Organic Matter Management, Next Steps

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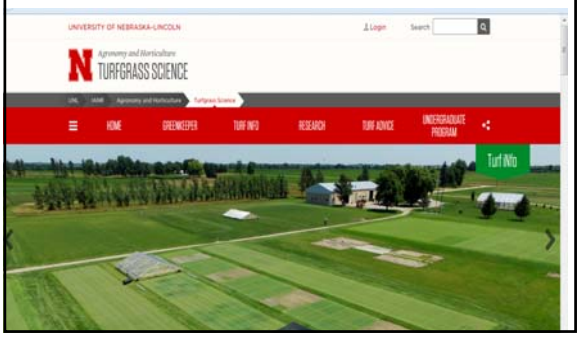

ASA Monograph (3RD Edition)

Chapter 12
Characterization, Development, and Management of Organic Matter in Turfgrass Systems

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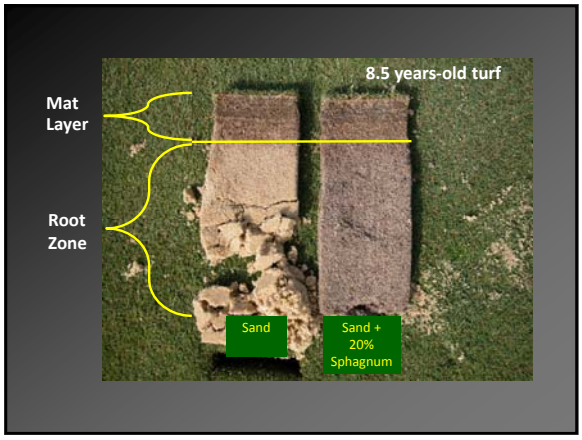
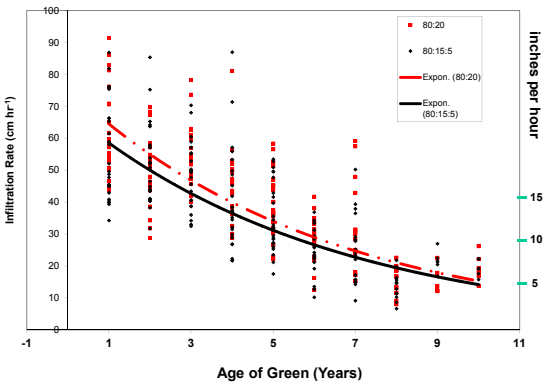


~~The~~ *My* organic matter journey……

- USGA/EIFG Greens Study (9 years).
- People a lot brighter than me
  - "Talking Turf" GCSAA conversation.
  - Paul Rieke, USGA visit
  - Conversation with Paul Vermeulen. Director, Competitions Agronomy at PGA TOUR, former USGA Agronomist.
- Great funding/time support from USGA (initially), NE-GCSA, GCSA of SD, Peaks and Prairies GCSA, industry and a slew of GC supers (3 years).
- Road Show.

Physical And Chemical Characteristics Of Aging Golf Greens

Roch Gaussoin, PhD
Jason Lewis
Ty McClellan
Chas Schmid
Bob Shearman, PhD



OM accumulates as sand greens age

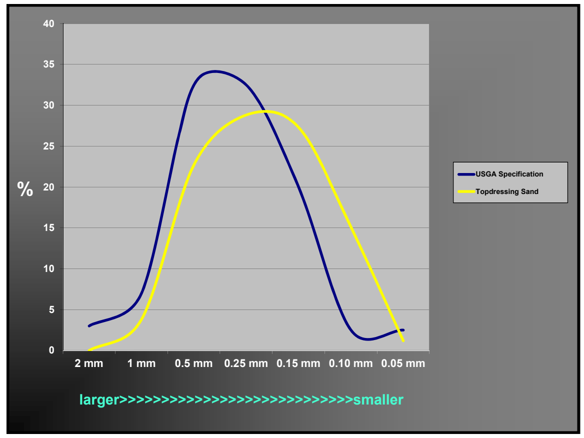
Formation of Mat

- Formation of mat layer currently increasing approximately 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

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

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).
- 5 of 8 rootzones were significant (z-score) for increased fine sand content.



