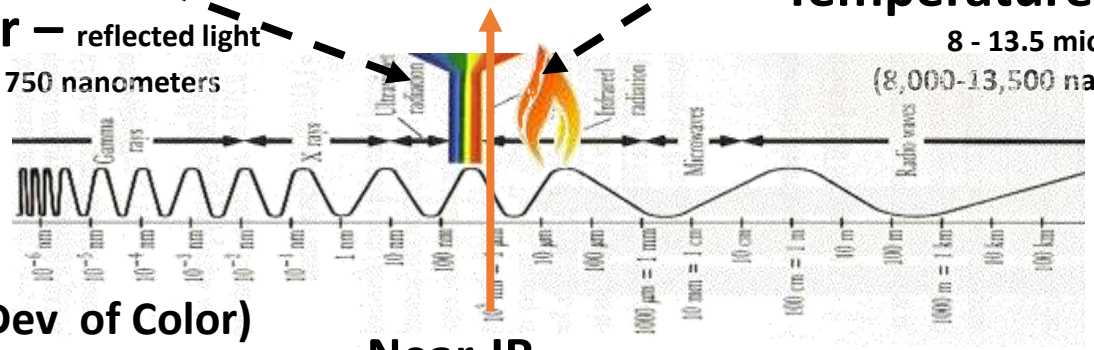
Color – reflected light

430 - 750 nanometers

Temperature – emitted heat

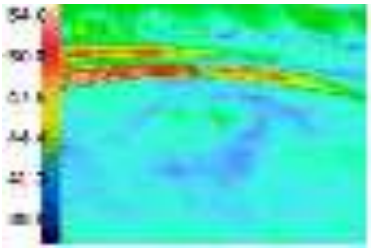
8 - 13.5 microns

(8,000-13,500 nanometers)



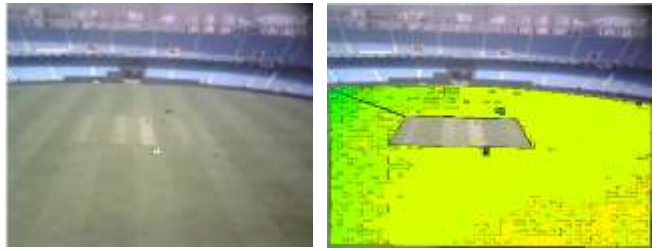
Near-IR – chlorophyll fluorescence

Approx 850 nanometers



Color (Hue°) & Uniformity (Std-Dev of Color)

