Soil Physics

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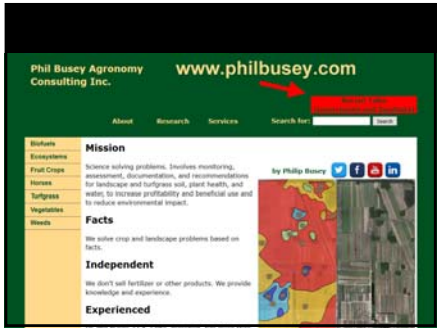

FACTORS RELATED TO SOIL PHYSICS

Irrigation	Because soil physics is very closely related to soil water relationships, need to be thinking about irrigation uniformity
Traffic	Because of the interrelated roles of soil physics, water, and wear and compaction, need to be thinking about managing traffic

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ATHLETIC FIELD USE CAPACITY

Field Condition	Hours per year
Sustain good field conditions	200 hours or less
Fair to good field conditions, some thinning turf and localized wear areas	400 to 600 hours
Significant turf loss, field surface damage, increased potential for athlete injury	Over 800 hours

From: Miller, Grady L. 2004. Athletic field use capacity. ENH991 (EP246). Univ. Florida.

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REMEMBER

- A healthy soil allows roots to breath
- Fines dominate (and amending with sand to improve drainage is almost futile)
- Geotechnical engineering ("soil mechanics") very different from agronomics
- Don't be confused by terms infiltration, percolation, leaching, drainage
- Soil is very, very complicated and there are major myths and major mistakes

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SOIL PHYSICAL FACTORS – 2 BIGGIES

Soil particle size	Fractions of sand, silt, clay, and sand sieve classes; coarse + medium + fine sand should be > 70%; sand sieve size very important
Organic matter	Can lead to improved soil structure (floccules), stability for athletes; more often, impedes drainage, should be below about 3% by weight; for quality peat with bulk density less than 0.15, about 1.5% by weight or 10% by volume may be suitable

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SOIL TEXTURE (SIZE DISTRIBUTION OF PARTICLES)

Separates	Particles larger than:
Gravel	2 mm
Very coarse sand	1 mm
Coarse sand	0.5 mm
Medium sand	0.25 mm
Fine sand	0.10 mm
Very fine sand	0.05 mm
Silt	0.002 mm
Clay	

USDA system from: Brady and Weil. 2008. The nature and properties of soil, 14th edition.

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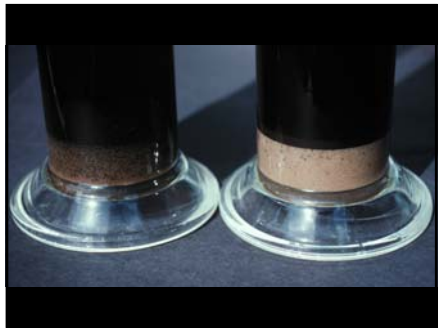

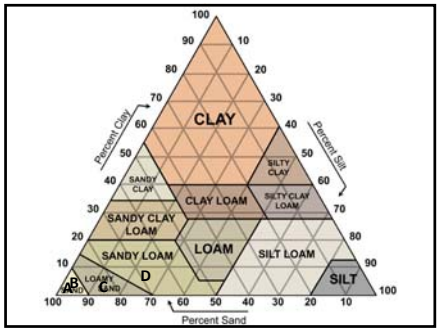

SOIL PARTICLE SIZE DISTRIBUTION,
SOIL PORE SIZE, AND SOIL WATER

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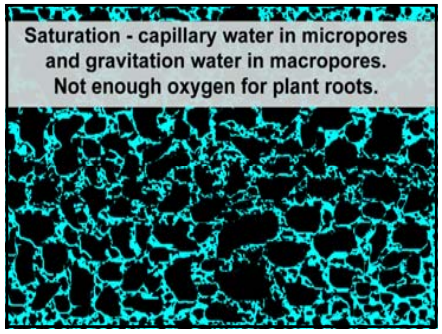

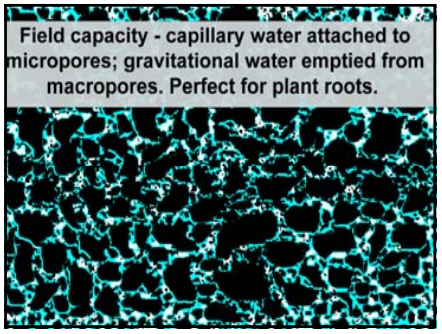

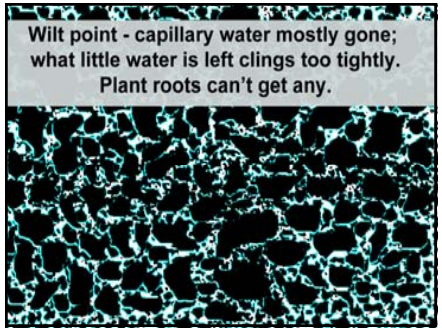

ORGANIC MATTER OF 4 SOILS

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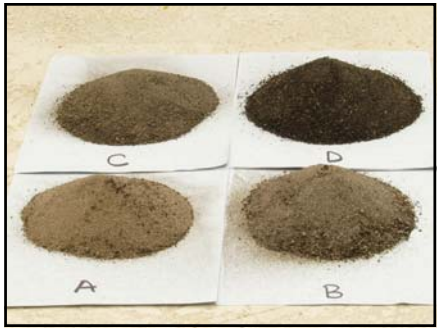

