

Power Hour-How to make grass grow
It's About Tine(s)
a closer look at tines and sand incorporation




GCSAA
Conference and Trade Show

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Download Presentation



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OM accumulates as sand greens age




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8.5 year-old turf



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Practices to change thatch into mat include topdressing and ...



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... cultivation.



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Research Need (2004)

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

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Organic Matter Management Study

Objectives

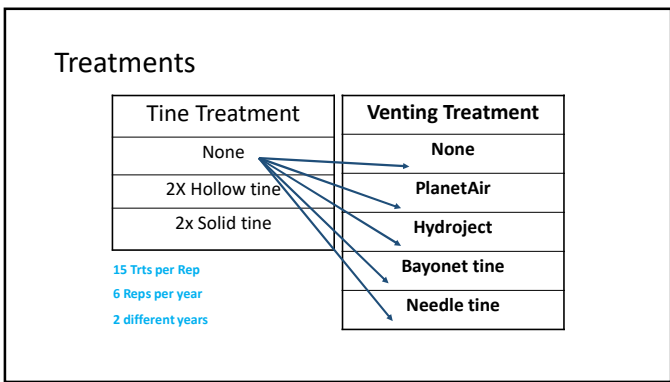
- Determine if conventional hollow tine is more effective than solid tine aerification at managing organic matter accumulation
- Determine if venting methods are effective at managing OM accumulation

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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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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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Tine Trial Fall 2021

- Check
- Hollow ½" ID Procore 648 - 3" target depth on all tines
Dryject = 5"
- Solid ½"OD
- DryJect (3x3) Sampled for OM the day after
- ¼" Solid (Needle) Treatment in 1' depth increments to 4 "
- DryJect (3x2)
- Needle + Solid
- Needle + Hollow

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Treatment	% OM 0-4"	
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
- **Data is preliminary**

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Spring 2023 Tine Trial

- ~~28~~ ²⁸ tine types/configurations including Viper tines
- 2 devices (ProCore 648 and DryJect)
- Timing (spring/fall)
- Topdressing before or after
- Data
 - OM
 - Surface parameters using the USGA GS3
 - Other data

Equipment and Tine Support Provided by

Ceres Turf, Inc. Heartland Golf & Turf Services LLC

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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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Treatments (Spring, FB Oct 3 except DryJect on Oct 16)

- Main Plots (42' X 60' with a 6' border between)
 - 1. Topdress before tines with 0.25"(0.125" on October 2023) on surface (equates to 1 (1/2 fall) ton/1000 ft² or 20 ft³/1000ft²)
 - 2. Topdress after tines
- Sub-plots (tine treatments) set at 3" depth
 - 4. ½" solid cross
 - 5. Untined control
 - 6. ¼" solid
 - 7. .50" solid
 - 8. 3/8" hollow, side eject
 - 9. 1/2" solid cross
 - 10. .75" solid slicing
 - 11. 1/2" hollow, tapered
 - 12. 1/2" hollow side eject
 - 13. DryJect 3X3
 - 14. Untined Control
 - 15. DryJect 2X3
 - 1. 5/8" Viper Nose™
 - 2. 1/2" Viper Nose™
 - 3. 3/8" solid

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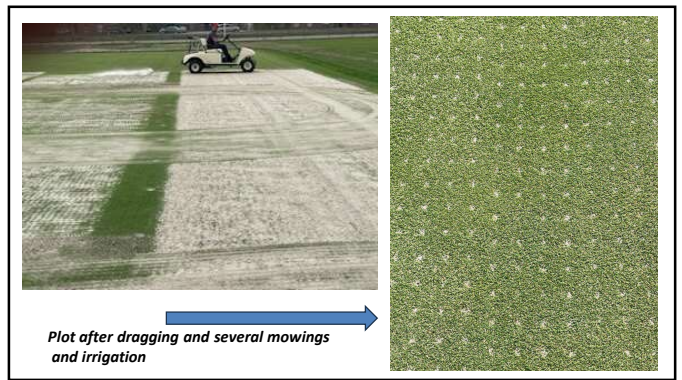
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Data Collection

- Organic matter, 3-5 days after treatment directly over aeration hole
- Infiltration approx. weekly
- NDVI (cover measured digitally) every few days
- Firmness
- Surface Moisture TDR 0-3'; 3-6"

- GS3
 - Ball roll
 - Smoothness
 - Trueness



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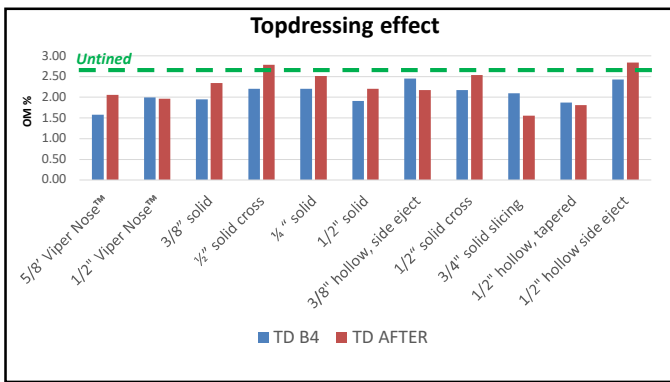


