



Reflections on 35 years of Turfgrass Research & Outreach



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Idaho Chapter
GCSAA
Grass Care Association of America
Idaho GCSA
 Spring Meeting & Trade Show
 Boise, Idaho
 February 23 & 24, 2023

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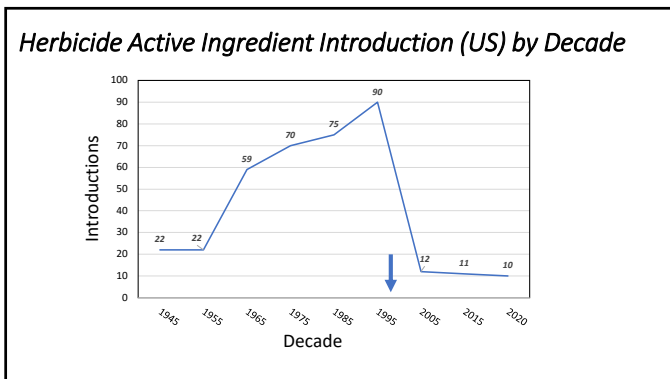


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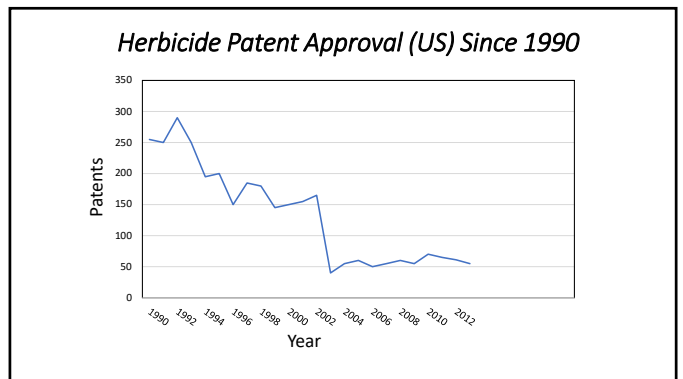
Perspective

1991	vs.	2021
	<u>Fertility</u> ↓	
3.5-8 lbs N/M	bentgrass green	1.5-3 lbs N/M
	<u>Pesticide Rates</u> ↓	
5-14 lbs ai/acre	preemergence	0.125-0.25 lbs ai/acre
	<u>Mowing heights</u> ↓↑	
0.125-0.25" 1.5-2.0"	bentgrass green home lawn	<0.125" ≥ 3"
14	Cultivars (bentgrass) ↑	26

