Biological Turf Restoration

Carol W., Wilson and Hyung-Ki Kim*
M.S. University of Wisconsin and Missouri USA
Vice President-A&V, Incorporated, Sussex, Wisconsin USA
President-H20 Chemists, Inc.
***Department of Feed & Nutrition Science,**
College of Animal Husbandry,
Kon-Kuk Unversity*

SUMMARY

There is a growing concern in the United States over the environmental and human health implications associated with heavy use of water, pesticides, and inorganic ferilizers in maintaining picture perfect golf courses. There is also a growing awareness that a beautiful course is not necessarily a healthy course. The following discussion reviews the interrelationship of turfgrass and the soil that supports it and provides basic information on currently available alternatives to turf management practices that feature intensive application of inorganic fertilizers, water and pesticides.

Soil is a dynamic natural environment in which microorganisms play an important role. Soil contains a large mass of microorganisms which produce thousands of enzymes that can catalyze the transformation and degradation of many organic molecules. (In top soil under optimum conditions may contain 10 billion cells per gram of soil.)

Turfgrass and the soil which supports it are interdependent. The natural organic cycle as applied to turf and soil begins with healthy vigorous grass plants storing up the sun's energy in green plant tissues as chemical energy. Animals obtain energy by eating plants and when plants and animals die, their wastes are returned to the soil and provide "food" for soil microorganisms. In the next step of the organic cycle soil microorganisms break down complex plant tissues into more basic forms and make the nutrients available to grass roots. Finally, growing plants extract the available nutrients from the soil. By free operation of this organic cycle, natural grasslands have some of the most fertile soils on earth.

1. Chemical Turf Management

Under current chemical turf management practices turf is watered intensively and inorganic fertilizers are applied heavily. This results in green but fragile and vulnerable turf. Fragile and vulnerable turf leads to the need to apply heavy doses of pesticides. Together, these result in a greater need for watering more frequently and for applying more inorganic fertilizers. Thatch is a build up of both living and dead grass roots that occurs in turf that has been subject to intensive chemical fertilization programs. Thatch usually takes 4 to 5 years to develop. When thatch forms, mechanical dethatching and mechanical aeration are usually required.

2. Overall Effects of Chemical Treatment on Turf

Applications of inorganic fertilizers cause grass roots to accumulate at the surface of the soil because they need not penetrate to seek nutrients. Thatch develops and reduces both moisture retention and absorption of nutrients. Reduced nutrition lowers the resistance of turf to disease and pests. Unless the turf is watered more frequently, it will brown out. Mechanical dethatching and mechanical aeration fraumatize grass plants further.

3. Overall Effects of Intensive Chemical Treatment on Soil

Soil looses the channeling and aeration benefits of healthy turf roots when roots accumulate at the surface. Contaminants from inorganic fertilizers build up in the soil and form salts that create a hostile environment for soil microorganisms. In addition, soil microbes are affected by heavy doses of pesticides. The formation of thatch causes underlying soil to compact, further affecting moisture retention. Soil pH may be affected, and decomposition of plant tissues ceases. Complex nutrients remain tied up and unavailable to plant roots. Lifeless depleted soil results. In essence the entire natural cycle is interrupted.

4. Turf Diagnostic

To determine if a specific area of turf is a candidate for biological restoration, cut a 4″ to 6″ deep triangular core from the turf with a knife or spade after a good soaking rain or a heavy sprinkling. Check the core for the following items: depth of moisture penetration, depth of root penetration, soil compaction, thatch formation. If roots are collecting at the surface, if the soil underneath the roots is compacted, or if thatch has formed, the turf being tested is a prime candidate for biological turf restoration.

5. Biological Turf Restoration

Rebuilding depleted soil and reconditioning turf is a gradual process-expect biological restoration to take 1 to 2 years. At present there are 3 categories of products commercially available: biological stimulants, biological fertilizers, and biological dethatchers. In varying stages of commercial development and testing are a number of varieties of biological pesticides and biological weed killers. For example, at Iowa State University studies have shown that corn gluten, when applied in the

spring will reduce emergent crabgrass by over 50% and also curb pests.

