Soil Assessment

Teresa Matteson

April 28, 2012

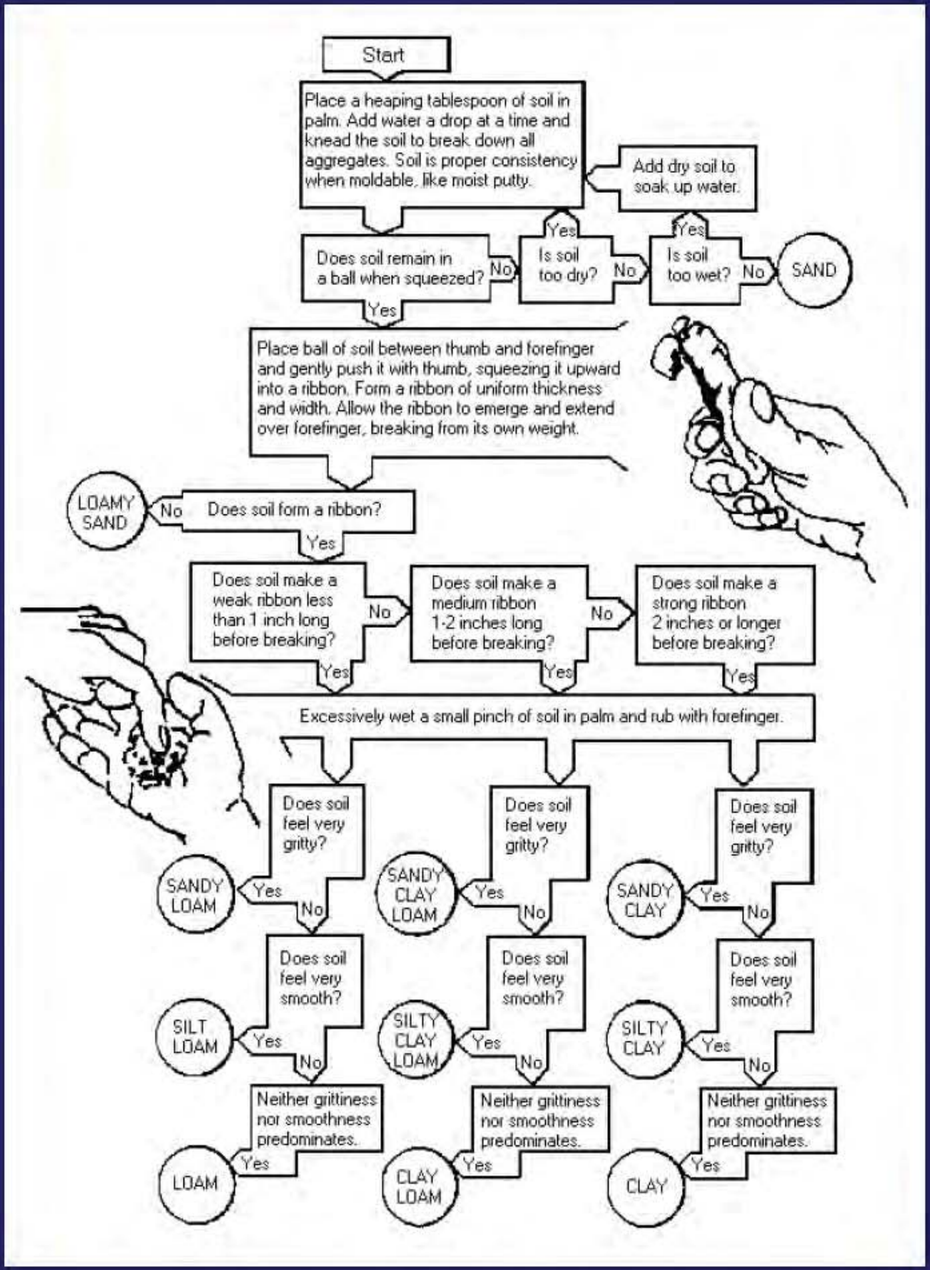
Soil Assessments

- Field
  - WV Soil Quality Card
  - NRCS Soil Quality Test Kit
- Classification
- Lab
  - OSU list of labs
  - Sample Collection
  - Soil Quality Project
    - Compaction & History
    - Lab tests

