

THE CHAIN REACTION OF SOIL COMPACTION

By Dr. Gil Landry, Jr.

Soil compaction can produce a chain reaction of problems forcing counter measures with a variety of management tactics.

Foot and vehicular traffic on turfgrass causes soil compaction, which in turn, leads to -

- A decrease in total pore space
- A decrease in the macropores, the large pores, essential for root channels, water drainage and air exchange
- Less pore continuity and uniformity of pores throughout the soil profile, making pores more isolated
- An increase in the micropores, small pores, resulting in higher water retention. Unfortunately, much of this water is unavailable for plant uptake.



Comparison of traffic control in background and excess field use in foreground.

- Decreased aeration exhibited by a lower level of the oxygen essential for healthy roots.
- Reduced infiltration and percolation, causing irrigation to become more complicated as drainage through the soil decreases.
- A dense soil with higher soil strength, especially as it dries, which in turn hinders rooting.
- An alteration in soil temperatures. In the summer, thin turf common on compacted areas allows solar radiation to heat the soil more than on adjacent non-compacted turf.

Because compaction drastically alters the physical properties of the soil, the plant soon perceives the difference and responds. The plant response includes: reduced leaf growth, quicker reaction to drought stress, reduced root development, slower growth rate, leaf yellowing, and reduced density in turf cover.

The combination of soil and turfgrass changes can cause the turf manager to make a number of changes, such as:

1. Increased pesticide use. The more open turf invites invasion by a number of weeds, especially those able to tolerate compacted soil - poa annua, goosegrass and knotweed. Also, a less healthy turf coupled with a moist environment

enhances the probability of disease, particularly brown patch and Pythium blight.

2. Increased fertilizer use. Compacted turf will not take up nutrients efficiently because of a less extensive root system and less viable roots. In general, compacted turf takes up to 10 to 30 percent less nitrogen when compared to a non-compacted site. However, increasing the nitrogen rate won't help; it will further increase succulence, reduce carbohydrate reserves and dramatically reduce rooting.

The take-home lesson is that adding nitrogen beyond normal rates will not correct soil compaction effects on turf, even though symptoms may be similar to those seen on nitrogen-deficient turf such as slow growth rate, open turf and, sometimes, yellow leaves. The problem is adverse soil physical conditions, not a nutritional problem.

3. Increased environmental and wear stresses. Any other factors such as close mowing, shade, or excessive nitrogen, that reduce carbohydrate levels and increase succulence will greatly enhance the potential for environmental stress / wear damage. If compaction occurs in

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combination with any of these other factors, expect even greater injury.

4. Increased difficulty in irrigation scheduling. The soils most susceptible to compaction are those with appreciable silt and clay. These already have low infiltration rates, which compaction further reduces. Thus it becomes more difficult to apply water slowly for a long period to recharge the soil. Unfortunately, compacted sites are often irrigated with light, frequent applications, which makes an already difficult situation worse.

5. Additional maintenance. In general, no single management practice will be a cure-all, but several will be necessary. The management choices are:

- Select compaction-tolerant species and cultivars when establishing or renovating. Examples are the use of a higher percentage of perennial ryegrass in mixes of Kentucky bluegrass or tall fescue, or the use of improved tall fescues.

- Control traffic as much as possible: rotate team drill areas, use two or three practice areas, restrict band practice on the primary football field, etc.

- Develop a good cultivation plan. Cultivation is the most important management technique to deal with soil compaction. Develop a program with proper equipment selection to meet your specific problems and budget, proper timing of cultivation, correct soil moisture conditions at the time of cultivation, and application of supplemental nitrogen to aid in recovery of any cultivation injury.

- Adjust your other cultural programs. Until the compaction can be alleviated, weed and disease problems will need to be chemically controlled. As cultivation improves the soil's physical condition, adjust irrigation practices to a deeper, less frequent regime. Use adequate nitrogen, but avoid excessive rates.

- Partially modify the soil by adding sand with core cultivation, or completely modify the soil, which may be the most cost-effective approach on high-use recreational sites. Chemical amendments - gypsum, wetting agents, various chemicals to improve/stabilize structure - have little beneficial effect because even the best aggregated soils develop poor structure under compaction.

- If possible, add more fields. Or, if necessary, consider adding an artificial turf alternative field to reduce stress and excessive use on existing facilities.



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