

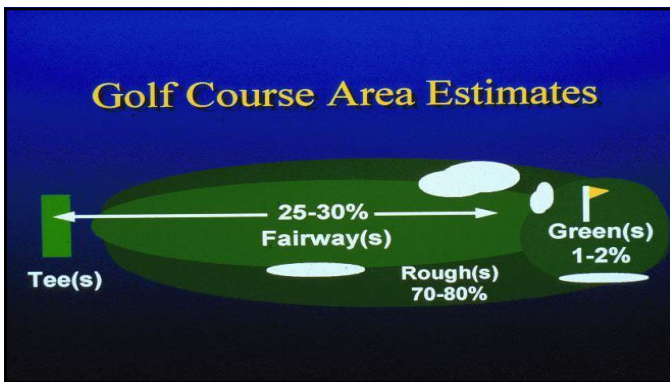
**Turfgrass Cultivation**  
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Causes and Locations of Traffic Stress

- Foot traffic
- Equipment
- Golf carts/Utility Vehicles

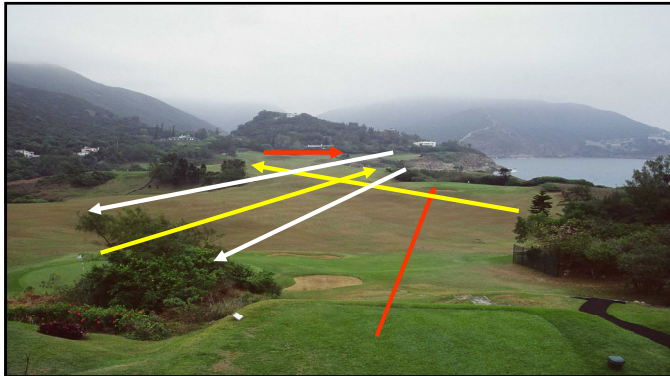
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### Underground: Sight Unseen

- Plants are immobile
- Often forgotten
- Large impacts on growth and development
- Water
- Nutrients

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*Landscape*

**“The ~~Nation~~ that destroys its soil destroys itself”**

**Franklin D. Roosevelt**

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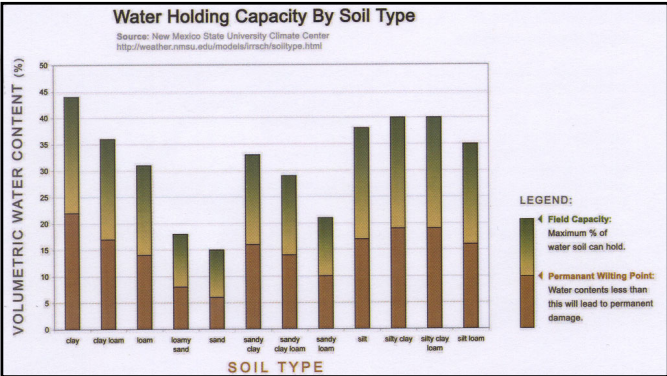


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### Soil Texture Problems

- Air/water movement
- Root development
- Water holding capacity
  - Irrigation requirements
- Nutrient holding capacity
  - Leaching potential
  - Fertilizer requirements
- Soil microbial populations

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Soil Structure

- Impacts
  - Water infiltration
  - Root development
  - Microbial populations
  - Other critters
  - Overall plant health

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Soil Bulk Density

- Density of the bulk soil in its natural state, including both particles and pore space
- Inversely related to porosity
- Organic soils have lower bulk densities
- Sands have higher BD than clays
- Impact how the soils perform

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Where do roots grow??

**Roots do not grow *in the soil*, they grow in the *air space* in the soil.**

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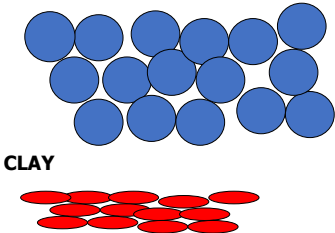
Soil Porosity

- Amount of air space (pores) in the soil normally expressed as a %
- Based on size and shape of soil particles
- Pore size
  - Macropores
    - large
    - aeration, infiltration
  - Micropores
    - small
    - water holding
    - nutrient holding

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**Soil Particle Shape**

**SAND**



**CLAY**


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Which soil has higher porosity?

a. Sandy  
b. Clayey

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What weighs more ?