Hand Texture Flowchart

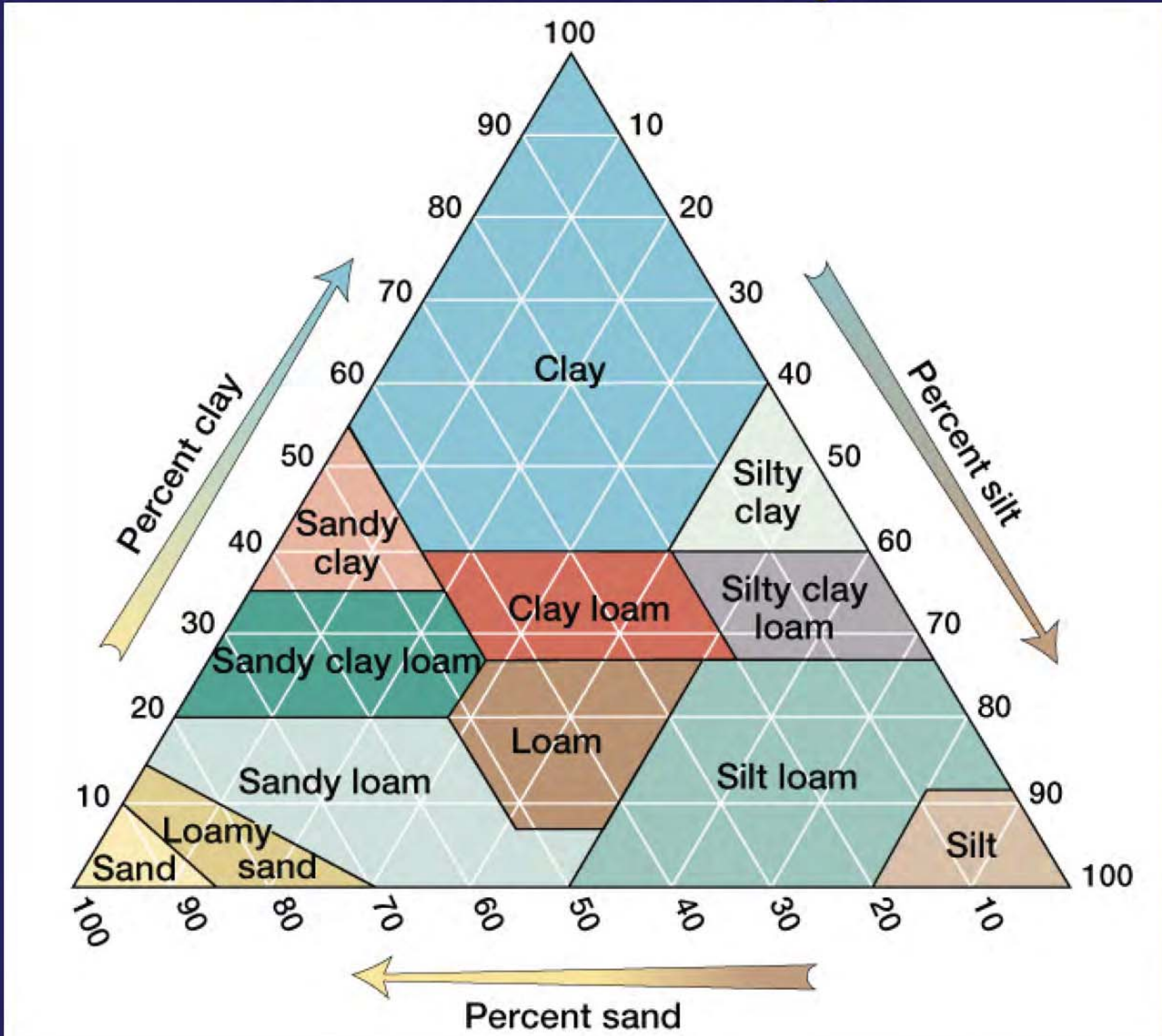
At home, do your soil texture

The trick is to use just enough water, but not too much!

