WATER: HOW IRRIGATION PRACTICES AFFECT SPORTS FIELD PERFORMANCE

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1

WHAT IS SPORTS FIELD PERFORMANCE?

Consistent and safe ***regardless of weather conditions***

- Maintain adequate:
  - Traction
  - Surface hardness
  - Turfgrass coverage

(Henderson et al., 2009)

2

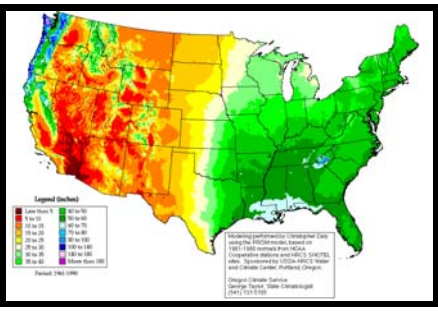
WHERE DOES WATER FIT IN?

Role of water in turfgrass

- Photosynthesis
- Transport nutrients from the rootzone
- Protection from temperature fluctuations
- Cell turgidity

3

HOW DO SPORTS FIELDS GET WATER?



4

SUPPLEMENTAL IRRIGATION

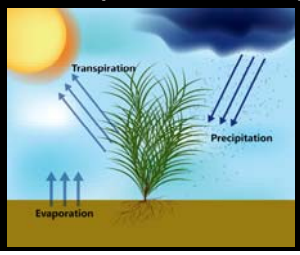
How much water needs to be applied?

- Depends on many factors...
  - Turfgrass species/cultivar
  - Soil texture
  - Soil moisture
  - Growing environment (evapotranspiration)

5

WHAT IS EVAPOTRANSPIRATION (ET)?

Combined effects of evaporation and transpiration



6

OBTAINING ET DATA

Weather stations provide on-site data!

- Reference ET (ET_o) is commonly used for irrigation scheduling

7

OBTAINING ET DATA

Online resources

- Historical data is somewhat limited…
- NOAA provides daily forecasted reference ET (FRET)

8

UTILIZING ET DATA

Crop coefficients (K_c) are a fractional percentage of ET_o (%ET_o) and can depend on season, grass species, maintenance level, and quality expectations

- Warm-season: 0.7
- Cool-season: 0.8

9

UTILIZING ET DATA

ET data is useless without understanding irrigation system output…

- "How many minutes should I run each zone?"
- Apply irrigation in volume (inches) NOT duration (minutes)
- Need to determine precipitation rate

10

DETERMINING IRRIGATION SYSTEM OUTPUT

Ways to calculate precipitation rate:

- Sprinkler head/nozzle performance data
  - Quick process
  - Does not account for distribution uniformity

Nozzle	Pressure PSI	Radius ft	Flow GPM	Precip in/hr ■	Precip in/hr ▲
08 Lt. Brown	40	44	7.6	0.76	0.87
	50	45	8.4	0.80	0.92
	60	46	9.2	0.84	0.97
10 Lt. Green	50	49	10.3	0.83	0.95
	60	50	11.3	0.87	1.00
	70	51	12.2	0.90	1.04
	80	51	13.0	0.96	1.11
13 Lt. Blue	50	50	11.1	0.85	0.99
	60	51	12.3	0.91	1.05
	70	52	13.3	0.95	1.08
	80	53	14.2	0.97	1.12
15 Gray	50	54	13.8	0.91	1.05
	60	55	15.7	1.00	1.15
	70	57	16.6	0.98	1.14
	80	59	18.3	1.01	1.17
23 Dk. Green	60	62	21.3	1.07	1.23
	70	64	23.0	1.08	1.25
	80	65	24.5	1.12	1.29
	90	66	25.9	1.14	1.32
25 Dk. Blue	60	66	23.9	1.06	1.22
	70	67	25.8	1.11	1.28
	80	68	27.7	1.15	1.33
	90	69	29.5	1.19	1.38

hunterindustries.com

11

I WAS TOLD THERE WOULD BE NO MATH…

I did the math for you!

