How Topdressing Can Affect Green Performance

Roch Gaussoin, PhD
Professor & Extension Turfgrass Specialist
University of Nebraska-Lincoln
rgaussoin1@unl.edu
@rockinsince57

Turfgrass Science
University of Nebraska

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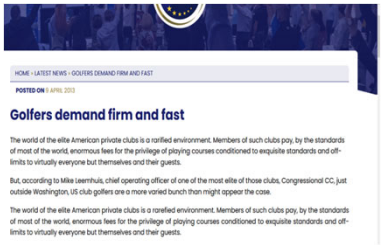
Green "Performance"

Playability **Agronomics**



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POSTED ON 9 APRIL 2013

Golfers demand firm and fast

The world of the elite American private clubs is a rarified environment. Members of such clubs pay, by the standards of most of the world, enormous fees for the privilege of playing courses conditioned to exquisite standards and off-limits to virtually everyone but themselves and their guests.

But, according to Mike Leemhuis, chief operating officer of one of the most elite of those clubs, Congressional CC, just outside Washington, US club golfers are a more varied bunch than might appear the case.

The world of the elite American private clubs is a rarified environment. Members of such clubs pay, by the standards of most of the world, enormous fees for the privilege of playing courses conditioned to exquisite standards and off-limits to virtually everyone but themselves and their guests.

Dry surface, well drained, good cover with "right" amount of organic matter

Does this compromise green agronomics?

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Topdressing

Old Tom Morris (1821–1908) is thought to have discovered the benefits of topdressing accidentally when he spilled a wheelbarrow of sand on a putting green and noted how the turf thrived shortly afterward (Hurdzan, 2004).

J.B. Beard is his classic textbook "Turfgrass Science & Culture, 1973 writes:
"The most important management practice for OM management is topdressing"

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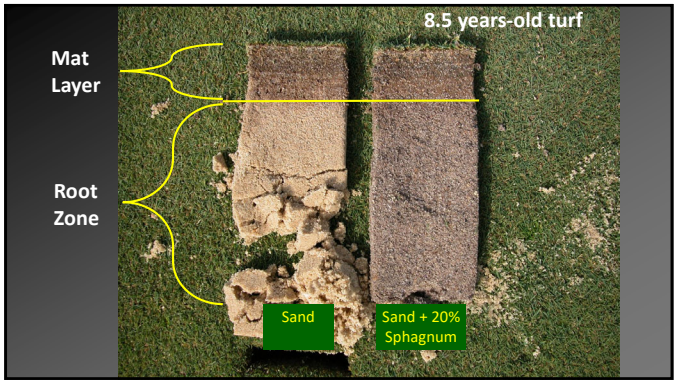

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Annual organic matter accumulation in a sand/ peat green

Year 1	2	3
0.65%	3.0%	6.0%

USGA spec. green constructed with 20% (by volume) organic matter

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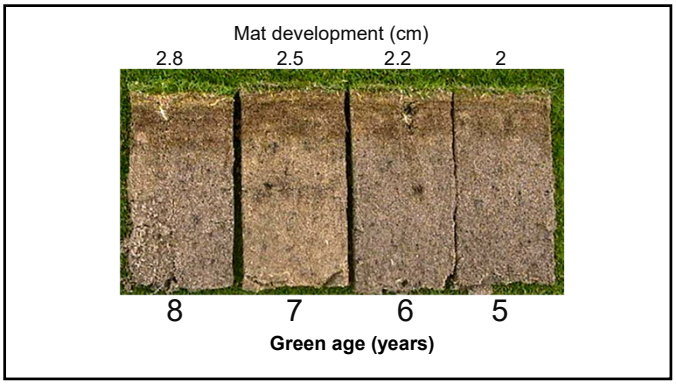

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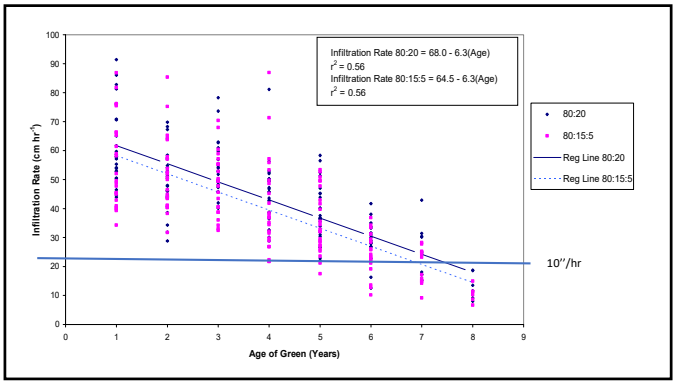

