INTERPRETING AND MODIFYING THATCH

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Thatch is a tightly intermingled layer of living and dead stems, leaves, and roots that develops between the zone of green vegetation and the soil surface. A slight amount of thatch is considered advantageous because it provides resiliency, increases wear tolerance, and insulates the soil against temperature extremes. However, in situations of excessive thatch accumulation increased disease incidence, localized dry spots, poor response to fertilization, greater susceptibility to injury from temperature extremes and proneness to scalping are associated with it (1).

In some instances of excessive thatch accumulation, the thatch layer becomes the primary growing medium for the turfgrass community. The crown of the turfgrass plant is no longer in contact with the soil surface but elevated into the thatch layer. Subsequent development of rhizomes and stolons, along with the majority of roots, occurs within the thatch layer (3). Previous studies have shown thatch to be a highly unfavorable growing medium for turfgrasses (2).

Expressing CEC of Thatch

Cation exchange capacity (CEC) is a good indicator of cation retention capabilities of soil. A study was done using four different saturating solutions to determine CEC of a Kentucky bluegrass thatch. Table 1 shows the values obtained based on both a weight (me/100 g) and volume (me/100 cc) basis.

Table 1. The cation exchange capacity (CEC) of thatch expressed on a weight basis and volume basis using four different saturating solutions.

		CEC	
REAGENT		me/100 g	me/100 cc
IN NH_4OAc (ammonium acetate)	pH 7.0	79.67	7.12
IN $Ba(OAc)_2$ (barium acetate)	pH 8.2	57.51	5.15
IN NaOAc (sodium acetate)	pH 8.2	47.64	4.11
IN $Ca(OAc)_2$ (calcium acetate)	pH 8.2	40.88	3.74

Notice on a weight basis thatch has a relatively high CEC but on a volume basis it is very low. This difference is due to the low bulk density (B.D.) of thatch. A soil will have a bulk density around 1.0 to 1.2 g/cc, but on the other hand thatch has bulk density values that have been measured as low as 0.12 g/cc. The volume measurement is more representative of the acutal CEC of thatch. Remember, a turfgrass plant grows in a volume of media not a weight of media. This may be an important consideration when receiving soil test results on samples containing a large amount of thatch. It may be more appropriate to make

interpretations on a volume basis than to take into account differing bulk densities of thatch and soil. Converting to a volume basis can be easily done by multiplying CEC and any other chemical measurement (phosphorous, potassium, calcium, etc.) by the samples bulk density. This conversion can be helpful in deciding one's fertilization needs.

Modifying the Thatch Layer

Excessive thatch accumulation is very undesirable due to the problems already mentioned. However, complete removal of the thatch layer may be impractical in some instances because it could result in the destruction of the turf.

Three studies were initiated to determine if the thatch layer could be modified by the incorporation of soil either by core cultivation (CC), vertical mowing (VM), or a combination of both. Core cultivation treatments were done at two intensities (1 or 3 times) with cores removed (NRI) or reincorporated (RI). Two of the studies were done on 'Penncross' creeping bentgrass, one in September of 1978 and the other in April of 1979. The third study was done in September of 1978 and a 'Merion' Kentucky bluegrass lawn.

Tables 2, 3, and 4 show the effect of cultivation on pH, organic matter (O.M.), bulk density (B.D.), CEC (me/100 g) and CEC x B.D. (me/100 cc). Incorporating soil into the thatch layer through increasing intensity of treatments resulted in changing its properties to reflect values closer to that of the underlying soil.

Table 2. The effect of soil inclusion on six properties of thatch and thatch-like derivatives for September-treated 'Penncross' creeping bentgrass.

Treatment[a]	Turf quality	pH	Organic matter (%)	Bulk density (g/cc)	CEC (me/100 g)	CEC·BD (me/100 cc)
Untreated	1.0 d[b]	6.27 c	55.83 a	0.260 h	63.10 a	16.40 e
1CC/RI	2.0 d	6.40 bc	28.50 b	0.320 g	56.30 ab	17.97 de
3CC/NRI	4.0 c	6.47 b	27.27 b	0.410 f	49.50 bc	20.27 bcde
3CC/RI	4.0 c	6.53 b	24.30 b	0.520 d	40.80 cd	21.17 bcd
VM	5.3 bc	6.57 b	28.30 b	0.443 ef	45.63 bcd	20.17 bcde
VM + 1CC/RI	5.7 b	6.50 b	24.80 b	0.463 e	41.77 cd	19.33 cde
VM + 3CC/NRI	6.3 ab	6.47 b	21.87 b	0.573 c	39.80 cd	22.63 bc
VM + 3CC/RI	7.3 a	6.77 a	14.57 c	0.740 b	33.03 ed	24.43 ab
Soil	--	6.90 a	6.73 d	1.200 a	23.47 e	28.17 a

[a]CC = core cultivation; RI = reincorporated cores; NRI = cores removed; VM = vertical mowed.

[b]Means within columns followed by unlike letters are significantly different at 5% level by Duncan's Multiple Range test.

Table 3. The effect of soil inclusion on six properties of thatch and thatch-like derivatives for April-treated 'Penncross' creeping bentgrass.