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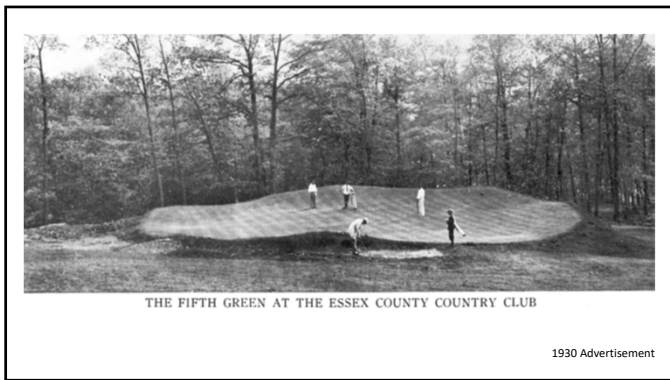
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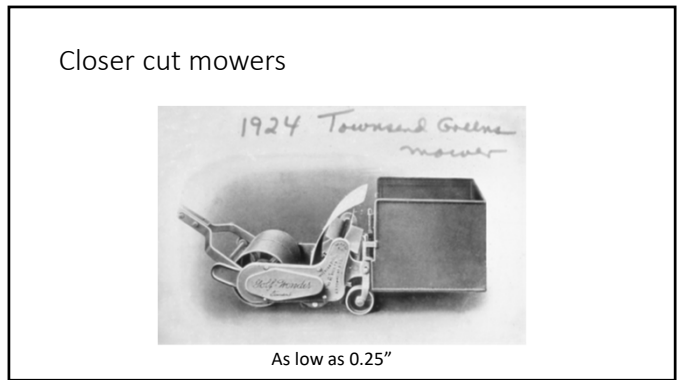
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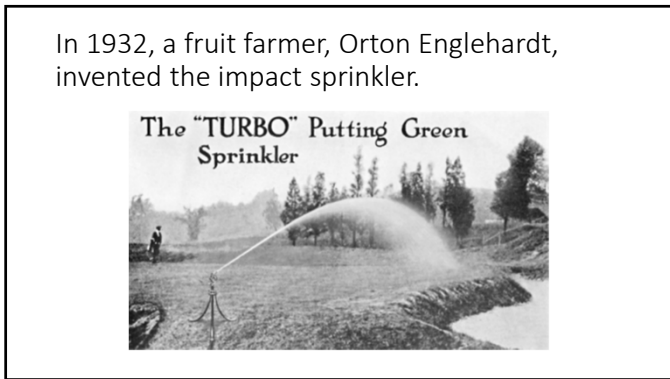
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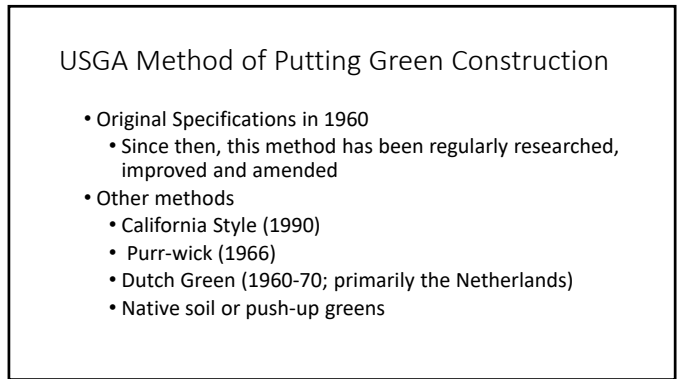
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Physical properties of sand-based
root zones over time
1996-2005
University of Nebraska-Lincoln

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Objectives

- Develop a better understanding of the impact of grow-in procedures on putting green establishment and performance.
- Investigate temporal changes in the soil physical properties of USGA putting greens.

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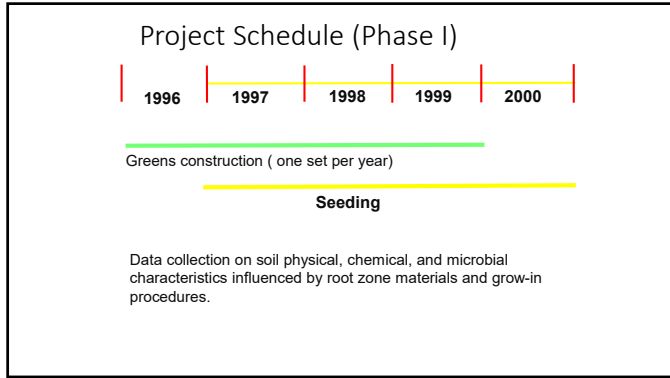
Materials and Methods

- Field experiment initiated in 1997
- Greens constructed every year for four years
- Two rootzone mixtures
 - 80:20 Sand:Peat (v:v)
 - 80:15:5 Sand:Peat:Soil (v:v:v)
- Two establishment treatments
 - Accelerated
 - Controlled

