



**Dos and Don'ts of Organic Matter Sampling**


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

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**How does organic matter accumulate?**

- Organic matter; defined
  - dead or near dead plant residue which accumulates in the grass ecosystem

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**How does organic matter accumulate?**

- As grasses mature there is a continual senescence of non or limited function parts (roots, shoots and leaves)
- Senescence also happens when damage or injury occurs

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**How much OM is produced annually?**

- Roots = 3500 lbs/acre
- Leaves = 2000 lbs/acre
- Other = 2500 lbs/acre
- TOTAL = 8000 lbs/acre

**Fairway height blue/rye estimated annual production**

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**Where does organic matter accumulate?**

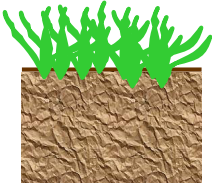
- Above ground
  - Thatch/Mat
  - clipping residue
    - relatively short term
    - "pseudo" thatch
- Below ground
  - rootzone
  - rhizosphere

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### Importance of (P)OM in the rhizosphere

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



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### Factors influencing rootzone (P)OM accumulation

- Mowing
  - increase height=increase rooting
- Irrigation
  - root growth restricted in waterlogged soils
- Cultivation
  - increase or decrease
- Fertility
  - increase or decrease
- Stress

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### Rootzone accumulation yearly in sand 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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### Thatch

A loose, intermingled, organic, layer of dead and living shoots, stems, and roots that develops between the zone of green vegetation and the soil

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*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).*



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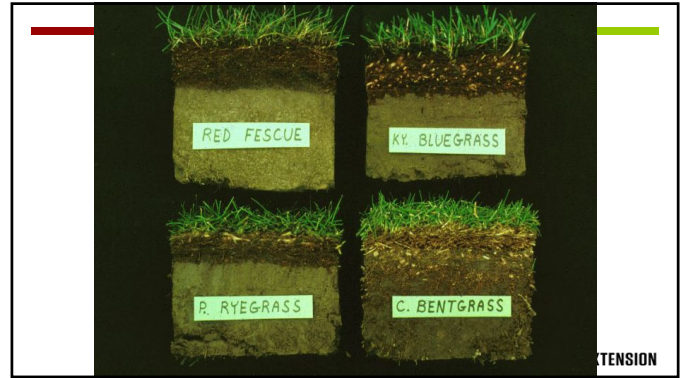
### and yet one more definition.....

### SOM- Soil Organic Matter

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### Benefits of "Moderate" Thatch

- Improved resilience and cushion
- improved wear tolerance
- insulate soil/crown to temperature extremes

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### Problems with excessive thatch

- Footprinting

A photograph showing a close-up of a green lawn with a single, dark, circular footprint where a shoe has stepped. The grass is otherwise healthy and green.

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### Problems with excessive thatch

- Scalping

A photograph of a lawn showing several irregular patches of dead, brown grass interspersed with green grass, a condition known as scalping.

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### Problems with excessive thatch

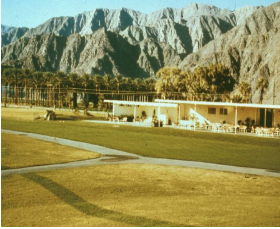
- LDS

A photograph of a golf course green with several large, irregular brown patches of dead grass, known as Large Dead Spots (LDS). A golfer is visible in the background.

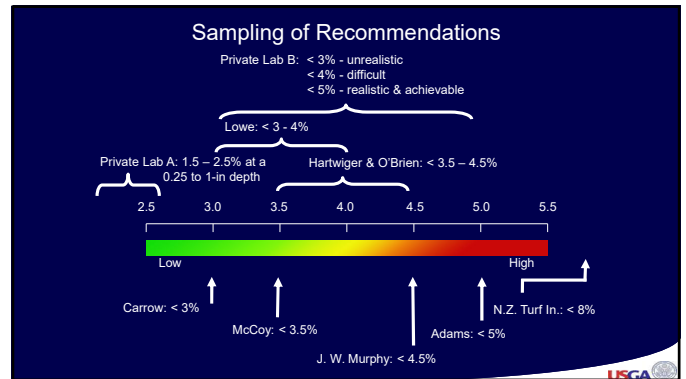
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## Problems with excessive thatch

➤ Reduced Stress Tolerance




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### Organic Matter Recommendations for Sand based Rootzones



- Range
  - ✓ 1.5 – 2.5% between 0.25 to 1-inches
  - ✓ 8 – 15%
- Recommendations for almost every point in between

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### Developing a Standard for Measuring Organic Matter in Putting Green Soils

▪ Collaborators:

- Roch Gaussoin / Professor / Agronomy & Horticulture / University of Nebraska-Lincoln
- Doug Linde / Professor / Plant Science / Delaware Valley University
- James Murphy / Professor / Plant Biology / Rutgers University
- Doug Soldat / Professor / Soil Science / University of Wisconsin-Madison

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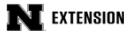
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## What is the most common analytic test?

