



Pastures Soil Compaction in Pastures

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As an agronomist I've often been asked to evaluate lawns or pastures for people. They frequently wonder why the grasses are stunted with weedy, thin areas and assume the problems are due to lack of fertility, insects, or disease.

Sometimes it's a physical problem rather than a chemical one. A condition seen often is high bulk density, in other words, soil compaction.

When a soil is compacted, air space is squeezed out of the soil. Root growth takes place in the air spaces around soil particles. Reducing the amount of pore space a root has to grow restricts plant growth. Also, air and water essential for growth can't diffuse into the root zone.

Soil compaction also contributes mechanical resistance to root penetration and inhibits the emergence of seedlings and spreading of rhizomes.

A simple test to determine if soil compaction is evident is to take your finger and dig it into a dry soil. If you can't work it through the top 2-3 inches of soil, the soil is probably compacted.

Clay textured soils are the most easily compacted, while sandy soils are the least. Alluvial soils in bottom lands and fine textured silt loams are also easily compacted.

There are other problems associated with soil compaction, besides inhibiting plant growth by physical obstruction, compaction causes water to flow over the surface rather than infiltrating into the soil. Surface runoff prevents water from being utilized by plants, and can lead to surface and groundwater contamination if fertilizers are applied to correct a problem because of misdiagnosis. The chemicals cannot reach their target and ultimately run off into a stream, creek, or ditch. Literally money down the drain.

Compacted soils don't heat up in the spring as fast and retain heat in the summer. Roots unable to penetrate the soil accumulate near the soil surface, drying out during hot afternoons. The roots cannot get into the subsoil where moisture and cooler temperatures are more suitable.

Intensive livestock use of a pasture eventually reduces the land's productivity as the ground becomes compacted. When desired grasses start to diminish because of compaction, weeds take over. Weeds are aggressive and efficient at getting established. Many of the worst problem weeds are broadleaves, exhibiting taproot systems rather than fibrous roots common to pasture grasses. Weeds can survive in compacted conditions better than grasses because taproots can penetrate compacted soils. Also, weeds adapt to drier soils. As the seeds continue to thrive, the grasses suffer and go dormant. Once the weeds overtake grasses, the tendency is to apply herbicides for control. This amounts to costs that could have been avoided, and addition of unneeded pesticides into the environment.



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Good soil structure is imperative for maximum yield of most agricultural crops, including forages. Table 1 shows the effects of compaction on the growth of corn, which is not a forage grass, but is a member of the grass family. Please note that the compacted unfertilized treatment produced more vegetative matter than the compacted fertilized treatment.

Maintaining a pasture with forage species growing at their optimum production level saves money. Livestock grazing on pastures is more cost effective than purchasing feed. Keeping pastures in an uncompacted state helps utilize water, fertilizers, and other pesticides more effectively. Less can be used to get into the root area where it is needed. This saves money as well.

One of the best methods commonly used to reduce soil compaction is to aerate. Aerators are available for purchase or rent and easily hook up to a tractor with a 3-point hitch. A walk behind model is available for use on smaller areas. There are also companies that provide that service.

The best time to aerate is in the spring or early summer when grasses are actively growing and fill in rapidly.

Has your lawn or pasture been aerated recently? Golf courses generally aerate 2 or more times a year to reduce bulk density!

Good pasture management can prevent soils from becoming compacted. This can be done by restricting grazing of animals on pastures during periods when soils are wet. This causes soil compaction, reduced plant growth, and can lead to water contamination.

The Effect of Moisture, Fertility Level, and Degree of Soil Compaction on the Growth of Corn plants*

Treatments	Weight of Total Plant (gm)
Loose, wet, fertilized	54.2
Compact, wet, fertilized	22.5
Loose, wet, unfertilized	33.7
Compact, wet, unfertilized	24.7

Bertrand & Kohnke, SSSA Proc., 21:137 (57).