Conclusions

- The K_{SAT} decrease over time *may* be due to organic matter accumulation above and in the original rootzone and/or the increased fine sand content originating from topdressing sand


Published December 19, 2014

RESEARCH

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

Abstract

Organic Matter Management Study

Objectives

1. Determine if conventional hollow tine is more effective than solid tine aerification at managing organic matter accumulation

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2. Determine if venting methods are effective at managing OM accumulation

Treatments

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

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None	None
2X Hollow tine	PlanetAir
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	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

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

Equilibrated to identify differences of the practices in question

Materials and Methods

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

OM Data Analysis Year 1

- No differences between green age except for higher % in older green

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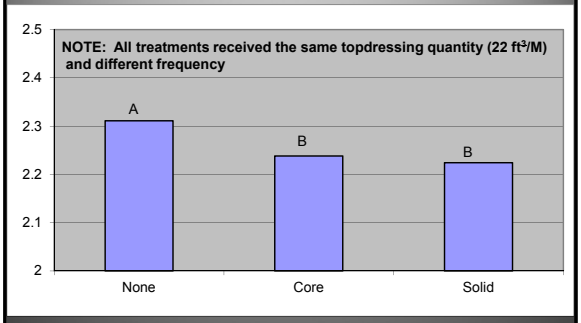
- No differences among venting methods

OM Data Analysis Year 1

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

Effect of Tines on OM after 1 yr



OM Data Analysis Year 2

- No differences between green age except for higher % in older green

OM Data Analysis Year 2

- No differences between green age except for higher % in older green
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OM Data Analysis Year 2

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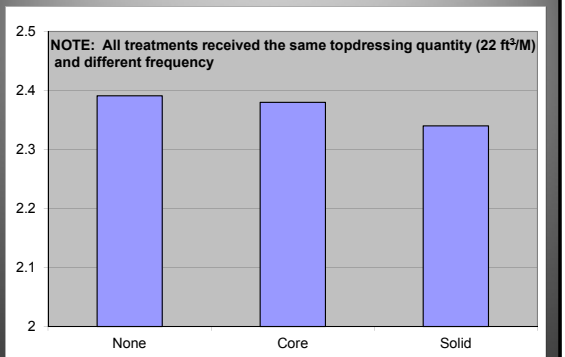
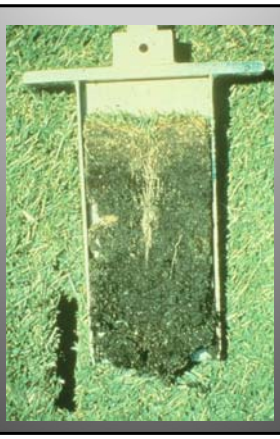
- No interactions with solid/hollow/none

