
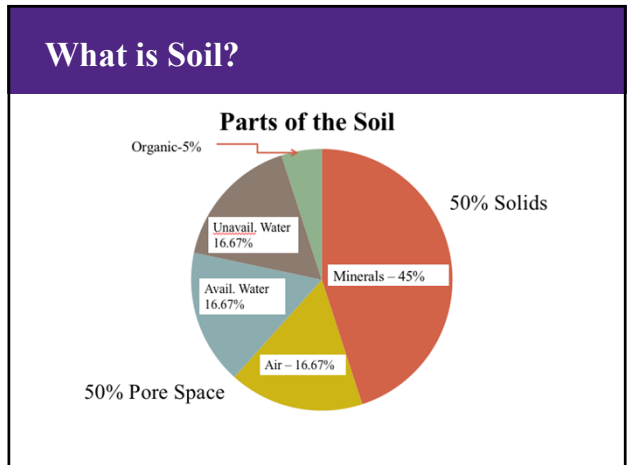


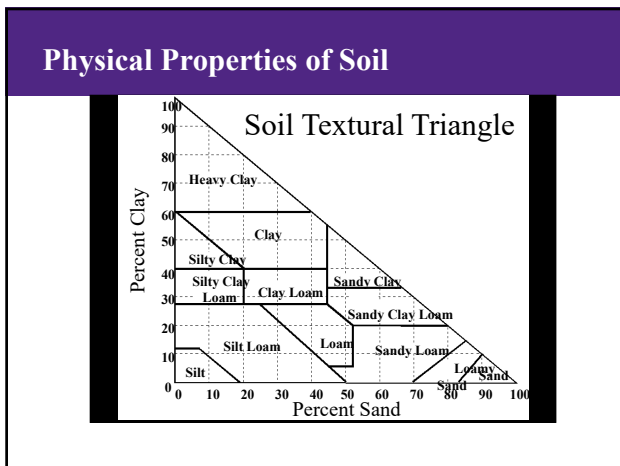
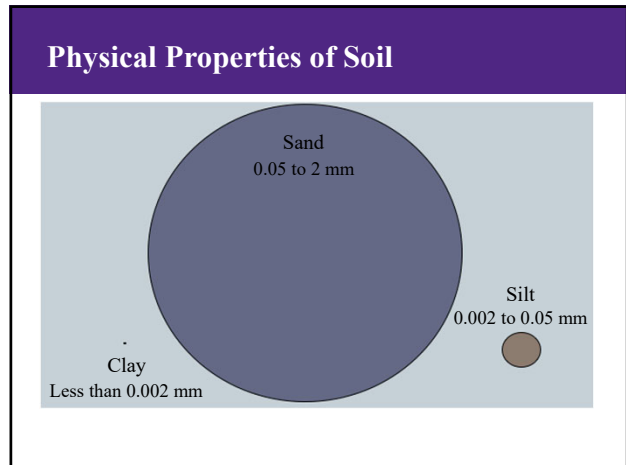
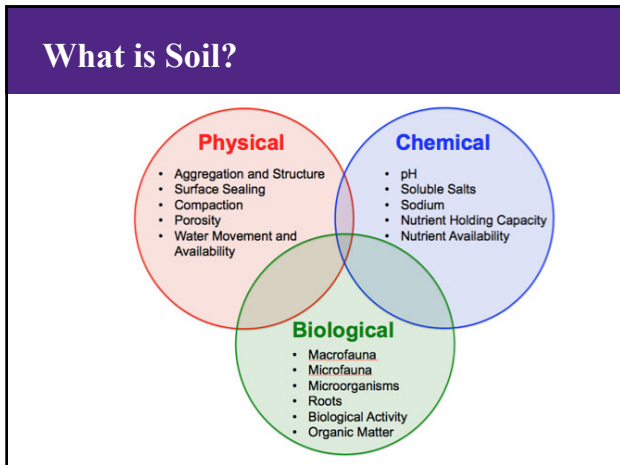
SOIL AND COVER CROPS