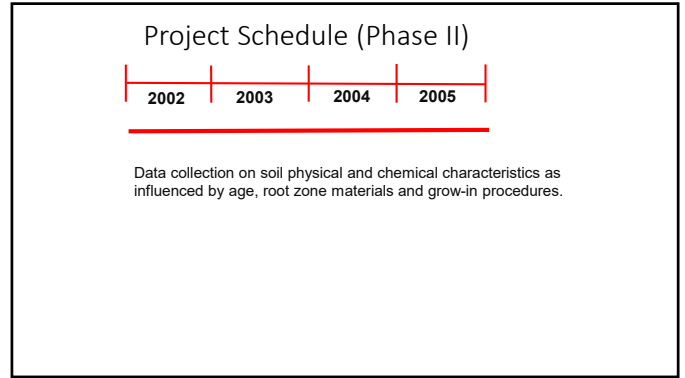
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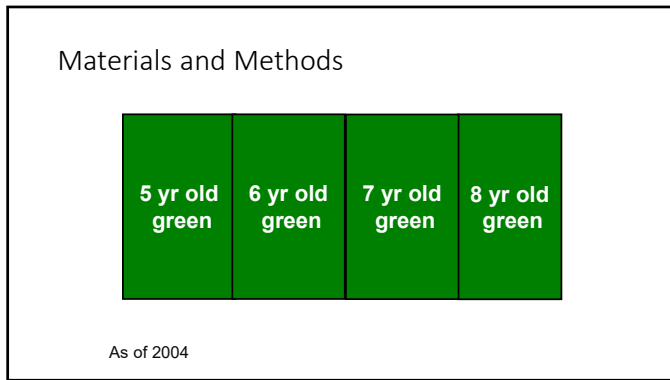
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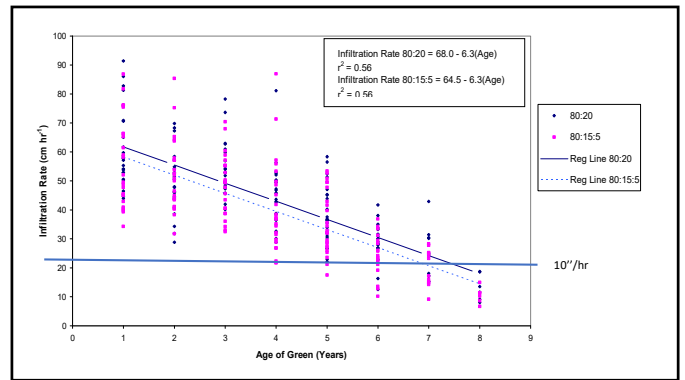
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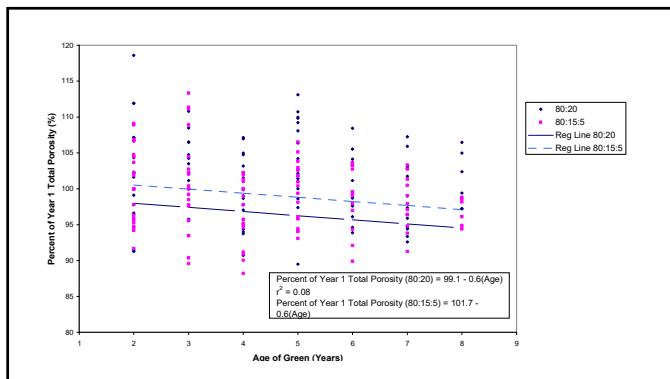
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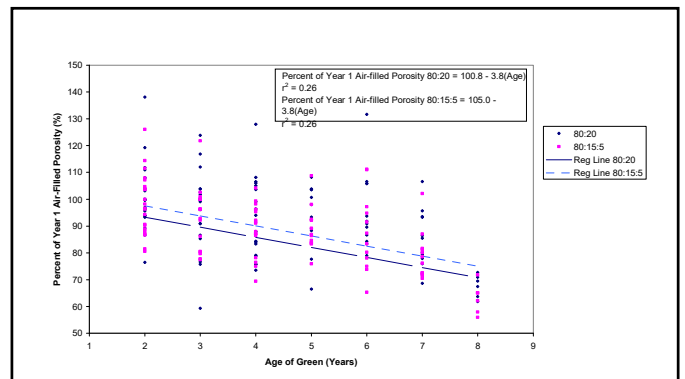
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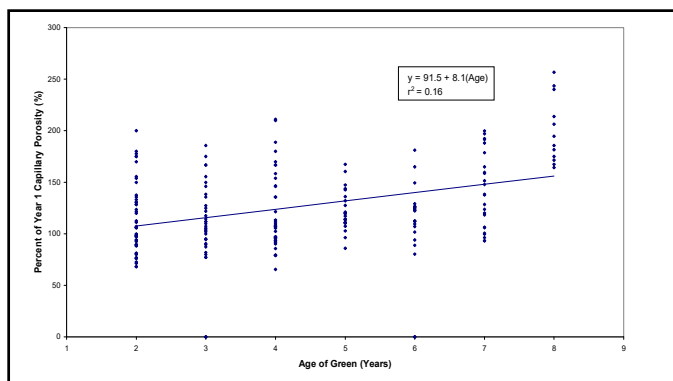
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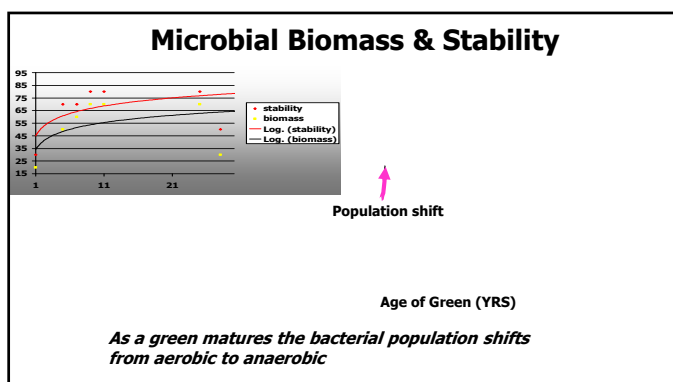