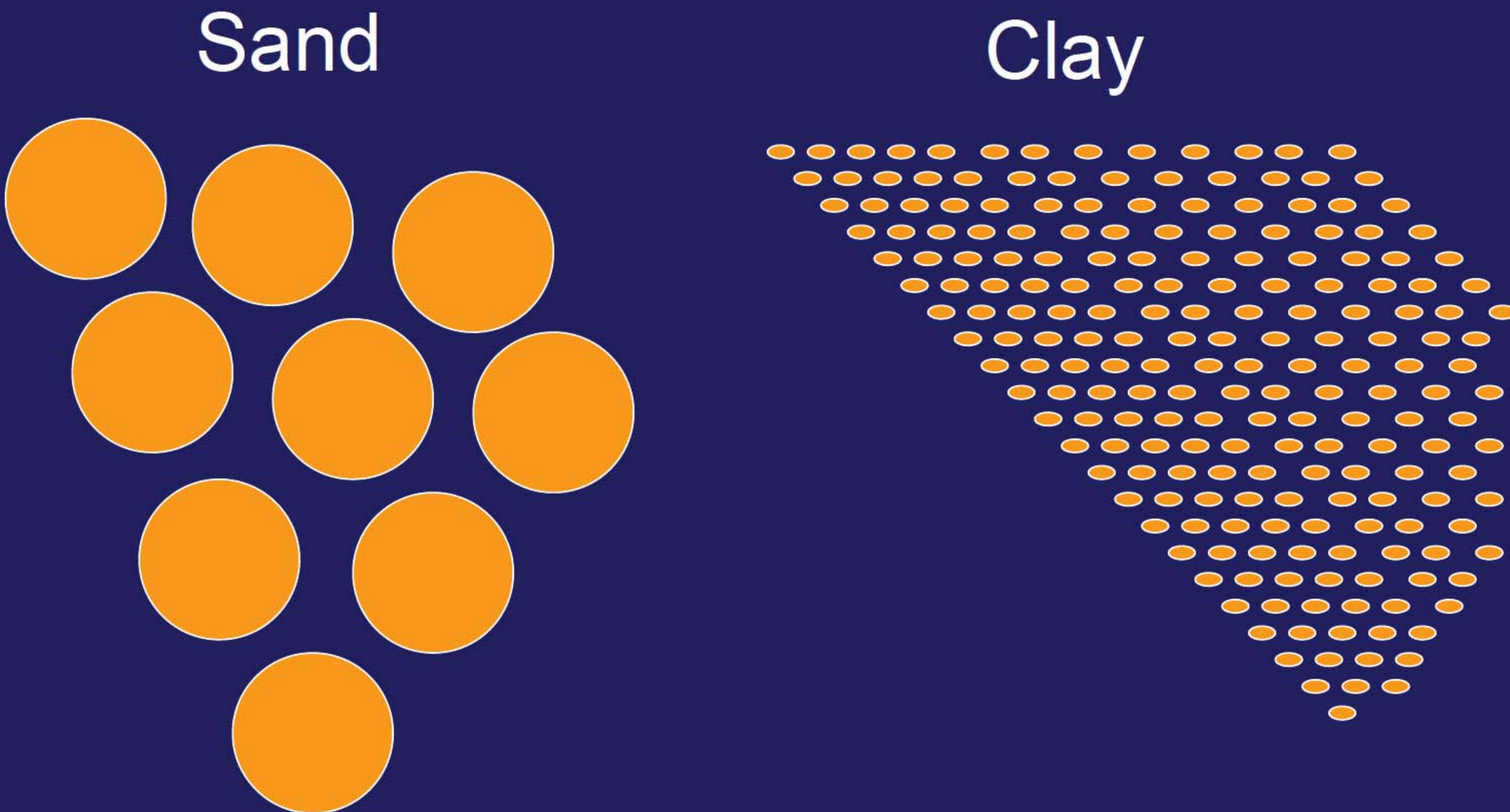


http://www.agriteach.com/members/soils/soil_texture_flowchart.gif

Soil Texture Triangle

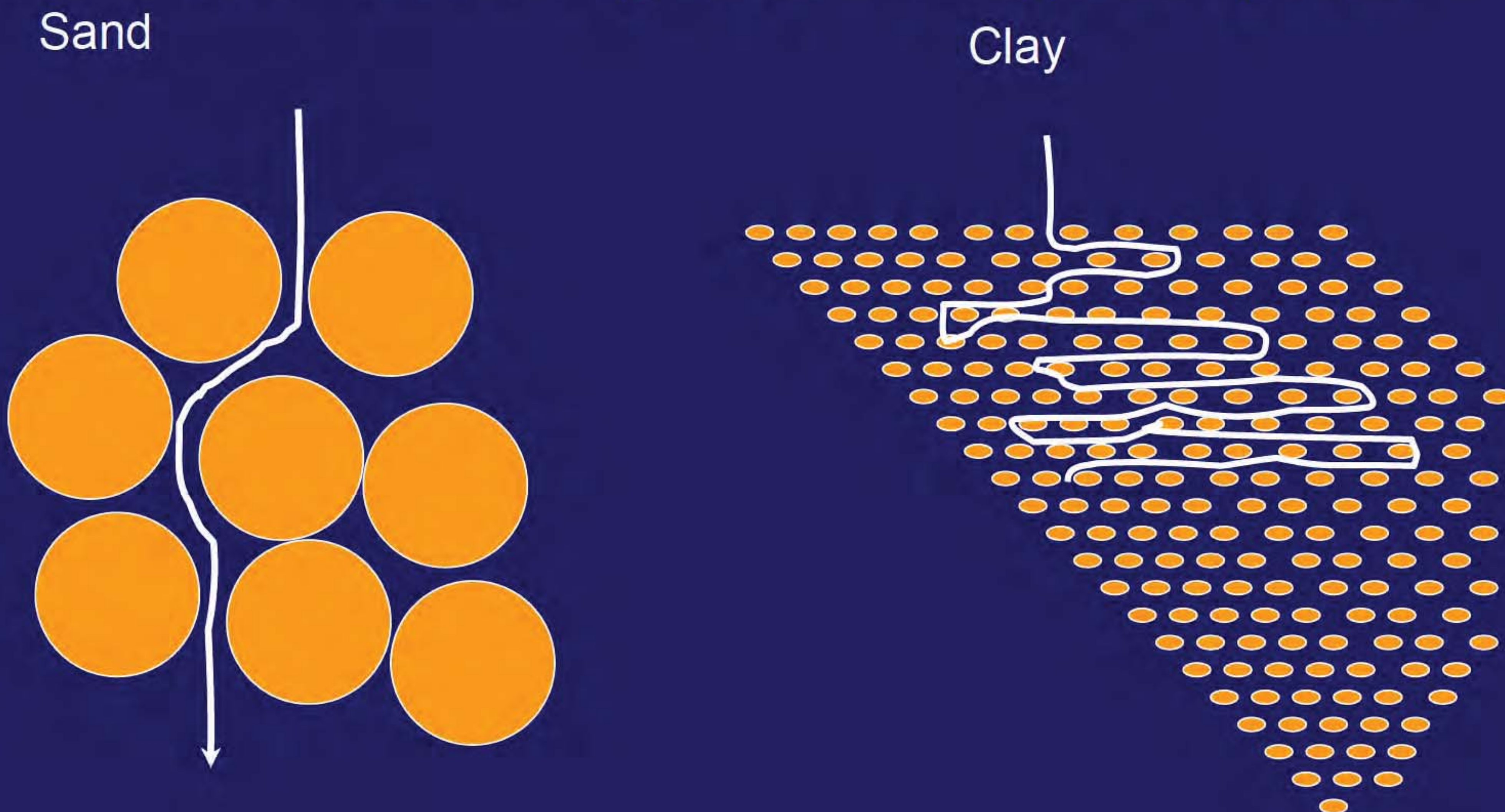


Fine clay has ~10,000 times as much surface area as the same weight of medium grain sand!



Coarse textured soils larger pores

Fine textured soils greater total pore space



Influence of Texture

	Sand	Silt	Clay
Water-holding capacity	Low	Medium	High
Aeration	Good	Medium	Poor
Drainage	High	Slow	Very slow
Nutrient retention	Low	Medium	High

WV Soil Quality Card

OSU Willamette Valley Soil Quality Card and Guide available online

Willamette Valley Soil Quality Card (EM 8711)

Willamette Valley Soil Quality Card Guide (EM 8710)

NRCS SQ Test Kit

http://soils.usda.gov/sqi/assessment/test_kit.html

Infiltration

Lab Assessments

- OSU Extension lab list

- Sample collection is

VERY IMPORTANT!