= **QUALITY** & Infers N,P,K



Temperature Infers

Photosynthesis

Respiration

Evaporation/Moisture

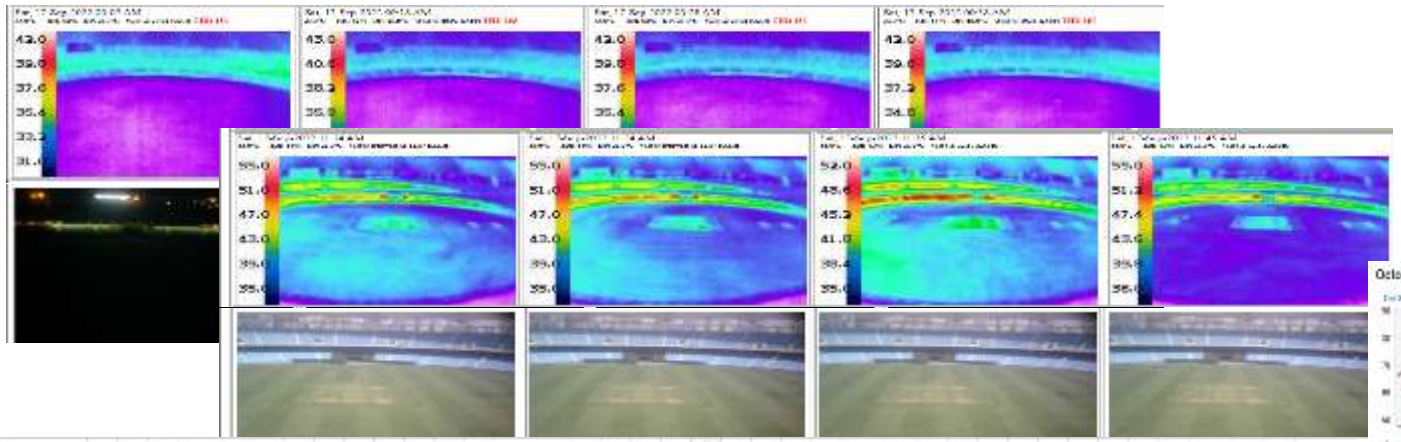
Plant Water Status

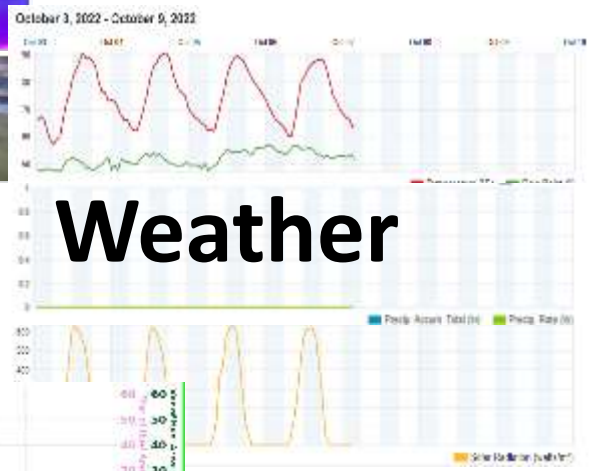
It makes for a ton of data

Turf-Vu

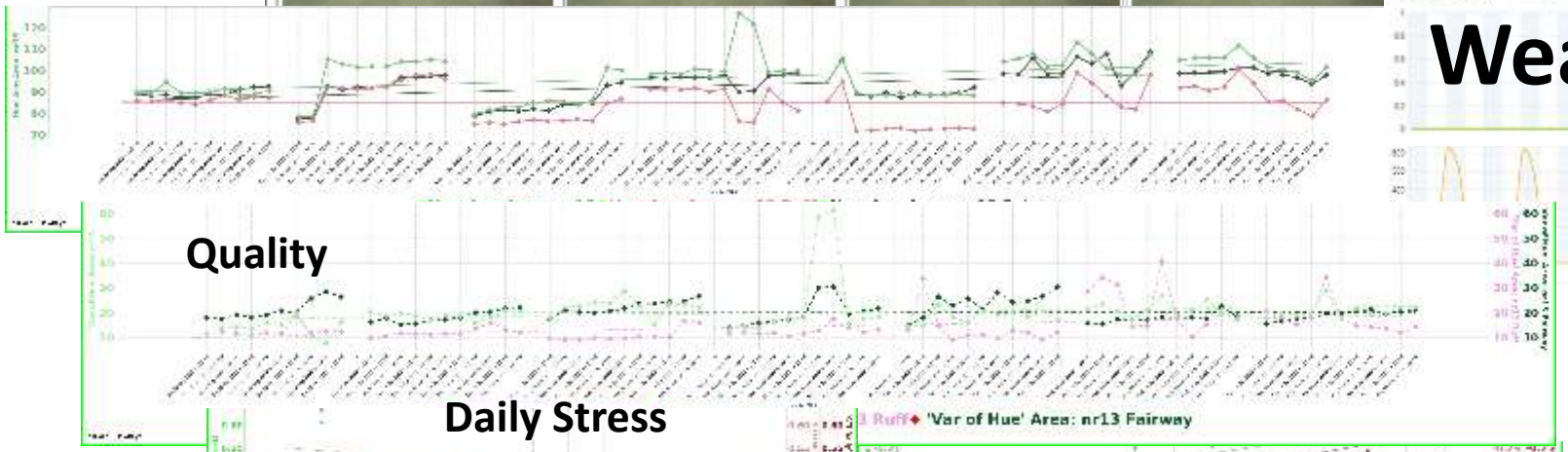
Persistent Imagery & Data

Images





Data

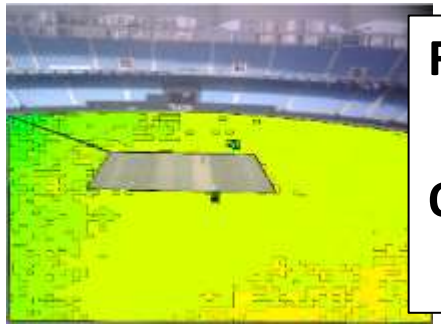


It's Lots of Pictures & Data

Turf-Vu

Distill Lots of Pictures & Data

Into Actionable Information



From: Hawk-Eye

To: e-mail and/or phone @ 1:15 PM

Outfield SE **Color** is declining toward yellow

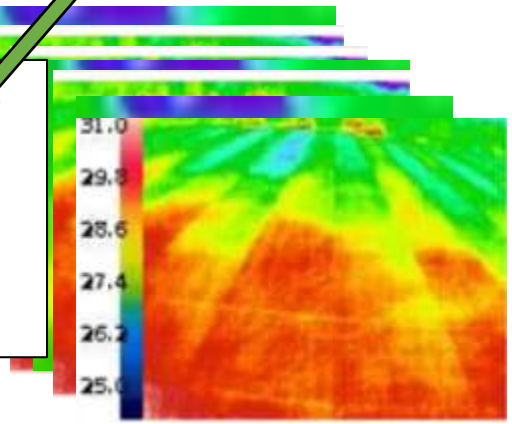
Look at it & consider N

From: Hawk-Eye

To: e-mail and/or phone @ sunset

Field 4 Zone 3 & 4 **IRRIGATE** Daily Stress >0.55

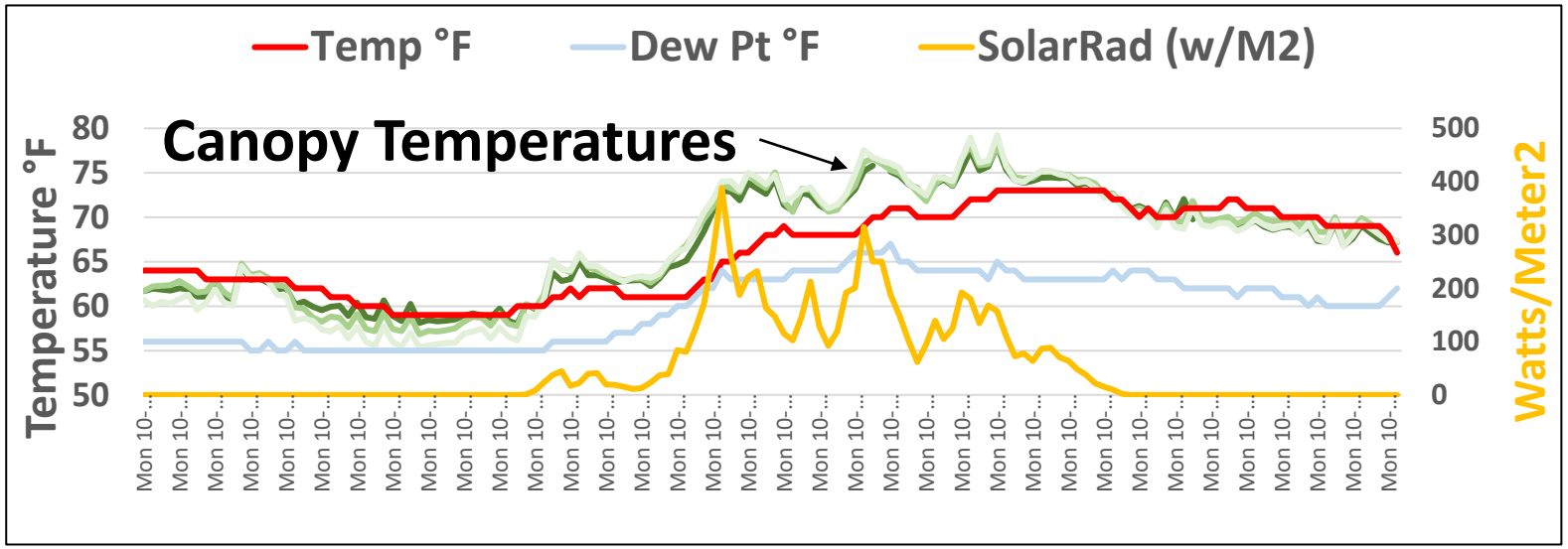
Add a turn to sprinkler



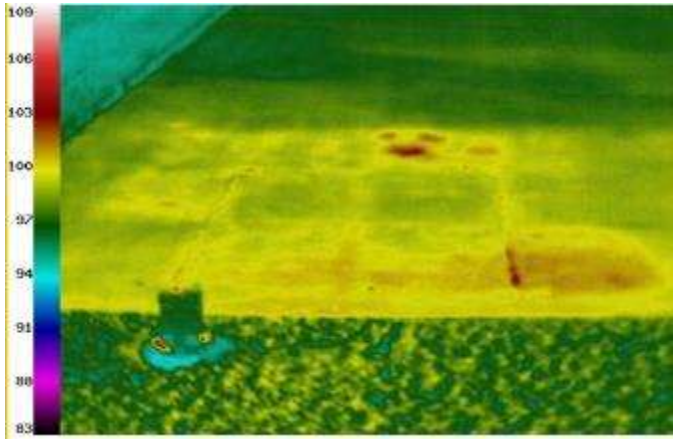
Turf-Vu

Using Thermal Images

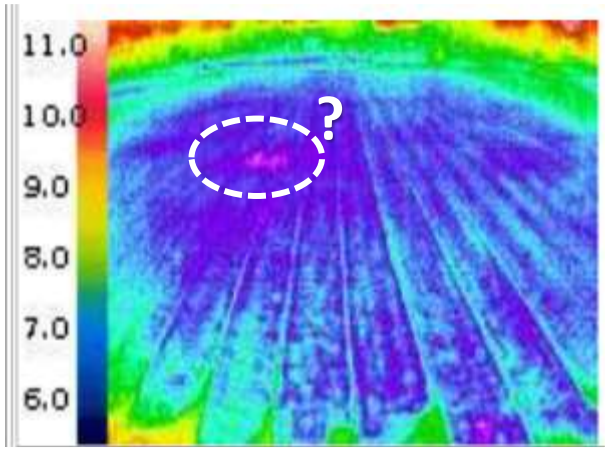
Day & Night



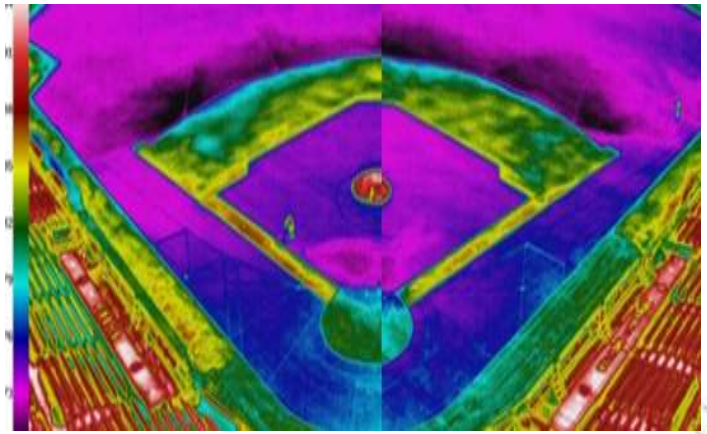
Research



Maintenance



Day-to-Day



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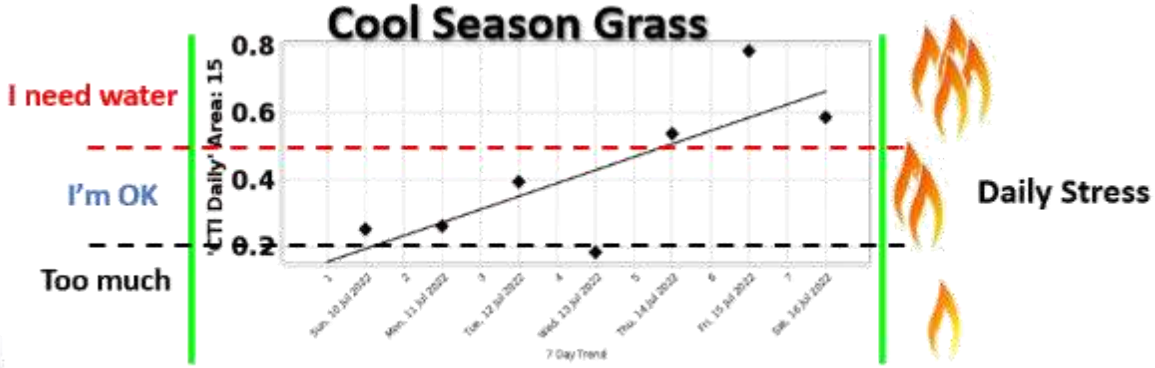
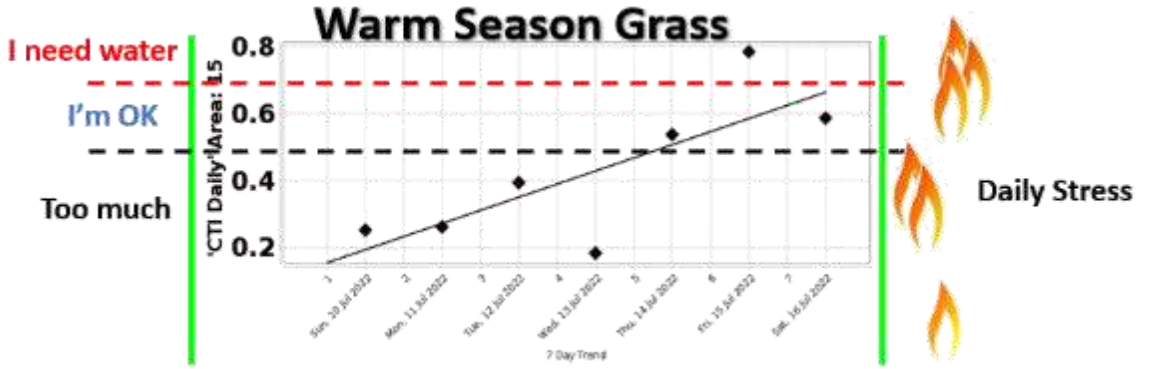
Using Temperature Stress Indices