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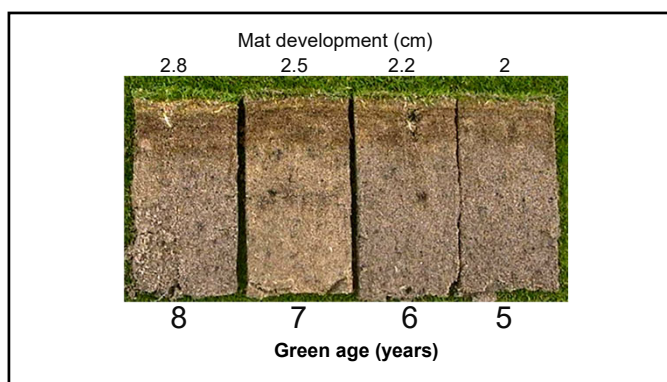
Microbial Properties

(data from O.J. Noer/USGA project on aging golf greens) and microbial survey of regional golf courses

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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 aeration

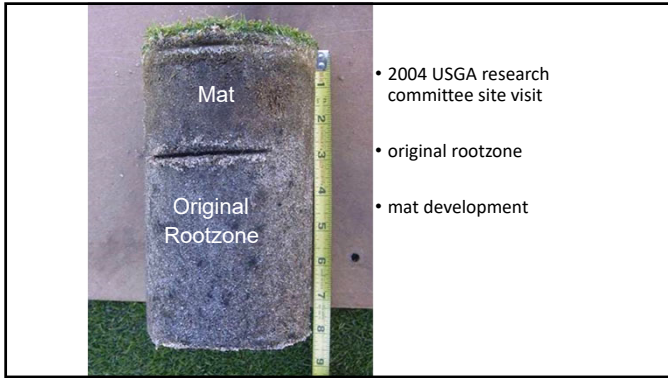
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Annual organic matter accumulation in a sand/peat green

Year	1	2	3
	0.65%	3.0%	6.0%

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

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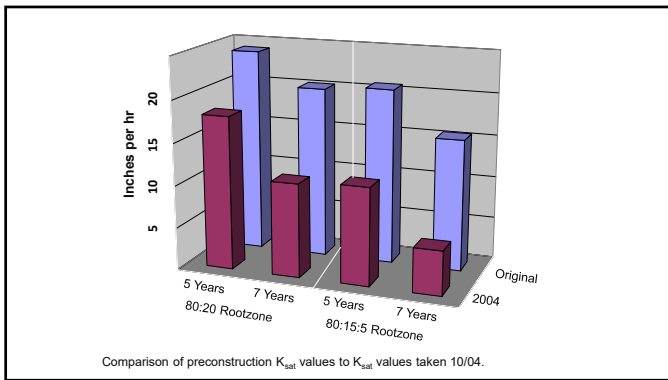
- 2004 USGA research committee site visit
- original rootzone
- mat development