WASHINGTON STATE UNIVERSITY
World Class. Face to Face.

What a Soil Test Tells You:

- Relative levels of nutrients in your soil
- Fertilizer recommendation
- Standard soil test: P, K, Ca, Mg, B, pH, lime
- No good soil test exists for nitrogen requirement

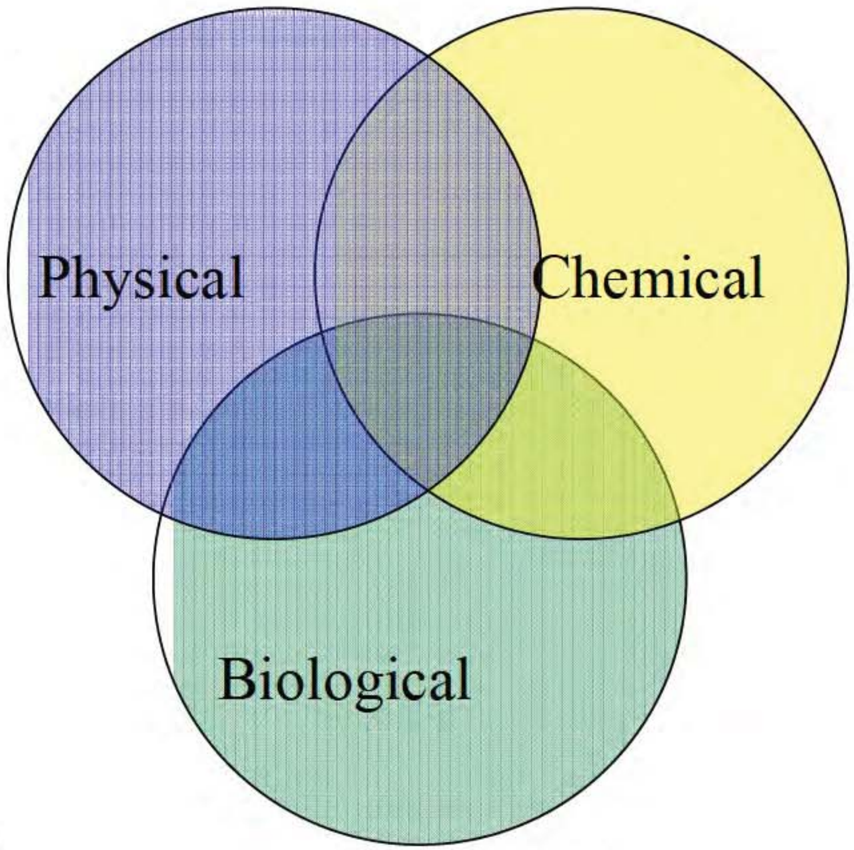
http://www.puyallup.wsu.edu/soilmgmt/Slideshows/SS-BasicMG/sld031.htm

Soil Quality

- **Sustain biological productivity**
- **Maintain environmental quality**
- **Promote plant, animal and human health**

Soil Health => Understanding soil processes

- Physical support for plants
- Aeration
- Soil water storage and movement
- Resistance to soil erosion
- Physical root proliferation and organism movement



- Nutrient storage and release
- Soil reactions
- Energy (C) storage

- Pest suppression
- N mineralization
- OM decomposition
- Support of microbial community