TOM BULLER

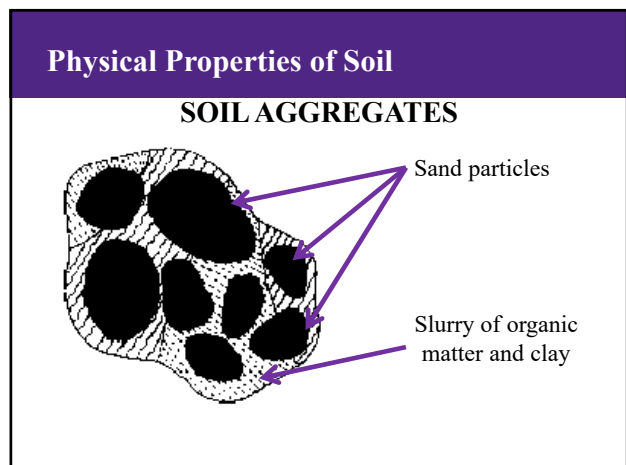
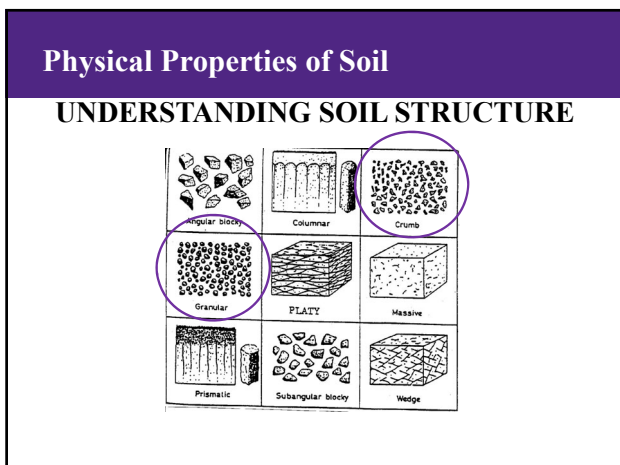


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- ### Physical Properties of Soil
- #### WHY SOIL TEXTURE MATTERS
- Water Movement
 - Water Holding Capacity
 - Soil Temperature
 - Soil Aeration
 - Soil Erosion
 - Nutrient Holding Capacity




Physical Properties of Soil

STRUCTURE IS FORMED THROUGH...

- Chemical Bonds
- Physical Bonds
- Organic Matter
 - Microbes



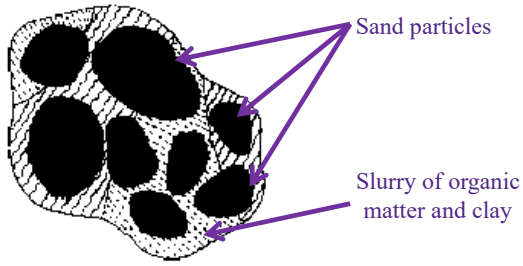
Single grains –
No organized structure



Grains formed into aggregates –
Good organized structure

Physical Properties of Soil

IT'S ALL ABOUT PORE SPACE



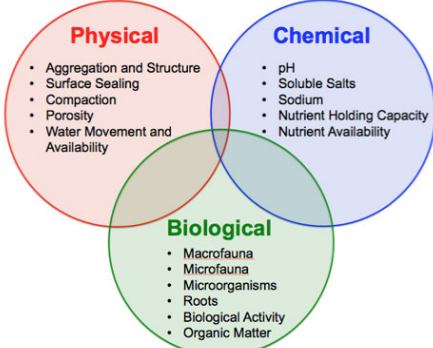
Sand particles

Slurry of organic matter and clay

Physical Properties of Soil

	Sandy Soil	Loam Soil	Clay Soil
Available Water (gal/cu. ft)	½ gal	1 gal	1 ½ gal
Depth 1" water penetrates	24"	16"	11"
Water infiltration per hour	2"	¾"	¼"

What is Soil?



Physical

- Aggregation and Structure
- Surface Sealing
- Compaction
- Porosity
- Water Movement and Availability

Chemical

- pH
- Soluble Salts
- Sodium
- Nutrient Holding Capacity
- Nutrient Availability

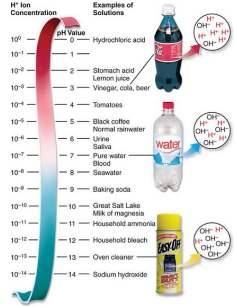
Biological

- Macrofauna
- Microfauna
- Microorganisms
- Roots
- Biological Activity
- Organic Matter

Chemical Properties of Soil

Understanding pH

- pH is a measure of Hydrogen ion concentration
- The pH affects nutrient availability
- Ideal pH range is 6.0-7.0 for most plants