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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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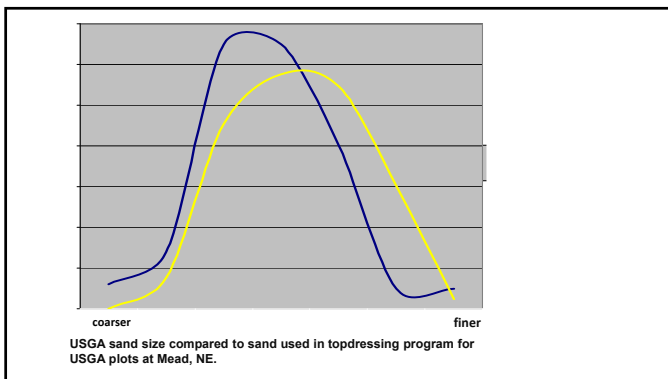


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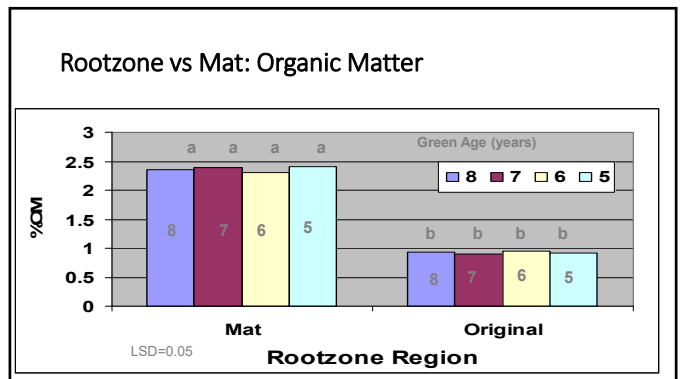
Change in Rootzone Particle Size Distribution

- 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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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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Conclusions

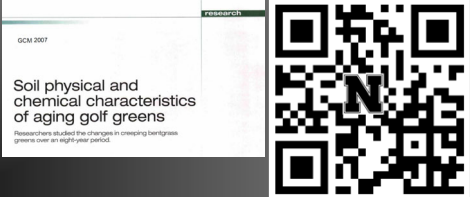
- Based on *in situ* green testing K_{SAT} decreased, and surface moisture increased, over time due to organic matter accumulation above the original rootzone and increased fine sand content originating from topdressing sand
- Organic matter did result in positive agronomic change: pH, CEC, nutrient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



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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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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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8.5 year-old turf



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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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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

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All treatments received the same topdressing quantity (22 ft³/M*) but different frequency

Equilibrated to identify differences of the practices in question

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

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Materials and Methods

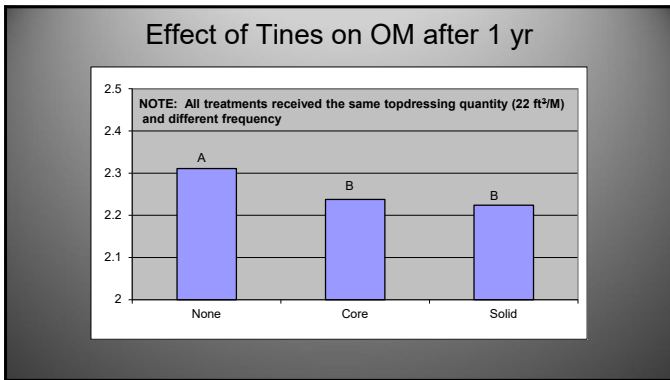
- Green Age:
 - 12 years
 - 9 years
- Data collected:
 - OM% (pre-cultivation/monthly)
 - Single wall infiltration (monthly)

