CULTIVATION EFFECTS ON TURF AND SOIL

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Two major concerns in turf management are soil compaction and thatch. Soil compaction results in a number of harmful effects such as reduced aeration, drainage, turf quality and tolerance to environmental stress. Thatchy turfs can be more susceptible to scalping, environmental stresses and certain disease and insect problems. Cultivation is one important management tool which the turf manager can use to deal with compaction and thatch problems. This two part report summarizes briefly some results from our ongoing turf cultivation research.

Part I

This study dealt with soil compaction and hollow and solid tine cultivation effects on shoot tissue and thatch development on a creeping bentgrass green. Treatments were no cultivation (check), hollow tine (HTC) and solid tine cultivation (STC). These three treatments were applied under noncompacted and compacted soil conditions. Cultivation treatments were applied once in 1984 and three times in 1985 and 1986 for a total of seven applications using a Ryan's Greensaire using 1/2 inch tines. Compaction treatments were applied with a Ryan's water filled vibrating roller on weekly basis during all three years. Shoot/thatch plugs were taken in November 1986. Aerial shoot tissue and thatch were separated and ashed at 600 degrees C to determine organic matter content.

Table 1 displays the weights of shoot tissue and thatch found in November, 1986. Compaction treatments surprisingly produced no effect on shoot tissue while thatch organic matter content was increased. The latter could be a result of periodic oxygen stress and reduced surface area in the compressed thatch layer which would inhibit the decay of organic matter.

The two cultivation treatments differed dramatically in their effects on shoot tissue and thatch contents. HTC decreased shoot tissue (likely due to the physical removal of turf with the soil cores and resultant injury) and increased thatch organic matter contents when compared to STC. The latter response was attributed to soil incorporation into the thatch layer with HTC.

If thatch accumulates it can become the predominant growing medium for stolons, crowns and roots. This type of growth medium can be extremely susceptible to environmental stresses. Modifying thatch with soil incorporation has several positive effects on the turf. Soil incorporation can act as a buffer and reduce the duration and intensity of certain stresses. Increasing the soil content of the thatch will result in soil covered crowns, stolons and roots growing in the thatch layer. The soil will provide protection against extremes in temperature and moisture and reduce mower scalp. These improved environmental conditions in the thatch can increase surface root activity. A more active root system at the surface will improve nutrient utilization within the thatch layer.

Part II

This study focused on the ability of several cultivators to loosen a compacted soil. Treatments were applied September 5, 1986 on a Michigan State University intramural field. The three cultivators used in this study were the Aer Way, Toro and Verti-Drain units. The Aer Way unit creates a triangularly shaped slot in the soil with the tip of the triangle reaching approximately the 4.5 inch soil depth. The Toro unit utilized 5/8 inch diameter hollow tines which penetrated to the 3 inch depth. The Verti-Drain unit tuilized hollow and solid tines on 2.5 and 4 inch spacings. Soil penetration varied from 6 to 9 inches with Verti-Drain cultivator. Soil resistance measurements were taken on September 19, 1986 with a soil penetrometer.

The Aer Way unit was limited in its ability to significantly loosen the soil surface 4 inches. This was due to the relatively wide spacings of tines on the Aer Way cultivator. Several passes over an area would be necessary with the Aer Way unit for it to effectively alleviate soil surface compaction. The Toro aerifier provided significant loosening of the surface 3 inches of soil, as a result of the close tine spacing. Neither the Aer Way or the Toro unit provided significant soil loosening beyond the 3 inch soil depth. The Verti-Drain unit equipped with hollow tines was the most effective treatment in loosening the soil. Soil disruption was detected at the 8 inch depth with hollow tines and the 7 inch depth with solid tines as measured with the soil penetrometer. The 2.5 inch tine spacing on the Verti-Drain unit tended to have lower soil strength values than the 4 inch tine spacing, however, this was not statistically significant.

These results demonstrate the need to evaluate your particular compaction problem and equipment capabilities. Soil surface compaction can be adequately managed with standard cultivation equipment which will penetrate through the compacted soil zone. Aerifiers with widely spaced tines will require more than one pass to adequately modify the soil surface. Subsurface and/or deep soil compaction can be affected only by using equipment which will penetrate to deeper depths. Utilization of aerifiers which reach different depths could be a creative means of loosening deeply compacted soils. This research will be continuing.

Table 1. The influence of compaction and cultivation on the organic content of aerial shoot tissue and thatch in November, 1986.

	Shoot Tissue	Thatch
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Noncompacted Soil (NC)		
Check	5.0	3.8
Hollow Tine (HT)	3.1	5.3
Solid Tine (ST)	4.8	3.9
Compacted Soil (C)		
Check	4.7	4.6
Hollow Tine (HT)	3.2	5.6
Solid Tine (ST)	4.6	4.3
Comparisons		
NC vs C	NS	*
HT vs ST	**	**

ns, * and ** refer to no significance and significant at the 0.05 and 0.01 level.