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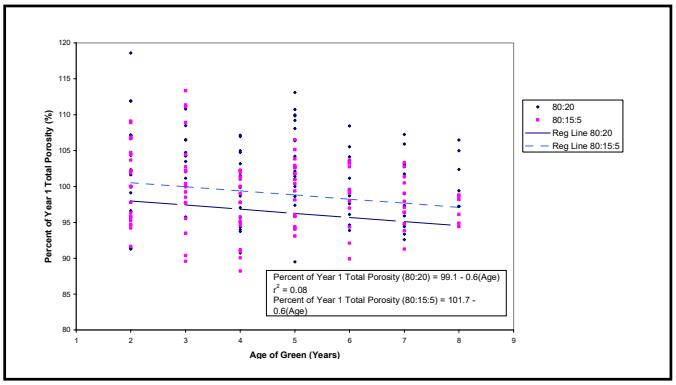

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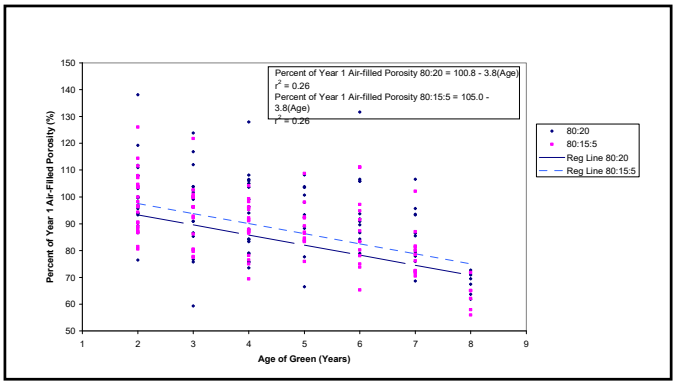

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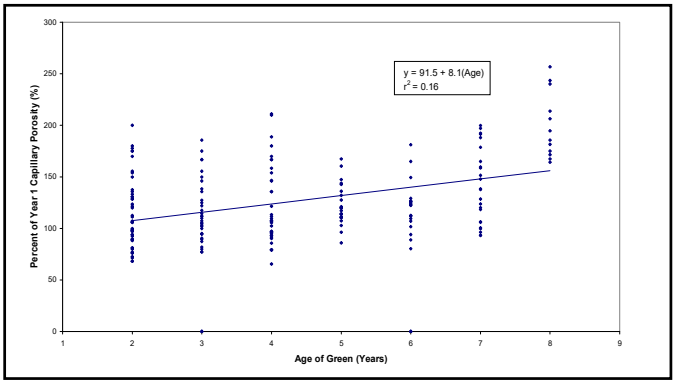

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Formation of Mat

- Formation of mat layer increased approximately 0.25" (0.65 cm) annually (following establishment year).
- No visible layering, only a transition is evident between mat and original rootzone.
- Topdressing program
  - Light, Frequent
    - every 10-14 days (depending on growth) and combined with verticutting
  - Heavy, Infrequent
    - 2x annually (spring/fall) and combined with core aerification

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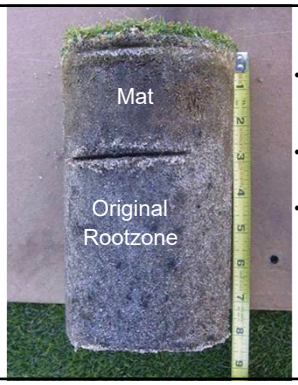

- 2004 USGA research committee site visit
- original rootzone
- mat development

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Materials and Methods

- 2004 rootzone samples taken below mat layer from each soil treatment and sent to Hummel labs for Quality Control Test (24 total samples)
- Tested against original quality control test (z-score).

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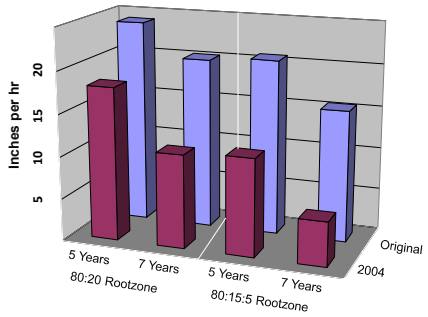

Comparison of preconstruction K_{sat} values to K_{sat} values taken 10/04.

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Change in Rootzone Particle Size Distribution

- All rootzones tested in 2004 showed increased proportion of fine sand (0.15 – 0.25 mm) with decreased proportion of gravel (> 2.0 mm) and very coarse sand (2.0 – 1.0 mm).

