If organic is so good, why am I tearing up my greens to get rid of it?

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Bolingbrook Golf Club
Bolingbrook, IL

Because of inherent ambiguity in terminology and sampling techniques, the term "thatch-mat" has appeared frequently since the late 2000's (McCarty et al., 2007; Barton et al., 2009; Fu et al., 2009).

and yet one more definition……..

SOM- Soil Organic Matter

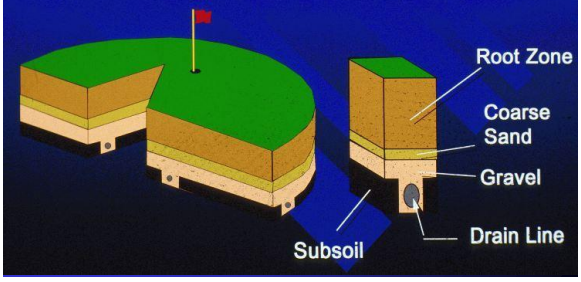
Physical And Chemical Characteristics Of Aging Golf Greens

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

THE USGA

Environmental Institute for Golf

USGA Specification Green



Treatments

- rootzone Mix
  - 80:20 (sand/peat)
  - 80:15:5 (sand/peat/soil)
- Grow-In Procedure
  - Accelerated
  - Controlled

Project Schedule (Phase I)

1996 | 1997 | 1998 | 1999 | 2000

Greens construction (one set per year)

Seeding

Data collection on soil physical, chemical, and microbial characteristics influenced by rootzone materials and grow-in procedures.

Project Schedule (Phase II)

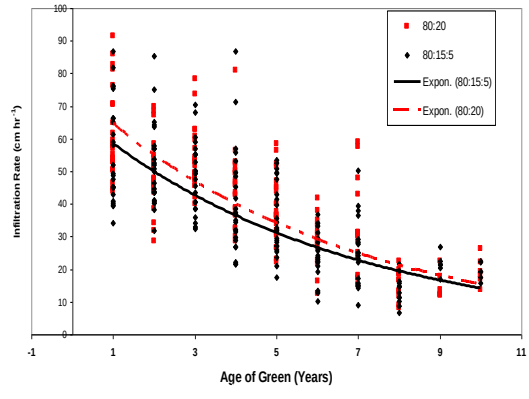
2002 | 2003 | 2004 | 2005

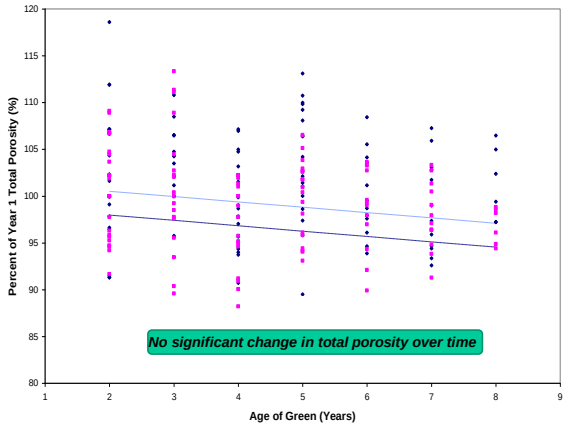
Data collection on soil physical and chemical characteristics as influenced by age, rootzone materials and grow-in procedures.

