Seeing Through the Thatch

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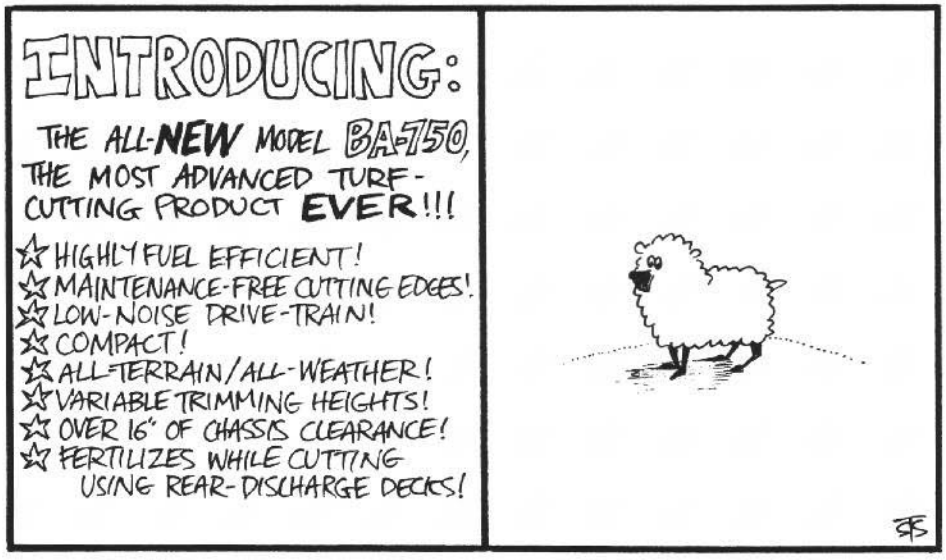
The USGA Green Section defines thatch as an accumulation of plant material at the soil surface, which, if left unchecked could develop into an undesirable mat. The American Society of Agronomy says differently. Thatch is a tightly intermingled layer of undecomposed living and dead organic material between the soil surface and the green portion of the plant. Some experts even go so far as to say that thatch consists of only dead material, not living. Still others describe thatch as the result of stem, crown, and root tissues high in cell wall lignin accumulating at the soil surface. Very confusing, right?

I began a thatch control study last fall, solely for the purpose of clearing up some of the murky waters surrounding thatch control. Like everything in life, I always thought a little was good, but a lot could be detrimental. The first reference to possible trouble with excessive thatch accumulation came in 1925, in the USGA Green Section Record, by O. B. Fitts, "If creeping bentgrass is allowed to grow through the season without topdressing, a loose, fluffy, or spongy turf will develop...a condition about which many complaints have been received."

Suddenly, I began to feel as though I were reinventing the proverbial wheel. Monthly topdressing applications were one of the treatments in my trial. I reasoned that over time, science and technology have come a long way, and we know much more about the environment that thatch exists in today, right? Wrong.

We know that a certain amount is desirable. Generally, 1/4" on a putting surface and 1/2" in a lawn or rough area is considered desirable. Thatch, if maintained at a desirable thickness, has many positive attributes. It increases wear tolerance, creates a built in cushion, and adds resiliency to golf course greens, which makes the ball "bite".

So, what's the problem? If the thatch layer becomes excessive, it can change the environment that the grass lives in. It can predispose the turf to other stresses, including disease and insect incidences. Heavy thatch layers can present a myriad of problems to the turf manager.



Thatch is a completely different growing medium than soil. It is highly porous, comprised mainly of large pores. Consequently, its water retention capacity is low, compared to a silt loam soil. By volume, it has a much lower cation exchange capacity than a typical silt loam soil. (Turgeon, 1979) Because of these two features, thatch has less ability to retain nitrogen after an urea application. Nitrogen can be lost to leaching in wet soils, and volatilized (converted to NH3) in dry soils.

The phenomenon of localized dry spots has also been associated with heavy thatch accumulation. (Carrow, 1979) When thatch becomes completely dry, it is very difficult to rewet.

On a putting green, excess thatch is oftentimes blamed for poor putting surfaces. It can produce an uneven and slow putting surface.

Kentucky bluegrass has been shown to be more wilt prone if heavy thatch layers are present. (Turgeon, 1979)

Among the most frightening problems thatch can present, is an increase in disease potential. Many diseases seem to thrive on thatchy turf. At the 1973 Wisconsin Golf Turf Symposium in Milwaukee, Dr. Malcolm Shurtleff, University of Illinois, said, "By holding moisture like a sponge, an excessive thatch layer provides an ideal microenvironment for the development of most disease-causing fungi." Fairy ring, *Rhizoctonia* brown patch, dollar spot, *Pythium*, *Helminthosporium* leaf spot and melting out, snowmolds, red thread, fusarium blight and leaf spots, have all shown a correlation with heavy thatch accumulations. (Turf Management, 1992)

Many turf specialists have associated *Pythium* blight with thatch accumulation. Research has indicated that *Pythium* populations in thatch were ten times greater than that of soil,

illustrating a strong potential for *Pythium* blight in thatchy turf. (Hall, Larson, and Schmitthenner, 1978)

Helminthosporium has been shown to produce large numbers of spores while growing on thatch. (Healy, 1968) There has also been a correlation found between thatch accumulation and *Helminthosporium* incidences.