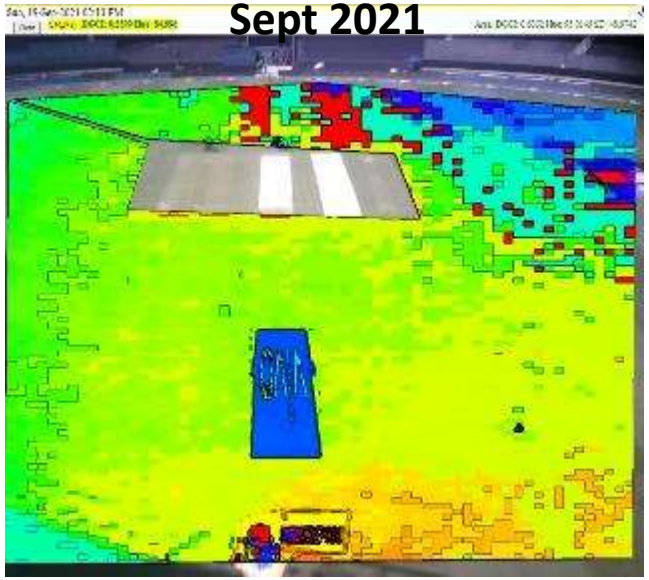




Irrigation = Water + Electricity + Pump Hours

Turf-Vu

Sept 2021



before

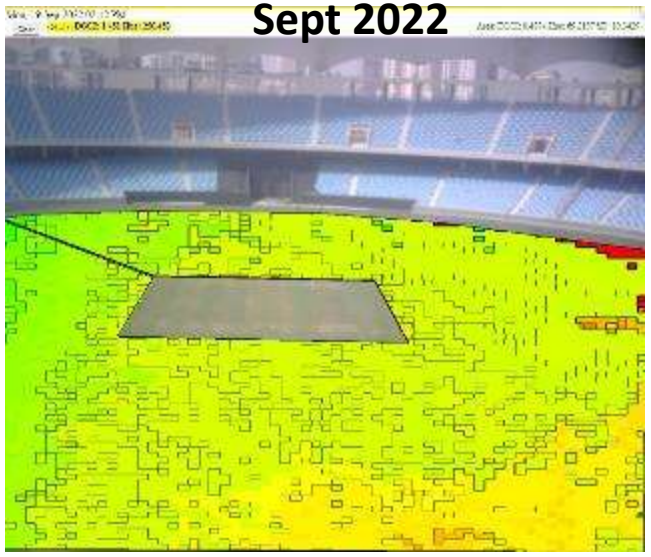
Ave Hue = 95°

Uniformity of Hue = 49

Using Visual Quality Indices

Change in Quality After Scarification

Sept 2022



after

Ave Hue = 69°

Uniformity of Hue = 10

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Use Cases

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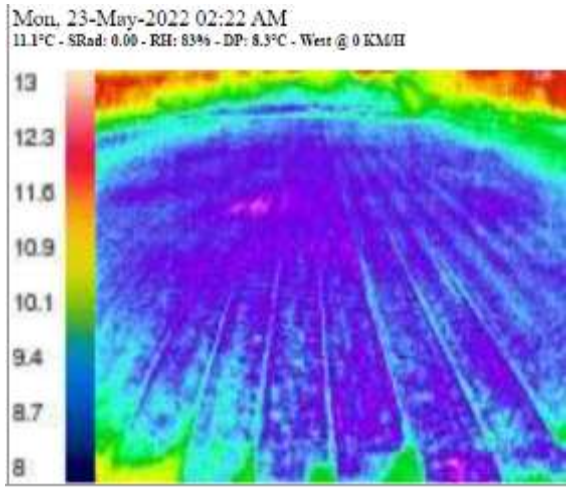
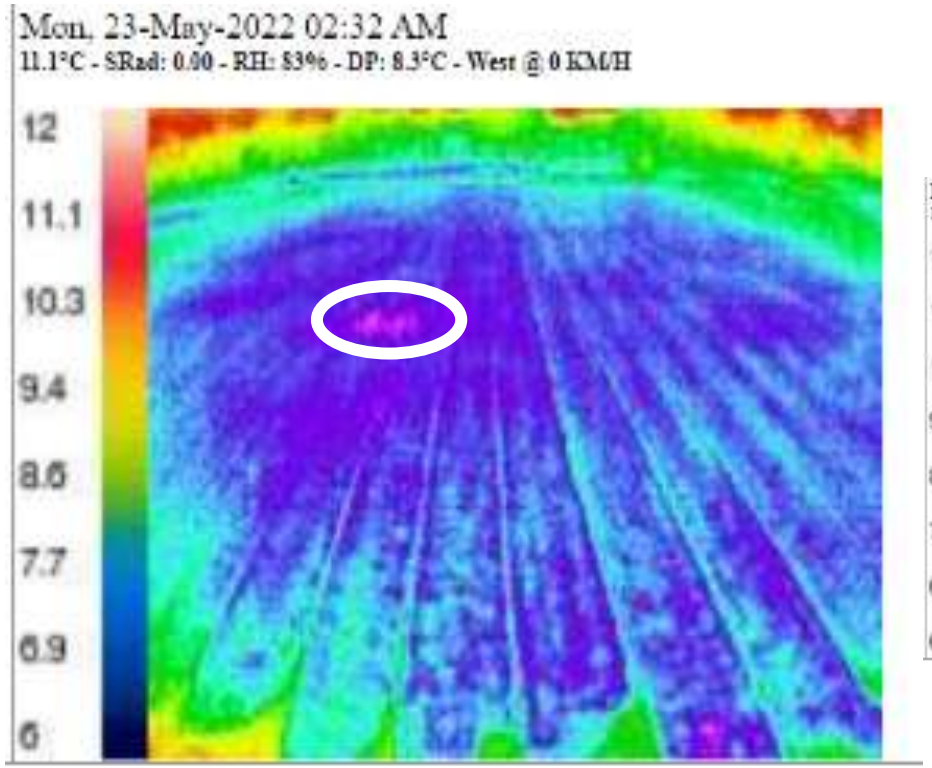
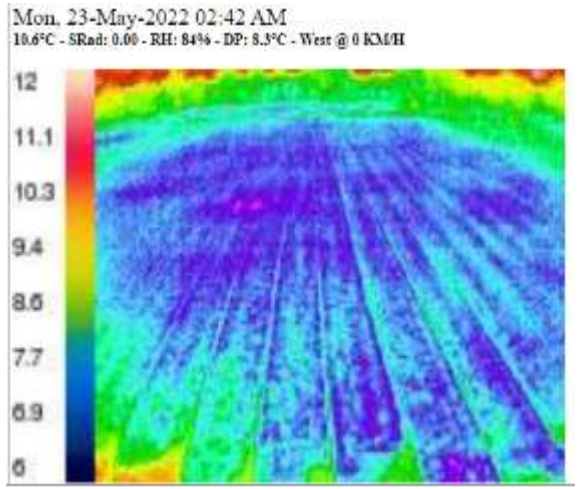
What's this ?