Treatment[a]	Turf quality	pH	Organic matter (%)	Bulk density (g/cc)	CEC (me/100 g)	CEC·BD (me/100 cc)
Untreated	1.0 d[b]	6.20 e	54.07 a	0.287 e	59.60 a	17.03 d
1CC/NRI	1.0 d	6.27 e	49.43 b	0.353 de	58.00 a	20.50 cd
1CC/RI	1.3 d	6.30 e	28.77 d	0.440 d	53.10 ab	22.70 bc
3CC/NRI	2.3 cd	6.27 e	39.60 c	0.420 d	50.10 b	20.97 bcd
3CC/RI	2.7 c	6.57 cd	25.50 de	0.650 c	38.67 c	25.13 b
VM	3.3 c	6.53 d	26.40 de	0.570 c	42.47 c	23.87 bc
VM + 1CC/RI	6.0 b	6.60 cd	24.57 de	0.550 c	41.47 c	22.97 bc
VM + 3CC/NRI	6.7 ab	6.67 c	23.87 e	0.543 c	42.73 c	23.07 bc
VM + 3CC/RI	8.0 a	6.80 b	17.30 f	0.843 b	29.70 d	25.00 bc
Soil	--	6.97 a	6.93 g	1.187 a	25.10 d	29.77 a

[a]CC = core cultivation; RI = reincorporated cores; NRI = cores removed; VM = vertical mowed.

[b]Means within columns followed by unlike letters are significantly different at 5% level by Duncan's Multiple Range test.

Table 4. The effect of soil inclusion on six properties of thatch and thatch-like derivatives for 'Merion' Kentucky bluegrass

Treatment[a]	Turf quality	pH	Organic matter (%)	Bulk density (g/cc)	CEC (me/100 g)	CEC·BD (me/100 cc)
Untreated	1.0 a[b]	6.63 b	81.50 a	0.140 f	80.57 a	11.27 e
1CC/RI	1.0 a	6.73 b	62.53 c	0.277 d	62.67 b	17.30 cd
3CC/NRI	1.0 a	6.60 b	57.00 c	0.263 d	63.97 b	16.83 cd
3CC/RI	1.0 a	6.73 b	34.93 e	0.437 bc	41.73 c	18.10 c
VM	1.0 a	6.73 b	70.70 b	0.203 e	70.47 b	14.33 de
VM + 1CC/RI	1.0 a	6.67 b	42.47 d	0.413 c	46.30 c	19.17 bc
VM + 3CC/NRI	1.0 a	6.67 b	58.00 c	0.277 d	64.63 b	17.80 c
VM + 3CC/RI	1.0 a	6.70 b	37.37 de	0.480 b	44.77 c	21.47 b
Soil	--	6.93 a	6.77 f	1.370 a	26.07 d	35.63 a

[a]CC = core cultivation; RI = reincorporated cores; NRI = cores removed; VM = vertical mowed.

[b]Means within columns followed by unlike letters are significantly different at 5% level by Duncan's Multiple Range test.

No longer is there a 'pure' thatch layer but a hybrid or a thatch-like derivative with properties intermediate between that of soil and thatch. Thus, by cultivation practices an improved growing medium can be achieved.

Poa Annua Invasion

It should be noted that the vertical mowing treatment had the vertical mower's blades set to the soil surface. This setting enhanced soil incorporation into the thatch. The cultivation treatments done had an effect of increasing Poa annua invasion into the turf (table 5). Timing and intensity are important considerations before implimenting these procedures. The more intensive the treatment the more Poa annua is seen and cultivating at the time of Poa annua germination will result in increased Poa annua pressure.

Table 5. Effect of mechanical renovation on Poa annua invasion for 'Penncross' creeping bentgrass.

Treatment	Poa Annua (%)	
	September 1978	April 1979
Untreated	0.0	6.3
1CC/NRI	-	5.0
1CC/RI	2.0	11.0
3CC/NRI	1.3	9.0
3CC/RI	2.0	18.3
VM	10.7	18.3
VM + 1CC/RI	16.7	23.3
VM + 3CC/NRI	15.0	25.0
VM + 3CC/RI	15.0	51.7

Conclusions

Thatch is a unfavorable growing medium but may be changed for the better by soil incorporation. Cultivation practices such as coring and vertical mowing are effective in accomplishing this task. There may be limitations on the intensity of treatment due to the effect on turf quality (tables 2, 3, and 4). These treatments seem practical for large areas of turf such as fairways, athletic fields and other large areas of turf. Cultivation treatments on creeping bentgrass sites such as putting greens are effective too, but may result in increased Poa annua invasion. Topdressing is a more viable alternative for incorporating soil into a thatch layer if Poa annua invasion is a concern and other factors are not (example: compaction problems). If Poa annua invasion is not a concern and the underlying soil a a favorable type, coring can be an effective and cheap way of topdressing.

Literature Cited

1. Beard, J. B. 1973. Turfgrass: Science and Culture. Prentice-Hall, Inc., Englewood Cliffs, N.J.

2. Hurto, K. A., and A. J. Turgeon. 1976. Characterization of thatch as a turfgrass-growing medium. Proceedings 17th Illinois Turfgrass Conference. College of Agriculture, University of Illinois at Urbana-Champaign. pp. 75-77.

3. Turgeon, A. J., K. A. Hurto, and L. A. Spomer. 1977. Thatch as a turfgrass growing medium. Illinois Research **19(3)**:3-4.