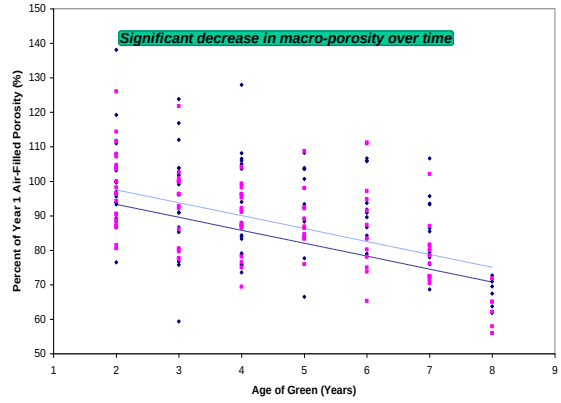
Materials and Methods

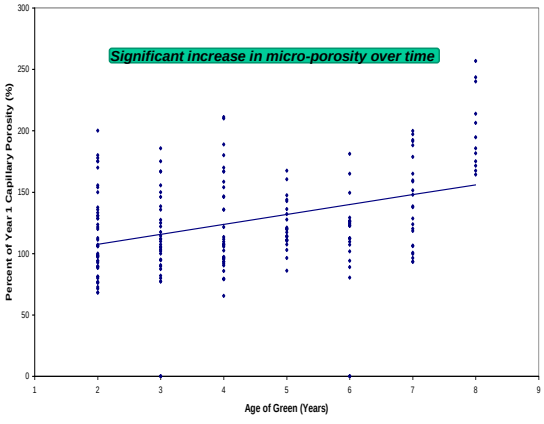
11 yr old green	12 yr old green	13 yr old green	14 yr old green

As of 2011









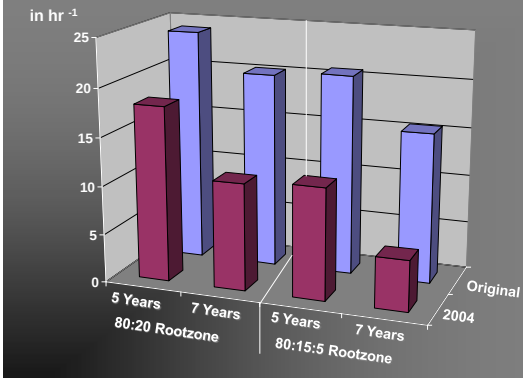
Formation of Mat

- 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 aerification

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

Materials and Methods

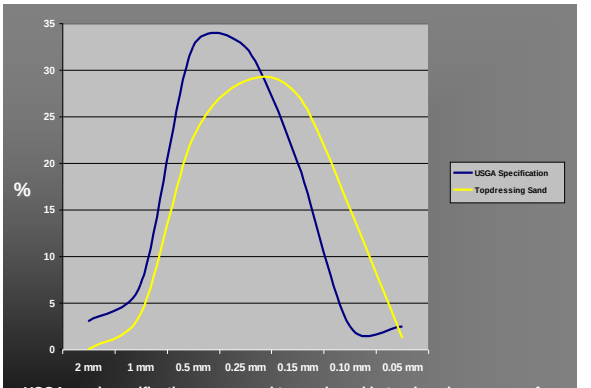
- 2004 rootzone samples taken below mat layer from each soil treatment and sent to Hummel labs for Quality Control Test (24 total samples) & tested against original quality control test (z-score).
- Other analysis also completed



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

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.



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

Conclusions

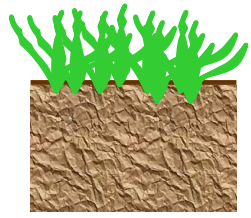
- The K_{SAT} decrease over time ***may*** be due to organic matter accumulation above and in the original rootzone and/or the increased fine sand content originating from topdressing sand

Root Zone: Mat vs. Original

- pH:
  - Mat < Original for all USGA and California Greens.
- CEC, OM, and all Nutrients tested:
  - Mat > Original for all USGA and California Greens.

Importance of OM in the rhizosphere

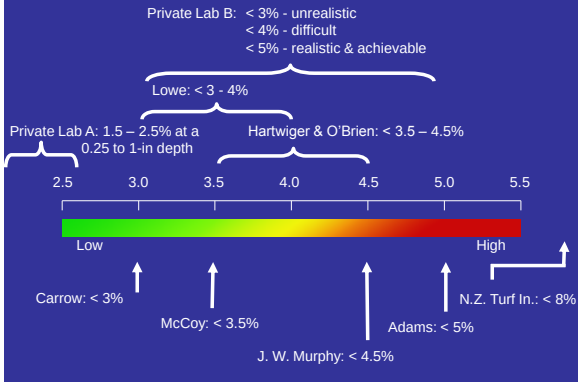
- deposition of particulate OM
- microbial niches
- nutrient uptake
- pathogen competition



Why is high OM considered to be "bad"?

- Loss of infiltration
- Decreased aeration
- Traps "toxic" gases
- Are these concerns real or imagined?
- Why the confusion?

