MEASUREMENT TECHNIQUES, WEAR TOLERANCE, AND NUTRITIONAL RELATIONSHIPS AS RELATED TO TURFGRASS THATCH*

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Important to the understanding of this study are the definitions of certain frequently used terms. THATCH, in this study, is defined as the accumulation of dead roots, stems, and crown tissues, between the soil surface and the verdure (green vegetation). Thatch should be distinguished from MAT which is thatch in a state of further decomposition due to the intermixing of soil from topdressing or earthworm activity. Another important term, PSEUDOTHATCH, is defined as the accumulation of undecomposed leaf clippings and some stems between the thatch layer and the verdure.

OBJECTIVES OF THE STUDY

(1) To evaluate the accuracy and reliability of five techniques for measuring turfgrass thatch accumulation. Actually various techniques are used to measure thatch and mat but no attempt has been made to determine the relative reliability of the various techniques.

(2) To assess the degree of benefit in terms of wear tolerance derived from various degrees of mat accumulation. A mat layer is known to affect the wear tolerance of the playing surface. However, little is actually known concerning the quantitative aspects of wear or resilience as affected by mat thickness.

(3) To determine the effects of selected cultural factors on the accumulation: decomposition ratio of turfgrass thatch. Such cultural factors as nitrogen fertility rates, nitrogen carriers, and cutting height supposedly affect this ratio; but to what degree is not known.

THATCH MEASUREMENT TECHNIQUE EVALUATIONS

Five methods of quantitatively measuring thatch on Kentucky bluegrass, annual bluegrass, and creeping bentgrass were evaluated:

(a) Thatchmeter - as a measure of resiliency or compressibility.
(b) Physical thickness measurement - non-compressed.
(c) Verdure - thatch dry weight (weight/unit area).
(d) Nonverdure - thatch dry weight (weight/unit area).
(e) Displacement of water (volume)

A prototype of the thatchmeter was provided by Dr. Gaylord Volk, University of Florida, from which a duplicate was constructed for use on cool-season turfs. Thatchmeter readings were recorded and sod samples were collected from thatched golf greens, tees, and fairways at Clio (Kentucky bluegrass), Grosse Pointe (annual bluegrass), and East Lansing (creeping bentgrass), Michigan.

Following the time-consuming procedure of sample preparation the remaining four measurement techniques were taken. The physical thickness or depth measurements were taken with a centimeter scale. The verdure and nonverdure-thatch dry weights were determined by ashing the samples at 1100 F for 10 hours. The amount of loss on ignition represented the organic matter (thatch) weight. In order to measure water displacement, a wetting agent had to be used to reduce the surface

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tension resulting from total moisture removal from the samples. The milliliter rise in volume of the solution within a graduated cylinder was recorded as the amount of water displaced or the colume (cc) of the sample.

Although the data is still being statistically analyzed, several observations can be made at this time. It appears that the thatchmeter is an unacceptable measure of thatch on cool season turfs mowed at heights greater than 0.25 inch. Thus, this technique shows some promise for the professional turfman as a quick, easy method of monitoring year-to-year thatch accumulation and resiliency characteristics on greens height turfs only.

The physical depth determination has its advantages and disadvantages. The advantages lie in the ease and rapidity with which researchers or professional turfmen can make the measurement. All it requires is a scaled measuring device. However, this method is a particularly inaccurate measurement of thatch for the researcher in the case of mat samples having variations in the amount of soil throughout the layer.

The water displacement technique could offer a reliable measure of thatch to the researchers. However, the prevalence of soil in varying amounts throughout the mat affects the accuracy of water volume displaced to the extent that there is little repeatability between samples.

It would appear that the dry weight methods are the most accurate. These techniques are a measure of the organic fraction (thatch) exclusive of all inorganic constituents. However, both are extremely time consuming, and thus are oriented towards research utilization.

MAT-WEAR TOLERANCE RELATIONSHIPS

For this study, five levels of mat accumulation on bentgrass greens were procured. Greens areas ranging in mat depth from zero to 35 mm, were contributed by Bill Raeburn - Lake O' the Hills, Haslett; Ron Foote - Forest Akers, East Lansing; Herb Klein - Dunham Hills, Milford; Bud Smith - Kearsley Lake, Flint; and Roger Schuiteman - Elks C.C., Grand Rapids.

A wear machine used to impose simulated traffic on the turf was operated until a comparable endpoint was achieved, i.e., until all the leaf and stem tissue was sheared away from the crown area of the plants. The number of revolutions required to reach this endpoint were counted and recorded for each of the greens. Extraneous factors as previous maintenance history, soil bulk density, soil texture, surface compaction, verdure succulence, and total cell wall were also analyzed.

The preliminary results from this investigation are presented in Table 1. The revolutions required to reach the endpoint (wear tolerance) increased significantly with each increase in both organic matter (thatch) weight and physical depth of the mat layer. There is, of course, an upper limit in mat depth at which the occurrence of mower scalping and foot-printing becomes objectionable on greens.

Although these preliminary results do not yet include the data from the various factors mentioned above nor the statistical analysis of these data, it would appear that the differences between treatment means are large enough to mask any effects of these factors.

EFFECTS OF CULTURAL PRACTICES ON THATCH ACCUMULATION

The intent of this study was to utilize the most effective thatch measurement technique, as ascertained from Study A, in evaluating the effects of fertility and cutting height on thatch accumulation. Extensive sampling was done on a long-term nitrogen/cutting height study in East Lansing, a nitrogen carrier study in Traverse City, and an old arsenic study at Purdue University, Lafayette, Indiana. Established studies had to be located as there wasn't time to apply treatments and expect to have differences in thatch accumulation develop.

The nonverdure-thatch dry weight technique was utilized to measure the thatch content of the numerous samples.

The data compiled to date is presented in Table 2. These results indicate a high correlation between the amount of thatch organic matter weight and both cutting height and nitrogen rate. Excess nitrogen and the higher cutting heights caused an increase in the thatch accumulation of chewings fescue.

Table 1. The influence of five depths of creeping bentgrass mat on wear tolerance as measured by a wear simulator operated until a comparable end point was achieved.

Thatch Organic Matter (mg/cm^2)	Physical Depth of the Mat (mm)	Average number of machine revolutions to reach the endpoint*
0	0	86
78.4	5.6	212
210.5	9.3	1217
450.0	21.0	2831
652.1	35.5	3350

* Average of 3 replications.

Table 2. Effects of nitrogen and cutting height on the accumulation of organic matter (thatch) in Wintergreen chewings fescue.

Nitrogen Rate (lb/1,000 ft^2/yr.)	Cutting Height (inches)	Organic Matter Weight (mg/cm^2)
0	.75	42.0
	1.50	51.7
2	.75	56.1
	1.50	66.7
4	.75	71.5
	1.50	84.6
8	.75	93.4
	1.50	109.6
12	.75	105.4
	1.50	123.2