LANDSCAPE Guide MANAGEMENT

THATCH

A deep build-up of thatch above the soil surface can mean trouble to turfgrass managers. One of the nation's foremost experts on thatch tells readers what it is and how to get rid of it.

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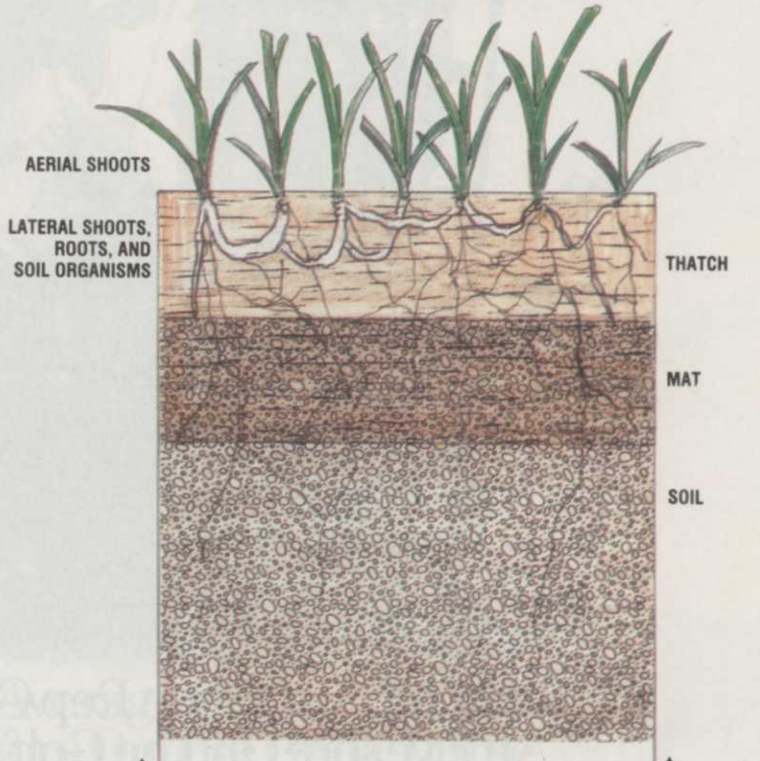
TURF SYSTEM



Soil organic matter may occur as largely indistinguishable additions to soil mineral matter, or as organic residues in or above the soil surface. The usually undecomposed, tightly intermingled layer of organic residue generated by the turfgrass community just above the soil surface is called thatch.

Causes of thatch

Clippings have been cited as a factor in thatch formation, so some people have advised removing clippings during mowing as a thatch-control measure. However, there is little evidence to support this observation. As a general rule, clippings decompose fairly rapidly, so they are not thought to contribute significantly to thatch formation.

If thatch is the result of an imbalance between the production and decomposition of turfgrass biomass, then any factor that either stimulates production without increasing decomposition, or suppresses decomposition without reducing production, would contribute to thatch formation. Using certain pesticides that inhibit earthworms and other decomposer organisms is a cause of thatch formation.

Thatch development has been observed in otherwise thatch-free turf following successive applications of chlordane, bandane and calcium arsenate. Earthworms were eliminated from these turfs, and various microbiological activities were suppressed.

Rapid thatch formation has also been observed on very sandy soils lacking earthworms and other macrofauna. Some extremely acid and/or highly compacted soils, also without earthworms, have been associated with substantial thatch accumulations. Thus, selecting a loamy soil with a slightly acid to neutral pH and teaming with earthworms and other beneficial organisms appears to be the best "preventive" control for thatch.

Where such soils are not available, various "curative" controls must be used. These will be discussed later.

Thatch formation

Thatch formation is not well understood. However, it probably begins with the net accumulation of turfgrass residues, originating as senescent leaves and/or stolons, at the soil surface. These residues are loosely arranged and thus do not, by definition, constitute thatch. However, they may be an important precursor to thatch (or they may simply be seasonal accumulations which will decompose or otherwise disappear).