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OM Data Analysis Year 1

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

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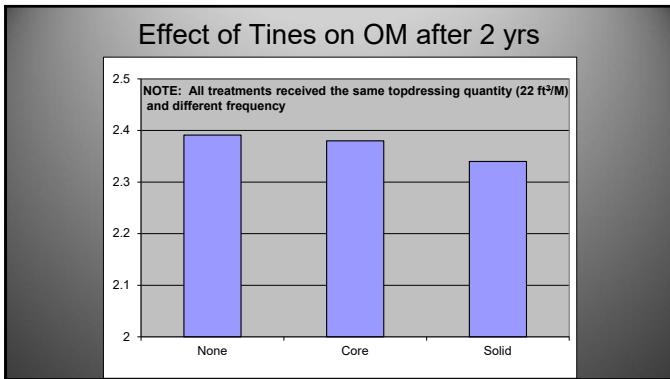


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OM Data Analysis Year 2

- 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

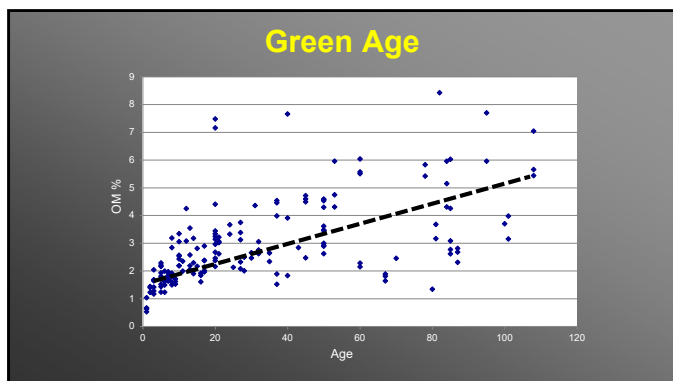
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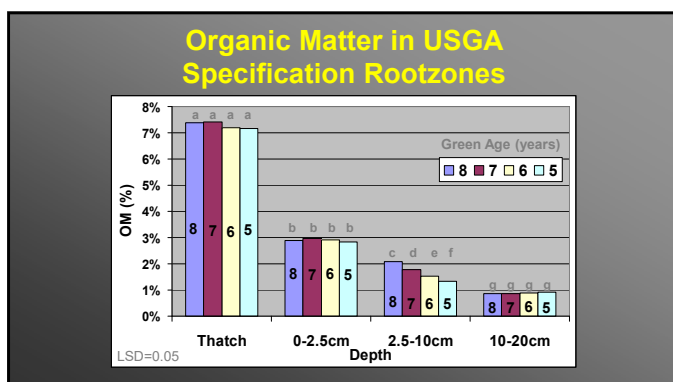


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Is the age effect misleading?

- Sampling issue:
 - Mat depth increases as green ages resulting in more OM in the same volume soil.

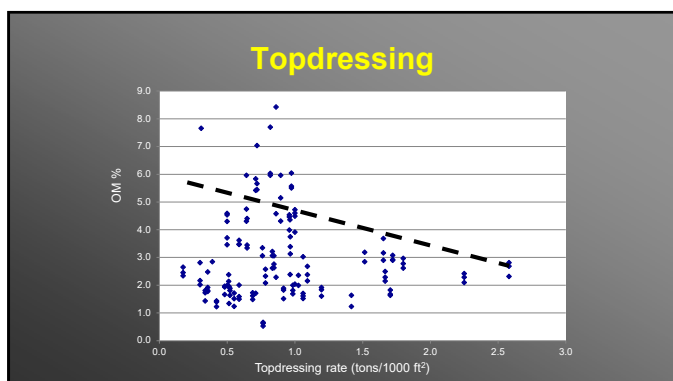
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Survey Summary

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


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

Charles J. Schmidt*, Hoch E. Gausman, and Sarah A. Gausman

Since organic matter (OM) accumulation in creeping bentgrass (Crested Dogfawn) putting greens has been a concern for decades, Gausman et al. (2011) investigated the negative effects associated with excessive OM (black sand), including decreased water infiltration, localized dry spots, reduced high and low temperature tolerance, increased pest problems, and reduced green speed. The objective of this study was to survey OM concentrations in CG greens throughout the continental U.S. to determine management practices and their interactions that significantly affect green OM content. Response techniques were used to determine the significance of various management practices and site specific characteristics on green OM content.