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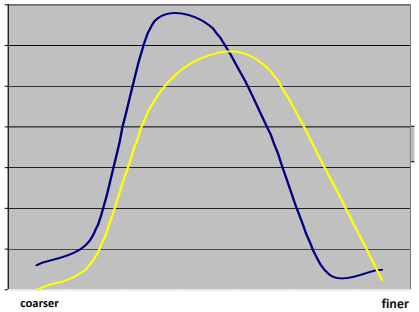

USGA sand size compared to sand used in topdressing program for USGA plots at Mead, NE.

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Conclusions

- Based on *in situ* green testing K_{SAT} decreased, and surface moisture increased, over time due to organic matter accumulation above the original rootzone and increased fine sand content originating from topdressing sand
- Organic matter did result in positive agronomic change: pH, CEC, nutrient holding capacity, microbial stability and amount

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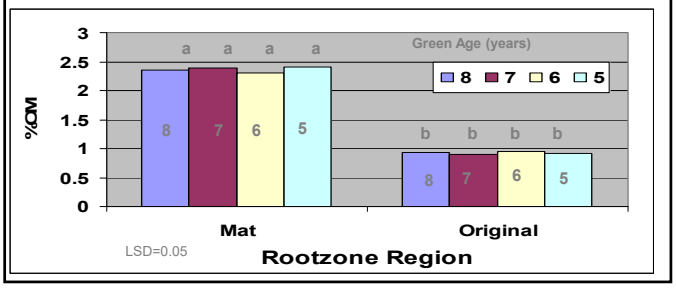
Rootzone vs Mat: Organic Matter



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Root Zone: Mat vs. Original

(samples taken July 15, 2004)

- pH: Mat < Original
- Mat > Original: CEC, OM, microbes and all nutrients

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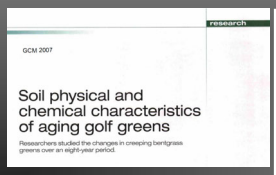
Want to know more?

- Gaussoin, R., R. Shearman, L. Wit, T. McClellan, and J. Lewis. 2007. Soil physical and chemical characteristics of aging golf greens. *Golf Course Manage.* 75(1):p. 161-165.



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"Typical" Topdressing Practices

- 2X year combined with 1/2" or larger coring or solid tines; sand to fill holes; spring and fall
- Light/frequent on 14 -21 day interval, often with venting and/or finer sand
- Rates from 18-40 $ft^3/1000ft^2$ per year

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Topdressing Nuances

- Critical to OM management
- On a push-up or sand based rootzone that has been topdressed the upper "layer" should receive the most scrutiny
- Choosing topdressing sand should become priority

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Soil Macropores

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Research Need (2004)

- Comprehensive evaluation of sand quantity, particle size, sampling protocol and cultivation methods

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OM accumulates as sand greens age

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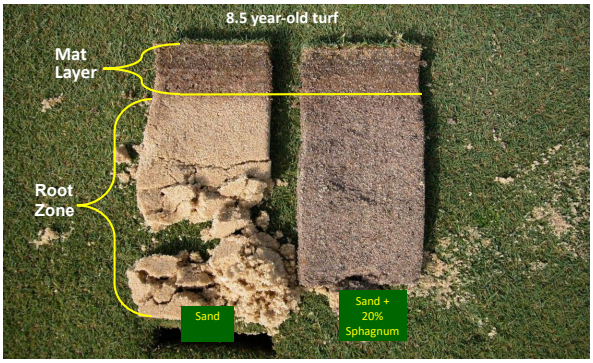

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Organic Matter Management Study

Objectives

1. Determine if conventional hollow tine is more effective than solid tine aerification at managing organic matter accumulation
2. Determine if venting methods are effective at managing OM accumulation

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Treatments

Tine Treatment	Venting Treatment
None	None
2X Hollow tine	PlanetAir
2x Solid tine	Hydroject
	Bayonet tine
	Needle tine

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2x Solid tine	Hydroject
	Bayonet tine
	Needle tine

15 Trts per Rep
6 Reps per year
2 different years
= A whole lot of fun for one graduate student or 180 trts

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All treatments received the same topdressing quantity (22 ft^3/M*) but different frequency

Equilibrated to identify differences of the practices in question

**1 ft^3 = 100 lbs of dry sand; yd^3 = 2700 lbs*

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Materials and Methods

- Green Age:
  - 12 years
  - 9 years
- Data collected:
  - OM% (pre-cultivation/monthly)
  - Single wall infiltration (monthly)

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OM Data Analysis Year 2

- No differences between green age except for higher % in older green
- No differences among venting methods
- No interactions with solid/hollow/none
- No differences among solid/hollow/none