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**

Effect of Tines on OM after 2 yrs





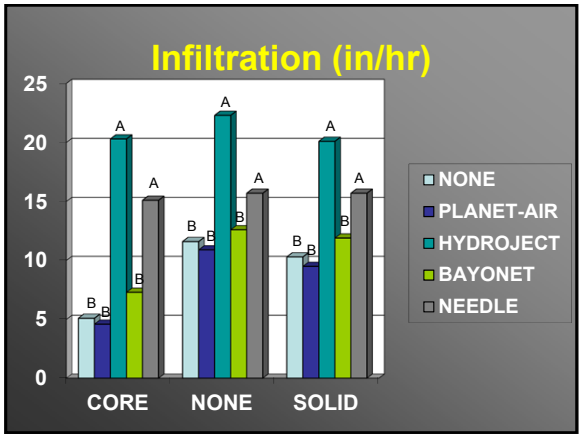
What these data do/don't suggest

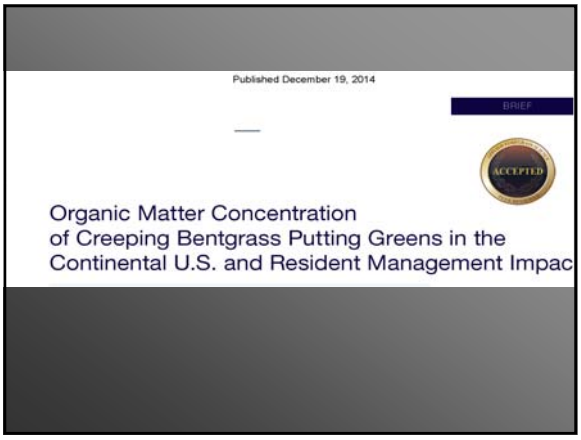
- Topdressing is the most consistent and repeatable factor in OM management
- Cultivation, when topdressing quantity was equal, was insignificant as a means to control OM
- However, a superintendent must use whatever tools they have at their disposal to insure sand is making it into the profile and not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

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

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

*Observed and calculated based on displacement and surface area opened





Project Objective

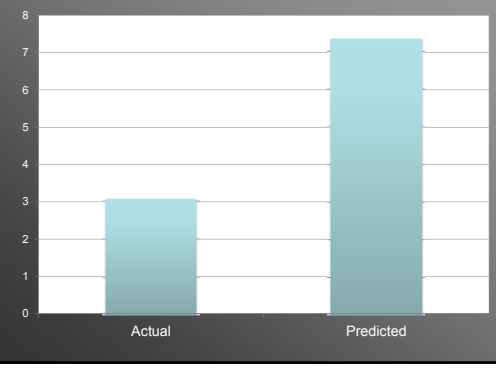
- National Survey
  - Determine cause and effect relationship among maintenance practices and their interactions relative to surface OM accumulation

2006/07/08 Samples

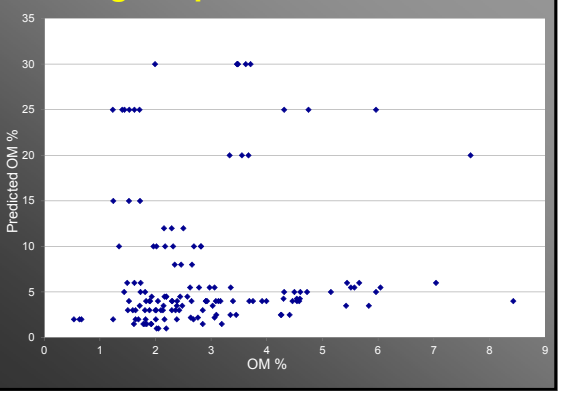
- Sixteen states
  - Nebraska, South Dakota, Iowa, Wyoming, Colorado, Washington, Wisconsin, Illinois, New Jersey, Minnesota, New Mexico, Montana, Hawaii, California, Connecticut, Arkansas.
- 117 golf courses sampled
  - More than 1600 samples