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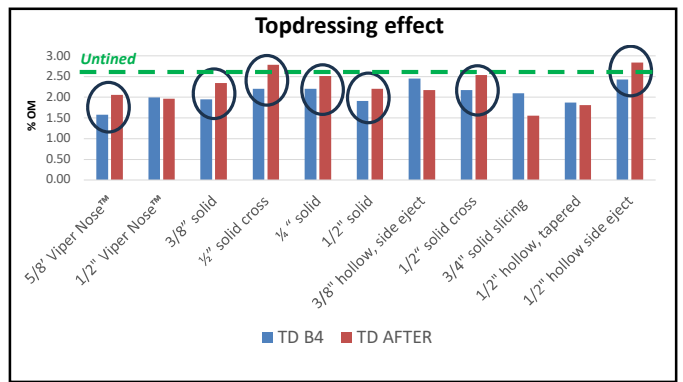
Fall 2023 Data Results (<.05 = statistical difference)

ANOVA	10-Oct	18-Oct	21-Oct	26-Oct		9-Oct	16-Oct	25-Oct
Effect	NDVI-1	NDVI-2	NDVI-3	NDVI-4	%OM	Infil-1	Infil-2	Infil-3
Topdressing (TD)	0.1161	0.5583	0.6987	0.2785	0.0466	0.3444	0.188	0.1061
Tine TRT	<.0001	0.0049	0.0353	0.114	<.0001	<.0001	<.0001	<.0001
TD*TRT	0.0761	0.925	0.2796	0.1175	0.0107	0.1	0.0076	0.4673