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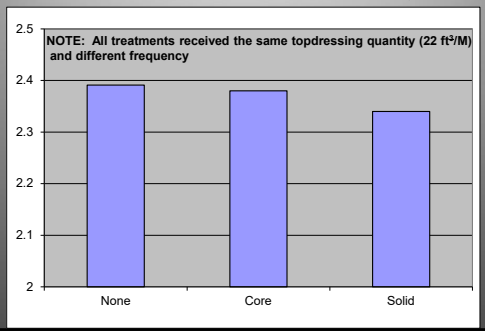
Effect of Tines on OM after 2 yrs



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What these data do/don't suggest

- Cultivation, when topdressing quantity was equal, was insignificant as a means to control OM
- However, a superintendent must use whatever tools they have at their disposal to ensure sand is making it into the profile and not the mower buckets

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Topdressing interval relative to Tine/Venting combinations (22 cu ft/M)*

- NONE/NONE
  - 5-10 days
- Solid & Hollow/NONE
  - 7-14 days
- Solid & Hollow/Venting
  - 14-18 days

*Observed and calculated based on displacement and surface area opened

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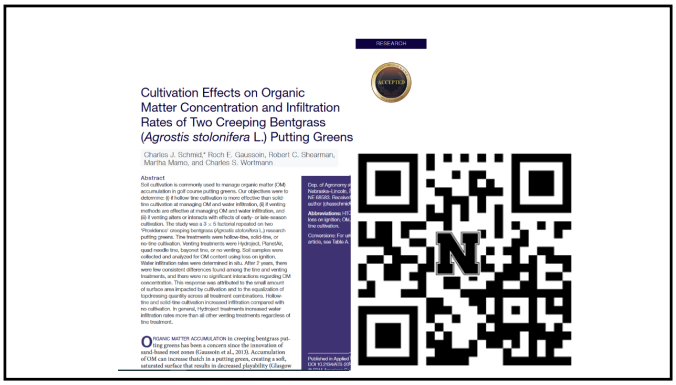

Cultivation Effects on Organic Matter Concentration and Infiltration Rates of Two Creeping Bentgrass (*Agrostis stolonifera* L.) Putting Greens

Charles J. Schmid,* Roch E. Gaussoin, Robert C. Shearman, Martha Mamo, and Charles S. Wortmann

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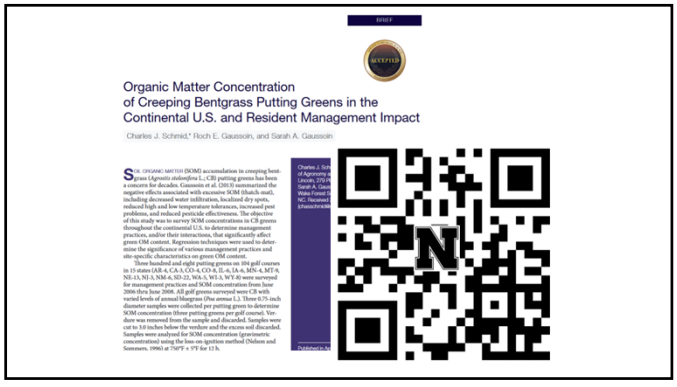

Organic Matter Concentration of Creeping Bentgrass Putting Greens in the Continental U.S. and Resident Management Impact

Charles J. Schmid,* Roch E. Gaussoin, and Sarah A. Gaussoin

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Survey Summary

- None of the variables collected, by themselves, or in combination with others, ***predicted*** OM
- Courses using >18 cubic ft*/M of topdressing with or without "venting" had lower OM
- Of the ***known*** cultivars, no differences in OM were evident

*1 ft^3 = 100 lbs of dry sand; yd^3 = 2700 lbs

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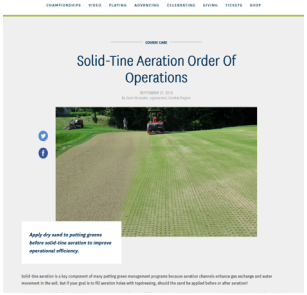
https://www.usga.org/content/usga/home-page/course-care/regional-updates/central-region/2018/solid-tine-aeration-order-of-operations.html



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AER-AIDER
Booth #2507

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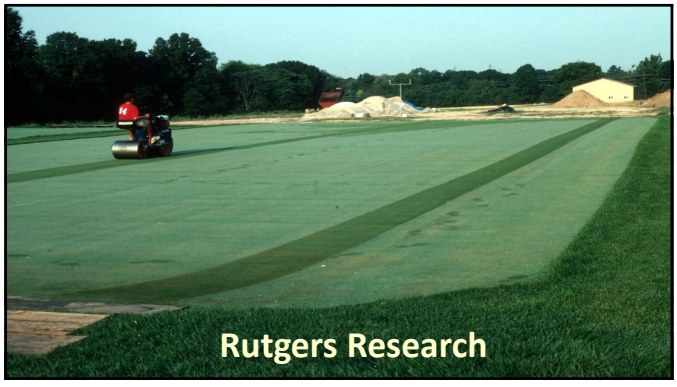