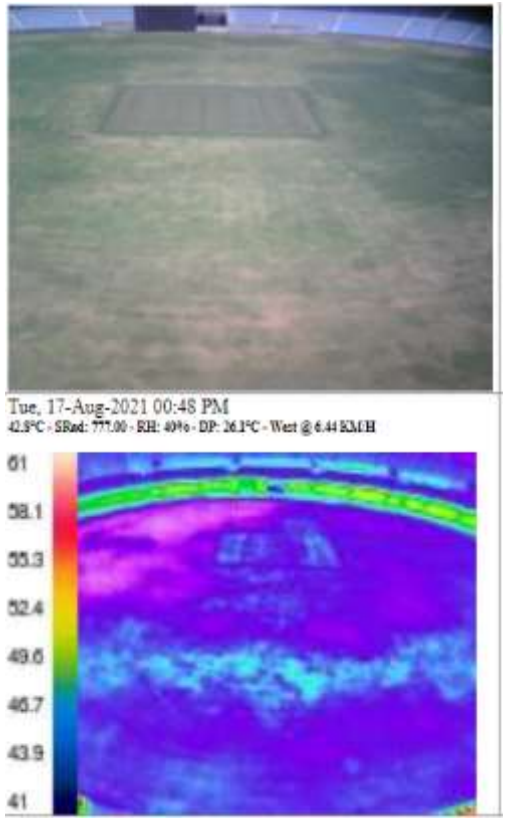




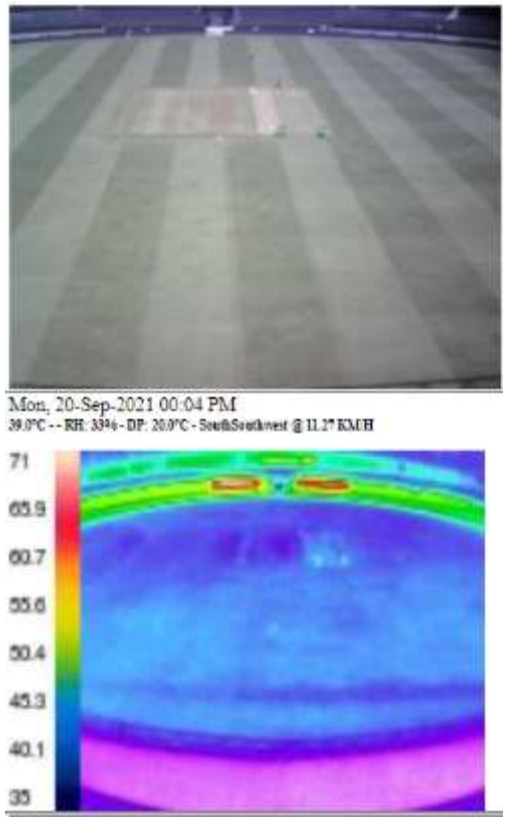
Turf-Vu

Check the Sprinkler Heads

17 Aug 21

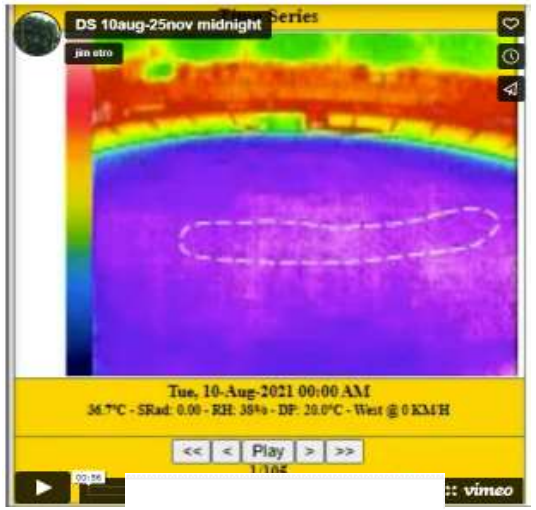


20 Sep 21



the Movie helps the assessment

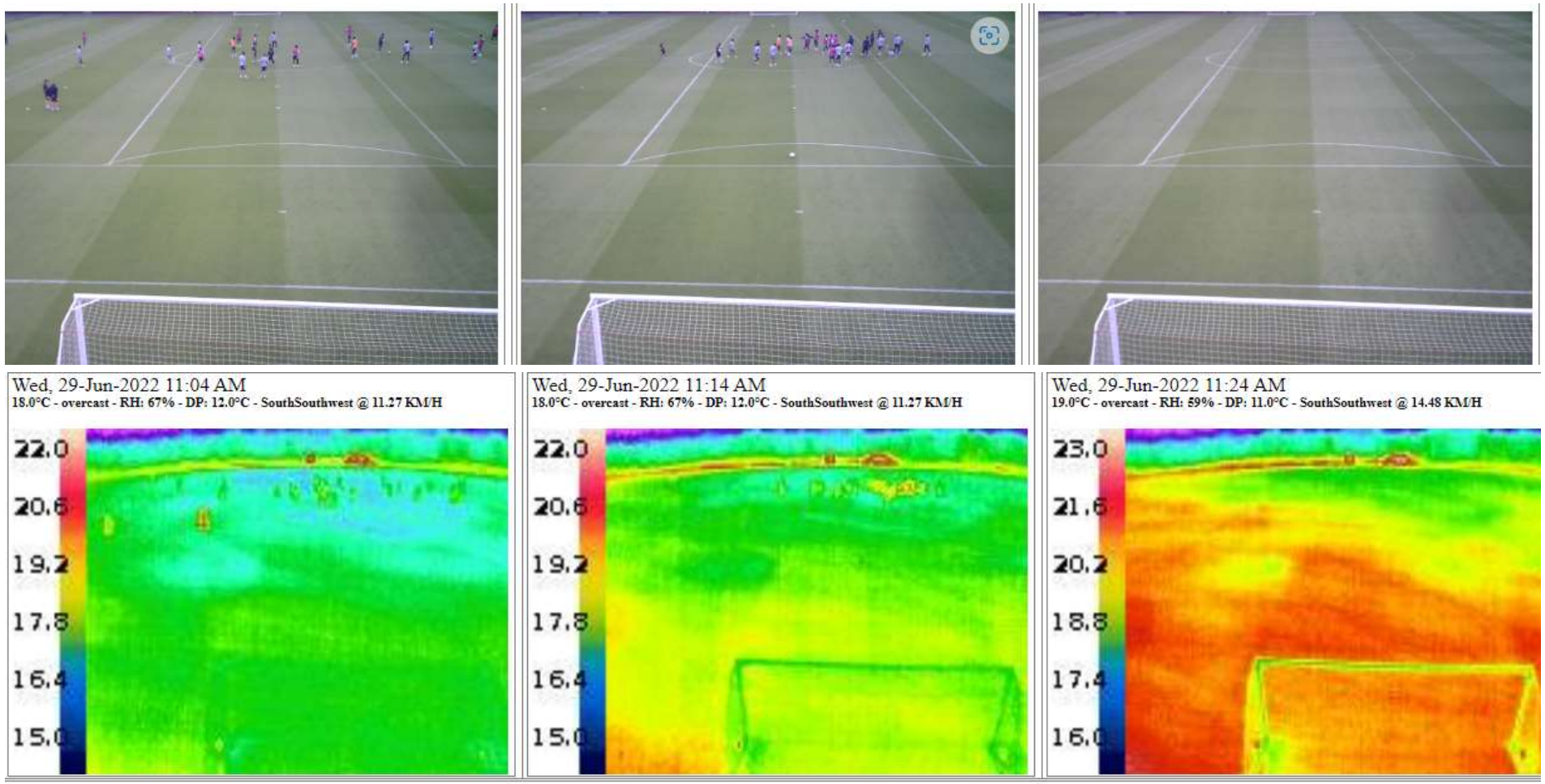
10 Aug – 25 Nov 21



https://vimeo.com/manage/videos/660516101

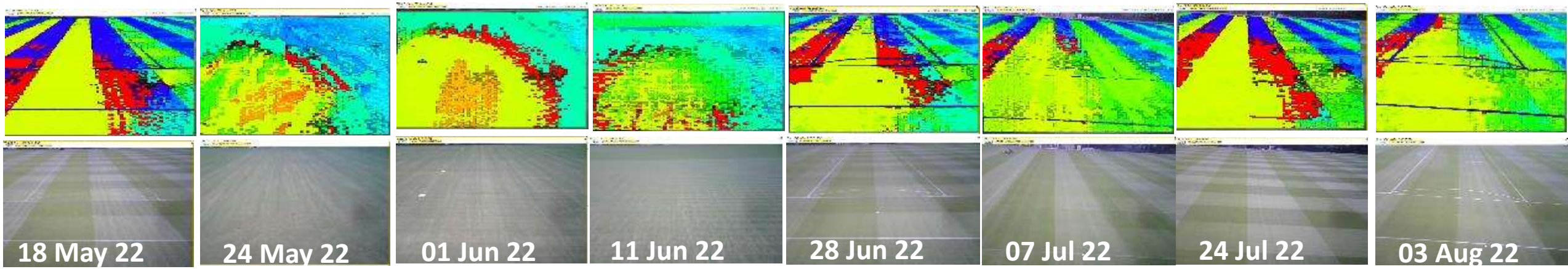
Turf-Vu

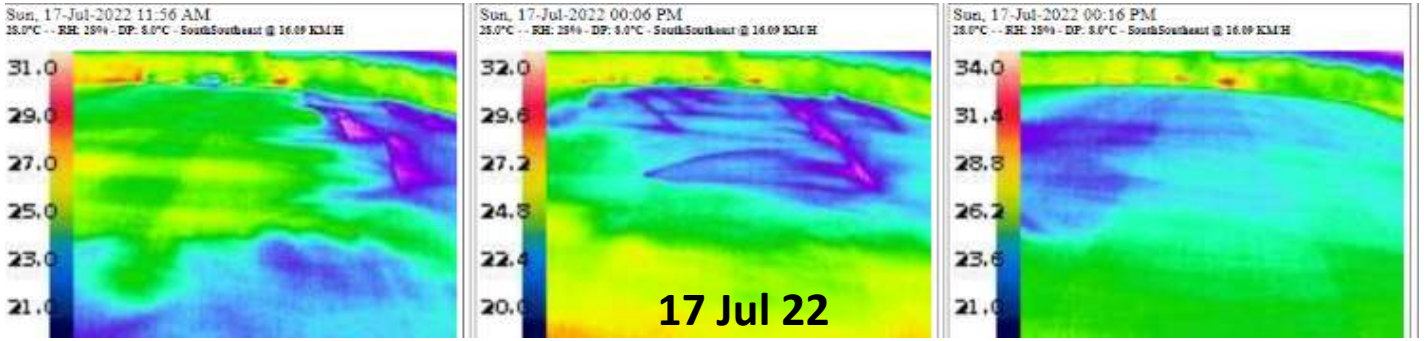
Check Irrigation Uniformity



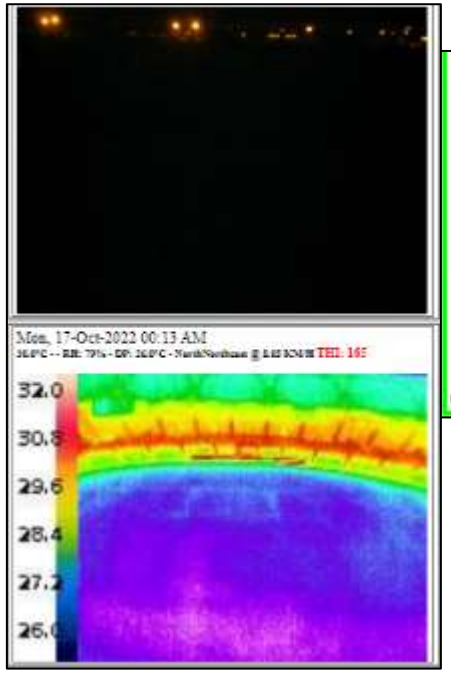
Turf-Vu

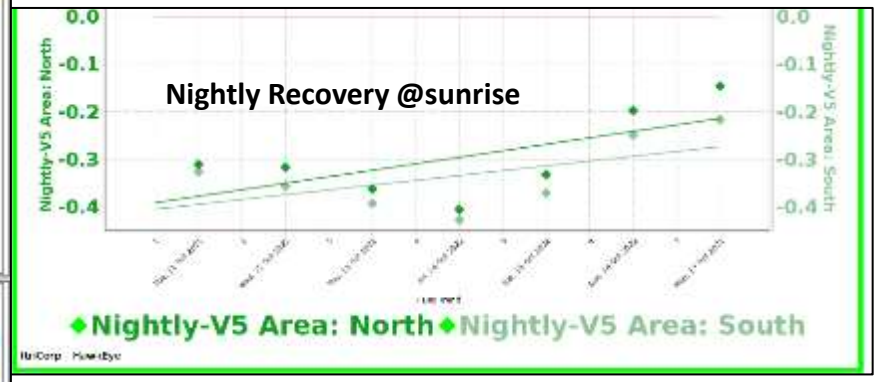
