Monitor Heat Stress on Greens with Hi-Tech Gizmos that Won't Break your Budget

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Problem: Pocketed Greens

gcm extra

- Surrounded by trees
- Nearby buildings and facilities
- Rocky outcroppings, landscaping

Excerpted from September GCM. Pocket change, Logan Freeman

Eight of the 21 greens at Mountain Branch GC in Joppa, Md., sit back within shaded tree-filled areas and need special management to look and play their best. **Photos by Logan Freeman**

Problem: Pocketed Greens

- Restricted air flow
  - Heat stress
- Shade
  - Especially morning shade
- Exacerbated by:
  - Poor drainage or excessive irrigation
  - Low mowing heights

Problem: Restricted Airflow

- Less mixing of drier air with humid layer near turfgrass canopy
- Increased humidity over green
- Lower vapor pressure deficit

Vapor Pressure Deficit (VPD)

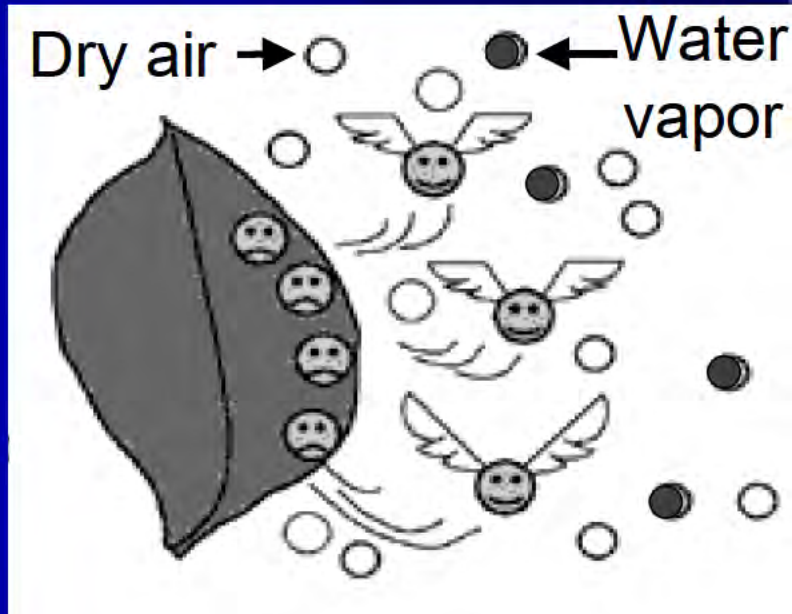
Measure of drying power of the air

Higher VPD

- Dry air above canopy
- Transpiration unhindered
- Evaporative cooling

Lower VPD

- Less dry air above canopy
- Transpiration stifled by inability to release moisture
- Higher canopy temperature