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Sand Particle Size (1-mm and 0.5-mm sands)

Particle Name	Diameter (mm)
Fine Gravel	2 – 3.4
Very Coarse Sand	1 – 2
Coarse Sand	0.5 – 1
Medium Sand	0.25 – 0.5
Fine Sand	0.15 – 0.25
Very Fine Sand	0.05 – 0.15
Silt	0.002 – 0.05
Clay	< 0.002

Photo: TJ Lawso

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Research on…

- Topdressing
  - ✓ Sand Size
  - ✓ Rate
- Cultivation

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Research Objectives:

1. Effects of topdressing with sand lacking coarse particles
2. Does core cultivation and backfilling holes with medium-coarse sand offset any negative effects of topdressing with sands lacking coarse particles?

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	Factors in the Experiment				
Treatment No.	Sand Size	Topdressing Rate during Growing Season	Cultivation (twice/year; May & Oct)		Annual Quantity of Sand Applied
			Hollow Tine	Backfill / Topdress	
		lbs. / 1,000-sq.-ft.		lbs. / 1,000-sq.-ft.	lbs. / 1,000-sq.-ft.
1	Medium-coarse	50	None	400	1,300
2	Medium-coarse	50	Core + Backfill	600	1,700
3	Medium-coarse	100	None	400	1,800
4	Medium-coarse	100	Core + Backfill	600	2,200
5	Medium-fine	50	None	400	1,300
6	Medium-fine	50	Core + Backfill	600	1,700
7	Medium-fine	100	None	400	1,800
8	Medium-fine	100	Core + Backfill	600	2,200
9	Fine-medium	50	None	400	1,300
10	Fine-medium	50	Core + Backfill	600	1,700
11	Fine-medium	100	None	400	1,800
12	Fine-medium	100	Core + Backfill	600	2,200
13	None	0	None	0	0
14	None	0	Core + Backfill	600	1,200

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Cultivation Factor

- Cored twice per year (May and Oct)
- Holes backfilled with medium-coarse sand at 600 lbs/1,000 sq ft
- At coring, non-cored plots topdressed with respective sand size at 600 lbs/1,000 sq ft

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Sand Picked-up with Mowing One Day after Topdressing

Sampling Date	7-Jul		17-Aug	
Mowing Height	0.110 inch		0.110 inch	
	Sand Picked-up	Portion of Sand Applied	Sand Picked-up	Portion of Sand Applied
	lbs/M	%	lbs/M	%
Sand Size				
Medium-coarse	4.0	5.1	5.4	7.0
Medium-fine	1.9	2.4	3.2	4.0
Fine-medium	1.9	2.5	1.8	2.3
LSD (5%)	0.4	0.5	0.5	0.6
Topdress Rate				
50 lbs/1000-ft²	1.6	3.1	2.1	4.1
100 lbs/1000-ft²	3.6	3.6	4.8	4.8
LSD (5%)	0.3	0.4	0.4	0.5

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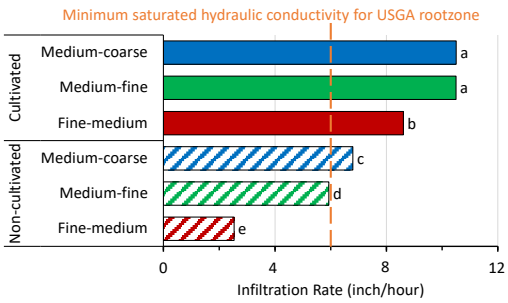
Sand Size x Core Cultivation Interaction
3rd round of 1-inch of water



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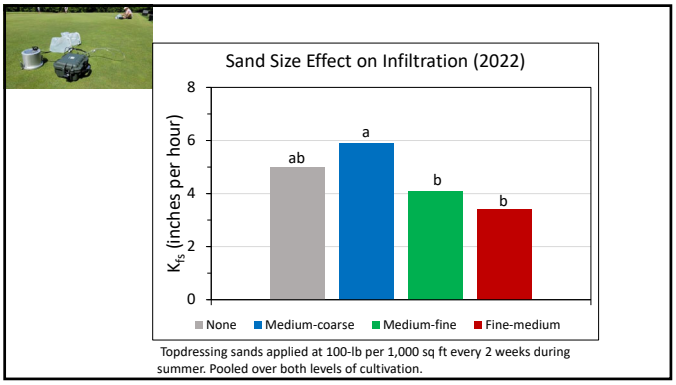