Chemical Properties of Soil

Plant Nutrients

Macronutrients

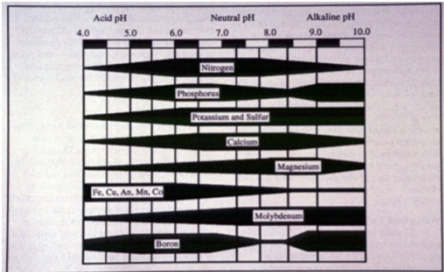
- Nitrogen (N)
- Phosphorus (P)
- Potassium (K)
- Calcium (Ca)
- Magnesium (Mg)
- Sulfur (S)

Micronutrients

- Boron (B)
- Chlorine (Cl)
- Copper (Cu)
- Iron (Fe)
- Manganese (Mn)
- Molybdenum (Mo)
- Nickel (Ni)
- Zinc (Zn)

Chemical Properties of Soil

Nutrient Availability & pH



Chemical Properties of Soil

Nutrient Availability & pH



Chemical Properties of Soil

Nitrogen

- Vegetative Growth
- Green Leafy Shoots
- Vigorous Stems



Chemical Properties of Soil

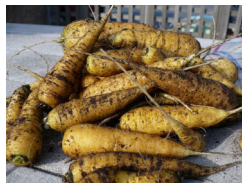
Nitrogen Deficiency



Chemical Properties of Soil

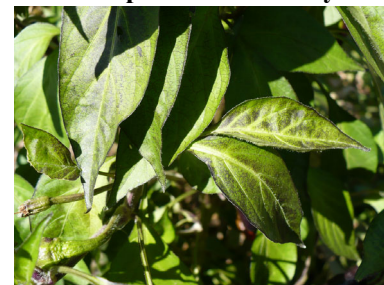
Phosphorus

- Flowering and Fruiting
- Hastens Maturity (Ripening)
- Root Development
- Seed Germination
- Seedling Growth



Chemical Properties of Soil


Phosphorus Deficiency



Chemical Properties of Soil

Potassium


- Disease Resistance
- Stem Strength
- Winter Hardiness
- Growth of Storage Roots
- Water Regulation



Chemical Properties of Soil

Micronutrients

- Very low levels are needed
- Test for deficiencies IF a problem is suspected
- Do not over-apply, as it can be toxic



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KSU Soil Testing Laboratory
2308 Throckmorton Plant Sciences Center
1712 Clifton Road
Manhattan, KS 66506-5503
Tel: 785-532-7897 Fax: 785-532-7412
www.agronomy.ksu.edu/soiltesting

Knowledge
for Life

Soil Test Report Billing Account #: 12 Sample Information:
Sample ID: 2N

Prepared For: Tom Buller Order Number: 14390
Douglas County Extension Lab Number: 008739
2110 Harper Received: 3/20/2018
Douglas Co. Fairgrounds Reported: 3/25/2018
Lawrence, KS 66046 County: Douglas
 (where sample was taken)

tombuller@ksu.edu tombuller@ksu.edu

Results

Analysis	Value Found	Analysis	Value Found
Soil pH (1:1, soil:water)	7.0	Organic Matter (LOI), %	2.8 %
Phosphorus (P) Mehlich-3	69 ppm	Potassium (K)	373 ppm
Zinc (Zn) DTPA Extraction	2.5 ppm	Calcium (Ca)	1329 ppm
Magnesium (Mg)	133 ppm	Sodium (Na)	22 ppm
Cation Exch. Capacity, Summation	8.8 meq/100g		

Vegetable Garden

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What is Soil?

Physical

- Aggregation and Structure
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- Compaction
- Porosity
- Water Movement and Availability

Chemical

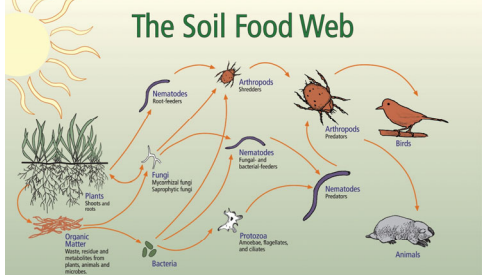
- pH
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Biological

- Macrofauna
- Microfauna
- Microorganisms
- Roots
- Biological Activity
- Organic Matter

Soil Biology

The Soil Food Web



First trophic level:
Photosynthesizers

Second trophic level:
Decomposers
Mutualists
Pathogens, Parasites
Floor feeders

Third trophic level:
Shredders
Predators
Grazers

Fourth trophic level:
Higher level predators

Fifth and higher trophic levels:
Higher level predators

Soil Health

The capacity of a soil to function as a **vital, living ecosystem** that sustains plants, animals, and humans.

