

Relationship of Thatch to Disease and Insect Stress

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Most turf will remain trouble-free the first few years after establishment. A few problems may occur, but diseases and insects are actually minimal those first few years, especially on home lawns. The length of time from establishment to the time when problems begin appearing varies depending on such factors as soils, turfgrass variety, maintenance and environmental conditions.

One factor generally associated with older established turfgrass is thatch, but this does not imply that turfgrass without a thatch problem is always disease and insect free. Thatch free turfgrass may also have disease and insect problems but not to the same extent. A turfgrass with a severe thatch accumulation will generally have more disease and insect associated problems.

The influence of thatch accumulation on disease and insect problems actually makes sense when the condition of turfgrass and factors involved with disease and insect problems are considered. Heavy thatch accumulation causes the turfgrass to grow under a stress situation most of the time.

Heavy thatch often results in many of the turfgrass crowns and roots growing in the thatch layer rather than in the soil. Because thatch does not have the moisture holding capacity that most soils do, turfgrasses growing in it are more prone to drought stress. Since the turfgrass crowns and roots are elevated in the thatch layer, the turfgrass also becomes less tolerant to temperature extremes and more prone to traffic stress. In addition, the turfgrass will have fewer roots into the soil to receive nutrients it requires to remain vigorous. Pesticides

applied to a "thatchy" turf are generally rendered ineffective by the thatch.

Turfgrass in a weakened condition is more susceptible to disease and insect problems, while vigorously growing and healthy turf is better able to resist insect invasion or an attack by a disease causing organism. Healthy turfs can also tolerate higher populations of disease-causing organisms and insects without showing damage and recover from the damage more rapidly. Therefore, disease and insect problems occur when there is a susceptible host, a favorable environment, and a causal organism.

Host

The host, of course, would be the turfgrass. For an attack by a disease causing organism or insect to occur the host must be susceptible to that attack. Most turfgrasses are tolerant or resistant to a disease or insect problem to a certain extent but certain turfgrass species and varieties are more tolerant or resistant than others. This tolerance is minimized, if the turfgrass is in a stress condition, or if populations of the disease causing organisms or insects accumulate to damaging levels.

Thatch accumulations may be involved with both factors, of creating stress conditions and providing a place for disease causing organisms or insects to thrive.

Environmental Conditions

The resulting environmental conditions of heavy thatch is ideal for many disease causing organisms and insects. This thatch environment provides an excellent place for the turfgrass

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same system is cycled while, with topdressing, a foreign soil source is used. Core cultivation, then, can be regarded as a comparatively efficient procedure for cycling soil and converting thatch to an integrated medium which is no longer thatch, but a derivative similar to what Beard (1973) describes as mat.

Depending upon the thickness and density of the thatch layer, once over with a core cultivator may not be sufficient to convert thatch to a mat-like derivative. In some cases, it may be necessary to remove a portion of the thatch and open up the remainder via vertical mowing before proceeding with core cultivation. Each site will have to be examined and a suitable procedure determined. However, the objective is clear; only the method for accomplishing the objective is site dependent.

Evidence to date suggests that the results are highly beneficial. Reduced disease, improved water relations and aeration, reduced pesticide-induced phytotoxicity, and generally superior turf are obtainable where thatch modification, rather than removal, is practiced.

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crowns, stems, roots and even the foliage to be attacked. The moisture, humidity, nutrition, and temperature of the thatch layer make conditions more favorable for the growth of certain organisms, but not ideal for the growth of turfgrass. Therefore, disease and insect problems may occur more readily on thatch stressed plants.

Pest (or Pathogen)

The third factor involved in a disease or insect problem would be the presence of a disease causing organism or insect that is capable of inciting a problem. The thatch layer may provide an ideal place for the growth and reproduction of the pest, allowing pest population to increase to a damaging level.

The thatch layer offers protection for the pest. This is especially true when considering chemical control because thatch forms a barrier to penetration of certain pesticides used to control disease or insect problems. The pesticide is either unable to penetrate the thatch layer, or it is absorbed by the organic matter of the thatch, making control of diseases or pests futile.

It is a generally accepted assumption that as thatch increases, disease and insect problems also increase, but research documentation is sparse. Perhaps the reason for this is the difficulty of working with thatch in trying to establish a cause and effect relationship. Let's look at a few examples in the literature dealing with thatch and disease and insect problems.

Disease

It is believed that many of the facultative parasitic fungi that cause disease on turfgrass are favored by a thatch accumulation. Apparently these fungi are capable of living on dead or decaying organic matter (thatch) as well as upon live turfgrass. Therefore, thatch is an ideal growth media for the establishment of this type of pathogen. Within this group are such fungal pathogens as *Fusarium*, *Rhizoctonia*, *Helminthosporium* and *Pythium* species. An increase in the incidence of the diseases caused by these pathogens has been noted with an increase in thatch accumulation.

Pythium Blight: Many turf specialists have associated *Pythium* blight with thatch accumulation. Research by Hall, Larsen and Schmitthenner (3) indicated that populations of *Pythium* species in the thatch increased approximately ten times over that of soil, indicating that there is a potential for increased *Pythium* blight with thatch accumulation.

Helminthosporium Leaf Spot: Several researchers have shown a relationship between thatch and leaf spot. Healy (4) has shown that *Helminthosporium* species can produce large quantities of spores (inoculum) while growing on thatch. Thatch accumulation favored greater incidences of *Helminthosporium* leaf spot in studies conducted by Murray and Juska (5). Work by Colbaugh and Endo (1) indicated that thatch accumulations may favor or inhibit the incidence of *Helminthosporium* leaf spot, depending on the moisture condition of the thatch.