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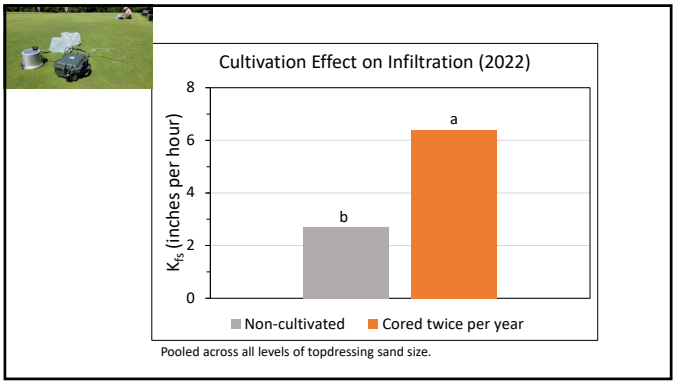

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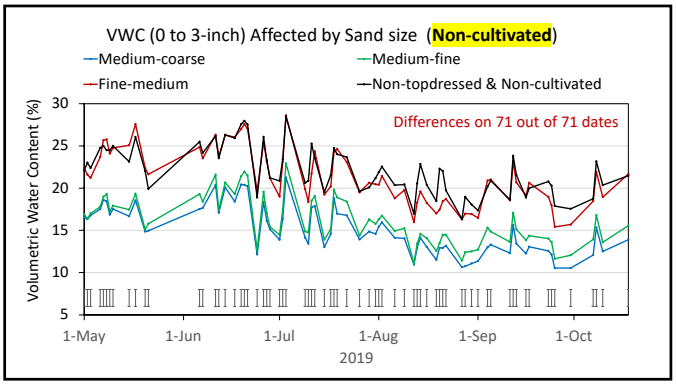

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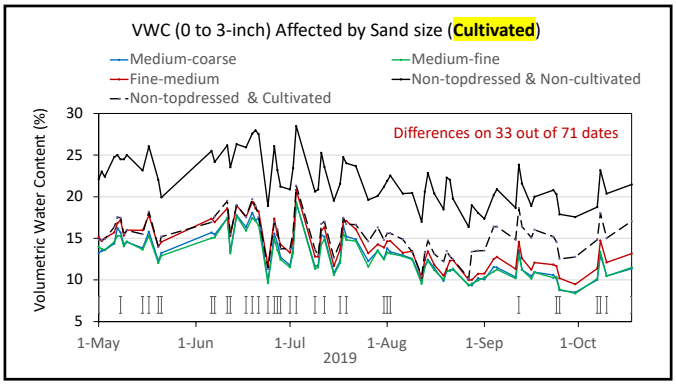

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Surface hardness (Clegg) and VWC before cultivation in October 2022.

Interaction		Clegg, 0.5-kg	VWC, 0- to 3-inch
		G_{max}	%
Cultivation	Sand Size		
None	Medium-coarse	81.5 b	17.3 c
None	Medium-fine	80.8 bc	20.0 b
None	Fine-medium	77.8 c	26.5 a
Twice a Year	Medium-coarse	91.6 a	11.5 d
Twice a Year	Medium-fine	92.5 a	11.7 d
Twice a Year	Fine-medium	92.2 a	12.6 d

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Surface hardness (Clegg) and VWC before cultivation in October 2022.

Interaction		Clegg, 0.5-kg	VWC, 0- to 3-inch
		G_{max}	%
Cultivation	Topdress Rate		
None	50-lb	78.8 c	23.0 a
None	100-lb	81.2 b	19.5 b
Twice a Year	50-lb	92.9 a	12.0 c
Twice a Year	100-lb	91.3 a	11.8 c

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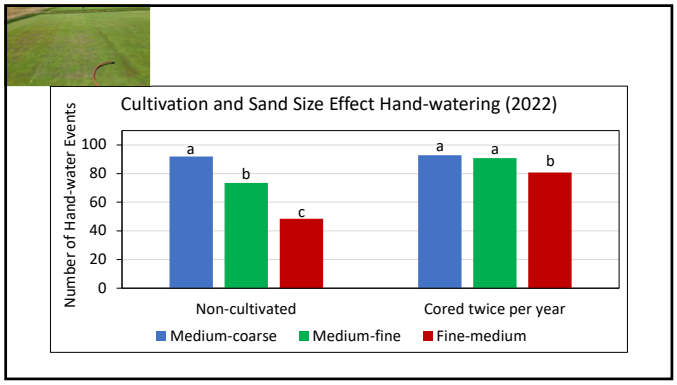