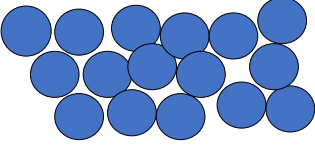


- A bucket of sand
- A bucket of clay

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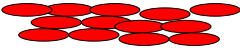
### Soil Texture Effects on Porosity

**SAND**



Macropores-  
low porosity

**CLAY**



Micropores-  
high porosity

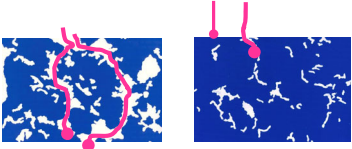
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### Air and water movement through soils

- Water infiltration
  - Macropores
  - Pore space continuity
- Water holding
  - Micropores
- Air movement
  - Pore space continuity
  - Micropores are barriers for movement
- Desirous to have 50% porosity
  - Half water
  - Half air filled

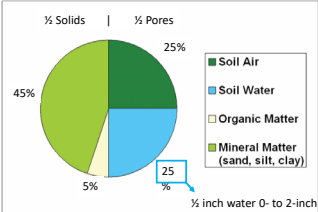
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### Soil Macropores



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### Idealized Proportions of Solids and Pores in Soil



Source: [https://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs142p2\\_052836.pdf](https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052836.pdf)

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**Compaction** is the compression of soil particles resulting in loss of pore space in the soil profile resulting in a decrease in soil aeration and water infiltration

Clays and silts have a high capacity for compaction; sands do not

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To maintain optimal plant growth the entire volume of air to a depth of eight inches must be renewed every hour

**Why?**

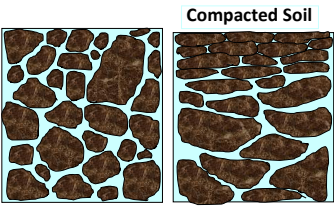
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*Where do roots grow??*

**Roots do not grow *in the soil*, they grow in the *air space* in the soil.**

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**Soil Temperature**



**Compacted Soil = +/-10 F**

*Thermal conductivity is increased by compaction because of decreased porosity.*

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*Improvement of compacted soils?*

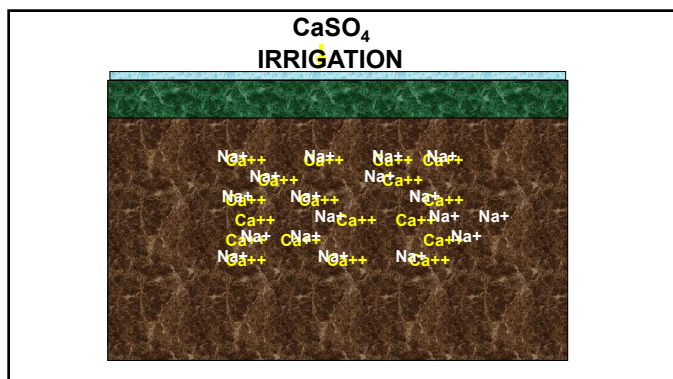
- Wetting Agents
  - Improve short term water infiltration in hydrophobic soils
- Gypsum (CaSO<sub>4</sub>)
  - "soil buster"
  - Only effective in sodic (sodium affected soils) with good drainage
  - Ca effect on soil structure not compaction relief

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Reality

Gypsum (calcium sulfate) is used to improve aggregation of silt-crusted puddled soil or soil damage/ dispersed by excess sodium.

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### Thatch

A loose, intermingled, organic, layer of dead and living shoots, stems, and roots that develops between the zone of green vegetation and the soil

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### Why does thatch occur?

