Cores, following aerification, showing thatch layer.

TOWN OF OAKVILLE

WHY YOU SHOULDN'T IGNORE THATCH

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Thatch is the intermingled layer of undecomposed organic material between the turf canopy and soil surface. It comprises living and dead plant tissue including shoots, stems and grass roots. The mat layer is the area of thatch mixed with soil, also found between the turf canopy and the soil surface, usually seen on golf course putting greens. It is often a result of frequent topdressing. Both thatch and mat are the subject of many turfgrass maintenance discussions and articles, primarily because excessive levels are responsible for a number of negative effects on the soil profile and turfgrass growth. Even with this wealth of information floating around, excess thatch continues to be an issue on a number of courses, whether on fairways, tees or greens. As such, this article will describe the effects of excess thatch, the factors that lead to its development and, most importantly, discuss preventative practices to reduce thatch levels.

What Does It Do?

Thatch and mat play an important role in cushioning the turf surface, improving wear tolerance, decreasing soil compaction and protecting the crown of the plant. However, when levels become excessive (usually more than 1.3 cm [0.5 in.], numerous issues can arise including:

- increased pest damage
- decreased water and nutrient retention
- reduced water infiltration
- decreased root health
- increased potential for localized dry spots
- reduced tolerance to extreme temperatures
- reduced efficacy of certain pesticides
- higher potential for scalping and crown damage

Thatch layers provide a haven for insects, weed seeds and overwintering structures of disease pathogens. The high organic matter content and large pore

Excess thatch layer

ADJACENT & TOP INSET, PAM CHARBONNEAU

space makes it ideal for the development of chinch bugs, sod webworms and cutworms. Diseases such as gray snow mold (*Typhula incarnata/ishikariensis*) and dollar spot (*Sclerotinia homoeocarpa*) are able to overseason in the thatch layer. In addition, root diseases such as summer patch (*Magnaporthe poae*) and take-all patch (*Gaeumannomyces graminis*) are more severe, due to overwintering and reduced stress tolerance. Stress-related diseases such as anthracnose (*Colletotrichum cereale*) have also proven more severe due to the decreased overall health of the plant.

Water movement is also negatively affected. When thatch layers become excessive, roots and rhizomes (horizontal stems) are restricted to those layers, likely because pore spaces are larger and easier to traverse. However, because of these larger pore spaces, water retention is quite poor. Over time, the plants suffer from drought stress; the roots are in the thatch layer, but the moisture is not. The lack of root growth in the soil layer beneath the thatch also reduces the porosity of the soil, often leading to greater bulk density. More often than not, areas suffering from excessive thatch for extended periods of time have compacted soil underneath. At this point, water infiltration is often reduced, as the water is trapped in the thatch layer and unable to penetrate the compacted soil. This further restricts root growth, as moisture is available only in the top layer beneath the plant; roots can get water without going any deeper.

If the thatch is allowed to completely dry out, water repellency can occur. Because thatch is primarily organic material, it is very difficult to re-wet after it has dried. This often leads to localized dry spots. This, in turn, causes increased runoff and wasted water, as well as drought. All of these factors damage both root and overall plant health. The roots remain shallow and more prone to drought stress, but are also more susceptible to temperature extremes as the large pore spaces cannot buffer temperatures as well as the soil layer.

Excessive thatch layers can also reduce pesticide and fertilizer efficacy. Many pesticides applied for weed, insect or disease management are organic in nature. Given the high organic matter content of thatch, pesticides can get bound in the thatch layers and not reach their targets. In addition, the microorganisms that break down thatch often break down the trapped pesticides before they have the chance to be effective. Fertilizers may also get stuck in the thatch layer due to decreased infiltration. They may be less effective for the plant because volatilization of certain nitrogen sources is found to be greater in excess thatch layers compared to soil.

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Excessive thatch layers can also reduce pesticide and fertilizer efficacy. Both can get stuck in the thatch due to decreased infiltration and not reach their intended targets. Excessive thatch can also lead to physical damage of the plant through an exposed crown or mower scalping.

Finally, an excess thatch layer can lead to physical damage of the plant either through an exposed crown or mower scalping. Thatch often raises the level of the crown, making it and the plant more susceptible to injury. In addition, the sponginess created by a thick thatch layer increases the potential for mower scalping due to bouncing of the equipment. Even if the plant is not scalped, the cut is often uneven, which compromises playability.

Where Does It All Come From?

Thatch develops naturally from the breakdown of the various parts of the turfgrass plant. Excess thatch builds up when the rate of production of plant material exceeds the rate of decomposition. Most often, plant material that does not easily decompose contributes to thatch layers – namely stems, stolons, rhizomes and root tissue. These tissues are highly lignified and therefore much more resistant to microbial breakdown. Leaf blades are about 80 per cent water and comprised primarily of cellulose, which is much more easily degradable than lignin. This is why, in most cases, leaving clippings on the surface will not significantly contribute to a thatch layer. However, if the rate of growth greatly surpasses the rate of decomposition, thatch can result from the senescence of any plant materials.