Some included and eight putting greens on 104 golf courses in 15 states (AZ, CA, CO, IL, IA, IN, MI, MN, MO, NY, NJ, OH, PA, SC, TN, VA, WI, WY). In 18 sites, soil samples were collected for management practices and OM concentration from four 200-ft² hole sites. All golf courses received some CG and varied levels of annual bagging (0 to 1.5). Three 0.75-inch diameter samples were collected per putting green to determine OM concentration (three putting greens per golf course). Samples were removed from the sample and discarded. Samples were cut to 1.0 inches below the surface and the excess soil discarded. Samples were analyzed for OM concentration (gravimetric, oven-dried) using the loss on ignition method (Delano and Sommers, 1966) at 700°C for 12 h.




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Topping

Old Tom Morris (1821–1908) is thought to have discovered the benefits of topping 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 topping"



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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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"Advocates of solid-tine aeration report that they get the same benefits of thatch and organic matter reduction with less labor for the collection and removal of aeration cores. Whether you pull a core or use solid tines, it's all about sand volume and the ability to dilute organic matter in the rootzone. Regardless of the method, the most important factor is filling the hole with sand. It's all about dilution, and if you can do that with less of a mess and less labor, then solid-tine aeration is a viable alternative."

From: <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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Please mark all that apply. In the last 5-10 years, on our greens, our facility has:

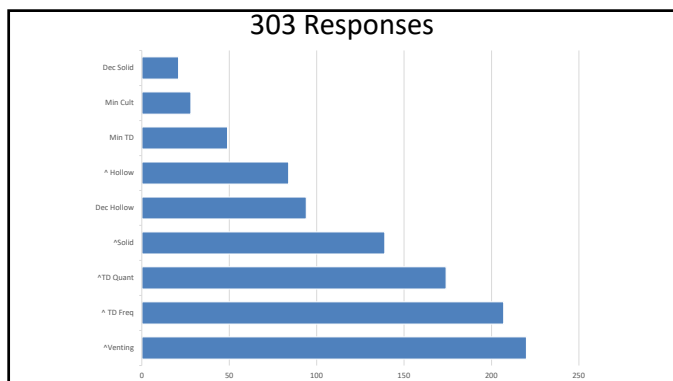
- Increased topping quantity
- Increased topping frequency
- Increased hollow tine (equal or greater than 0.5") aeration
- Increased solid tine (equal or greater than 0.5") aeration
- Decreased hollow (equal or greater than 0.5") tine aeration
- Decreased solid tine (equal or greater than 0.5") aeration
- Made minimal changes in topping application quantity/frequency.
- Made minimal changes in cultivation practices.
- Increased "venting" practices.

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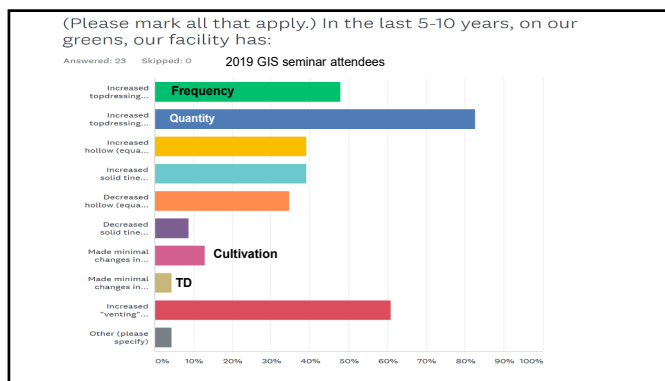
2016 Survey Respondents via Greenkeeper



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What these data do/don't suggest