Irrigation Uniformity

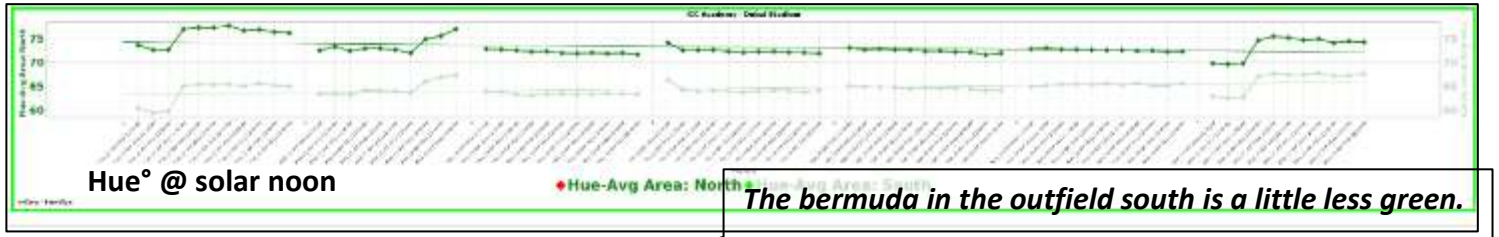




Turf-Vu

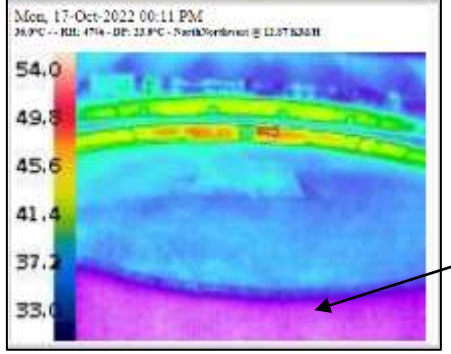


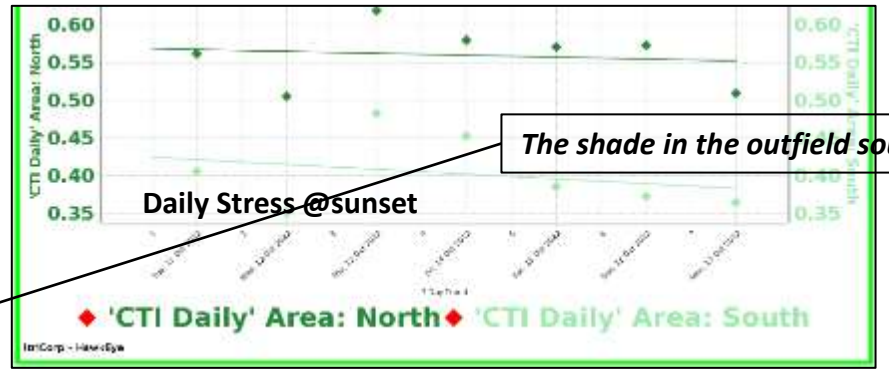




The bermuda in the outfield south is a little less green.

But it is OK.

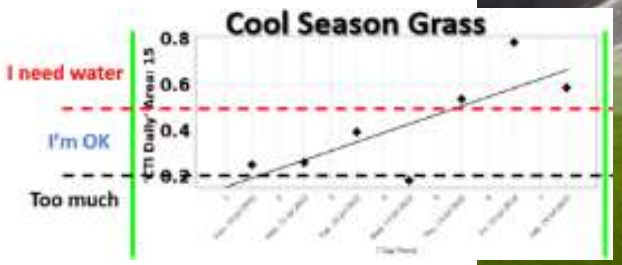




The shade in the outfield south calls for less water

Turf-Vu

Guiding Irrigation



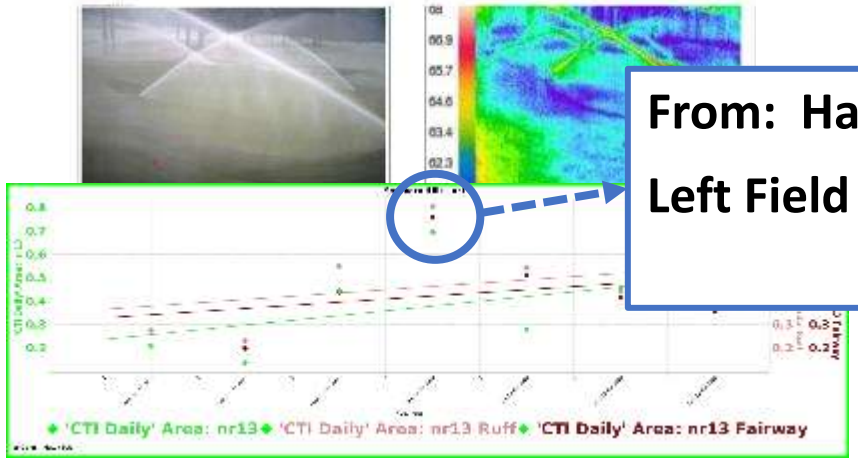
Use your regular irrigation schedule.

When you irrigate today, let the System tell you if you should:

add water

or

take away water



From: Hawk-Eye @sunset

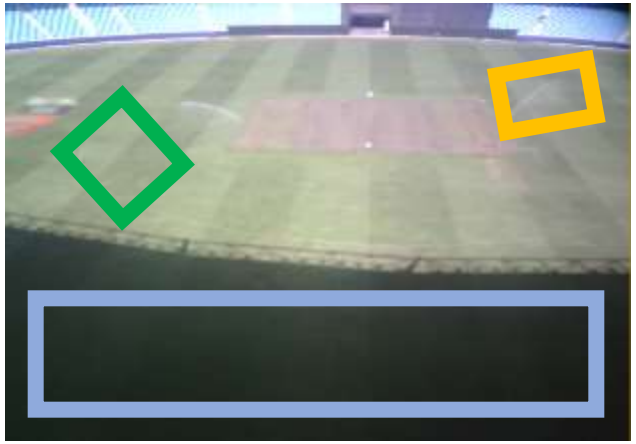
Left Field IRRIGATE

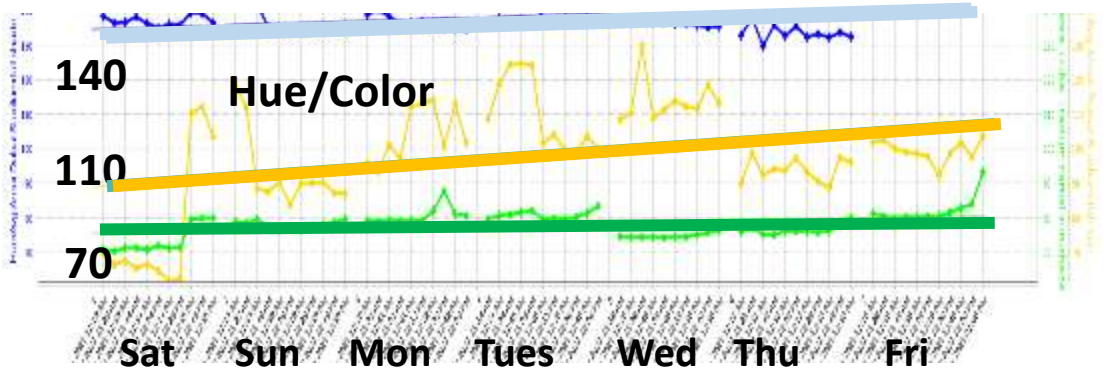
Add a turn to sprinklers

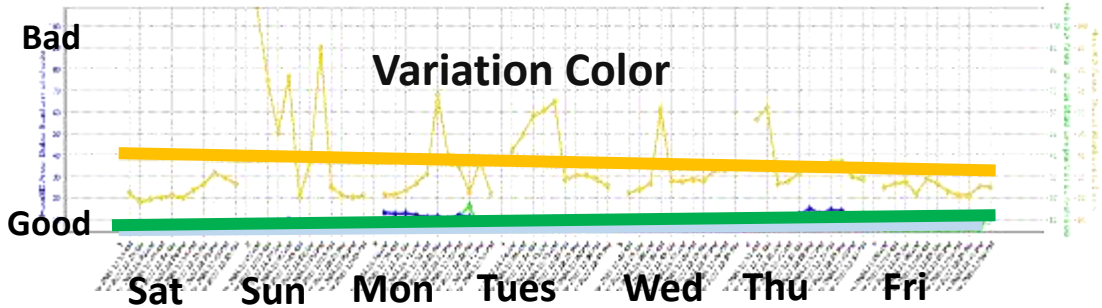
Turf-Vu

Measure the Impact of Shade on the Field

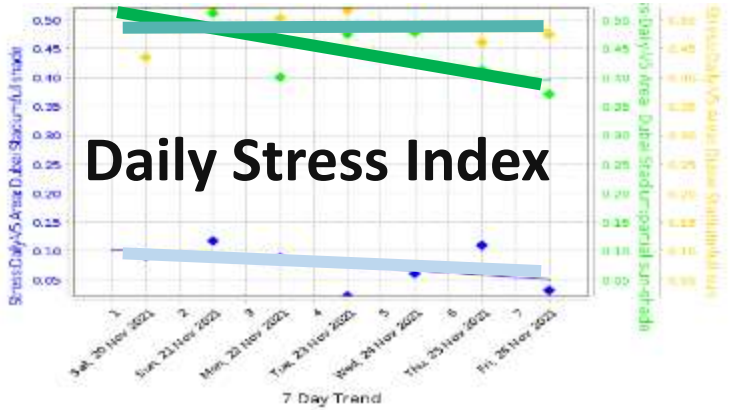
Full Shade
Partial Sun & Shade
Full Sun





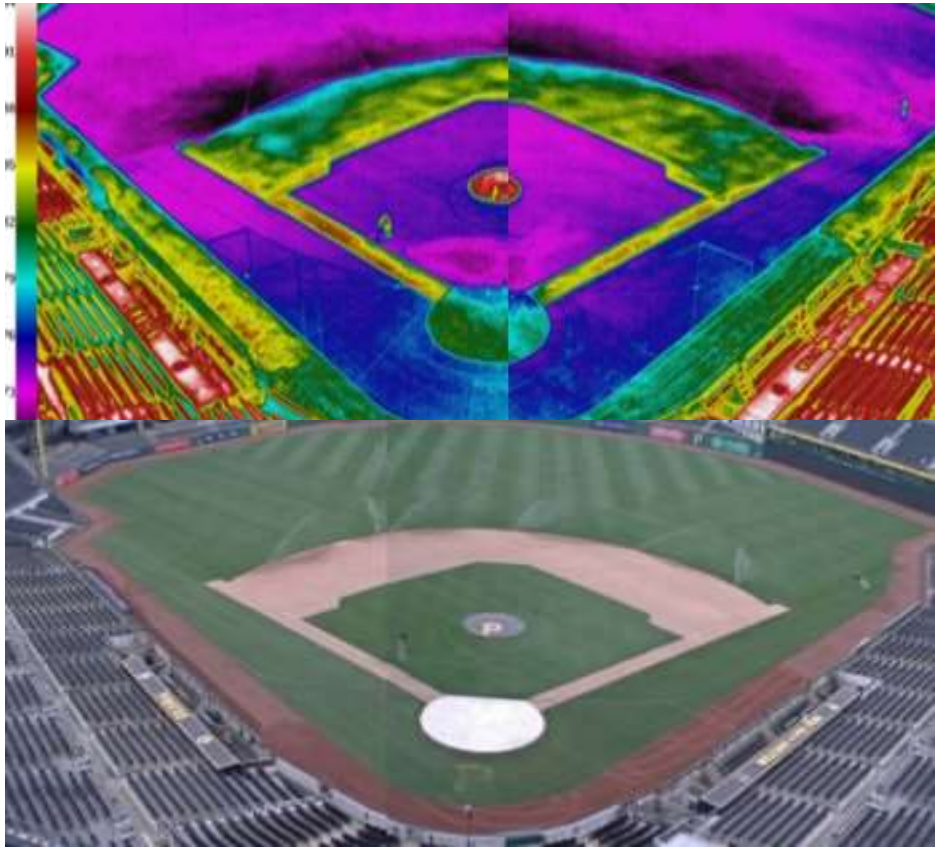


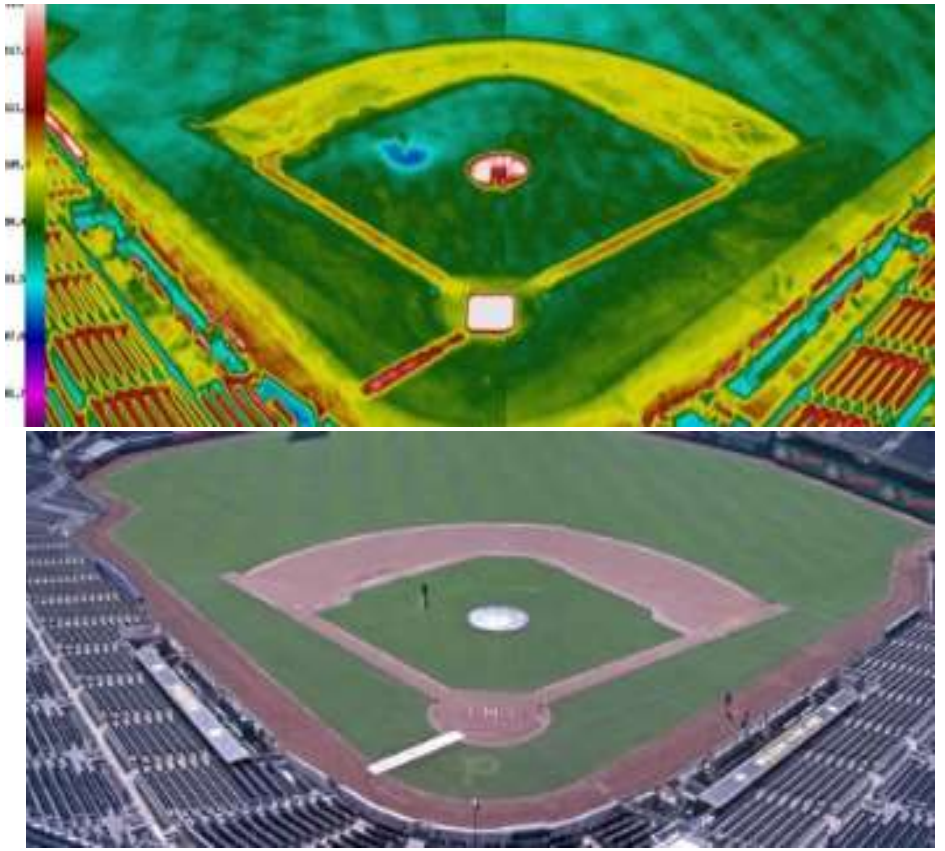
Zone 1 too much shade – cut back in water
Zone 2 ✓ - maintain ≈ .2”/day
Zone 3 full sun – add water & scarify in off season