Four Full Circle Square Spacing	
Spacing between sprinklers (ft)	50
Spacing between rows of sprinklers (ft)	50
Discharge of one sprinkler (GPM)	11.3
Precipitation rate (in/hr)	0.435

12

DETERMINING IRRIGATION SYSTEM OUTPUT

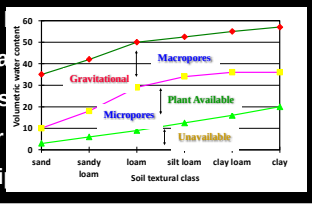
Ways to calculate precipitation rate:

- Perform an irrigation audit
  - Precise, determines irrigation system efficiency (DU)
  - More time-consuming/ expensive than using nozzle charts

13

PUTTING ET DATA TO WORK

- Sum ET data between irrigation events
  - Frequency dependent on soil texture
- Multiply ET
  - Warm-sea
  - Cool-seas
- Account for
- Utilize preci



14

CALCULATING RUN TIMES

$$\frac{\text{ET} \times \text{Kc}}{\text{DU} \times \text{PR}} \times 60 = \text{min irrigation to apply}$$

$$\frac{0.5\ \text{in} \times 0.7}{0.75 \times 1\ \text{in/h}} \times 60 =$$

15

CALCULATING RUN TIMES

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$$\frac{0.5\ \text{in} \times 0.7}{0.75 \times 1\ \text{in/h}} \times 60 = 28\ \text{min irrigation to apply}$$

16

FURTHER FINE-TUNING IRRIGATION

Portable soil moisture sensors

17

FURTHER FINE-TUNING IRRIGATION

Buried soil moisture sensors

18

FURTHER FINE-TUNING IRRIGATION

Smart irrigation controllers

19

MOISTURE MAY BE OUT OF OUR CONTROL...

Athletic events take place across a variety of field conditions

20

SOIL TEXTURE AFFECTS WATER FLOW

21

TRAFFIC TOLERANCE

Determine the impact of varying soil water content (SWC) levels for turfgrass performance characteristics and soil physical properties in silt loam and sand root zones

22

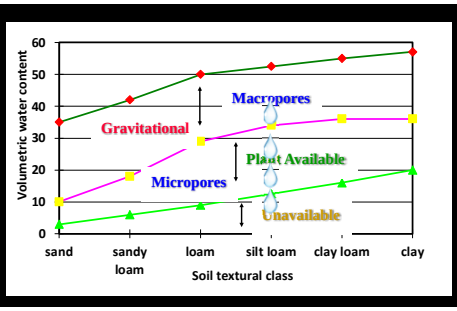
MATERIALS AND METHODS

Silt loam rootzone (28% sand, 48% silt, 24% clay)

- 'Tifway' hybrid bermudagrass
- 4 soil water contents
  - 10% (± 3.5)
  - 17% (± 3.5)
  - 26% (± 3.5)
  - 35% (± 5.0)

23

MATERIALS AND METHODS



24

MATERIALS AND METHODS

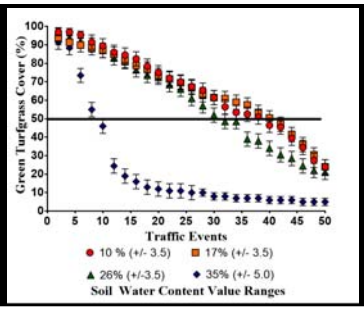
Traffic simulation

50 total traffic events (10/week)

Baldree Traffic Simulator (Kowaleski et al., 2013)

25

TRAFFIC TOLERANCE – SILT LOAM



26

TRAFFIC TOLERANCE – SILT LOAM

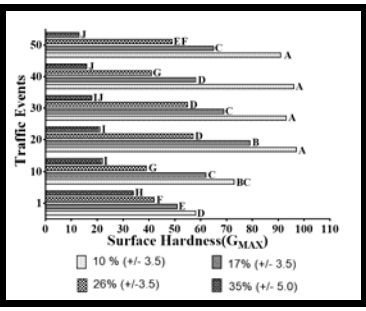
Soil water content comparison through 10 traffic events