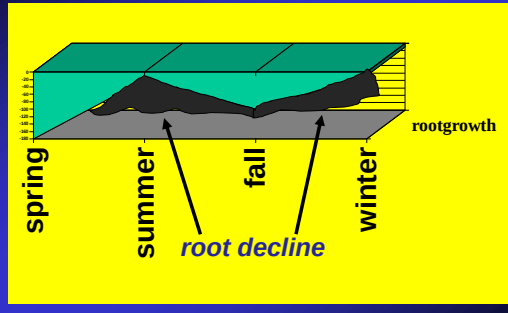
Sampling of Recommendations



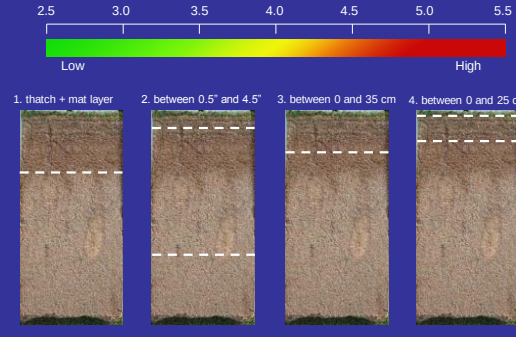
Analysis Methods

- Many exist, but the most relevant is "combustion" or "loss on ignition"
- The sample represents both dead and *living* organic matter
  - Food for thought……

Seasonal Root Depth



Organic Matter Sampling Protocols



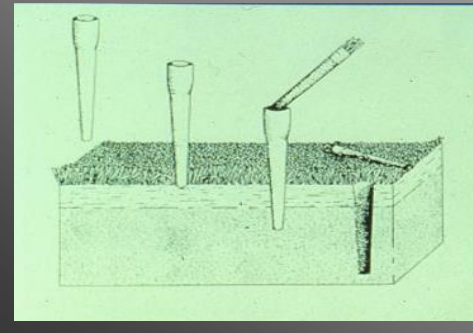
There is no "magic" number

How do you get rid of OM?

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

How effective is removal?

- Surface disruptive, short and long term
- Core aeration is the most widespread practice recommended for OM management



Tine Size and Surface Area Chart

Tine Size (in.)	Spacing (in.)	Holes/ft^2	Surface Area of One Tine	Percent Surface Area Affected
1/4	1.25^2	100	0.049	3.4%
1/4	2.5^2	25	0.049	0.9%
1/2	1.25^2	100	0.196	13.6%
1/2	2.5^2	25	0.196	3.4%
5/8	2.5^2	25	3.07	5.3%

Influence of Rootzone Organic Matter on Putting Green Quality and Performance

- Funded by:
  - USGA (2006)
  - Nebraska Golf Course Superintendents Assoc. (2007-2009)
  - Golf Course Superintendents Assoc. of South Dakota (2006-2009)
  - Peaks & Prairies GCSA (2007-2009)

Project Objective

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

Test Procedures

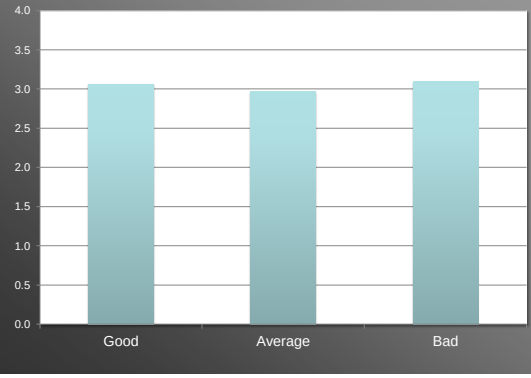
Years 1, 2, & 3

- At least 3 different greens per golf course sampled
- Soil samples taken from 3 different area per green
- Samples were evaluated for OM levels using LOI
- Management survey
- GPS location
- NOA climate data

