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 fiberous 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 affects 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.

LITERATURE CITED

1. Colbaugh, P. F. and R. M. Endo. 1974. Drought stress: an important factor stimulating the development of *Helminthosporium sativum* on Kentucky bluegrass. Proc. Second. Inter. Turfgrass Res. Conf. E. C. Roberts (ed.). American Society of Agronomy, Madison, WI pp 328-334.
2. Cutright, N. J. and M. B. Harrison. 1970. Some environmental factors affecting *Fusarium* blight of 'Merion' Kentucky bluegrass. Plant Disease Reporter 54:1018-1020.
3. Hall, T. J., P. O. Larsen and A. F. Schmitthenner. 1978. Survival of *Pythium aphanidermatum* in naturally infested *Agrostis palustris - Poa annua* golf course turfs. Proc. Am. Phytapathol. Soc. Phytopathol. News. 12:176.
4. Healy, M. J. 1968. Infection and development of *Helminthosporium sorokinianum* in *Agrostis palustris*. Phytopathology 58:273-276.
5. Murray, J. J. and F. V. Juska. 1977. Effect of management practices on thatch accumulation, turf quality and leaf spot damage on common Kentucky bluegrass. Agron. J. 69:365-369.
6. Niemczyk, H. D. 1977. Thatch: a barrier to control of soil inhabiting insect pest of turf. Weeds, Trees and Turf 16:16-19.
7. Niemczyk, H. D. 1978. Personal Communication.
8. Smiley, R. W. and M. M. Craven. 1978. Is *Fusarium* blight of Kentucky bluegrass an Abiotic disease? Presented at the 70th Annual American Soc. Agronomy Meetings. Chicago, IL, Dec. 3-8, 1978.

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"Use of certain pesticides over a 3-year period caused a marked build-up of plant debris (thatch) of 'Kentucky' bluegrass (Poa pratensis L.) turf above the soil surface. Applications of the chlorinated hydrocarbon insecticides, dieldrin and chlordane, resulted in a thatch layer of 20 mm or more. The use of the carbamate insecticide, carbaryl, caused an average thatch thickness of 1.3 mm. The plots that received no insecticides or the mercuric fungicide, phenyl mercuric acetate (PMA), had no measurable thatch. The thatch depths were closely associated with plant debris weight.

In this study as the number of earthworm burrows increased, the amount of thatch decreased. Where earthworms were present to any extent, thatch was virtually non-existent. This research reitereated that earthworms are important agents in organic litter decomposition. Earthworms can influence decomposition in several ways. Among these are organic debris breakdown, giving greater surface area for increased microbal activity; they also mix organic litter with the soil.

It should be noted "that where earthworms flourish the amount of organic matter they consume is limited by the availability of supply rather than their capacity to ingest it" (4). Thus, it seems that increased organic matter production — through the use of more fertilizer and faster growing cultivars, may be offset by earthworms to the point that thatch build-up would be little, if any. Also, other benefits from earthworms such as their burrowing, which considerably improves soil aeration and drainage, should be noted.

In the early 1970's pesticide influence on earthworm populations and associated thatch problems began to be considered more often by turf professionals. Earthworm control recommendations were deleted from many published turf pesticide recommendation lists. A critical evaluation of whether or not earthworm control was necessary or desirable began to receive more attention. Earthworms on golf greens are often considered undesirable. However, many different kinds of earthworms and macrofauna occur in the soil, and many of these could be desirable, even on golf greens. Generally, a rough soil surface caused by earthworms ("night crawlers") is most common in areas of low soil fertility and shade. Proper fertilization, use of better cultivars and shade reduction are possible means of developing a better cover over the casts to reduce or elminate the rough surface problem.

Since research (3) had indicated that certain turf insecticides might induce thatch, it seemed possible that other type pesticides might also cause a thatch. A few turf pesticides, especially of the 1960's and early 1970's had dual use. For example, an insecticide might be used at a very heavy rate for crabgrass control. Also, long term pesticide use, often at high rates, might be expected to reduce earthworm populations and cause thatch accumulation. Consequently, investigations (6) were undertaken to study the influence of six preemergence herbicides (bensulide, calcium arsenate, DCPA, bandane, siduron and benefin: on thatch accumulation. This work revealed that in the fall following 2 successive spring applications, thatch had accumulated to a depth of 1.4 cm (.6 in) where calcium arsenate had been used, and to 2.1 cm (.8 in) where bandane had been used. No thatch had accumulated from the use of the other four herbicides. Also of interest in this study is the fact that "essentially no thatch accumulation was observed following the first series of herbicide treatments". This observation could help explain the lack of close association of pesticide use with thatch development.

In another report (7) it was noted that four annual applications of the six preemergence herbicides mentioned above had thatch accumulations only in bandane and calcium arsenate treated plots. Samples taken from the plots treated with bandane and calcium arsenate revealed no earthworms; whereas, there was no great difference in earthworm counts made in plots treated with the other materials or in areas not receiving treatment.

It has been reported (2) that "annual applications of insecticides to bluegrass turf over a three-year period did not create a thatch build-up. Diazinon, Gardona, trichlorfon (Dylox), fenthion (Baytex), and carbaryl (Sevin), were investigated in this study. It was also noted that when dieldrin and chlordane were applied 3 times a year over a 5 year period insecticide levels in the thatch layer were very high as compared to that in the soil.

It appears that adequate research has been done to demonstrate that certain pesticides may induce thatch. Also, thatch has been observed to accumulate rapidly where earthworms were not present. However, it has been noted (5) in a report that "thatch accumulation was not considered to be due to inhibitory effects of fungicides toward earthworms".