http://ohioline.osu.edu/aex-fact/0804.html

Restricted Airflow: Influences on Turfgrass

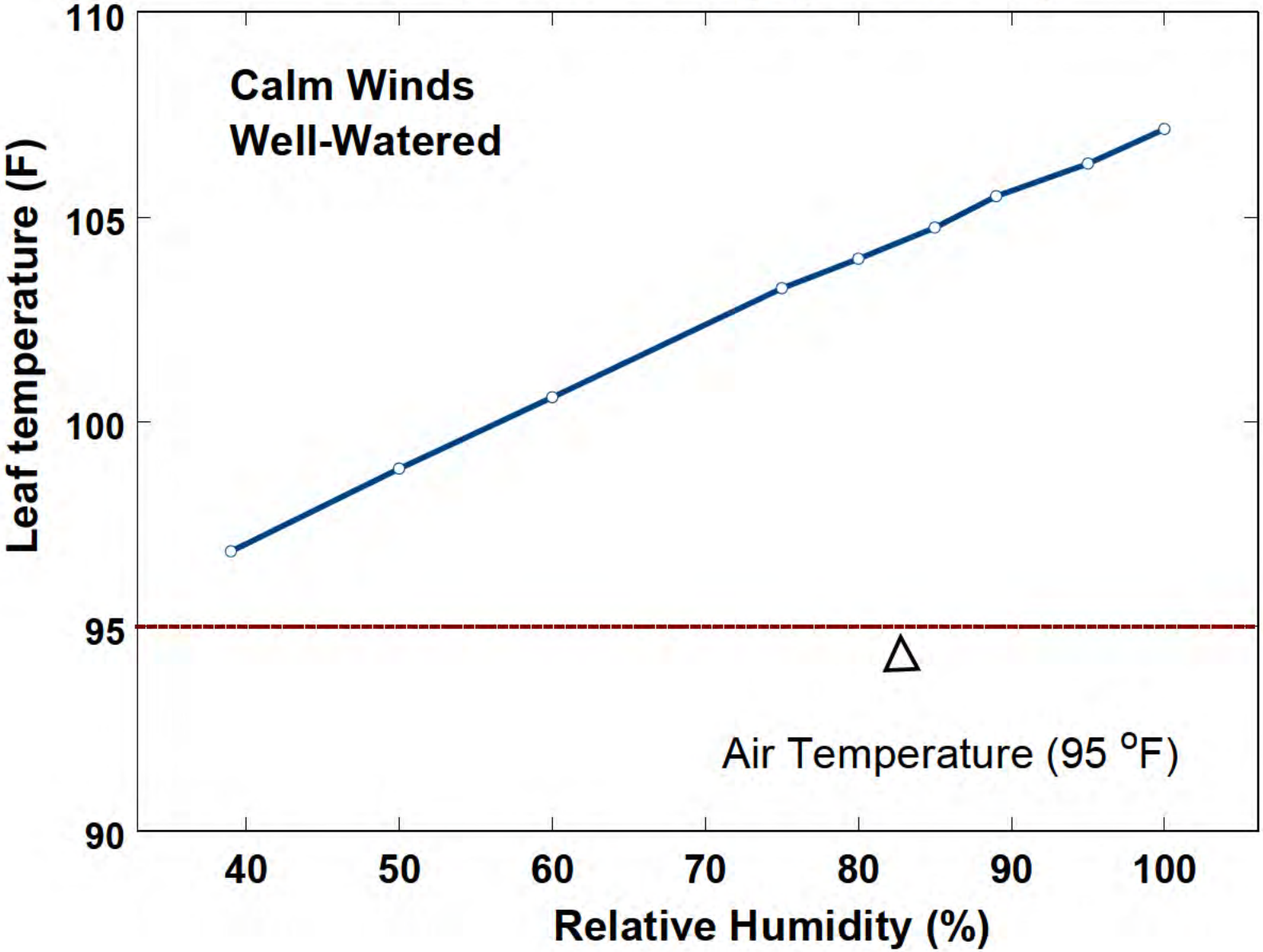
- ⬇ Transpiration
- ⬆ Leaf Temperature
- ⬆ Soil Temperature
- ⬇ Photosynthesis
- ⬆ Respiration
- ⬇ Turfgrass quality