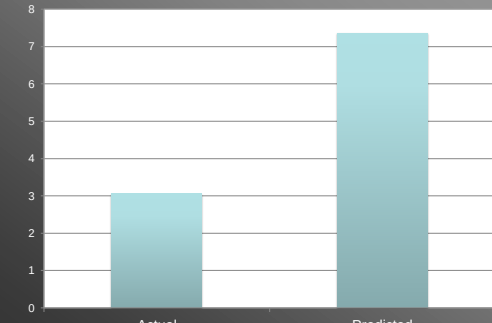
Sampling Locations

- 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

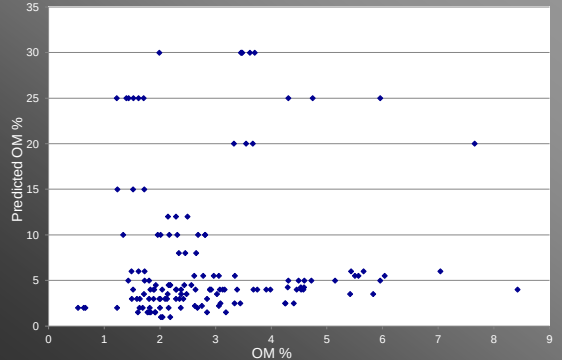
Problematic vs Non-problematic



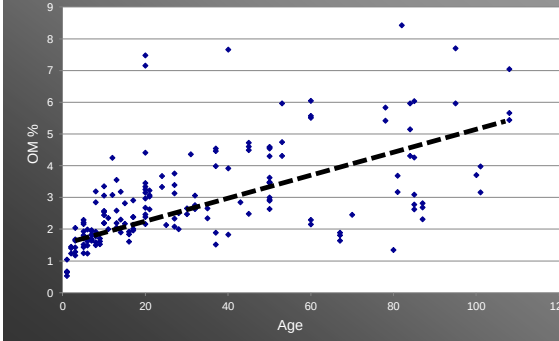
Superintendent predicted vs actual



Range of predicted vs. actual



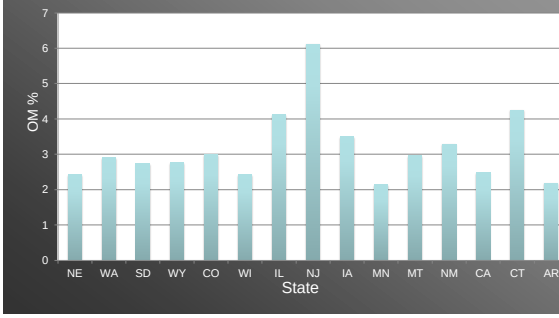
Green Age



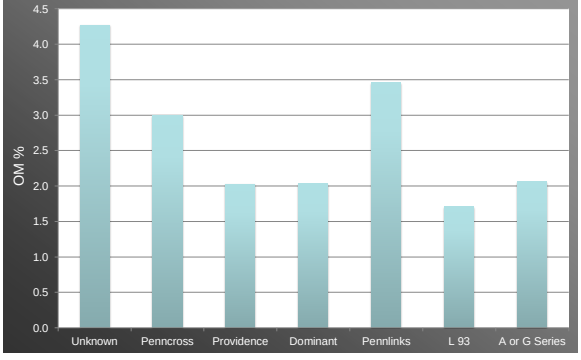
Is the age effect misleading?

- **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**

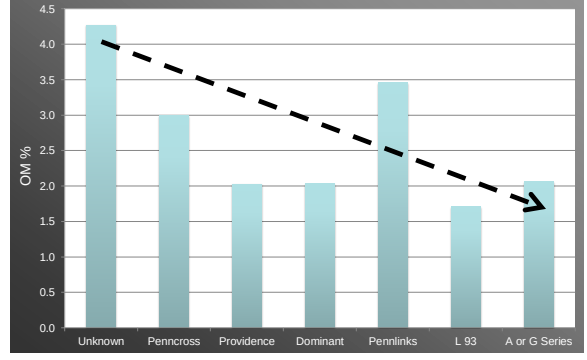
State Differences (highly correlated with age)