Turf-Vu

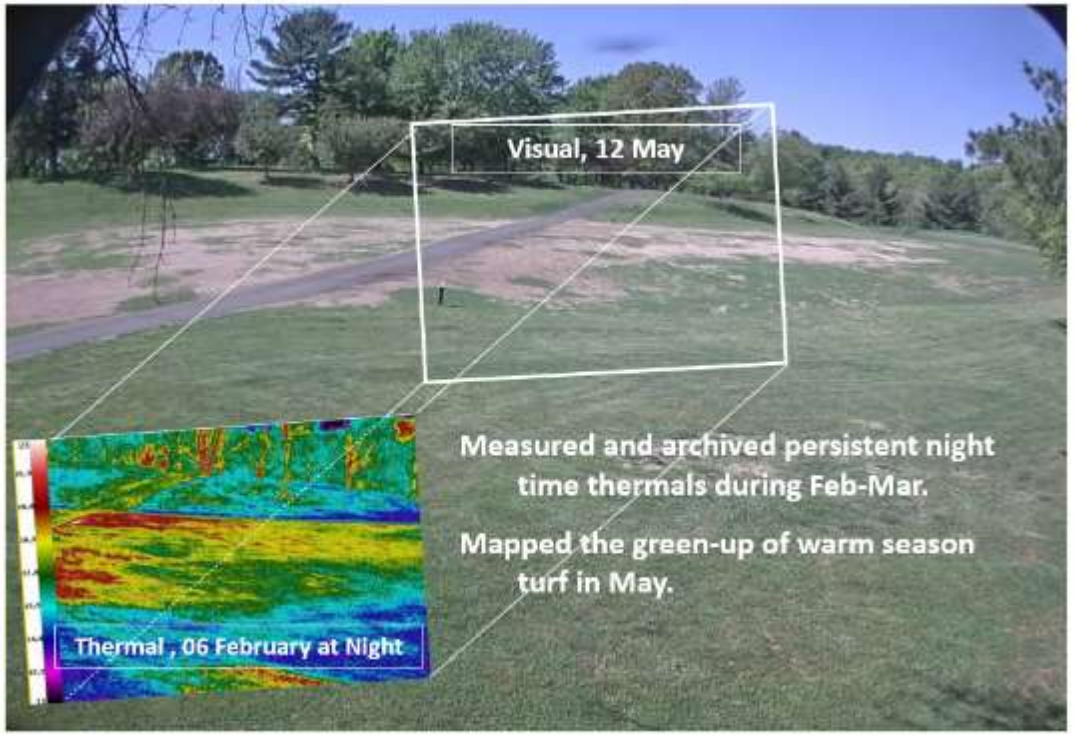
Monitor & Adjust Skin Uniformity

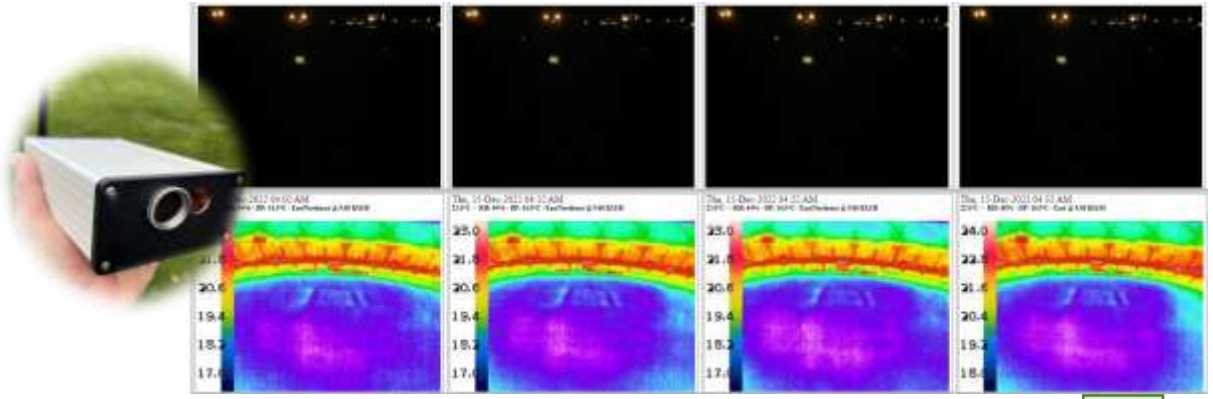


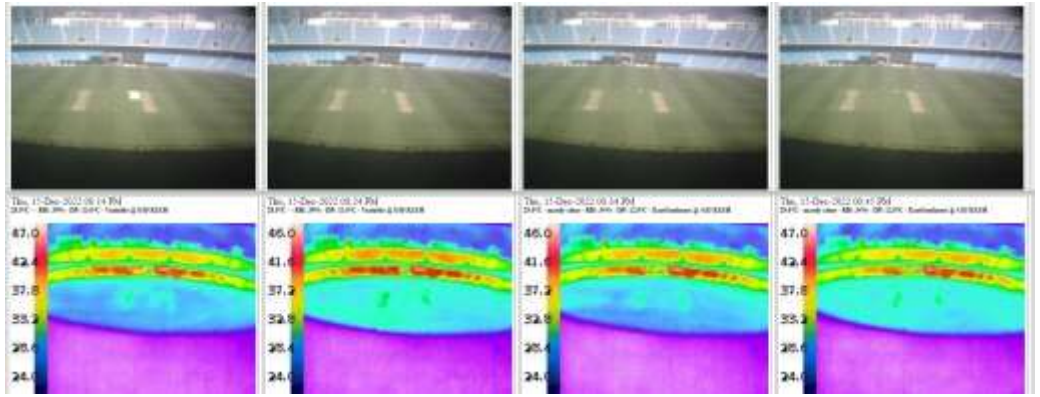


Turf-Vu

Getting Ahead of Winter Kill







It’s not how the picture looks. **It’s about the information in it.**

Measuring HUE° **Measuring Turf Temperature**

Autonomously 24/7/365

And how easy it is to use.

ItriCorp

No Boundaries

Hawk-Eye™

Latest Site Images

Search Image Data Archive

Set Notices

Weather Sites

Hawk-Eye Notes

Hawk-Eye Dashboard

How-To Hawk-Eye

http://itricorp.com/our_business/Why_and_How_it_works.html

From: Hawk-Eye

To: e-mail and/or phone

Turf-Vu

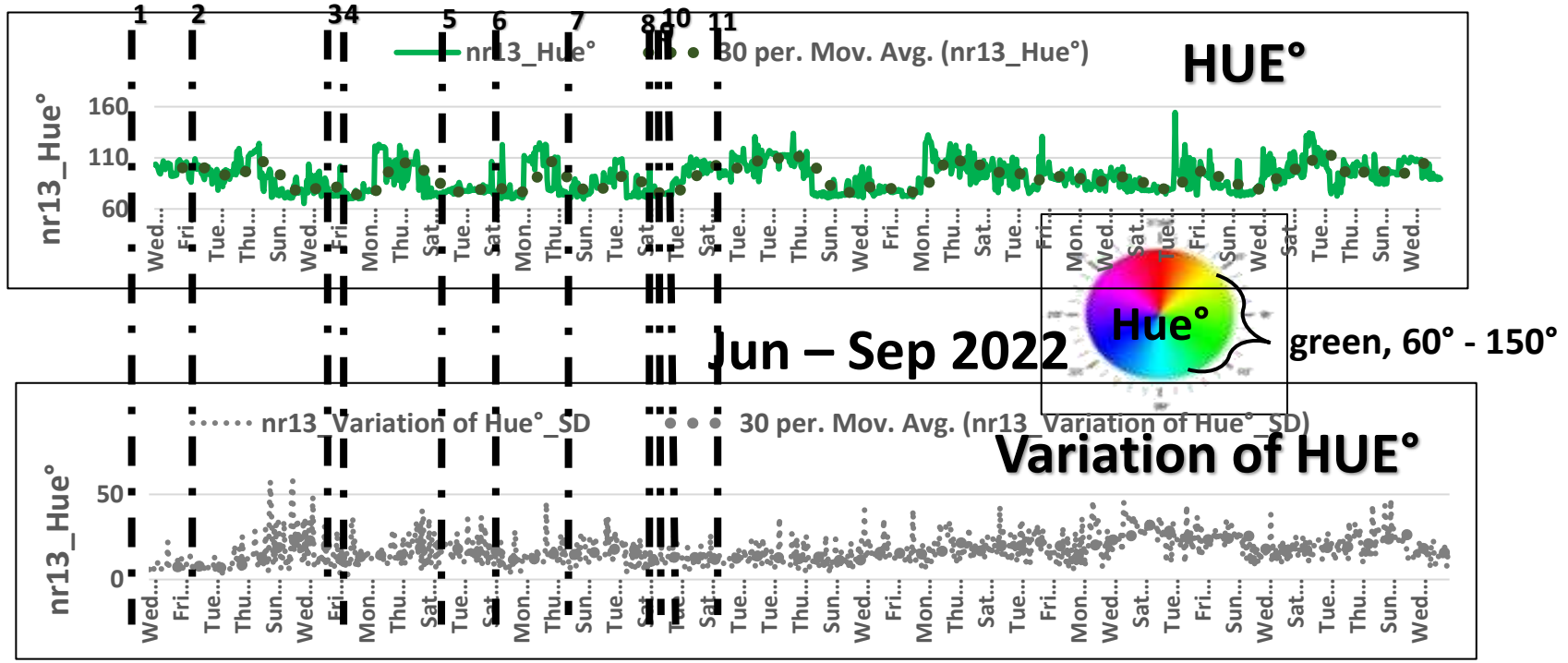
We are(want to be) Working On w/partners

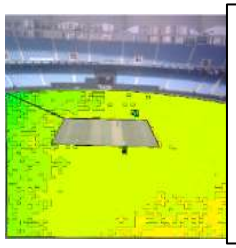
- Using Hue° Measurements to Test & Guide Fertility Applications.
- Monitoring Skin/Pitch Uniformity.
- Relationship of Mowing Pattern to Disease Control and Irrigation.
- Understand the Daily Stress & Nighttime Recovery Relationship.
- Grow Lighting