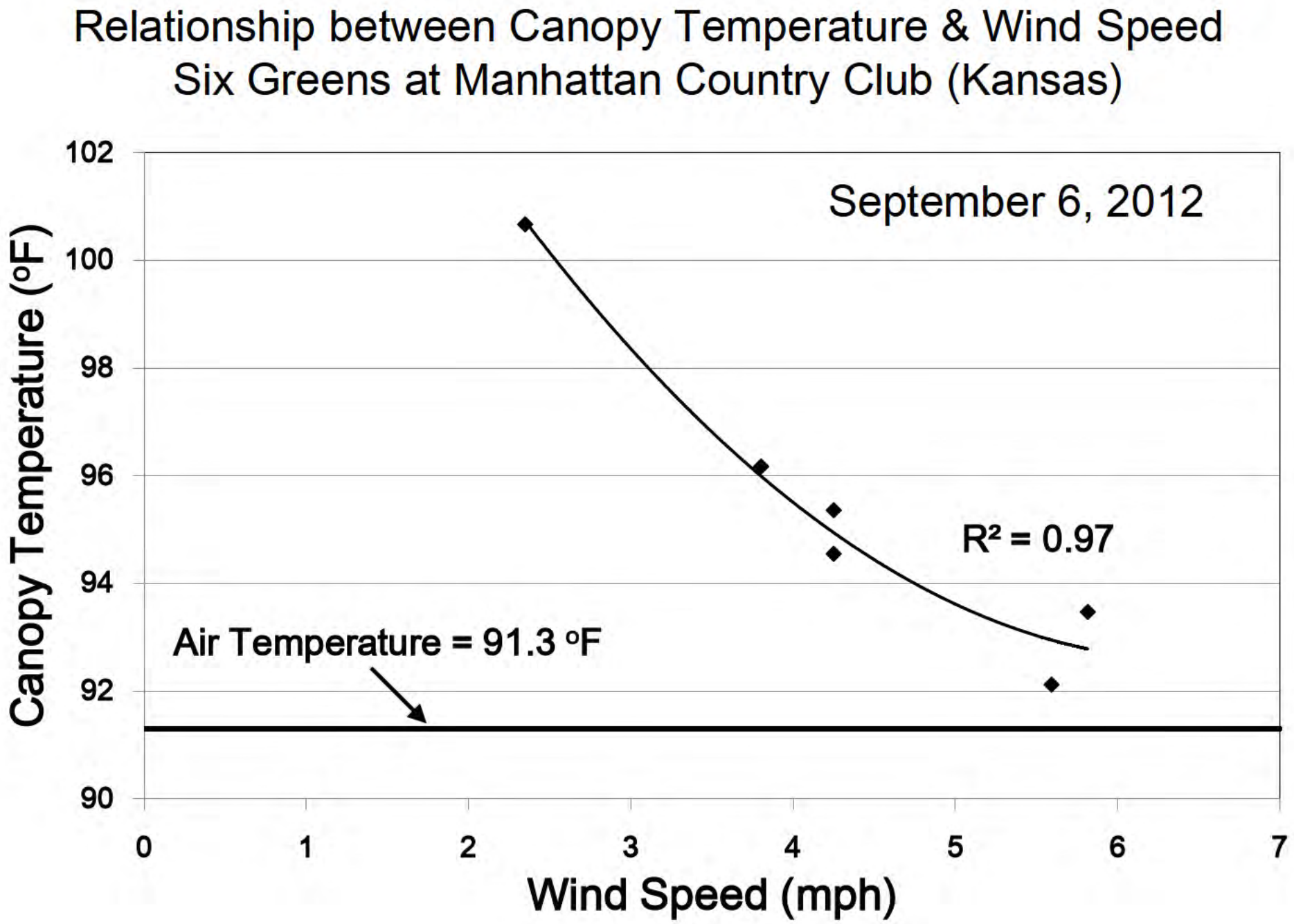
Transpiration:
Removes Heat via
Evaporative Cooling

Factors affecting Transpiration:

- Relative Humidity: Drying power of air
- Windspeed

Relationship between Canopy Temperature & Relative Humidity (Modeled)




Relationship between Canopy Temperature & Wind Speed
Six Greens at Manhattan Country Club (Kansas)
September 6, 2012
R² = 0.97
Air Temperature = 91.3 °F
Canopy Temperature (°F)
102
100
98
96
94
92
90
0
1
2
3
4
5
6
7
Wind Speed (mph)