Factors that can contribute to thatch development include turfgrass species and cultivar, excess nitrogen fertility or irrigation, continual use of broad-spectrum pesticides, non-neutral pH levels and com-

pacted soils. Certain turfgrass species – including Kentucky bluegrass (*Poa pratensis*), creeping bentgrass (*Agrostis stolonifera*) and velvet bentgrass (*Agrostis canina*) – are more prone to developing excess thatch than others. Within these species, different cultivars have varying potential for thatch development. Newer, finer-leafed cultivars of creeping bentgrass such as the A and G series are notorious for building excess thatch layers in a relatively short period of time, as is velvet bentgrass. These species and cultivars are known for their dense growth, which produces more material than can be broken down by the microorganisms.

The effect of excess nitrogen fertility on thatch development is related to increased growth. When high amounts of quick-release nitrogen are added to turf, growth is often rapid, which leads to excess thatch formation over time. Excess irrigation, use of broad-spectrum pesticides and highly acidic or alkaline soils also lead to increased thatch development as they inhibit the microbial populations responsible for breakdown of the thatch material. Excess irrigation often leads to reduced oxygen in the thatch and soil, robbing the organisms of the oxygen they need to function. Overuse of broad-spectrum pesticides is also believed to reduce microbial population levels. Finally, most microorganisms function best at neutral pH levels (pH = 7.0); therefore highly acidic or alkaline soils decrease microbial activity and, subsequently, decomposition of thatch.

Soil compaction can result from excess thatch levels, but it may also contribute to thatch development. Highly compacted soils are resistant to root penetration and water infiltration and also have reduced pore space and subsequently oxygen availability.

As mentioned earlier, soil compaction can result from excess thatch levels, but it may also contribute to thatch development. Highly compacted soils are resistant to root penetration and water infiltration and also have reduced pore space and subsequently oxygen availability. All of these factors lead to shallow rooting and reduced microbial activity in the soil, both of which can lead to excess thatch formation.

What Can You Do About It?

Knowing the contributing factors is the first step towards prevention. Aside from species or cultivar choice, many daily maintenance decisions can affect the potential for thatch development.

- Use smaller amounts of nitrogen more often to discourage a sudden flush of growth. If large amounts are applied

only a few times throughout the season (typically the case on fairways), choose primarily slow-release nitrogen to avoid a surge of growth.

• Water turf deeply and infrequently to encourage deeper root growth and allow the surface of the soil to dry out periodically. This ensures adequate oxygen availability in the top layers of the soil.

• If you have highly acidic or alkaline soil, you can attempt to neutralize it with lime or an acidifying fertilizer. More often than not, however, the nature of the irrigation water is likely the cause of the imbalance, making any attempt to alter soil pH temporary. However, if thatch levels are already excessive, a temporary adjustment may be enough to allow for greater microbial degradation.

Although prevention is important, thatch levels will often increase over time even if you follow the above guidelines. At that point, more active maintenance methods are necessary to remove and prevent excess thatch. Numerous studies have looked at various thatch reduction practices, including core cultivation, vertical mowing, topdressing and the use of biological thatch controls. These biological controls often contain some natural bioactive ingredients and/or specific microbial populations aimed at organic matter decomposition. Unfortunately, their effectiveness is often erratic; one study showed no decrease in thatch levels compared to untreated plots.

On the other hand, core cultivation, vertical mowing and topdressing tend to disrupt the playing surface, a particularly important issue on putting greens. This is partly why thatch layers are allowed to accumulate to a detrimental level. Many superintendents would rather deal with thatch than member complaints. However, given the damage it can cause, superintendents would be well advised to take this issue seriously.

Core aerification improves soil quality by both removing thatch and opening up pore spaces in compacted soils. Very little surface area is actually affected by most


Water deeply and infrequently.

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Happy Fall!

core cultivation, so it is recommended this practice be done at least once per year (preferably twice) depending on other factors, including turfgrass species and cultivar. Vertical mowing involves slicing of the turf surface to remove underground material. Many superintendents prefer to lightly verticut or groom their greens to achieve the same results, as it has a less severe effect on playability. On greens, this practice may be acceptable to cut through stolons and prevent excess build-up, but research indicates water infiltration is significantly increased only through deep (~ 2 cm [0.8 in.]) vertical mowing two times annually, not with periodic grooming. Increased water infiltration was also observed with core cultivation; both thatch removal and increased soil porosity were achieved with this practice. Interestingly, topdressing alone was not found to significantly reduce thatch or increase water infiltration.

What's Next?

The Guelph Turfgrass Institute is currently conducting a rather extensive thatch reduction study on an established mixed green comprising creeping bentgrass, annual bluegrass and velvet bentgrass. Thatch levels at the onset of the experiment were ~ 2 cm (0.8 in.). Treatments include various diameter tines for core cultivation, solid tine cultivation, vertical mowing at different depths and topdressing. The study should be complete by the end of the 2009 season and I look forward to sharing the results.

The important thing to remember about thatch levels is that you need to monitor them each season since there are so many factors that can affect accumulation, including the weather itself. There is no doubt excess thatch is detrimental to turfgrass growth, regardless of what part of the golf course is affected. Although many thatch reduction maintenance practices are disruptive, a couple of weeks of less-than-ideal playing conditions is well worth it in the long run. Turf will be healthier and more stress-tolerant. Now if members start to complain, you'll have the knowledge to back up your decision. Once they understand the threat, the inconveniences may be a little easier to deal with.

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