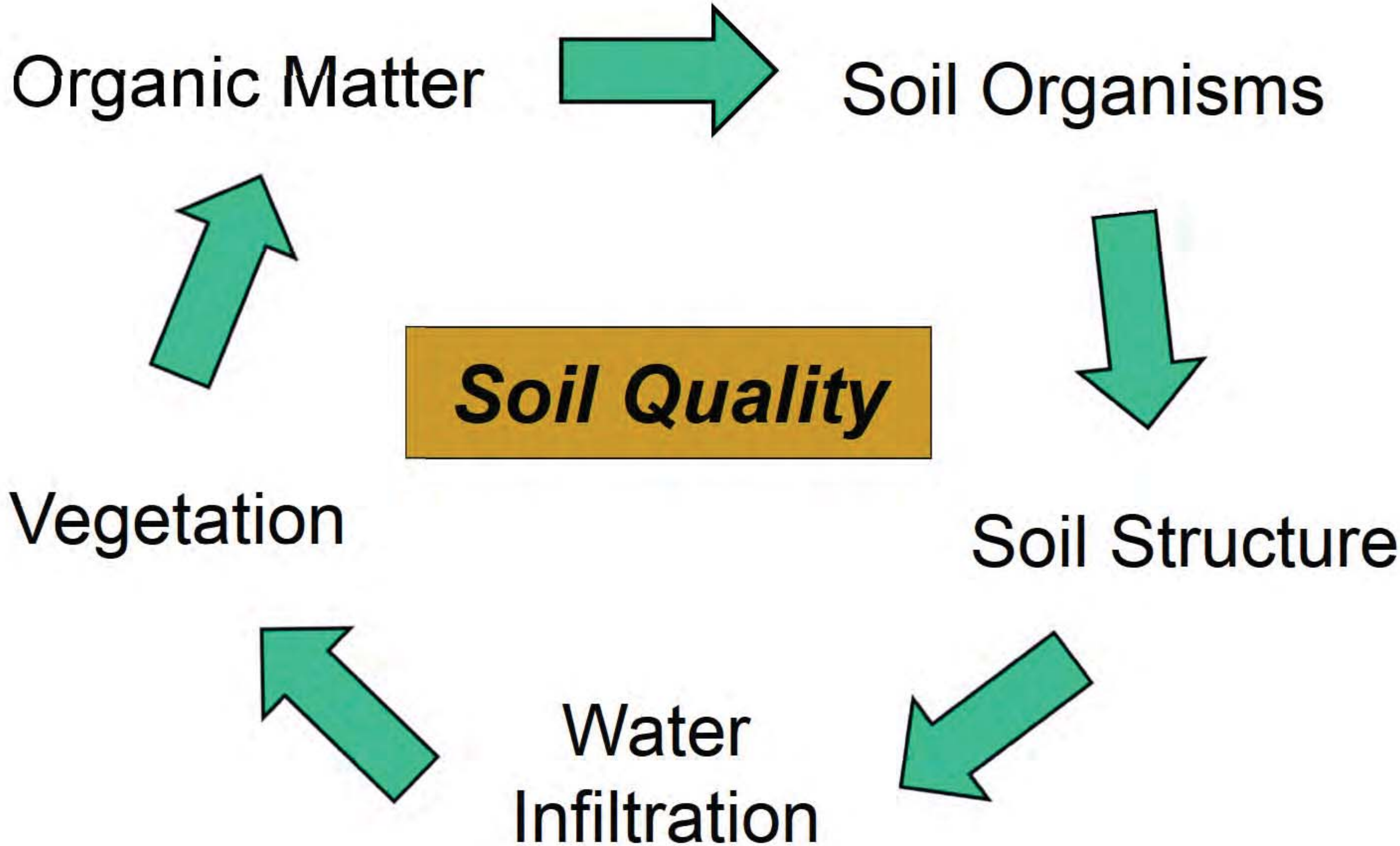
Why Evaluate SQ?

- Informed management decisions
- Lower production costs
- Build soil capital
- Reduce environmental impacts

Soil Quality Project *Mission Statement*

provide farmers
with an assessment package
that describes on-farm soil quality
to guide future management decisions

Management and Soil Quality



Soil Classification and Mapping

- 2010
  - ➢ 7 farms
- 2011
  - ➢ 3 farms

Soil Mapping and Classification

Lab Assessments: Answer is in the BAG!