- Rate of organic matter production exceeds ability of micro- and macro-organisms to decompose this material
- Management practices discourage activity of micro- and macro-organisms



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### Thatch: The Negative




- Can become hydrophobic (water repellent)
- Porous; poor water retention
- Difficult to rewet
- Poor N and K retention
- Increased weed, disease, and insect problems
- Decreased pesticide effectiveness (insecticides)

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**Layering**

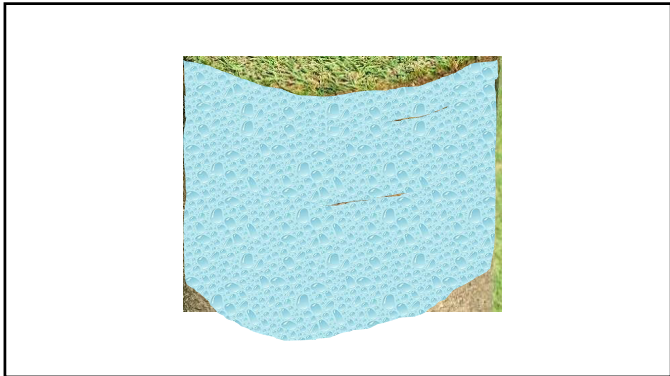
- Water retention is non-uniform
- Thatch/mat layers can store twice as much water than the root zone



NOT a function of drainage

Rather it is the difference in pore size distribution among layers


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**Turfgrass Thatch/Compaction Remedies**

- Cultivation techniques
  - Core cultivation
  - Vertical mowing



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**Core Cultivation**

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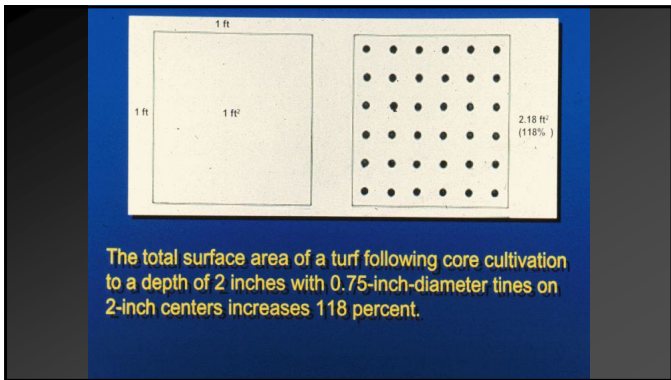




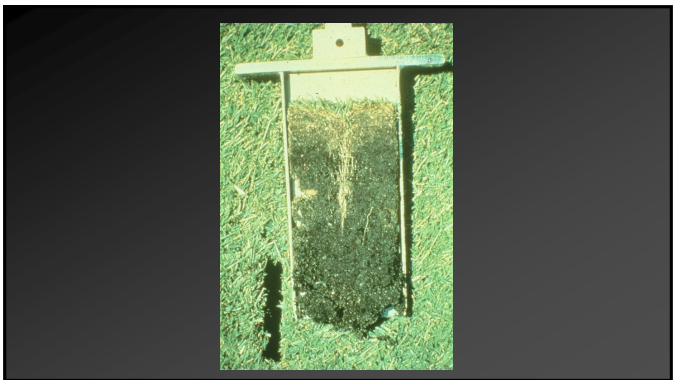
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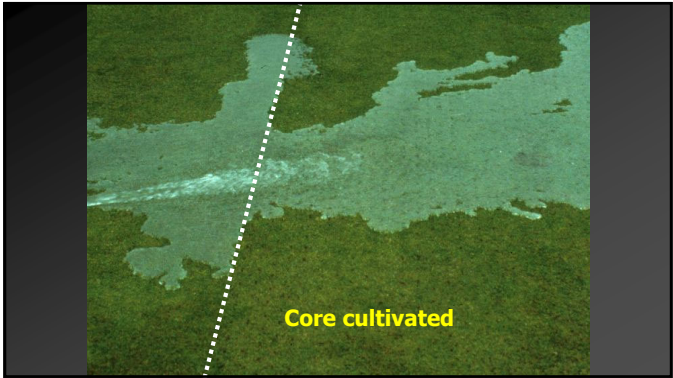
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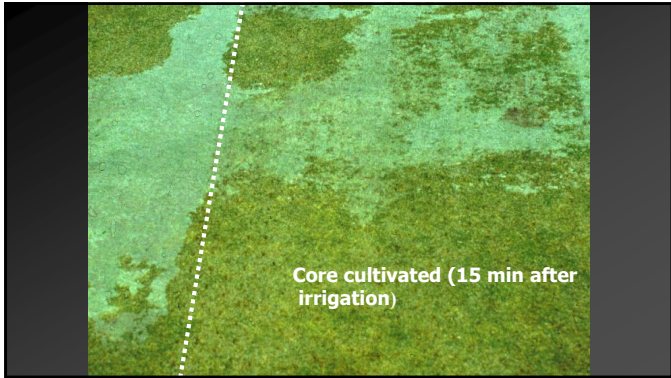
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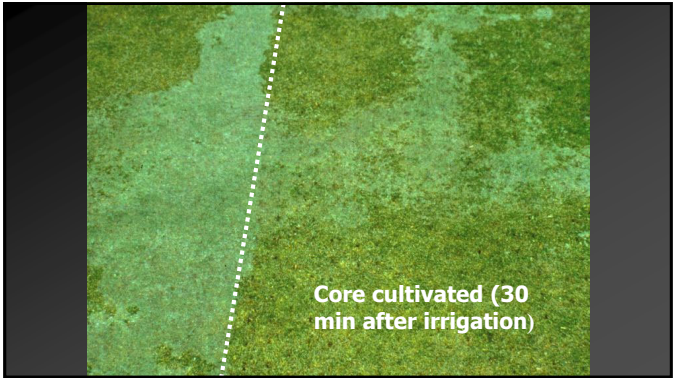
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*Dragging cores, post cultivation, into the turf is topdressing*