The next probable step in thatch formation is the initial growth of turfgrass plant organs (roots, rhi-

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zomes and stolons) in the loosely arranged medium formed from the deposition of organic residues at the soil surface. What, specifically, triggers this type of growth is unknown. The author has observed adventitious roots arising from Kentucky bluegrass that appear much like the "prop" roots of corn plants. That is, they arise from aerial shoot nodes above the soil surface. The extent to which aboveground rooting may contribute to thatch formation, if any, is unknown.

Subsequent turfgrass growth results in the elevation of crowns above the soil surface to positions well within the thatch layer. This may be due to continued development of existing crowns associated with aerial shoots, or to the formation of new crowns from emerging rhizomes or other lateral shoots.

Crowns are compressed stems with little or no internode elongation. At the top of the crown is the growing point containing leaf primordia and, at the very top, an apical meristem. New leaves arise from the lowermost primordia; new primordia arise from cell division at the apical meristem. This also contributes to further development of the crown itself, as long as its associated shoot survives.

As organic debris is deposited, the crown may be allowed to continue developing to a position well above the soil surface. Then, roots emerging from the crown develop, at least initially, in the organic layer. Rhizome tips are pushed through the soil principally by internode elongation; once the tip encounters light, internode elongation ceases and a new crown begins to form. In a thatch-free turf, this occurs near the soil surface. In a thatchy turf, however, it occurs above the soil surface and in the thatch layer.

As in the previous example, roots and lateral shoots emerging from crowns may develop, at least initially, in the organic medium. This intimate association of living and dead plant material would, in all likelihood, contribute to the organic layer's stability. The layer would also come closer to fitting the definition of thatch given earlier: it would be "tightly intermingled" because of the binding effect of living roots and other plant organs residing therein. As older shoots and roots die, the crowns, roots, and lateral shoots may eventually grow mostly in the thatch, rather than in the soil. Thus, substantial thatch can be the primary growth medium for the turfgrass community while the underlying soil is of only secondary importance.

Characteristics of thatch

Thatch typically has a lower bulk density than soil. Since the soil underlying thatch may contain few roots or rhizomes, it tends to be more compacted than thatch-free soils in which these organs grow extensively. This illustrates the favorable effects of root and rhizome growth on soil physical conditions.

The thatch layer may contain some soil. Much of the soil may have been carried by earthworms to the turfgrass surface during the spring and fall. In intensively cultured turfs, soil can also accumulate in the thatch as a result of top-dressing, core cultivation and vertical mowing.

A valid soil test should include the thatch as part of the sample, and separate analyses should be conducted for the thatch and soil layers.

The effects of incorporating soil into thatch include: increased bulk density, increased nutrient and water retention, reduced pesticide leaching, and accelerated decomposition of the organic residues making up the thatch.

Since thatch is typically regarded as an organic medium essentially lacking soil, including soil into the thatch results in a thatch-like derivative (sometimes called mat) with entirely different physical and chemical properties. Physically, thatch is analogous to coarse sand in that it has large pores. This property means that thatch has better aeration than most soils, as well as better resistance to compaction under traffic. However, the large pores readily lose water to the underlying soil and evapotranspiration to the atmosphere.

An additional problem is that upward water movement stops at the thatch-soil interface where capillary pore continuity is disrupted.

Importance of thatch

Because of thatch's poor water-retention capacity, and also because of restricted rooting, thatchy turfs are especially prone to wilting during long droughts. When completely dry, thatch may become hydrophobic and thus repel water. Consequently, thatchy turfs generally need more irrigation than thatch-free turfs. The frequent waterings needed to sustain thatchy turfs during hot, dry weather tend to leach nutrients and pesticides through the thatch; thus, these materials have to be applied more often than would be necessary on a thatch-free turf. This condition is worsened by thatch's low nutrient-retention capacity.

When nutrient-retention capacity is expressed as the cation-exchange capacity (CEC) in meq per 100 grams of soil/thatch, the values for thatch may be relatively high compared to most soils. This is largely due to the low bulk density (BD) of thatch, typically 0.25 grams per cubic centimeter, compared to soil bulk densities that average in excess of 1.0 g/cc.