Loss on Ignition (LOI)

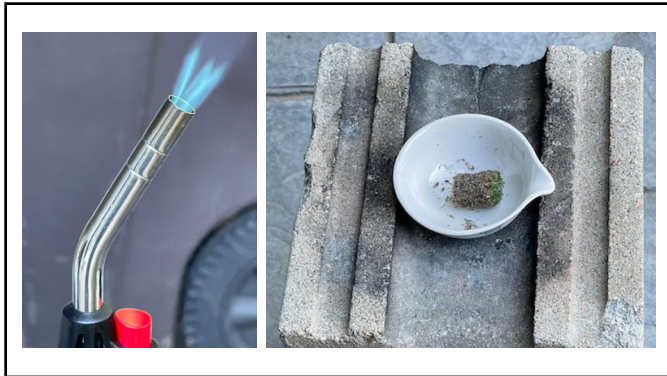
- 100-1200°C (370 °C norm)
- Sample is weighed, placed in oven, then weighed again
- OM% determined % by weight (or mg/g)
- Ovens are \$1200-\$2500



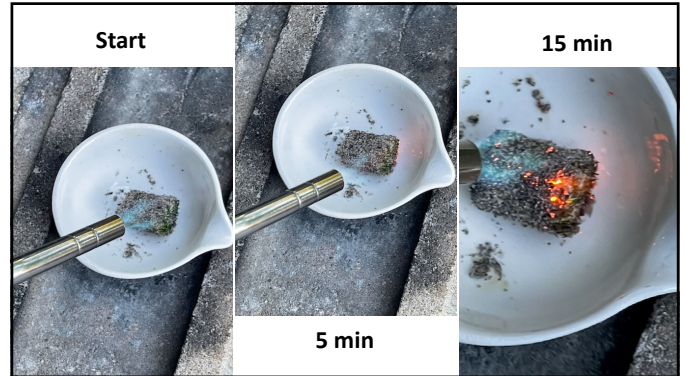
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**Developing a simple, practical method for organic matter content determination by superintendents**

Leifeld and Kogel-Knabner (2001)

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**Don't try this at home.....**

- Methods using hydrogen peroxide adapted from Leifeld and Kogel-Knabner (2001) were time-consuming and step intensive for practical use.
- Attempts to find a correction factor were also not discovered.
- Regression models based on data of the best attempt showed a high level of variation measuring OM percentages of pre-determined lab mixed samples.
- A rapid, practical, inexpensive, and reliable method to test OM content on golf using equipment available on a typical golf course is not feasible.
- Like the torch fiasco, you still need an analytic balance and other lab equipment

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**Accuracy and Precision**

Need to have a root zone specific **sampling** and analysis protocol for OM

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**Taking a representative sample**

- Sample depth(s)
- Number of samples
- Sample location
- Sample size
- Time of year
- Verdure on or off?



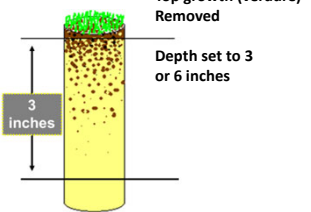
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**Historic Sampling Depth (as approved by the SSSA)**

➤ Sampling issue:

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




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*What are you most interested in?*


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**# of samples and location**

- 3 golf courses at different geographic locations
- 5 holes at each course
- Samples from N to and E to W on 10 ft centers

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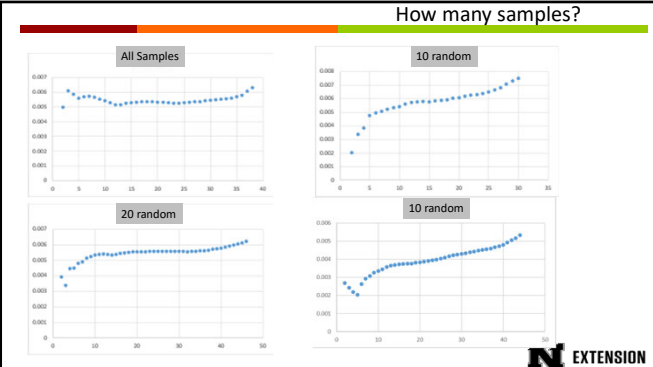
Loc	N	E
1	1	B
2	1	C
3	1	D
4	1	E
5	2	A
6	2	B
7	2	C



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**How many samples?**



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**Sample size**



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**Verdure on or off?**



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Findings to date.....

- small diameter samples (0.75" or 1.5") can be useful for accurately determining organic matter, no differences between size; samples should no less than ~10 feet apart; at least 20 samples per green; Y TBD-how many greens?
- Leave verdure on
- Sample top inch or 2 (or multiple depths OM246 or OM123); bulk samples from across green
- *Practical note-avoid areas of high traffic (entry/exit points etc.); avoid outside edges of green; sample "problem" areas separately*

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### Next steps (*lots of data yet to analyze*)

- How does sample preparation (grinding and sieving) affect variation of soil organic matter?
- How does time of year affect sampling?
- How does soil organic matter vary within and across putting greens within the same property?
- Confirmation of what is the optimal number of samples required to balance accuracy with practicality?

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### OM Testing

- Take annual tests to determine long-term trend
  - Same time of year
  - Same location and green
- Correlate your test results with turf quality and performance during stressful environmental conditions to determine need for changes in management program
- Threshold/critical levels likely vary across the globe and from course to course



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### Final Notes

*Much of the data presented today is preliminary.....*



International Sports Turf Research Center and other labs offer comprehensive soil evaluation which goes beyond sending in a sample. If you are currently using a lab and are pleased with their service and results than stick with it. They may be using a different sampling/analytic protocol.



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### Funding Acknowledgements

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Nebraska Turfgrass Association



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