**Topdressing after core cultivation**

*Topdressing material for lawns can be compost or other amendments but not sand*

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**Mat**

Thatch that has been intermixed with mineral (soil) matter. Biologically Active & critical for healthy turfgrass

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**Frequently Asked Questions**

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### When is the best time to core cultivate ?



- **Spring**
  - Active root growth is occurring
  - Just prior to irrigation season
  - Good time for overseeding
- **Fall**
  - Will stimulate some root growth
  - Good time for overseeding
  - Takes advantage of winter freeze/thaw cycles
- **Summer**
  - Less desirable due to heat, excessive drying problems

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### How often can you core cultivate?

- Depends on soil type, amount of thatch, level of compaction
- At least yearly for the average location
- More often for thatchy, compacted turf
- Combine with overseeding or fertility

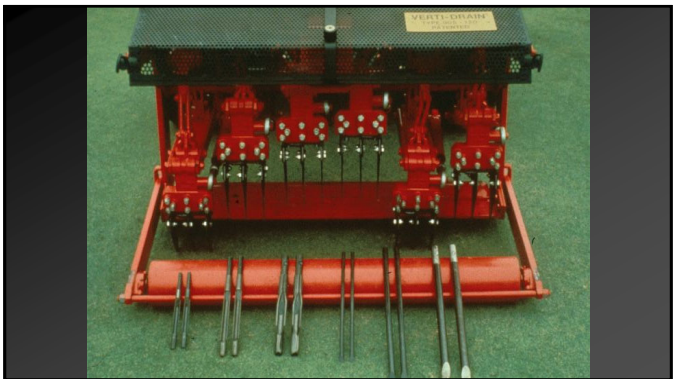
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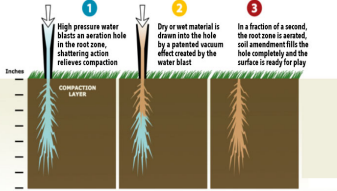


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**DryJect**

1 High pressure water blasts an aeration hole in the root zone, shattering action relieves compaction

2 Dry or wet material is drawn into the hole by a patented vacuum effect created by the water blast

3 In a fraction of a second, the root zone is aerated, soil amendment fills the hole completely and the surface is ready for play


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**Soil Moisture Content Prior to Aeration**

moist drier



hollow tine, very compacted ↔ solid tine, slicing, spiking

use soil moisture content to optimize desired effect

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**Thanks!**

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