Problematic vs Non-problematic

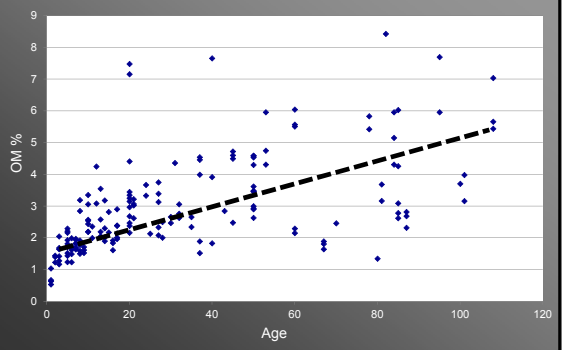
Superintendent predicted vs actual



Range of predicted vs. actual



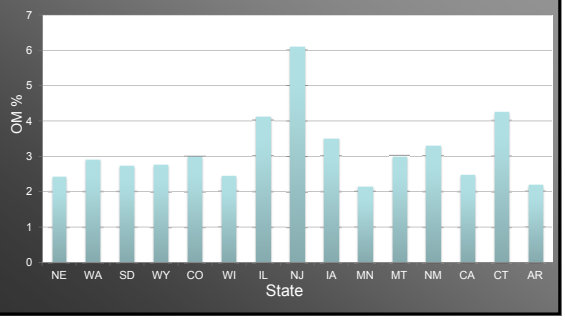
Green Age



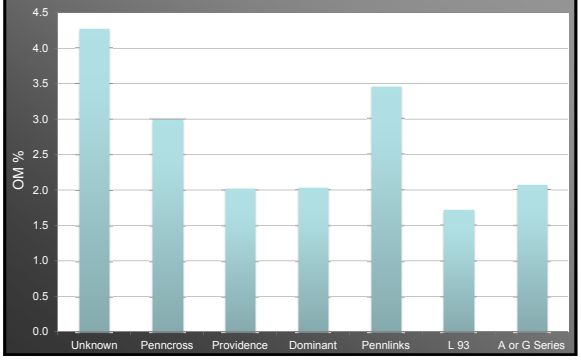
Is the age effect misleading?

- **Sampling issues:**
  - **Mat depth increases as green ages resulting in more OM in the same volume soil.**
  - **Because deposition is relatively uniform, % per unit depth within the true mat layer is relatively uniform**

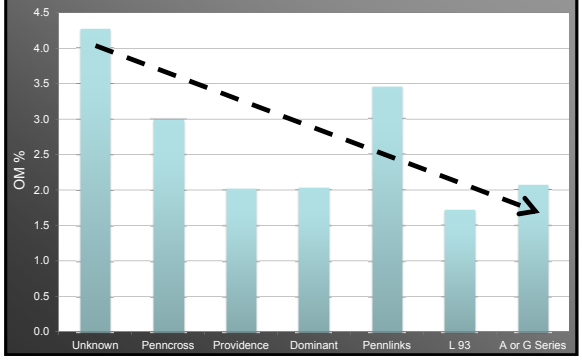
State Differences (highly correlated with age)



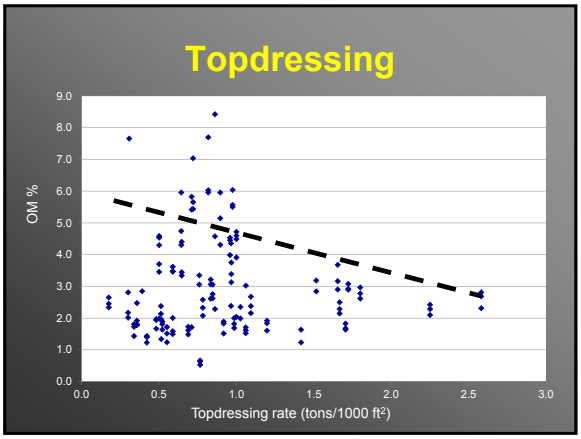
Cultivar



Cultivar



Topdressing



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 ft³ = 100 lbs of dry sand; yd³ = 2700 lbs