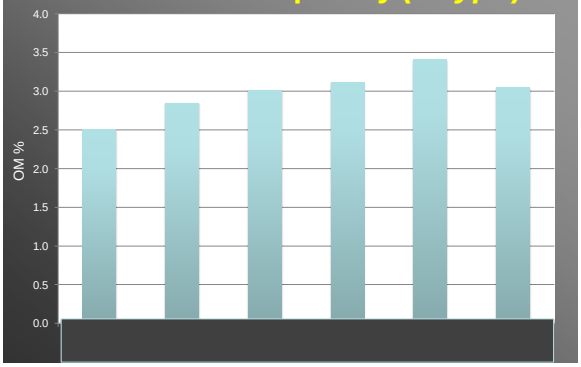
Cultivar



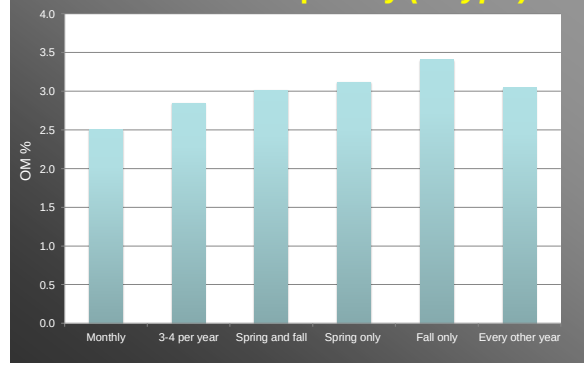
Cultivar



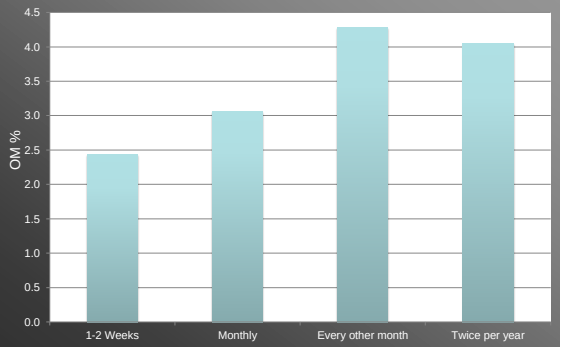
Cultivation Frequency *(& type)*



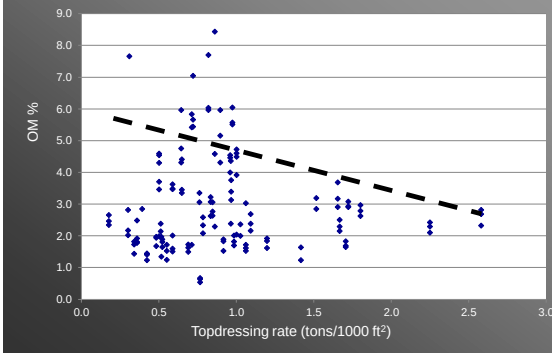
Cultivation Frequency *(& type)*



Topdressing Frequency



Topdressing



Survey Summary

- None of the variables collected, by themselves, or in combination with others, ***predicted*** OM
- Courses using >20 cubic ft*/M of topdressing with or without "venting" had lower OM

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

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

SOIL ORGANIC MATTER (SOM) accumulation in creeping bentgrass (*Agrostis stolonifera* L.; CB) putting greens has been a concern for decades. Gaussoin et al. (2013) summarized the

Charles J. Schmid and Roch E. Gaussoin, Dep. of Agronomy and Horticulture, Univ. of Nebraska-Lincoln, 279 Plant Science Hall, Lincoln, NE 68583.

Organic Matter Management Study

Objectives

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

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 less invasive cultivation (LIC) 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

Treatments

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

15 Trts per Rep

6 Reps per year

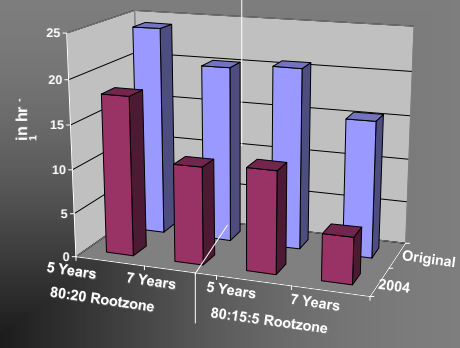
2 different years

= A whole lot of fun for one graduate student or 180 trts

Materials and Methods

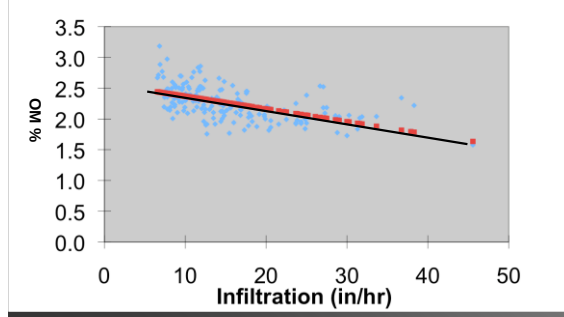
- Green Age:
  - 12 years
  - 9 years
- Data collected:
  - OM% (pre-cultivation/monthly)
  - Single wall infiltration (monthly)

