CULTIVATION PRACTICES FOR COMPACTED SOILS

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Compaction of soil results in many undesirable effects such as reduced soil aeration, water infiltration and percolation. These soil responses to compaction can reduce turf shoot and root growth which leads to lower turf quality and tolerance to environmental stresses.

Soil porosity can be divided into two major types of pores; macropores and micropores (also referred to as non-capillary and capillary pores, respectively). Macropores are the large soil pores which govern the rate of water infiltration and percolation and the soil aeration status. Additionally, macropores are the channels through which plant roots explore the soil. Micropores are responsible for the soil's water holding capability. In general, compaction of soil reduces the amount of macropores with a concomitant increase in micropores. Thus, soil compaction creates a chronically "wet" soil with poor aeration and conditions for root survival.

Cultivation is one cultural practice the turf manager can use to alleviate poor soil conditions associated with compaction. Cultivation attempts to create large soil voids and loosen the soil profile. The channels left behind will enhance water infiltration and provide avenues for root extension into deeper portions of the soil profile.

Figure 1 displays the effect of several soil cultivators on the soil strength of a Michigan State University athletic field. Three cultivators were used in this study; the Aer Way aerifier, Toro aerator, and Verti-Drain aerifier. The Aer Way unit creates a triangular shaped slot in the soil with the tip reaching 4 to 5 inches deep. The Toro unit, utilizing 5/8 inch diameter tines, penetrated to the 3 inch depth. The Verti-Drain unit, equipped with hollow and solid tines on 2.5 inch spacings penetrated to the 6 and 9 inch depth, respectively. Cultivation treatments were applied on September 5, 1986 with one pass over and soil resistance (hardness) measurements were taken with a soil penetrometer on September 19, 1986.

Due to the relatively wide spacing of tines on the Aer Way unit this cultivator was limited in its ability to loosen the soil profile. In contrast, the Toro aerator provide significantly greater loosening of the soil surface 3 inches due to closer tine spacing. To achieve similar reductions in soil strength the Aer Way unit should be operated more than once over a field. Neither the Toro or the Aer Way unit produced soil loosening below the 3 inch depth. The Verti-Drain unit provided the most dramatic loosening effect on the

soil profile. Soil disruption was detected at the 8 inch depth with hollow tine treatment and the 7 inch depth with solid tines.

These results indicate the necessity for turf managers to evaluate their particular soil compaction problems and equipment capabilities. Soil surface compaction (3 inches deep or less) can be managed with equipment which penetrate through the compacted soil zone. Cultivators with widely spaced tines may require several passes to sufficiently breakup the compacted surface zone. Ideally, coring holes should be spaced no greater than 3 inch apart on highly compacted sites. Deep soil or subsurface compaction can be managed adequately with deep tine cultivators which will penetrate and disrupt those compacted zones, such as the Verti-DRain unit.

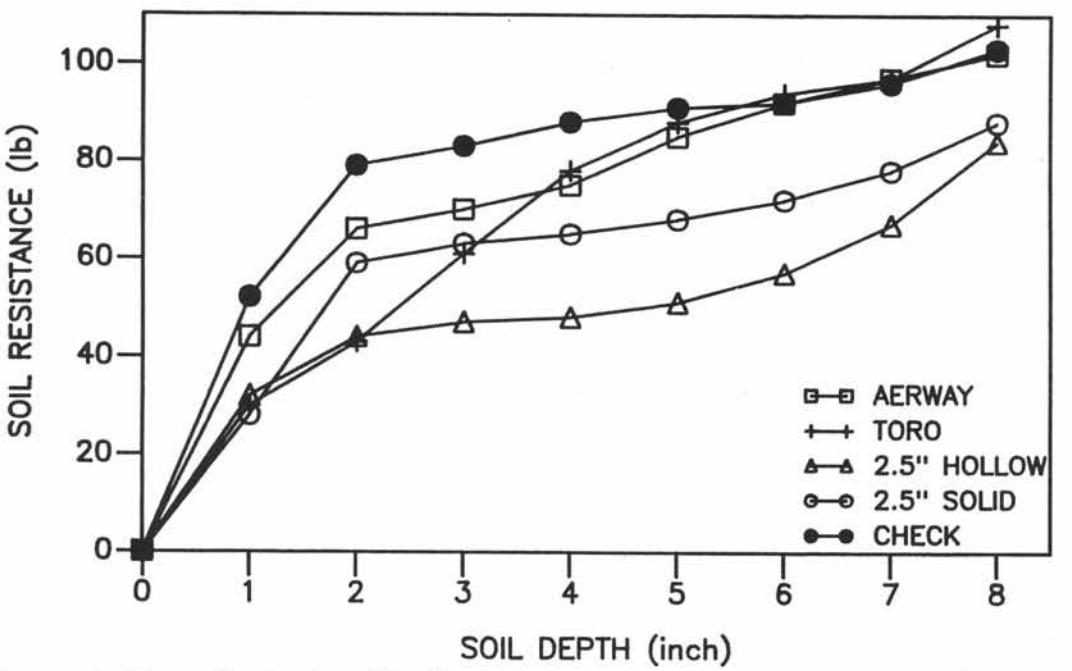

Figure 1. The effect of cultivation on the soil strength of an athletic field.

Table 1 presents turf visual quality data from a cultivation study on a "Ram I" Kentucky bluegrass turf. The cultivators used were the Toro aerator, Coremaster unit, and Verti-Drain unit. The Toro unit was equipped with 5/8 inch diameter hollow tines and penetrated to the 2.75 inch depth. Three treatments frequencies were performed with the Toro aerator; a September only, September-May, and September-May-