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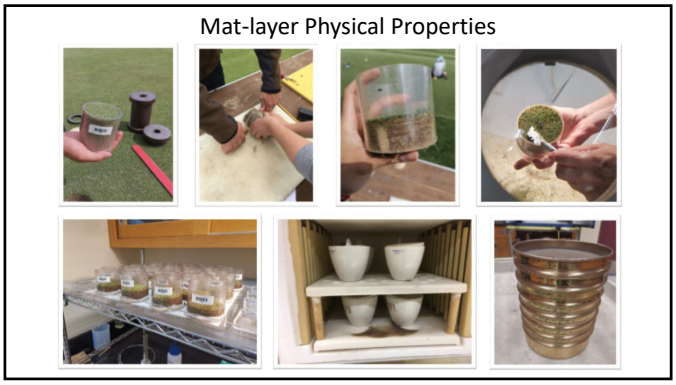

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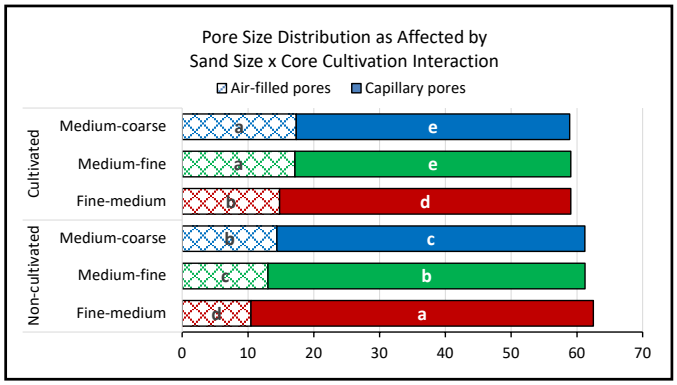

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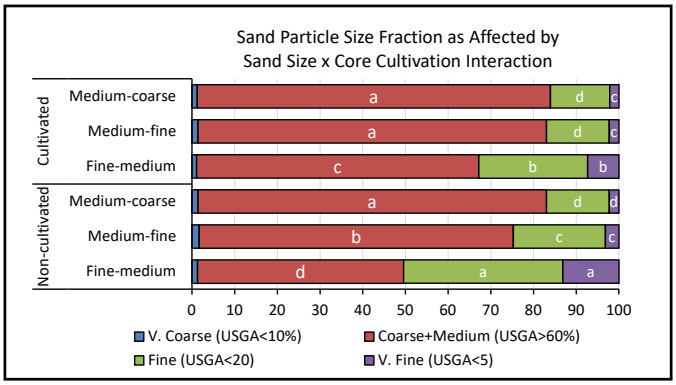

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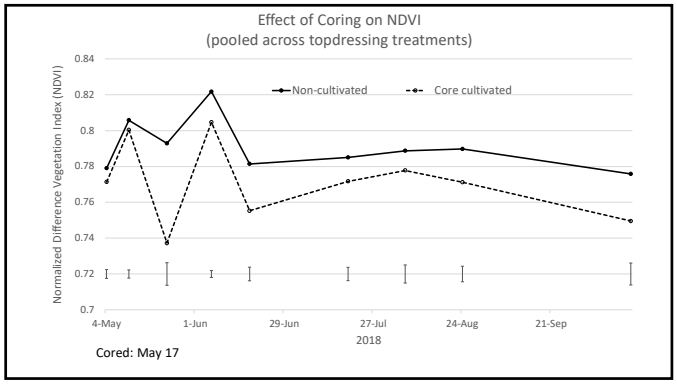

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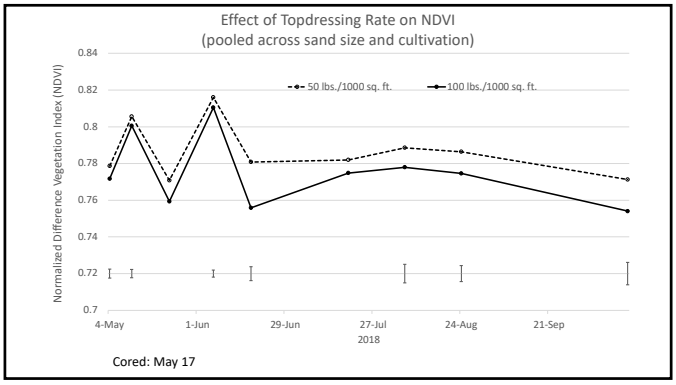