Infiltration Effects



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

Relationship between OM and Infiltration



*Significant at α = 0.01

OM Data Analysis Year 1

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

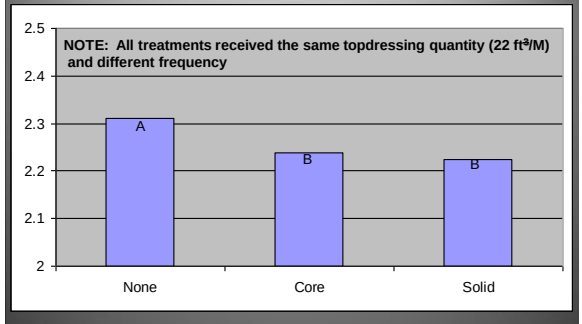
OM Data Analysis Year 1

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

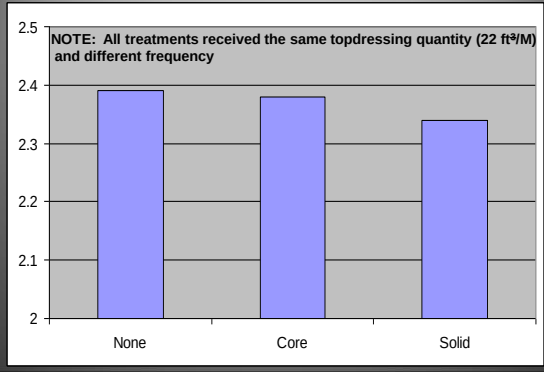
OM Data Analysis Year 2

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

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



Acknowledgements

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

What these data do/don't suggest

- Topdressing is the most consistent and repeatable factor in OM management
- Cultivation 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

Published December 19, 2014

RESEARCH

ACCEPTED

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

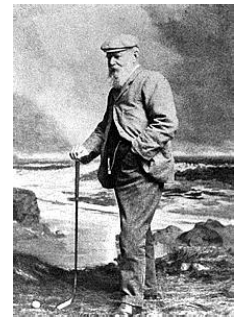
Charles J. Schmid,* Roch E. Gaussoin, Robert C. Shearman, Martha Mamo, and Charles S. Wortmann

Abstract

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"



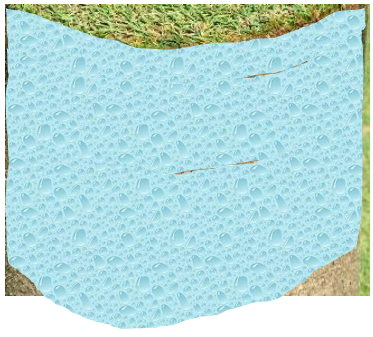
"the solution to pollution is dilution"

Layering

- Water retention is non-uniform
- Thatch/mat layers can store twice as much water than the root zone

NOT a function of drainage

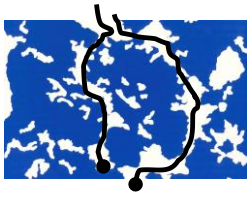
Rather it is the difference in pore size distribution among layers

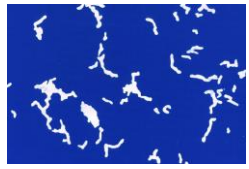


Layering

- Aeration alone not that effective
- Must topdress to dilute OM (change its pore size distribution) and use deficit irrigation

Compacted





Pores must be continuous (connected)!

ASA Monograph (3RD Edition)

Chapter 12

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

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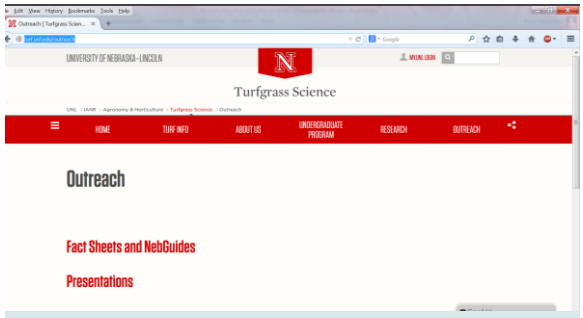

http://turf.unl.edu/outreach