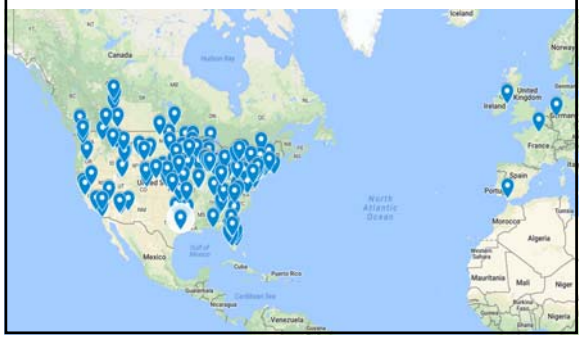
Topdressing

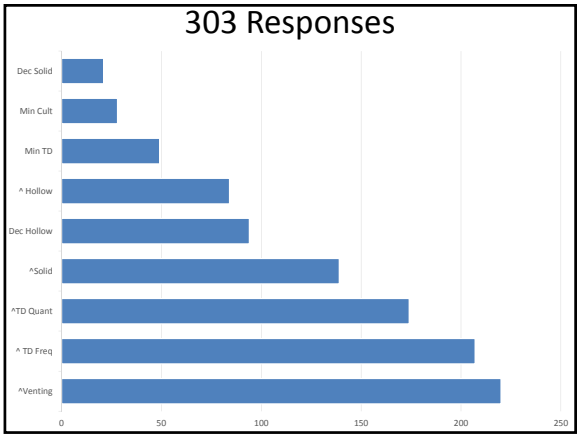
Old Tom Morris (1821–1908) is thought to have discovered the benefits of topdressing accidentally when he spilled a wheelbarrow of sand on a putting green and noted how the turf thrived shortly afterward (Hurdzan, 2004).

J.B. Beard is his classic textbook "Turfgrass Science & Culture, 1973 writes:

"The most important management practice for OM management is topdressing"

2016 Survey Respondents via Greenkeeper





How do you get rid of OM?

- Decomposition (microbial)
  - Increase surface area and aeration
  - Inoculation (???)
- Removal
  - Power raking, dethatching, core aerification
- Dilution
  - Topdressing

"the solution to pollution is dilution"

Clarification/over-simplification *regarding OM Management* on sand based rootzones

- One size does not fit all
- The optimal % OM has not been scientifically/universally determined and may be mythical
- Cultivation is critical to increase efficiency in sand incorporation
- Solid are not different than coring tines
- The benefits of topdressing continue to be identified.

Next steps…….

https://www.golfcourseindustry.com/article/greens-golf-topdressing-agronomics/

Does your TD sand meet USGA specs?

90%

77%

72%

88%

When do you topdress?

	All Year	Warmer Months	Cooler Months
Northeast	57	29	14
Central	32	52	16
Southeast	55	43	2
West	45	54	1

Data presented as percentages

https://www.golfcourseindustry.com/article/greens-golf-topdressing-agronomics/

Preferred particle size (mm's):

	VC 1-2	C 0.5-1	M 0.25-0.5	F 0.15-0.5	VF 0.05-0.15	Silt/ Clay
Northeast	9	13	55	19	4	0
Central	2	11	51	35	1	0
Southeast	0	4	57	35	4	0
West	2	12	49	32	2	2

Data presented as percentages

https://www.golfcourseindustry.com/article/greens-golf-topdressing-agronomics/

Frequency of Heavy Topdressing (per/yr):

	1X	2X	3X	>3X	*+ Light TD?*
Northeast	17	45	25	11	85
Central	28	50	11	11	86
Southeast	18	41	21	20	86
West	19	61	12	7	86

Data presented as percentages

https://www.golfcourseindustry.com/article/greens-golf-topdressing-agronomics/

Frequency of Light Topdressing (days):

	7	14	21	28	>28	*Same amount?*
Northeast	10	43	15	14	18	Yes
Central	7	42	28	7	16	Yes
Southeast	32	56	6	4	2	No
West	8	41	24	13	14	Yes

Data presented as percentages

https://www.golfcourseindustry.com/article/greens-golf-topdressing-agronomics/

RUTGERS
THE STATE UNIVERSITY OF NEW JERSEY

Topdressing Sand: Sorting Out What Matters

Nebraska Turf Conference
Wednesday, January 9, 2019
9:00 – 9:45 a.m.