Fusarium blight is often associated with thatch accumulation. The causal organism is capable of living off organic matter such as thatch. (Smiley and Craven, 1978) In addition, the disease has been shown to be more severe on turfgrasses under drought stress, a condition that is common with heavy thatch layers.

Like diseases, many insects are also influenced by accumulations of thatch. Typically, it is common to see strong correlations between surface inhabiting insects and thatch accumulations. Subsurface inhabitants, however, are usually unaffected by thatch accumulations. Again, as with many diseases, healthy turf is more likely to withstand an insect attack.

Surface inhabiting insects, including sod webworm, chinch bugs, adult billbugs, and armyworms are often more common in thatchy turf. The thatch layer provides an ideal overwintering environment, protecting the insects from the cold temperatures. Sod webworms may actually require thatch, as they are seldom a problem in thatch free turf. (Joyner, 1979)

While insects that live in the soil below the thatch don't seem to be influenced by thatch accumulations, the thatch may play a role in their survival. Thatch is notorious for tying up pesticides and preventing them from penetrating to the soil, making control difficult. (Turf Management, 1992)

So, a little thatch is good, and a lot of thatch is potential trouble. Just like I thought. But where does thatch come from, and why is it only a problem in some areas, and not others?

Thatch is created when organic matter is deposited faster than it can be decomposed. The environment, species of grass, and management practices all influence the rate of thatch development, in addition to the rate of decomposition

Kentucky bluegrass and creeping bentgrass are both prone to develop thatch, especially the improved varieties. By nature, these are spreading grasses, which produce rhizomes and stolons. Rhizomes and stolons require more energy to decompose because of high lignin content. Therefore, these grasses will have a tendency to accumulate more thatch than bunch type grasses.

Obviously, creating an environment that is suitable to the microfauna that consume thatch helps to prevent accumulations. Turf growing in wet, cold, acidic, very sandy, or heavy clay soils all tend to develop thatch. (Butler, 1979) The organisms that decompose thatch are inhibited by these adverse conditions.

Ideally, the pH of the thatch layer should be between 6.0 and 7.0. Thatch is naturally slightly acidic, which is not conducive to the microfauna that consumes thatch. Even O. J. Noer often advised an application of lime to reduce thatch accumulation on ailing greens. (Bengeyfield, 1987)

High rates of pesticide applications have been shown to cause heavy thatch accumulation, by limiting the micro- and macrofauna populations that consume thatch. A study conducted in Kentucky in the late 80's, revealed that earthworm populations decreased by 60-99% after a single application of the fungicide benomyl or the insecticides ethoprop, carbaryl, or bendiocarb. Significant effects of these pesticide applications lasted for 20 weeks. (Potter, Buxton, Redmond, Patterson, and Powell, 1990)

Whether or not fertility levels cause thatch remains to be seen. For every article that says excessive nitrogen causes thatch, another says there was no significant change in thatch accumulation, even at 20 pounds of nitrogen/1000 square feet.

While nitrogen will push excessive top growth, we know that leaf tissues are easily decomposed by microorganisms, which also require some amount of nitrogen as a food source. Generally, a 25:1 ratio of carbon to nitrogen is considered ideal. (Beard, 1973)

Management strategies that encourage root growth to rise to the surface correlate well to thatch accumulation. Whether that means growing turf on a heavy clay soil with lots of compaction or growing turf on sandy soils with improper irrigation techniques, roots will tend to rise to the surface of the soil.

The more we know about what causes thatch, the greater our ability to prevent thatch from building up in the first place. Irrigation schedules, mowing practices, and topdressing schedules all need to compliment each other in order to prevent thatch accumulations from becoming excessive.

Watering deep and infrequently encourages roots to grow deeper into the soil, rather than rise to the surface. This also helps to keep the disease potential in check, as overwatered turf areas are more prone to disease infestations.

Cultivation techniques, such as topdressing, core aerification, vertical mowing, and spiking, have been practiced for decades, all with some success. Each of these methods of control incorporates some soil into the thatch layer, thereby encouraging microorganisms. However, each of these practices needs to be done on a regular basis in order to get acceptable results.

So, are professional turf managers supposed to run out to the nearest bait shop to purchase night crawlers? Not quite. This is one of the reasons I began the thatch reduction study on a home lawn and a golf course fairway. There is an abundance of thatch reducing products available to the turf manager.

While some products claim to feed the microbial population, others claim

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to supply additional microbes, often found in thatch. With the unending supply of products available, it is difficult to know which ones work in our soils, and which ones don't. And what about aerification and topdressing? What role will cultivation methods play with these new products?

Thatch control is not a once a year project; instead it requires an integrated approach involving prevention, biological control, and mechanical removal. (Carrow, 1979) Some interesting results were published in 1995 by Dr. Rich Gaussoin, University of Nebraska, which indicated that aerification, in addition to some of the thatch degradation products, significantly reduced thatch.

Over the next three years, we will be replicating some of these same studies at O.J. Noer Turfgrass Research Facility and University Ridge Golf Course, and we hope to clear up some of the confusion surrounding the control and prevention of excessive thatch.

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