17% SWC

35% SWC

27

SURFACE HARDNESS – SILT LOAM



28

CONCLUSIONS – SILT LOAM

- **Athletic field performance was best between 7 and 20% SWC**
- **30% SWC or above negatively impacts sports field performance**
- **As soil water increases, surface hardness decreases**

29

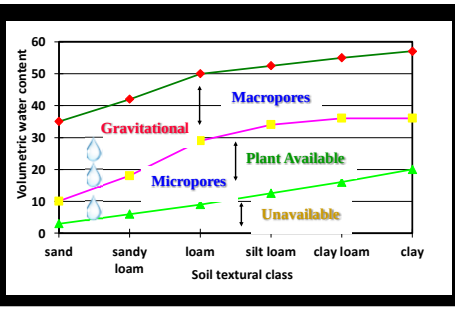
MATERIALS AND METHODS – SAND

Sand rootzone (USGA specifications)

- **3 soil water contents**
  - **8% (± 3)**
  - **16% (± 3)**
  - **25% (± 5)**
- **'Tifway' hybrid bermudagrass**

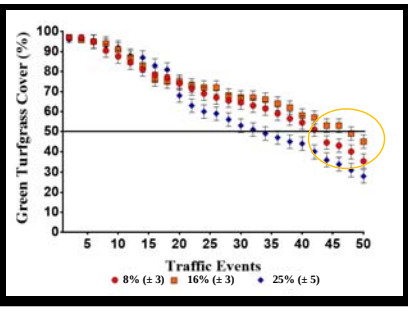
30

MATERIALS AND METHODS – SAND



31

TRAFFIC TOLERANCE – SAND



32

TRAFFIC TOLERANCE – SAND

Soil water content comparison through 10 traffic events

8% SWC 25% SWC

33

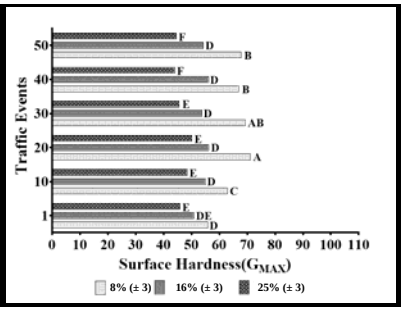
TRAFFIC TOLERANCE – SAND

Soil water content comparison through 10 traffic events

8% SWC 25% SWC 35% SWC (silt loam)

34

SURFACE HARDNESS – SAND



35

CONCLUSIONS – SAND

- Soil moisture had minimal impact on athletic field performance
- A predictive model was created for the loss of green turfgrass coverage due to SWC and traffic events

36

FINAL THOUGHTS

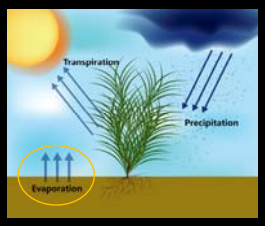
- Irrigation management is critical
- Tools are available to reduce water use while still maintaining high-performing turf
- Ideal soil moisture is low to medium range for plant available water

37

WHAT'S NEXT?

Alleviating saturated rootzones

- Increasing the E fraction of ET

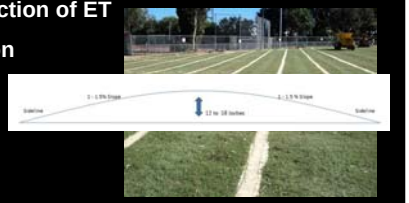


38

WHAT'S NEXT?

Alleviating saturated rootzones

- Increasing the E fraction of ET
- Deep tine aerification
- Sand cap
- Internal drainage
- Crowning



39

RESOURCES

- Evapotranspiration
- Precipitation rate calculator
- Irrigation audits
- Research on sports field performance under different moisture regimes

40

Questions???

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SportsTurf MANAGERS ASSOCIATION

41