James A. Murphy, Ph.D.
Extension Specialist in Turfgrass Management

Sand Particle Size

Particle	Diameter (mm)	Sieve Mesh #
Fine Gravel	2 – 3.4	10 – 6
V. Coarse Sand	1 – 2	18
Coarse Sand	0.5 – 1	35
Medium Sand	0.25 – 0.5	60
Fine Sand	0.15 – 0.25	100
Very Fine Sand	0.05 – 0.15	270

Difficult to incorporate

Particle Size Distribution for Drainage

Particle Name	Diameter (mm)	Recommendation (by weight)
Fine Gravel	2 – 3.4	Not more than 10% total, maximum of 3% fine gravel
Very Coarse Sand	1 – 2	
Coarse Sand	0.5 – 1	Minimum of 60%
Medium Sand	0.25 – 0.5	
Fine Sand	0.15 – 0.25	Not more than 20%
Very Fine Sand	0.05 – 0.15	Not more than 5%
Silt	0.002 – 0.05	Not more than 5%
Clay	< 0.002	Not more than 3%
Total Fines	very fine sand + silt + clay	Less than or equal to 10%

Research Objectives:

1. Effects of topdressing with sand lacking coarse particles (0.5-mm sand)
2. Does core cultivation and backfilling holes with medium-coarse sand offset any negative effects of topdressing with sands lacking coarse particles?

Sand Size	2-1 mm Very Coarse	1-0.5 mm Coarse	0.5-0.25 mm Medium	0.25-0.15 mm Fine	0.15-0.05 mm Very Fine
	% (by weight) retained				
Medium-coarse (1-mm)	0	30	60	10	< 1
Medium-fine (0.5-mm)	0	0	74	24	2
Fine-medium	0	4	27	48	21

Treatment No.	Factors in the Experiment: Sand Size	Topdressing Rate during Growing Season	Cultivation (twice/year; May & Oct): Hollow Tine	Cultivation (twice/year; May & Oct): Backfill / Topdress	Annual Quantity of Sand Applied
		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

Research says, so far (3 years)…

1. Topdressing improved the surface:
   - reduced the OM concentration
   - produced a drier surface
2. Sand size impacts on mat layer physical properties:
   - medium-fine (>20% fine sand) increased the fineness of sand in mat layer but this did not influence infiltration or VWC
     - medium-coarse and medium-fine similar water infiltration and surface wetness
   - fine-medium sand slowed water infiltration and increased surface water retention
     - fine-medium sand substantially increased fine and very fine particles in mat layer

Research says, so far (3 years)…

3. Core cultivation and backfilling with medium-coarse sand very effective at:
   - reduces surface wetness and OM concentration
   - reduces the amount of fine and very fine sand in the mat layer, thus offsetting the negative impact of those particles

Managing for Drier Mat Layer

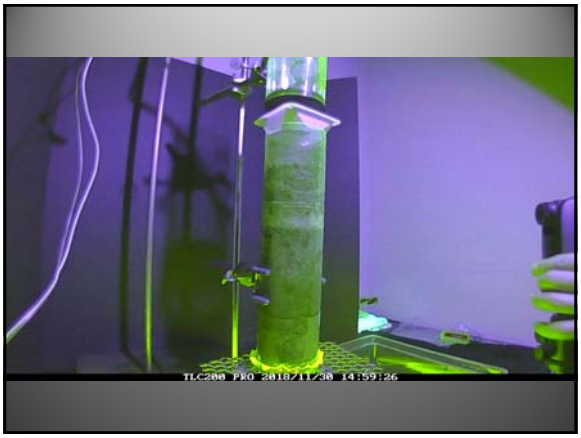
Topdressing
- Cost and interference with play and mowing are limiting factors
- Apply as much and as often as feasible (~48 tons / acre)
- Select as coarse a sand as feasible
  - medium-fine (0.5-mm) sand with less 30% fine sand

Core Cultivation
- Very effective at producing a drier surface
- Needed if reducing OM is important *(allows for more sand incorporation)**
- Time for healing is greatest limitation *(less so for solid tines and venting)**

**Gaussoin adds*

Organic Matter Next Steps at UNL…

- *"the solution to pollution is dilution"*
- Next Steps
  - Topdressing impacts on structure and fluid dynamics



Acknowledgements

- USGA
- Environmental Institute for Golf
- Nebraska GCSA
- GCSA of South Dakota
- Peaks & Prairies GCSA
- Jacobsen, Toro, JRM & PlanetAir
- Nebraska Turfgrass Association