With these aspects in mind, it appears that thatch problems could sometimes be reduced or perhaps eliminated by using pesticides that have not demonstrated a significant influence on thatch development. More testing to determine the influence of existing and experimental turf pesticides on thatch development could provide useful management information for professional turfmen.

Some of the pesticides used in the past appear to cause long-term turf problems by influencing thatch accumulation. One area, where pesticides were applied some 20 years earlier, had distinct thatch accumulation; whereas, adjoining untreated areas had none. In this area, thatch was associated with a serious winter drought or desiccation problem.

Activated charcoal has been useful in inactivating certain pesticides, and certainly more research is needed on "turning-off" pesticides. Removal of thatch and working the soil might remove or dilute pesticides to the point where earthworms might reinfest, or be introduced into the soil. More work is needed on this possible means of thatch control. However, some work in this general area has already been done. It was reported (1) that where earthworms had been introduced the surface mat as a discrete layer disappeared.

LITERATURE CITED

1. Barley, K. P. and C. R. Kleinig. 1964. The occupation of newly irrigated lands by earthworms. Aust. J. Sci. 26:290-291.

2. Randell, R. 1972. Relationship of thatch to insecticides used for turf. 13th Ill. Turf. Conf. Proc. p 19.

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Integration of Control Methods Necessary to Prevent Thatch Buildup

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Excessive thatch accumulation results in degradation of turf and increases maintenance. Turfgrass cultural problems associated with thatch are: (a) greater susceptibility to heat, cold, and drought stress, (b) localized dry spots, (c) increased insect and disease incidence, (d) scalping, (e) reduced effectiveness and penetration of fertilizers and pesticides, (f) more wilt, (g) greater iron chlorosis, and (h) increased time, labor and money to maintain an acceptable turf.

Thatch control is not a once a year project. Instead it requires an integrated approach involving prevention, biological control, and mechanical removal. Each of these aspects requires a basic understanding of how thatch forms and how it is decomposed.

Prevention

Thatch develops in turfs because shoot growth results in organic matter accumulation at a faster rate than decomposition occurs. One approach to thatch control is to reduce accumulation by restricting excessive shoot growth. Factors which contribute to unnecessary shoot growth are discussed below.

Vigorous turfgrass cultivars: Turfgrass species and cultivars utilized for recreational turf are often vigorous. While this characteristic is important for persistence and recuperation from use, it also promotes rapid tissue production. Where feasible, the turf manager should use cultivars less prone to thatch development.

Excessive nitrogen fertilization: Thatch consists of an intertwined layer of living and dead stems, rhizomes, stolons, leaves and roots of grasses. Adequate nitrogen is required for acceptable turf quality and recuperative potential; however, excessive nitrogen increases shoot production which contributes to thatch accumulation.

Excessive irrigation: Applying excessive irrigation enhances shoot production and therefore results in thatch buildup.

Mowing and collection of clippings: Thatch accumulation can be reduced in bermuda and zoysia turfs by mowing closely. This retards total shoot production. For cool season turf, clipping removal has little influence on thatch accumulation since the leaf tissues easily degrade. Clippings contribute more to thatch buildup in bermuda and zoysia. Removal will aid in preventing thatch in these turfs; however, clippings only contribute 15-25% to the thatch.

Biological Control

The decomposition process for thatch normally involves digestion and mixing with soil by earthworm and insect activity. At the same time fungi, bacteria, actinomycetes and other microorganisms are active in decomposing various constituents within the thatch. Any factor which interfers with this natural decomposition pathway will enhance accumulation.

Promoting microorganism activity: Degradation will occur at a rapid rate if microenvironmental conditions within the thatch are suitable for a large, balanced microorganism population. The primary environmental variables influencing microorganisms are moisture, aeration, temperature, pH, organic matter, and inorganic nutrient supply. When a turf manager topdresses with a well-composted topdressing mix, he is adding microorganisms to the soil. However, more importantly he is changing the microenvironment to favor sustained microorganism activity. With topdressing soil well intermixed with thatch, moisture retention is improved. Also, due to a denser and moister environment temperature, variations are decreased. Thus, improved moisture and temperature conditions aid in maintaining an active microorganism population within the thatch.

Thatch and its decomposition products consist of a wide variety of organic compounds. To adequately degrade such a diverse assortment of compounds requires a very diverse microbial population including fungi and bacteria. Thatch tends to become acidic even if the underlying soil is alkaline. Exception to this would be if irrigation water is alkaline. When the thatch pH reaches 6.0 or less many bacteria involved in decomposing resistant components of thatch are no longer active. Thus, a light application of lime to keep the thatch

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3. Randell, R., J. D. Butler, and T. D. Hughes. 1972. The effect of pesticides on thatch accumulation and earthworm populations in Kentucky bluegrass turf. HortScience 7:64-65.

4. Satchell, J. E. 1967. Lumbricidae, Soil Biology. A. Burges and F. Raw (ed) Academic Press, N.Y.

5. Smiley, R. W. and M. M. Craven. 1978. Fungicides in Kentucky bluegrass turf: Effects on thatch and pH. Agron. J. 70:1013-1019.

6. Turgeon, A. J., T. D. Hughes, and J. D. Butler. 1972. Thatch accumulation in bluegrass after applying preemergence herbicides two years. 12th Ill. Turf. Conf. Proc. p 19-20.

7. Turgeon, A. J., R. P. Freeborg, and W. N. Bruce. 1975. Thatch development and other effects of preemergence herbicides in Kentucky bluegrass turf. Agron. J. 67:563-565.