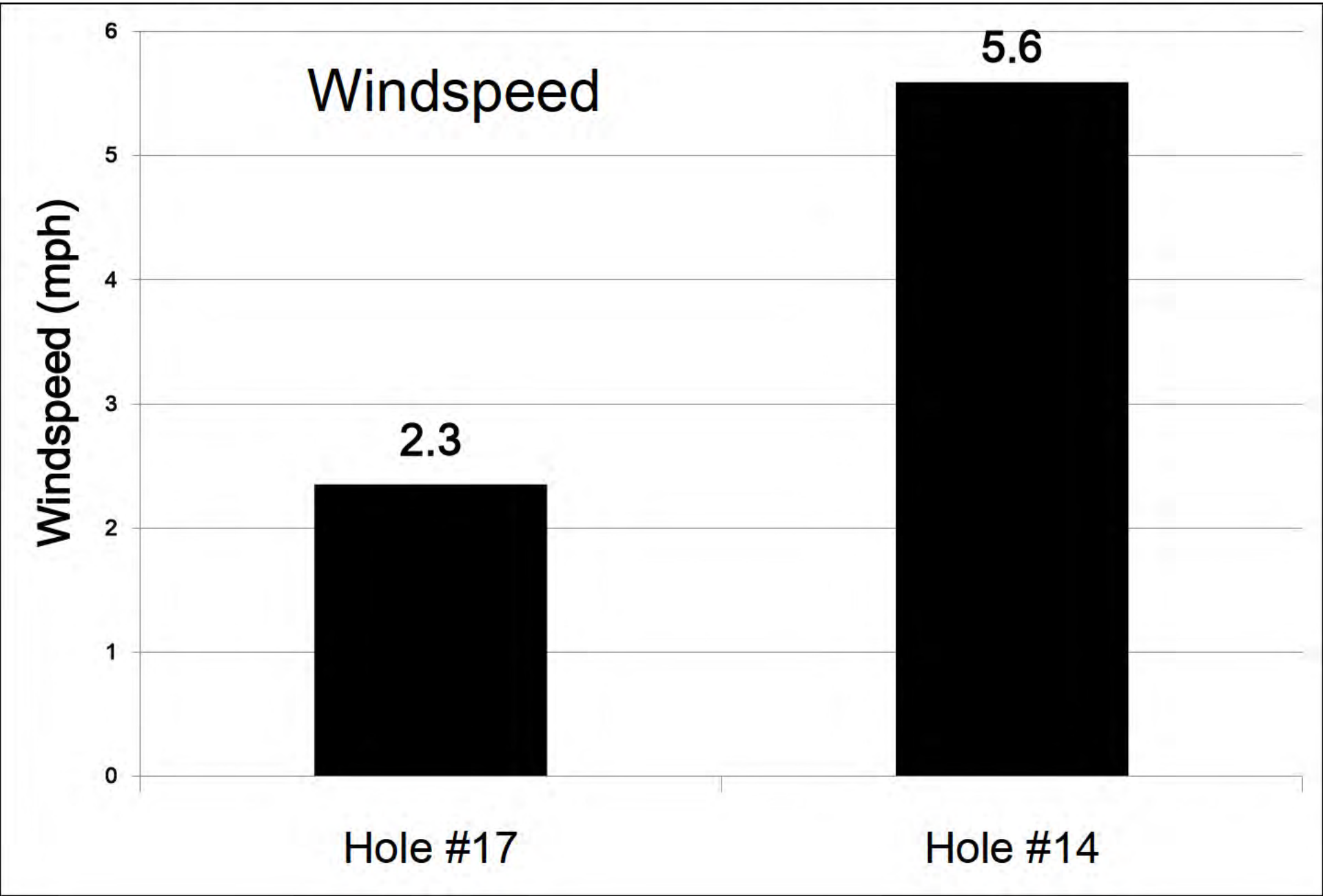
Manhattan Country Club

Manhattan, Kansas

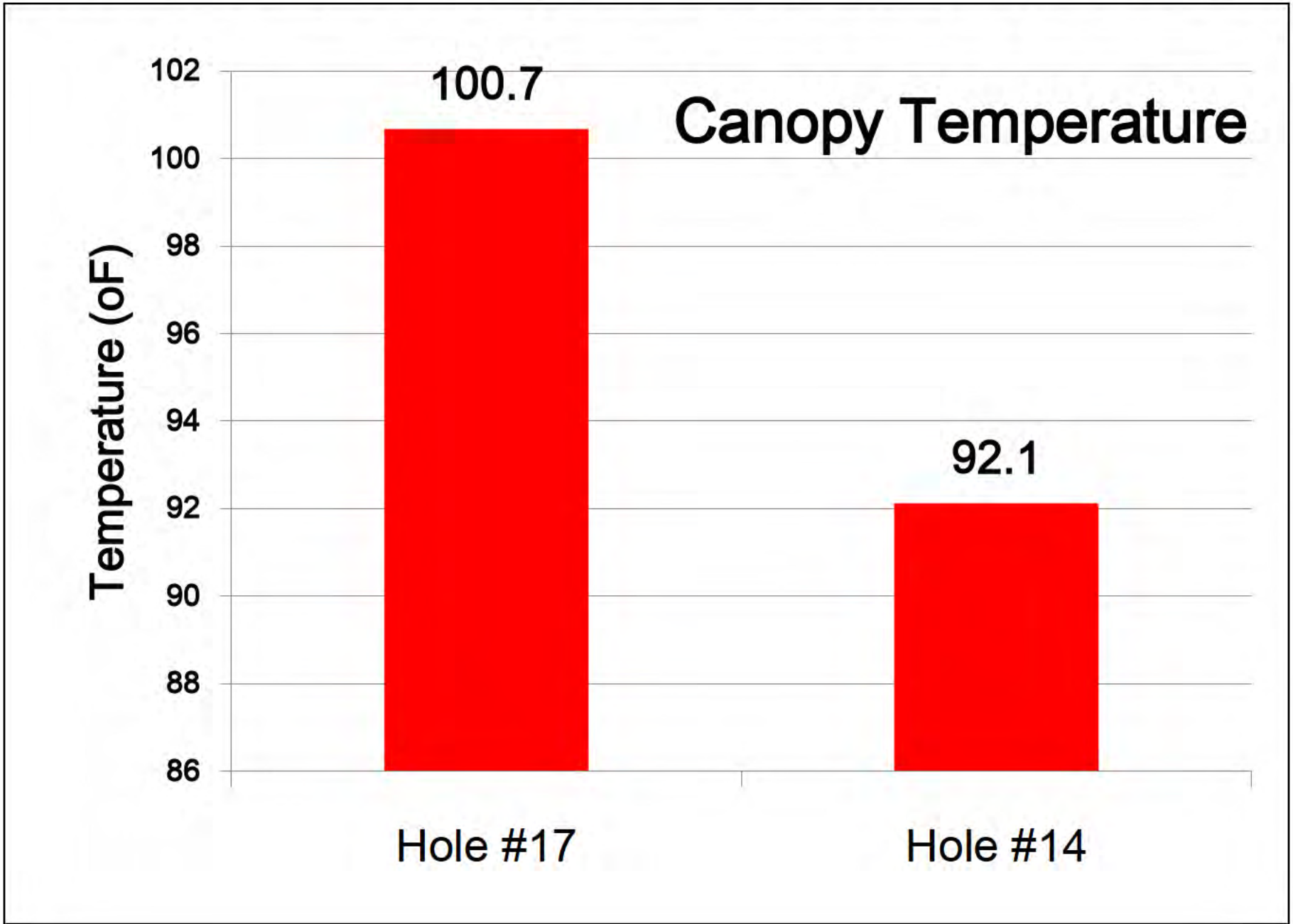
Hole #17

Hole #14

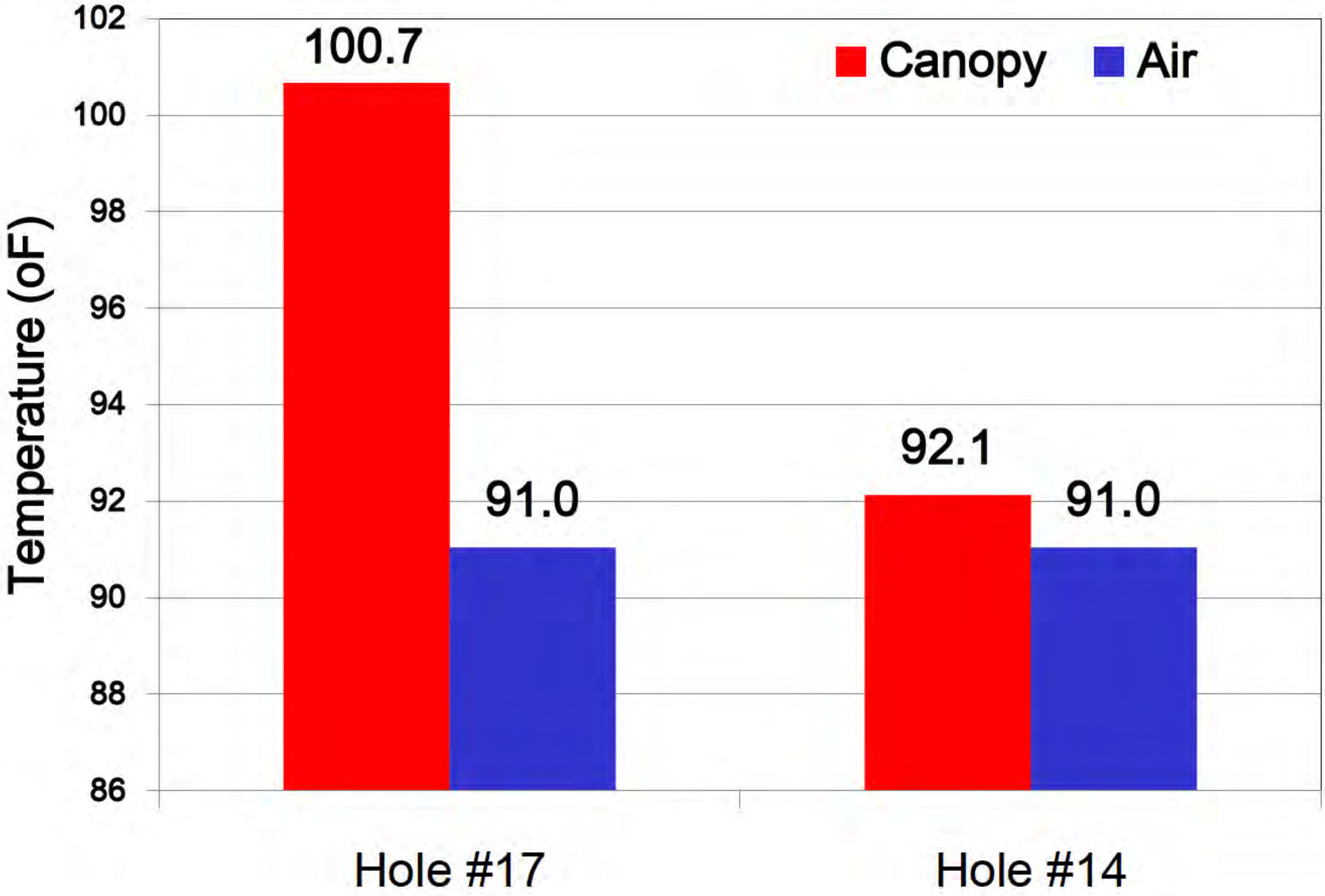
Manhattan Country Club, Manhattan, Kansas



Manhattan Country Club, Manhattan, Kansas



Manhattan Country Club, Manhattan, Kansas



Lower Leaf Temperature

1. Improve circulation of air across green
   a. Tree removal or thinning understory
   b. Fans
2. Removes humidity near surface
3. Increases evapotranspiration
   a. Evaporative cooling