Fusarium Blight: *Fusarium* blight is another disease that is often associated with thatch accumulation. There seems to be some correlation, as it oc-

curs primarily on aged turfgrass (3 or 4 years old). The causal organism is also a fungus that can live off organic matter such as thatch. This disease has been shown to be more severe on turfgrass under a drought stress (2). Therefore, a greater potential exists for *Fusarium* blight to occur in turfgrass with a thatch accumulation. Recent research by Smiley (8) may indicate a somewhat different correlation between this disease and thatch. In this case, the thatch decomposition itself may be more important than the amount of thatch accumulation.

Control of Diseases: Disease control would depend on the pathogen and the chemical used. Some of the chemicals are held in the thatch layer, while others may leach through the thatch. The materials bound to the thatch may give better control to those organisms in the thatch, but, if the pathogen occurs on the foliage or within the soil, then these materials would not be as effective. So there could be differing effects depending on the specific disease and the type materials used. This is a relatively uninvestigated area which may explain some of the erratic fungicide responses.

Insect Problems

As with disease causing organisms, an increase in insect problems depends on the type of insect and how thatch may influence its activity. Thatch layers seem to make little difference on population of soil inhabiting insects. However, with surface inhabiting insects, thatch may have significant influence on their activity. Again, as with diseases, the turfgrass is better able to tolerate a population of insects when in a healthy condition. Therefore, if thatch is severe and causing stress, then the turf is more prone to insect damage.

Soil Inhabiting Insects: Thatch does not seem to affect the activity of soil inhabiting insects. These insects (grubs) cause problems on thatched turfgrass as well as thatch-free turf. Since these insects live in the soil, thatch does not affect their development.

Surface Inhabiting Insects: This group of insects includes the sod webworm, chinch bugs, adult billbugs, and army worms. Thatch provides an ideal habitat for the overwintering of these insects, as it gives protection from the low temperatures, which appears to be the only direct influence that thatch may have on these insects, with the exception of the sod webworm. Sod webworms survive best in the cover of thatch and are seldom a problem on thatch-free turfgrass. Sod webworms have real difficulty in surviving in bare soil, so thatch is very important to continued populations of these insects. Thatch does not appear to be as important with the other insects within this group.

Control: Control measures are affected by the thatch, as it inhibits the penetration of insecticides, not allowing the chemical to reach the soil below. Control of the soil inhabiting insects would definitely be less effective with a thick thatch cover (6). However, thatch may improve the effectiveness of control of insects that remain on the surface or within the thatch. Many of the insecticides are absorbed by the thatch, making them more likely to come in direct contact with the surface feeding insects (7).

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Changes in Management Needed Due to Thatch Accumulation

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The influences of thatch on turfgrass management are many. The effects of a layer of undecomposed organic matter no more than ¼ to ½ inch deep on irrigation practices and water availability can be noticeable. Also, serious disease and insect problems may be directly associated with thatch accumulation. Mowing, aerification and fertilization practices may be affected by thatch.

Thatch problems seem to become more evident when management is directed toward production of an excellent turf. In some instances thatch problems can be associated with low growing, dense, heavy organic matter producing cultivars. In other instances heavy thatch may be related closely to stoloniferous grasses or to those of a strong fibrous nature.

Heavy fertilization programs were thought to cause serious thatch problems. However, field observations do not necessarily bear this out. One fertility trial area that received up to 20 pounds of nitrogen per 1000 sq. ft. per year for several years developed no noticeable thatch. Thus, it became more and more evident that heavy thatch accumulation on many turf areas, even where management levels were high, was not "natural". Rather it resulted because of specific environmental conditions or management practices.

Turfs growing on soils that are wet and cold, very acid, sandy or heavy clay may have noticeable thatch accumulations. Whether such site conditions exist naturally or are caused by man - acid soils

from use of acid-forming fertilizers, or use of "pure" sand medias for athletic fields — they may contribute to thatch build-up. It is apparent that where these factors exist to cause thatch build-up, management, topdressing, aerification, dethatching or treating with a wetting agent to counter the problem will be needed.

For many years pesticides were widely used in the turfgrass industry with almost total attention given to the control of specific pests. Ultimately, field observations began to suggest that thatch problems were sometimes severe where pesticides had been used. Such observations indicated that it was time to begin long-term field investigations of some commonly used pesticides to determine if they contributed significantly to thatch problems.

The role of microorganisms, especially bacteria and fungi, in organic matter breakdown indicate that the routine use of fungicides might greatly influence thatch build-up. This has been substantiated in a recent report (5) that indicates that long-term fungicide programs can materially influence thatch accumulation. This investigation reports that the physical depth of noncompressed thatch was significantly greater following application of certain fungicides, but not others.

Another factor, earthworms, should be considered as it influences thatch accumulation. Some early work (3) that influenced pesticide use and thinking was summarized as follows.

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Another important aspect of thatch and control relates to the various organisms that live in the thatch. The thatch layer is an ideal environment for organisms that may reduce insect populations. There are many predacious insects, mites, and other animals in the thatch that feed on insects.

Certain fungi living within the thatch may also be involved in reducing insect populations, therefore, the thatch may in some cases, be helping the turfgrass manager.

Conclusion

It is apparent that thatch and its effects on disease and insect problems is complicated. It is not simply an increase in thatch and an increase in problems relationship. There are other factors involved making this area very difficult to study. However, it can be said that there is often a relationship between disease and insect problems and thatch accumulation. It can be further stated, that if thatch is causing turfgrass stress then the turf is more prone to disease and insect problems.

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