Turf-Vu

Guiding Fertility Tests & Applications

In Progress w/Vineyard





From: Hawk-Eye

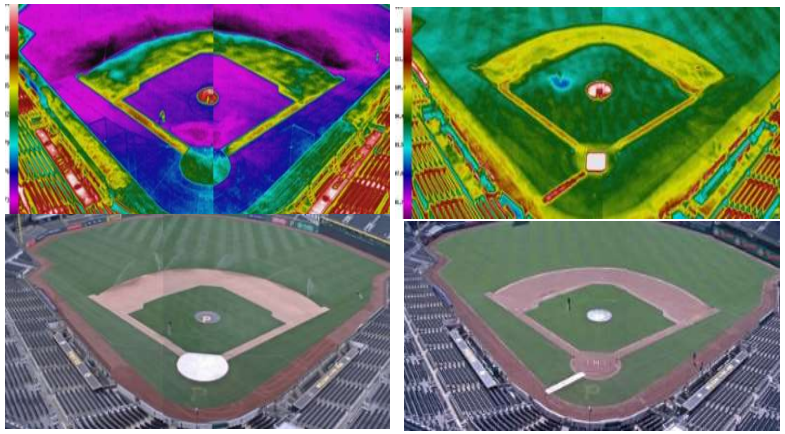
To: e-mail and/or phone @ 1:15 PM

Outfield SE **Color** is declining toward yellow

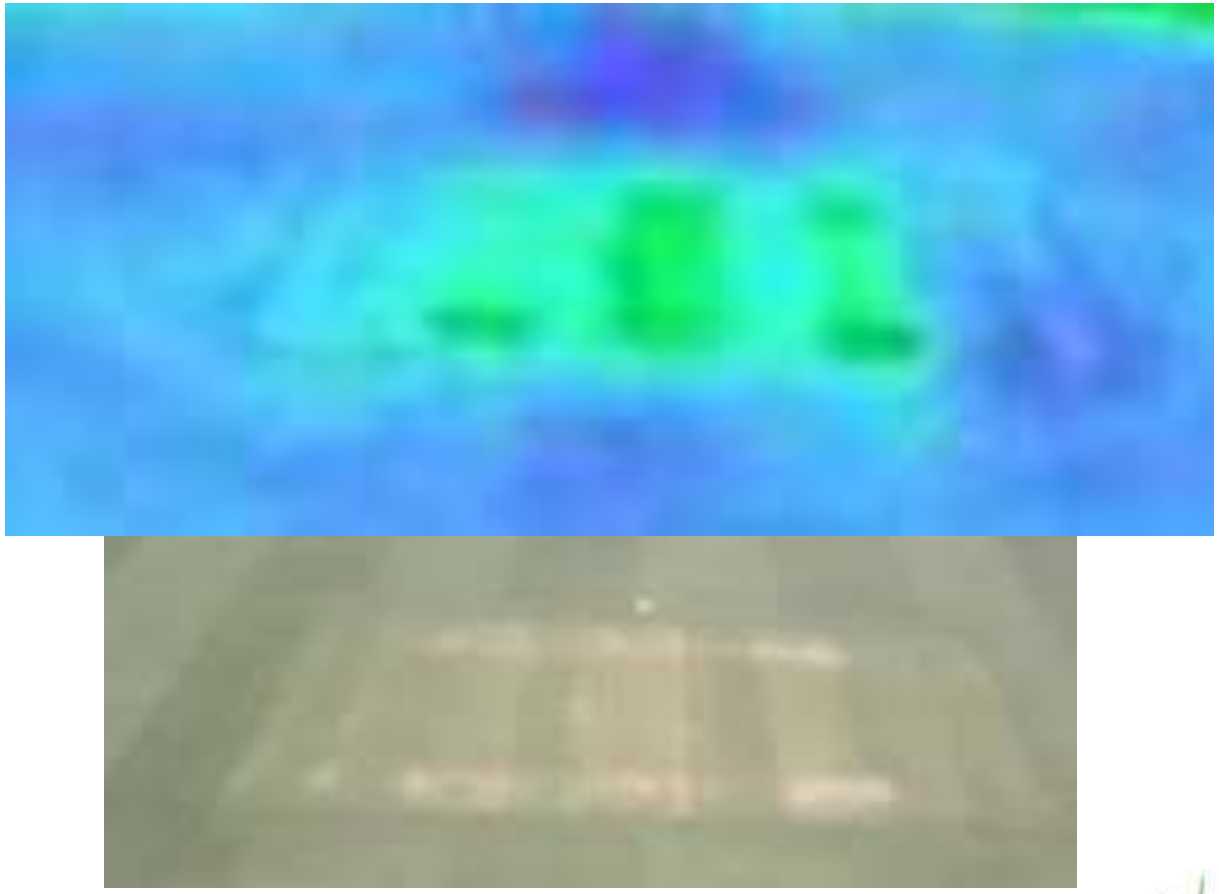
Test it

Turf-Vu

Pitch Uniformity

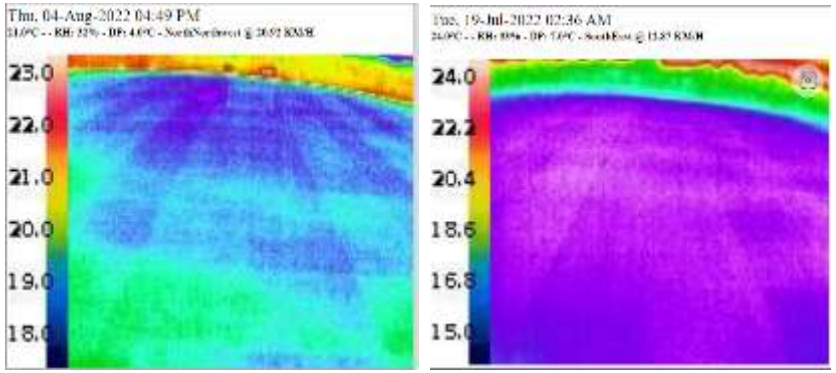


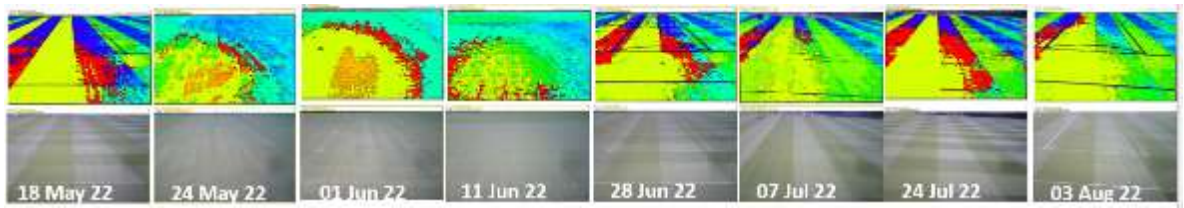
Skin Uniformity



Turf-Vu

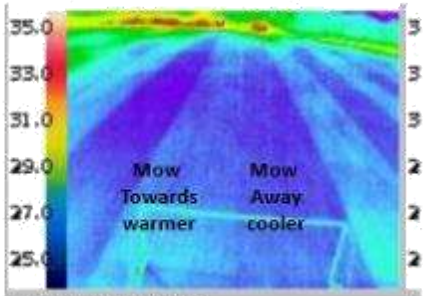
Mowing Patterns



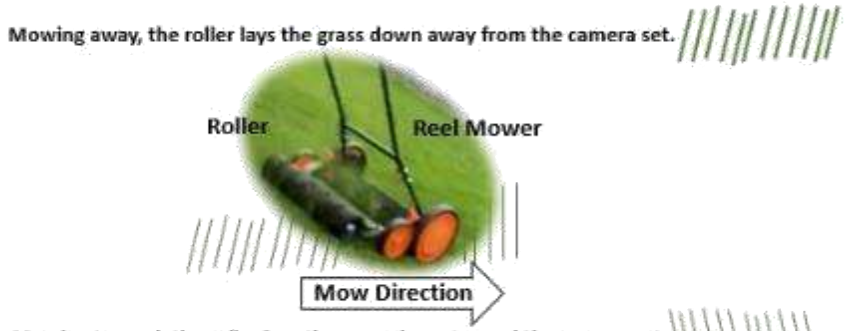


The canopy in the NNW end of the field (nearest the camera) consistently warmer than the SSW end, day and night?

If you stand on the end line at the end away from the cameras, the visual pattern reverses. Not the temperature pattern.



The Sun is behind the camera all day.
The temperature difference is most pronounced between 11h and 16h. It goes away after sunset.



Mowing away, between 11h and 16h, some visible light is reflected off the Epicuticular wax away from the grass.

That energy is not absorbed to be radiated as heat, but it is plenty for photosynthesis.

"So What"

Mowing patterns are cool and have an aesthetic value. But does it matter that half a field may be a degree warmer during the afternoon?

? Does it have an impact on stress and irrigation demand?

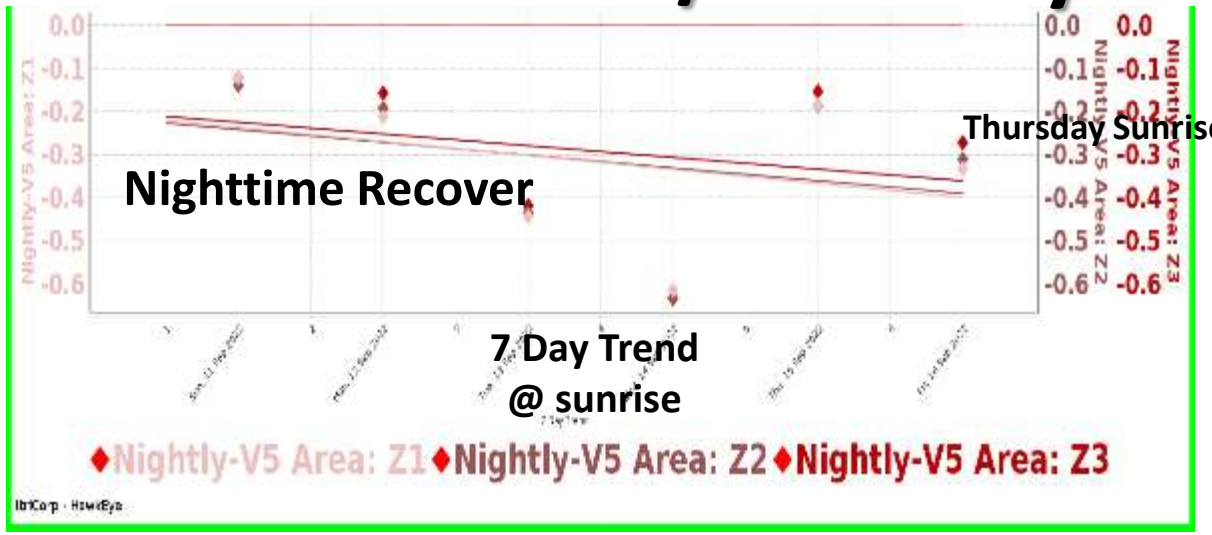
? Does it open a door to disease in the cooler/moister part of the pattern?

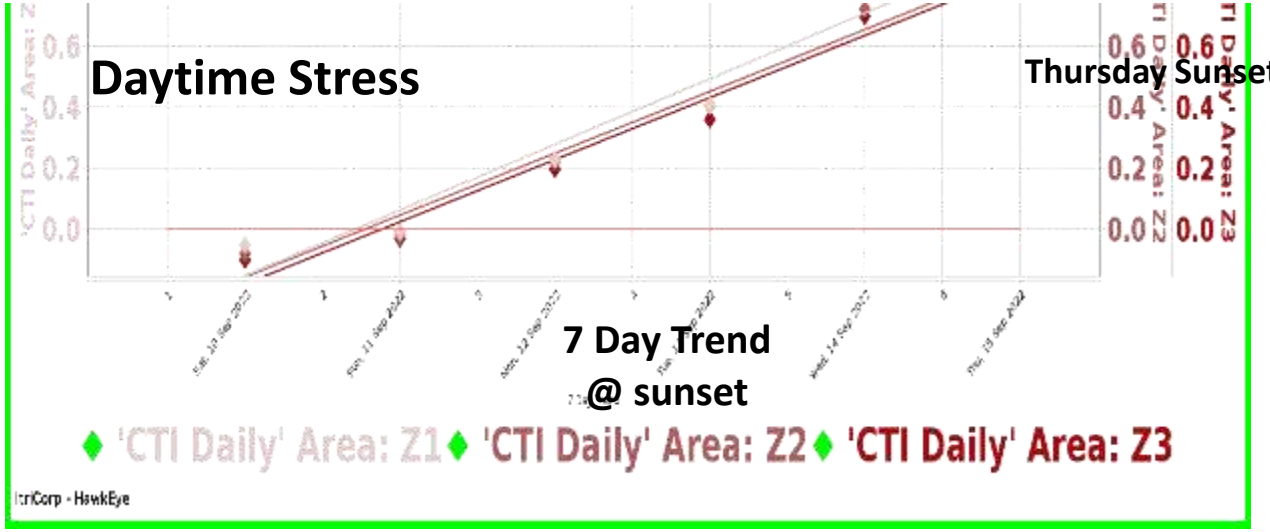
? Does it impact player safety?

Turf-Vu

Understand the Stress/Recovery Relationship

In Progress





Index the Stress/Recovery Relationship

Turf-Vu

Grow Lighting

Turf-Vu