precisionusa.com

airmaxfans.com

Fans

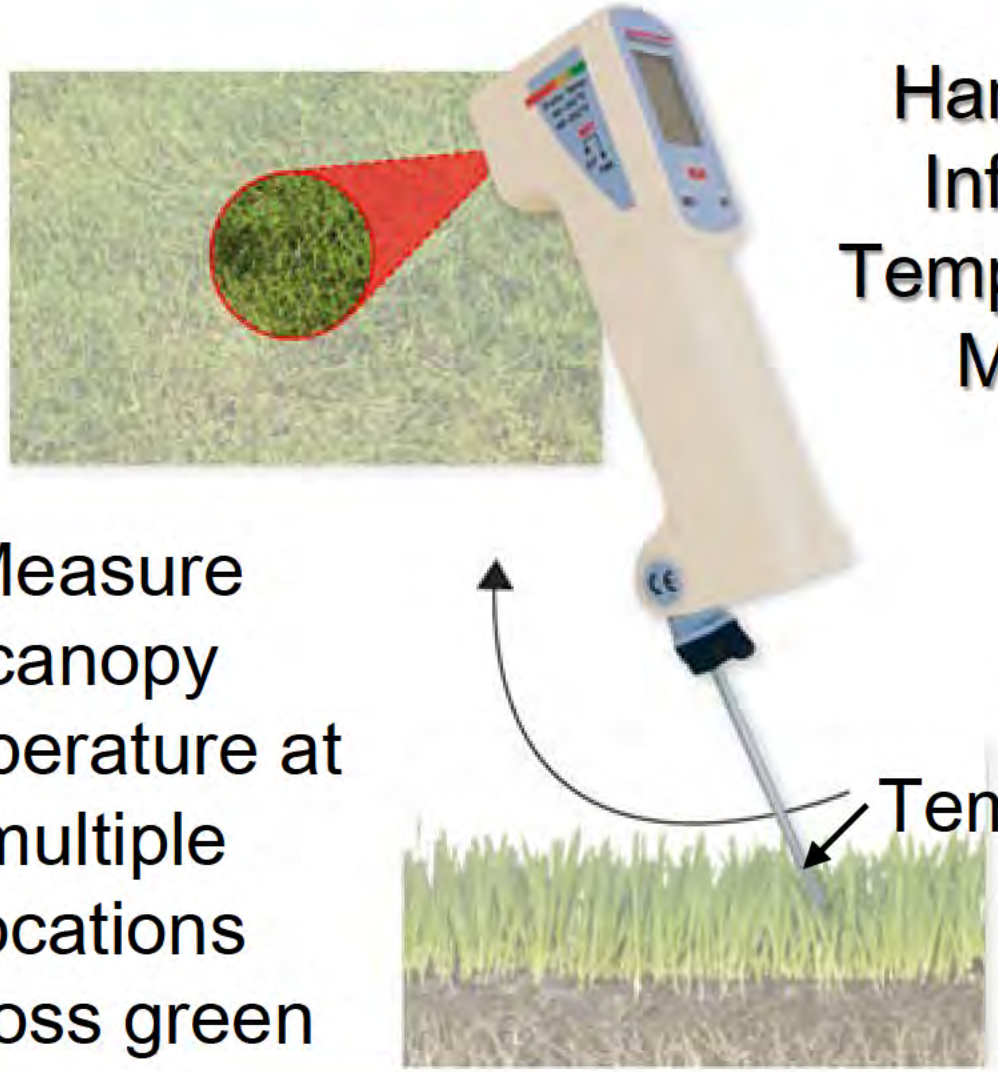
- Placement of Fans
  - Blowing with direction of prevailing winds
  - Main goal is to achieve 3 to 4 mph windspeed over turfgrass canopy
    - Check several areas around green

Handheld Weather Stations

Measuring Canopy Temperature

- Different than measuring air temperature
- Handheld infrared thermometer
  - IRT
  - Check several areas across green