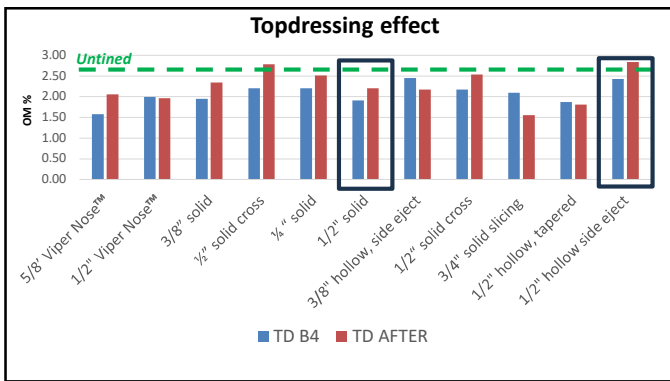
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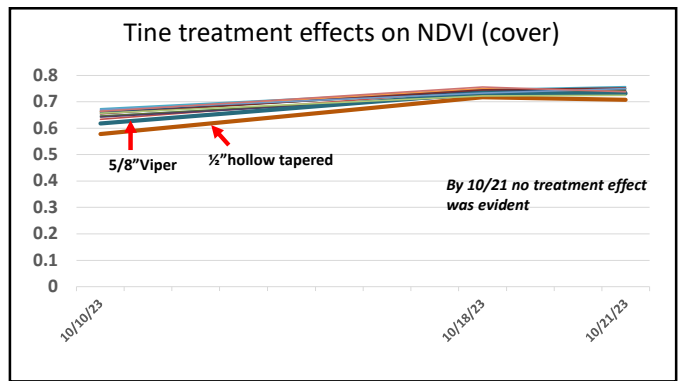
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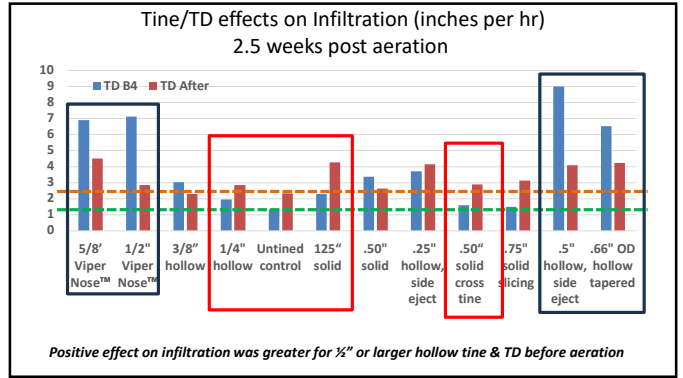
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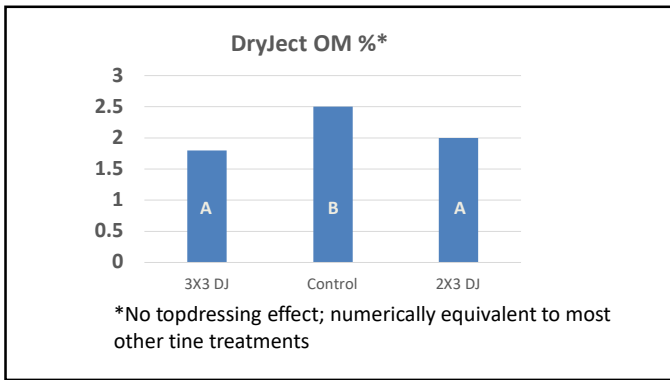
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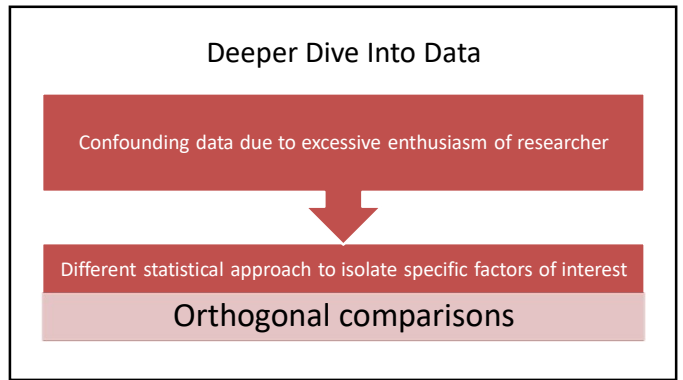
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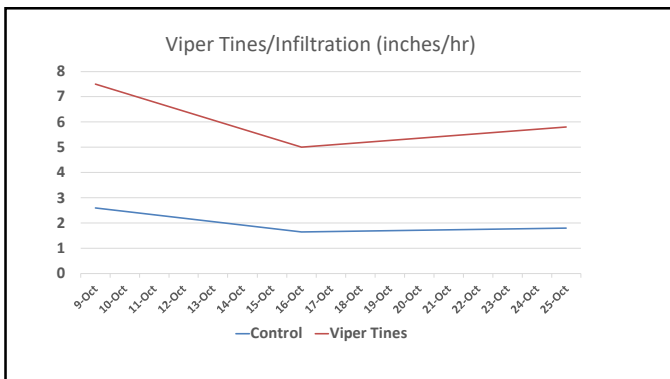
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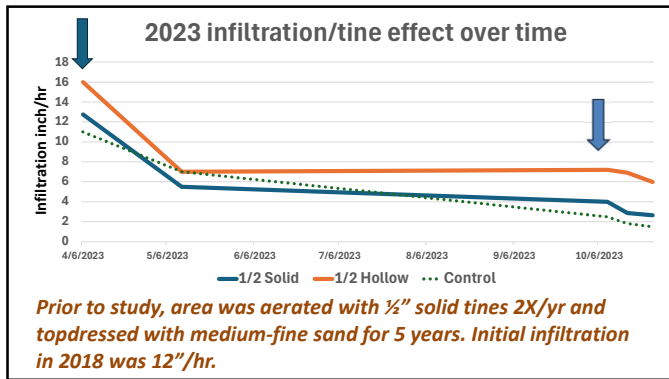
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1/2 Solid	1/2 Hollow
% OM	
1.8	2.4

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Oct-25 Infiltration	
1/2 Solid	1/2 Hollow
Inch/hr	
2.8	6.6

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- ### Early Results
- Lots of stuff going on
 - Topdressing before aeration, even with some hollow tines will incorporate more sand
 - Higher and prolonged infiltration greater for hollow tines 1/2" or larger than any solid tines
 - Viper tines had greatest increase in infiltration over time than any other tine
 - **Uninterrupted use of solid tines needs to be rethought**
 - Study will continue into 2024.....maybe longer

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PROCORE 648 VS 648S

- Is there a difference in solid tine displacement and sand reception?

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Champions Run, Omaha, NE

Aerated on separate areas of the sand-based nursery putting green at 0.125" HOC, with 1/2" solid tines set at 3" with a 648S and 648. Each area was 60 ft².

Sampled with a 1" probe above aeration hole; 0-3" and 3-6" with 10 random locations per aerator

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Results

	648	648S
OM % 0-3"	2.2a	1.6b
OM % 3-6"	1.6a	1.4a

Different letters within a row indicate statistically significant differences at P < .01 based on a paired t-test with 18df

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Acknowledgements

- USGA
- Environmental Institute for Golf
- Nebraska GCSA
- GCSA of South Dakota
- Peaks & Prairies GCSA
- Toro, DryJect, Ceres Turf, Inc
- Nebraska Turfgrass Association

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Contact Information

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Thank you!



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