- Cultivation, when topdressing quantity was equal, was insignificant in affecting OM
- Superintendents, however, must use **whatever tools** they have at their disposal to ensure sand is making it into the profile and not the mower buckets

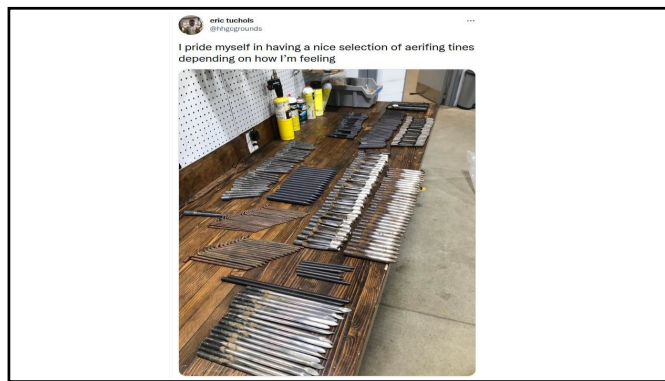
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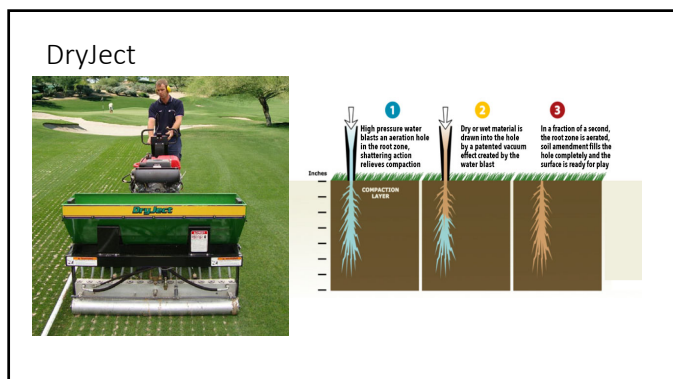
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Dryject/Tine Trial Fall 2021

- 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


- 9 tine types
- 2 devices (ProCore and DryJect)
- Multiple treatments
- Surface and firmness using the USGA GS3 digital golf ball

Equipment and Tine Support Provided by

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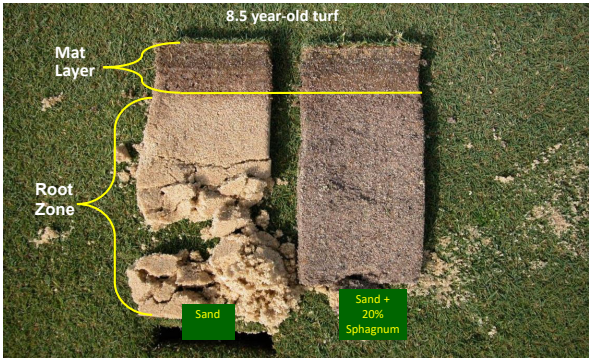
What have we learned?

- 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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8.5 year-old turf



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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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Key is matching your growth rate to optimize topdressing +

How much sand to use for topdressing?

- Generic recommendation is 20-40 ft³ per 1000 sq. feet/yr (about 0.5 inch/M/yr)
 - UNL worked showed 20-24 ft³ for OM management
- Varies by amount of:
 - Traffic
 - Grass species or cultivar
 - Nitrogen Applied
 - Water Applied
 - Microclimate/Location

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#clipvol "One bucket at a time"

- Micah Woods, Asian Turfgrass Center
 - Asianturfgrass.com



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"Growth Potential"


- Pace Turf
 - <https://www.paceturf.org/public/sand-and-growth-potential>



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Chapter 12 ASA Monograph (3RD Edition)
Characterization, Development, and Management of Organic Matter in Turfgrass Systems

R.E. Gaussen, Dep. of Agronomy and Horticulture, Univ. of Nebraska
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 C.A. Dockrill, Teagasc College of Amenity Horticulture, Dublin, Ireland
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Acknowledgements (UNL)

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- Nebraska Turfgrass Association

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