Biological stimulants are usually formulated with organic nutrients, enzymes, and biodegradable surfactants. These products are intended to stimulate existing microbes in the soil or microbial additives that are being used to recondition the soil. Biological stimulants, by virtue of microbe stimulation and the addition of soil wetting agents, conditions the soil to increase moisture retention and reduce soil compaction. Biological stimulants may be used with inorganic fertilizers and pesticides as well as with organic and biological fertilizers. Biological stimulants tend to reduce the amount of either type of fertilizer required. Biological stimulants are also intended to improve turf resistance to disease and therfore decrease the amount of pesticides required. Finally, biological stimulants improve moisture retention so that less frequent watering is required. The net result is that biological stimulants will make grass stay green longer, and make it more resistant to pests and disease.

Biological fertilizers contain organic nutrients. Some biological fertilizer products also contain soil microorganisms to replace those lost or weakened through chemical treatment. Biological fertilizers cannot be used in conjunction with inorganic fertilizers. Frequently, biological fertilizers are used in conjunction with biological stimulants. When used in combination, biological stimulants will jump start the biological fertilizer effects.

Initially, biological fertilizers should be applied every 60 days for the first growing season. Thereafter, they should be applied only in the spring and fall. Application rates of biological fertilizers vary but most are applied at a rate of 2~4 pounds(0.91kg to 1.8kg)per 1000 square feet (93 square meters). Application rates of biological stimulants also vary but a typical application rate would be 2~4 liters per 10,000 square feet (929 suqare meters) diluted with 25~50 parts water to apply.

Biologycal dethatch products contain organic nutrients, enzymes, and sometimes microbial cultures to assist in degrading thatch. Thatch build up is very difficult to remove by biological means. On the otherhand, use of a bioloical dethatch product or a biological fertilizer with microorganisms will significantly reduce the formation of new thatch following a mechanical dethatching.

6. Points to Remember in Implementing a Biological Restoration

1. Begin after a mechanical thatch removal and mechanical aeration to speed the restoration.
2. Allow at least 4 weeks between application of inorganic fertilizers(or 2 weeks for pesticides) before beginning with biological fertilizers.
3. No walting is required between the application of inorganic fertilizers and biological stimulant products.
4. Apply biological fertilizers when the average temperature is 58℃ or more.
5. Leave grass clippings on the turf to recycle the nutrients stored up in the grass plants.
6. Apply chemical weed control and pesticide only when absolutely necessary.

7. The Results of Biologycal Restoration

New thatch will not form under a biological turf management program. Microorganisms will

release enzymes to degrade and neutralize contaminants that have built up in the soil and soil will loosen up and open up again. Improved soil moisture retention will reduce the need for sprinkling. Biological activity in the soil will resume, and chemical balance will be restored to the soil. Turfroots will penetrate deeper and a dramatic improvement in growth and vigor of turf will result. Finally, the turf will retain its green color longer and be mere resistant to disease and pests under a biological treatment program.

Literature Cited

1. Alexander, M. 1961. Introduction to soil microbiology. John Willy & Sons, Inc., New York, p.472.
2. Burges, A., and F. Raw (ed.). 1967. Soil biology Academic Press, New York, p.532.
3. Clark, F.E. 1957. Living organisms in the soil. In soil Yearbook Agr. US Govermeit Pringting Office, Washington. p.157-165.
4. Couch, H.B., and J.R. Bloom. 1980. Influence of environment on diseases of turfgrasses. Phytopathology 50:761-763.
5. Daniel, W.H., and E.C. Roberts. 1966. "Turf mnagement in the United States." Adv. in Agron. 18:259-326.
6. Liebig, G.F.Jr. 1966. Aresenic. In "Diagnostic criteria for plants and soils". Univ. of California Div. of Agr. Sci.
7. Musser, H.B. 1962. "Turf management". McGraw-Hill, New York.
8. Rhode Island Agriculture Experiment Station. 1957. Sponginess in Turf. In Rhode Island Agriculture 4(1):5.
9. Russell, E.W. 1961. Soil contitions and plant growth 9th ed. John Wiley & Sons, Inc., New York, p.688.
10. Tronghton, A. 1957. The underground organs of herbage grasses. Bull, No. 44. Common wealth Bur. of Pastures and Field Crops. England, p.163.