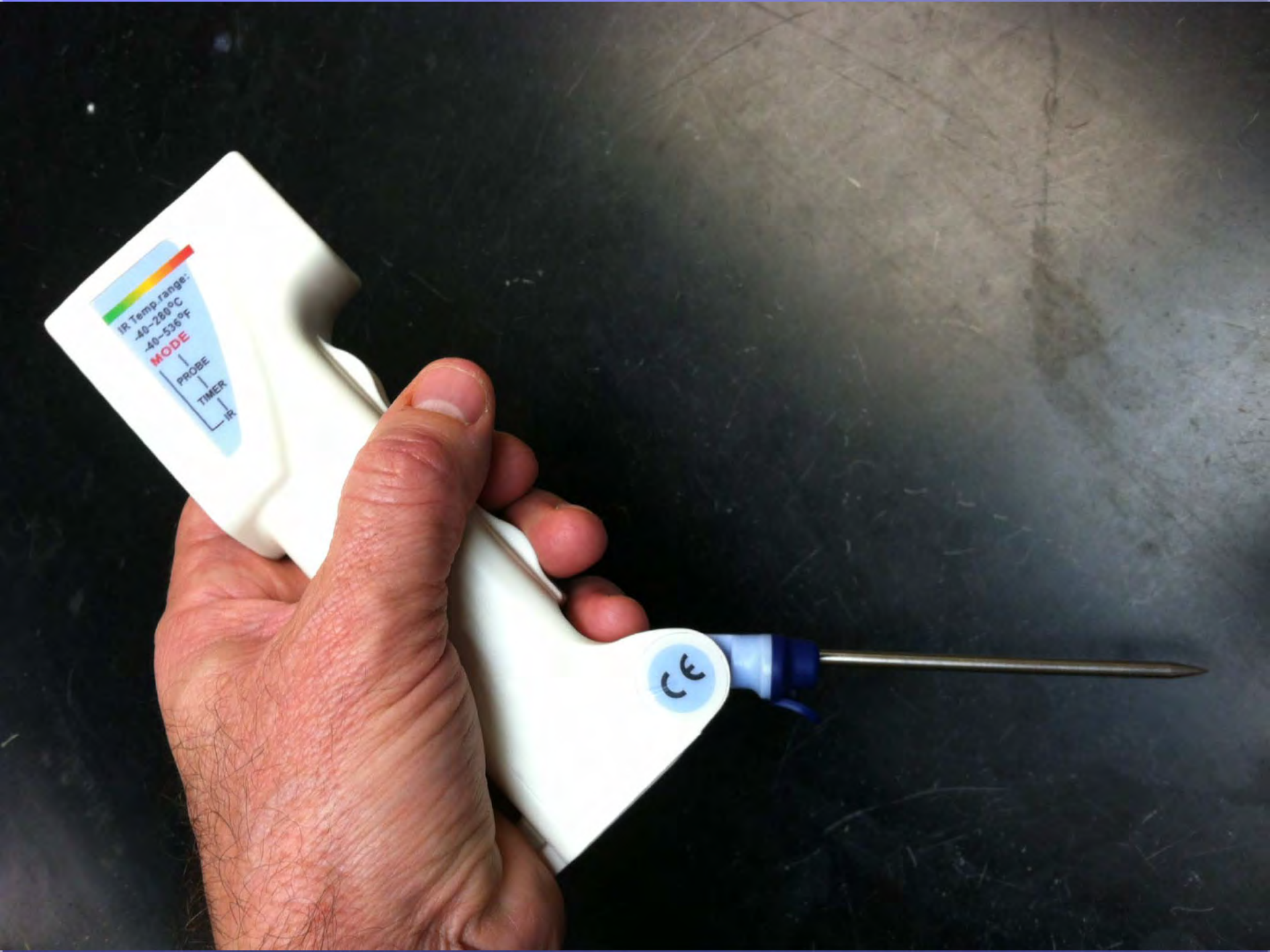
Monitor Effects of Windspeed on Canopy Temperature



Handheld Infrared Temperature Meter

Measure canopy temperature at multiple locations across green

Soil Temperature


IR Temp.range:
-40~260°C
-40~536°F
MODE
PROBE
TIMER
IR
CE

Canopy Temperature

- Ideal for shoot growth
  - 60-75 °F in cool-season turf
  - 80-95 °F in warm-season turf
- Heat stress:
  - >85 °F in cool-season turf
  - >113 °F in warm-season turf

Measuring Soil Temperature

Soil Temperature

1. Cool-season grasses
   a) Ideal for root growth & initiation
      i. 50-65 ^{o}F
   b) Creeping bentgrass
      i. New root initiation stops at ~75 ^{o}F
2. Warm-season grasses
   a) Ideal for root growth & initiation
      i. 70-85 ^{o}F

Thank you!! Questions?

Other Management to Lower Leaf Temperature

1. Syringing
2. Raise mowing heights
   a) Promotes transpiration
   b) Shades & cools soils
   c) Raise by 1/32 inch
      i. 1/8 (.125) to 5/32 (.156)
      ii. 25% more leaf area!

Other Management to Lower Leaf Temperature

3. Maintain soil oxygen
   a. Don’t over-irrigate
   b. Provide for drainage
   c. Relieve compaction
4. Avoid mechanical damage during stress
   a. Topdressing, cultivation