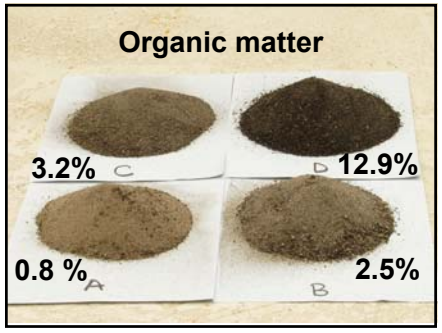

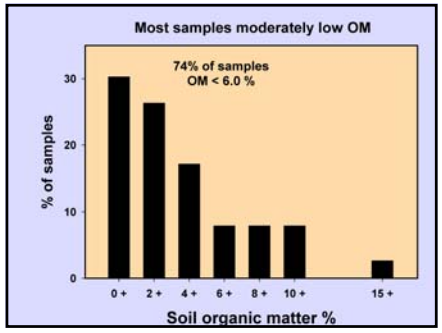

MORE SOIL PHYSICAL ANALYSIS

- Texture (sand, silt, clay particle sizes, including sand sieve sizes)
- Porosity (macro or air-filled vs. micropores)
- Organic matter (very complex)
- Bulk density
- Hydraulic conductivity - how easily water flows through soil pores (if saturated, K_{sat})

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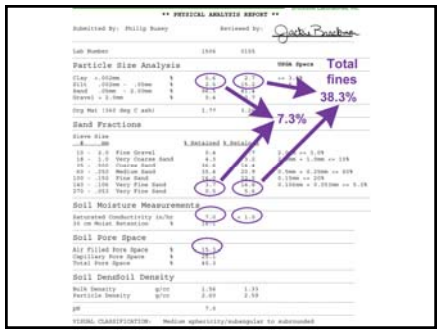

SOIL PHYSICS AND HEALTHY SPORTS TURF

	Sports Turf Soil			
Particle size	A	B	C	D
Sand (%)	96.9	92.1	81.4	69.4
Silt (%)	2.6	6.2	15.2	22.8
Clay (%)	0.5	1.1	2.7	6.6

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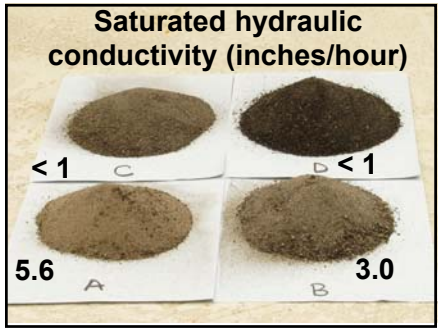

SOIL PHYSICS AND HEALTHY SPORTS TURF

Sample Location	A	B	C	D	Goal
Saturated conductivity (in/hr)	5.6	3	< 1.0	< 1.0	> 3
Moisture retention (%)	22	30.4	29.8	57.6	14 to 20
Air filled pore space (%)	4.6	2.5	9.3	2.7	18 to 25
Bulk density (g/cc)	1.59	1.43	1.33	0.95	1.2 to 1.6
Organic matter (%)	0.8	2.5	3.2	12.9	< 3
Very fine sand + Silt + Clay	20.5	33.9	38.3	45.2	< 25

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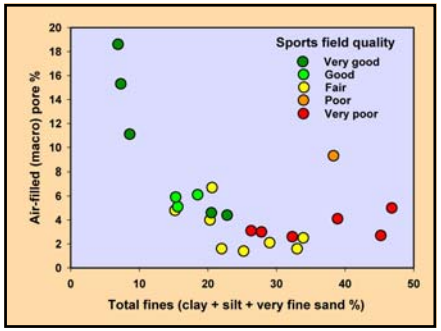

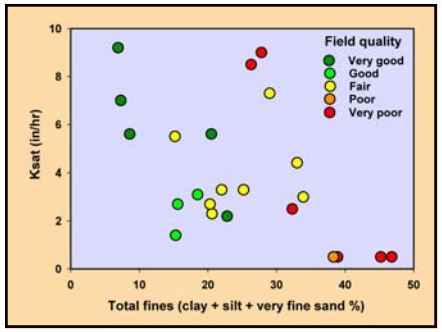

EFFECTIVE CORE CULTIVATION

- 2 to 6 times per year
- Soil exposed should be 3.5 to 10% of area
- Prefer 2.5 to 4 inches penetration
- Area and depth determine enhancement of diffusion
- During times of peak shoot and root growth
- Be careful at times of peak goosegrass germination
- Prefer cam (vertical tines) over drum
- Prefer closed hollow tines over open spoon tines
- Not a panacea if soil is not right

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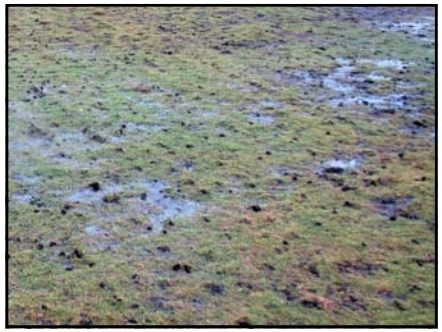

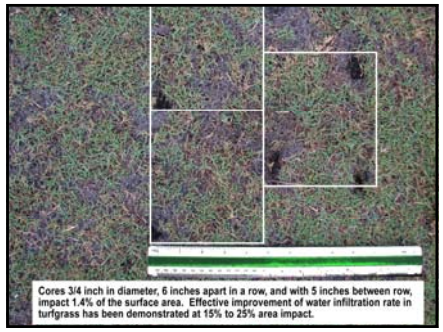
Cores 3/4 inch in diameter, 6 inches apart in a row, and with 5 inches between row, impact 1.4% of the surface area. Effective improvement of water infiltration rate in turfgrass has been demonstrated at 15% to 25% area impact.