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Soil Health Benefits

- Reduced erosion
- Increased plant health and bioavailable nutrients
- Increased water infiltration
- Increased water and nutrient storage capacity
- Increased productivity
- Increasingly important under stress



Minimize Disturbance

- Vertical Tillage
- Shallow Tillage
- “No-Till”- heavy mulch and rolled cover
- Occultation
- Perennials



Maximize Cover

- Cover Cropping
- Mulching
- Planting Density





Maximize Diversity

Cover Cropping
 Crop Rotation- diversity through time
 Companion planting
 Farmscapes/buffer strips
 Animals?

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Native Pollinators of Watermelon in South Carolina



Miss Jenkins, a recent graduate of Clemson University, found growing wildflowers near watermelon fields can attract pollinators needed to help improve quality and yields.
 Image Credit: Clemson University Public Service and Agriculture
https://rjceprints.clemson.edu/all_dissertations/2382/



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Landscapes surrounding farms affect insect pests, crop yields, study finds

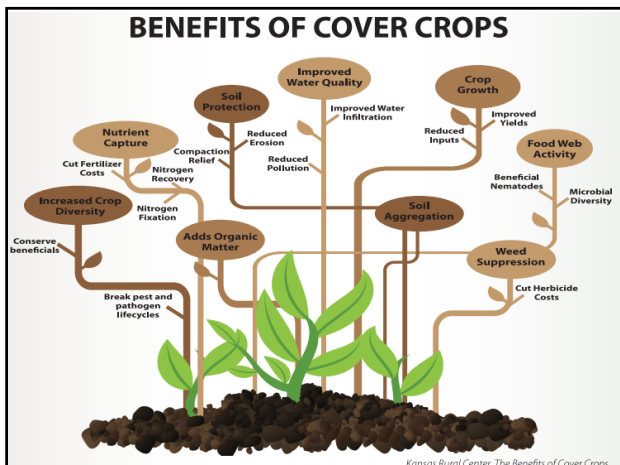
Perez-Alvarez, *Ecological Applications*, 2018, 28(3), 842-853

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Maintain Continuous Living Roots

Cover Cropping
Intensifying Rotations
Living Mulch
Perennials

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Cover Cropping Basics

- Choose the right cover for your needs
- Solid stand critical
- Heavy seeding 1.5-2x suggested rate
- Plan for termination
- Tools
 - Broadcast Seeder/ Incorporate
 - Drill
 - Mower

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Cool Season Covers

Winter Kill- Summer Annuals

- Oats
- Tillage Radish- Reduce Compaction, nematocide
- Buckwheat- quick to grow, and break down, bee forage

Legumes

- Chickling Vetch- Quick N fix

Overwintering- Winter Annuals

- Cereal Rye- biomass, allelopathy
- Winter wheat
- Triticale

Legumes

- Austrian Winter Peas- pea shoots???
- Hairy Vetch
- Crimson Clover

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Warm Season Covers

Sorghum Sudangrass- Organic Matter, Smother

Millet- Pearl and Japanese- Organic Matter, Smother

Buckwheat- quick to grow, and break down, bee forage

Legumes- N Fixation

- Cowpeas
- Forage Soybeans
- Sunn Hemp- Expensive Seed- biomass, N

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LAG TIME

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Learn More

- K-State Research and Extension
 - Soil testing
- Web soil survey- <https://websoilsurvey.nrcs.usda.gov/>
 - Learning soil type
- Growing Growers
 - Growinggrowers.org

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Other Resources

Sare.org

bookstore.ksre.k-state.edu/

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Connect with Support

- USDA- NRCS- Natural Resource Conservation Service- National Conservation programs
- Douglas County Conservation District- Local Conservation Programs

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FARM BEGINNINGS

Learn with Douglas County Extension about the basics of starting your small local farm!

VIRTUAL WEBINAR SERIES

Jan 28: Farm Management

Feb 4: Soil & Cover Crops

Feb 11: Pest Management



Feb 18: Food Safety & Adding Value

Feb 25: Chickens

March 4: Small Grazers

March 11: Large Grazers

*All webinars are noon-1pm



Register online at:
<http://bit.ly/DgCofarm>

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Douglas County

QUESTIONS?

Tom Buller
tombuller@ksu.edu

785-843-7058