When CEC is expressed on an undisturbed volume basis (CEC*BD), these values provide a reasonable comparison of the relative nutrient-retention capacities of different media. The CEC*BD of thatch is typically much lower than that of a loamy soil. This, coupled with the large aeration capacity of thatch, accounts for soluble nutrients rapidly leaching through the thatch layer of many turfs. Selecting slowly soluble or slow-release nitrogen formulations reduces the nitrogen leaching potential and thus increases the efficiency with which turfgrass uses this nutrient.

Another problem associated with thatchy turf fertilization occurs because soil-testing laboratories routinely discard the thatch before testing samples (if, in fact, the thatch is received with the soil). If most of the turfgrass root system is confined to the thatch layer, the value of soil-test results in determining fertilizer requirements is questionable. A valid test should include the thatch as part of the sample, and separate analyses should be conducted for the thatch and soil layers.

Pesticides applied to thatchy turf initially contact the thatch, not the soil; thus, the mobility, metabolism and action of pesticides in thatch determine the efficacy, persistence and selectivity of these chemicals. Attempts to characterize pesticide activity based on studies conducted in soil media may lead to inaccurate conclusions when applied to turfgrass systems with thatch.

Field studies conducted at the University of Illinois showed that several pre-emergence herbicides were substantially more injurious to thatchy turf than to thatch-free turf. Corresponding laboratory studies showed that these herbicides were more mobile in thatch than in silt loam soil. Thus, the herbicides were allowed to contact the turfgrass roots and rhizomes in the thatch, but were held above these plant organs where they occurred in the soil in a thatch-free turf.

This work established two dimensions of potential turfgrass injury from pre-emergence herbicides: the inherent susceptibility of turfgrasses to injury from herbicides that contact their roots and rhizomes, and the accessibility of these plant organs to surface-applied herbicides due to the nature of the media containing these organs.

Control of thatch

There are two fundamental approaches to controlling thatch in turf. The first involves physically removing organic debris to directly reduce the amount of thatch. The second involves incorporating soil into the thatch either through recycling the soil contained in the turf-soil profile or through topically applying soil from a different location.

The first approach usually uses a vertical mowing machine, with knives or tines mounted along a rapidly rotating, horizontal shaft. The machine, when set to the proper depth of penetration, removes portions of the thatch. Where a substantial thatch layer exists, this procedure usually results in depositing large amounts of debris that must be removed from the site to avoid further turf damage.

Depending on the amount of thatch and the distribution of roots and other plant organs in the thatch-soil profile, this procedure can moderately to severely injure the turf. Thus, a long period of recovery and some replanting may be needed following vertical mowing to re-establish the turfgrass community. Furthermore, if the original cause of thatch development is not corrected, the thatch condition will probably re-develop.

The second approach—incorporating soil—can convert the thatch into a more favorable growth medium by modifying its edaphic properties. It can also promote the decomposition of organic residues making up the thatch.

Accomplishing the first objective depends on the thoroughness with which the soil is dispersed into the thatch layer. Depending upon the thatch layer's thickness and bulk density, some vertical mowing may be needed to reduce and/or open up the thatch layer and thus help the soil incorporation process. The second objective also depends on thoroughly incorporating soil into the thatch. However, as decomposition is a biological process, much more time is required to realize this effect.

As indicated earlier, the soil can be incorporated with screened soil applied as a top dressing and matted into the turf. Care should be taken to ensure that the top dressing soil is similar in texture to the soil underlying the turf, and that subsequent top dressings use the same or very similar soils.

A less expensive alternative is to recycle the soil from the thatchy turf. This is done by core cultivation and subsequent re-incorporation of the soil from the cores, or by deep vertical mowing to pull soil up and into the thatch layer.

Obviously, these cultivation methods will not produce results as uniform as top-dressing does; however, for large sites, they may offer the only practical means for effectively incorporating soil into the thatch. **LM**

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