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Conclusions

Core cultivation plus backfilling with *medium-coarse* sand:

- reduced capillary porosity and OM
- increased air-filled porosity
- consistently drier playing surface

Sand size effects with core cultivation (interaction)

Medium-coarse and medium-fine sands

- similar at reducing surface wetness and OM
- finer sand distribution in mat layer under topdressing with medium-fine sand but core cultivation corrected (matched medium-coarse sand topdressing)

Fine-medium sand

- Much greater surface wetness and reduced infiltration due to increase in fine particle size and capillary porosity under non-cultivated conditions
- Core cultivation and backfilling with medium-coarse sand reduced negative effects; however, the quantity of fine and very fine particles in the mat layer remained above 30%

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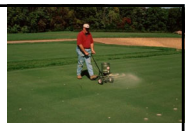
Managing for Drier Mat Layer



Topdressing

- As much and as often as feasible (~1 ton / 1,000 sq ft / yr)
  - ***18-22 ft³/M/YR****
- Select as coarse a sand as feasible
  - 0.5-mm sand okay if dominated by medium sand, not fine and very fine
- Cost and interference with play and mowing are the limiting factors

Core Cultivation

- Very effective at producing a drier surface
- Time for healing is greatest limitation
  - ***Solid Tine Cultivation?****

Gaussoin adds

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Dryject Trial Fall 2021

- Check
- Hollow ½" ID
- Solid ½"OD
- DryJect 1 (3x3)
- Needle
- DryJect 2 (3x2)
- Needle + Solid
- Needle + Hollow

Procore - 3" target depth on all tines except Dryject = 5"

Sampled day after treatment in 1' depth increments to 4 "

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Treatment	% OM	
Check	4.5	a
Hollow	3.7	b
Needle	3.1	c
DryJect (3x3)	2.7	d
Needle + Hollow	2.3	d
DryJect (3x2)	2.3	d
Needle + Solid	2.3	d
Solid	2.2	d

- No differences among depths
- Dilution only
- Dryject and needle tine were least surface disruptive
- Hollow tine response was unexpected
- ***Data is preliminary***

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Spring 2023 Tine Trial

- 26 tine types/configurations
- 2 devices (ProCore and DryJect)
- Timing (spring/fall)
- OM by depth
- Surface and firmness using the USGA GS3 digital golf ball

Equipment and Tine Support Provided by

TORO DryJect WET CTI Ceres Turf, Inc.

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What have we learned?

- A high-quality sand and a well-built root zone are relatively stable and will perform properly for many years.
- What changes over time is the surface…

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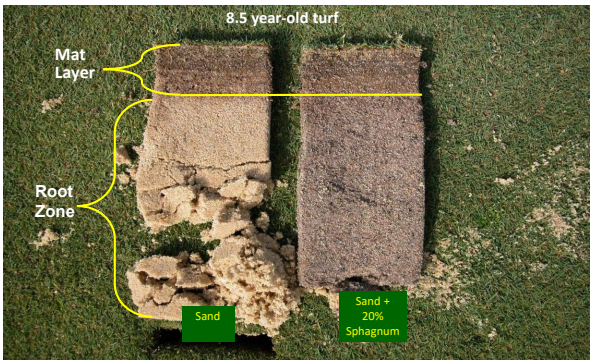

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It matters how you manage the accumulating thatch/mat layer

- Cultivation has a significant impact. At minimum, use practices that help incorporate sand.
- Topdressing is critical. Can use a fine sand (0.25-5 mm) to ensure enough sand will be applied during summer, in combo with a medium (< 1 mm) with more aggressive aerification (core, solid or injection). Avoid sands of < 0.15.

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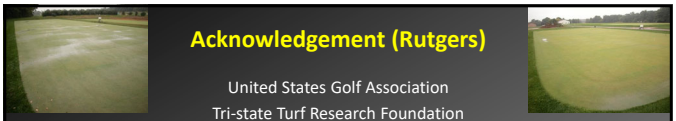

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Chapter 12 ASA Monograph (3RD Edition)

Characterization, Development, and Management of Organic Matter in Turfgrass Systems

R.E. Gaussoin, Dep. of Agronomy and Horticulture, Univ. of Nebraska
W.L. Berndt, Dep. of Resort and Hospitality Management, Florida Gulf Coast University
C.A. Dockrell, Teagasc College of Amenity Horticulture Dublin, Ireland
R.A. Drijber, Dep. of Agronomy and Horticulture, Univ. of Nebraska

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Thank you and best wishes for 2023!

Roch Gaussoin
rgaussoin1@unl.edu
@rockinsince57

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