Sample for Soil Quality

10 compaction readings
10 shovels of soil = composite sample

SQP Report

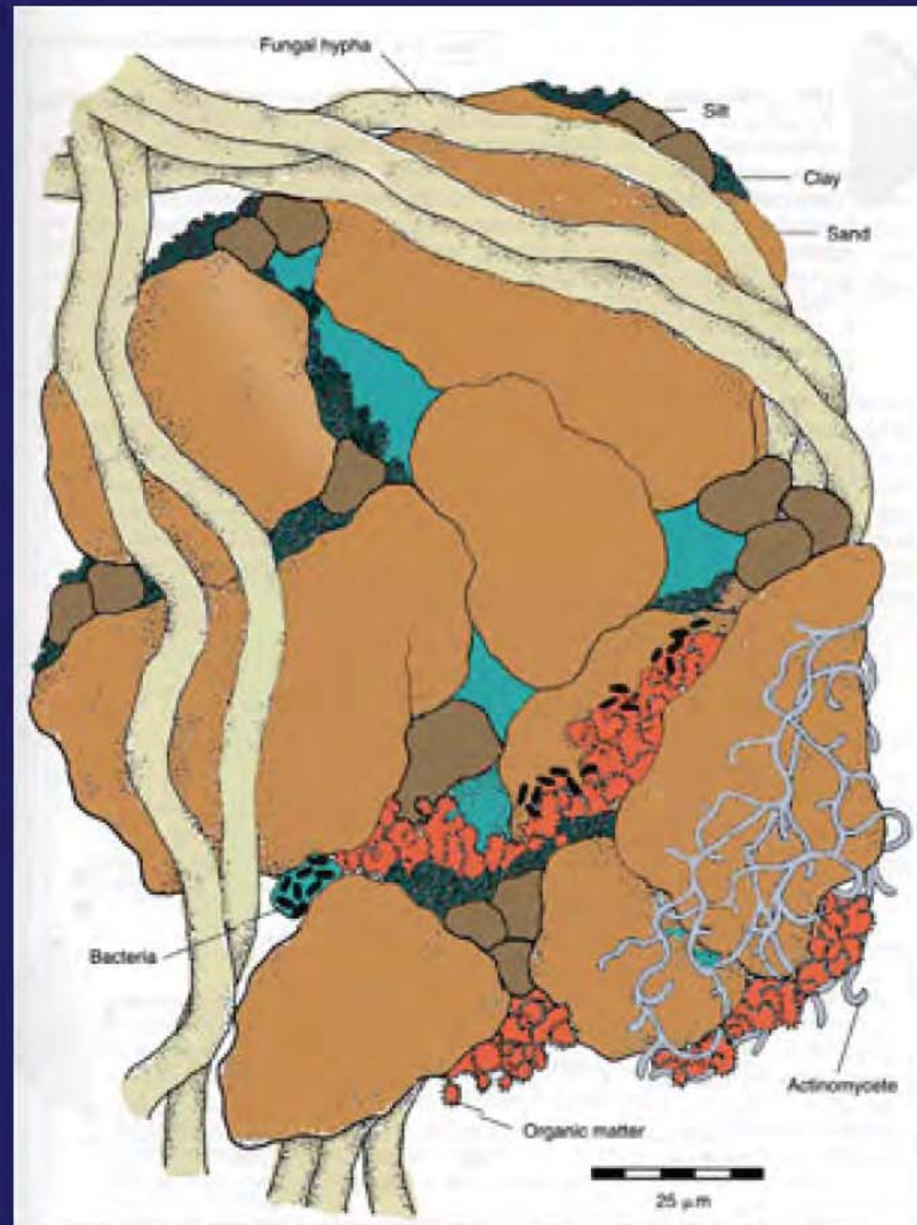
- for fee basis
- cost share opportunities

Soil Quality Assessment Report		
Name of Farmer	**Farm name**	**Sample ID#**
		23
Farm Location		**Sampling Date**
	OR	
Field ID per farmer	**GPS Coordinates**	**Field Agent**
Last Crops Grown		**Field Soil Texture**
weeds and bare soil		sandy loam
Management	fallow	

	Indicators	**Value**	**Units**	**Range for SQP soils**	**Constraints**
Physical	Soil Textural Class	73	% sand	n/a	
	sandy loam	16	% silt		
		11	% clay		
	Aggregate Stability	10	%	5-89	aeration, infiltration, rooting, crusting
	Surface Hardness	545	psi	9-575	root growth, water transmission
	Subsurface Hardness	628	psi	55-628	rooting at depth
Biological	Organic Matter	1.1	%	1.0-11.5	energy, C storage, water and nutrient holding
	Active Carbon	145	mg/kg soil (ppm)	98-901	organic material to support biological functions
	Potentially Mineralizable Nitrogen	0.0	ppm N per day at 22 oC	0.04 - 0.66	ability to supply N
					Recommended ranges west of the Cascades - check crop fertilizer guide.
Chemical	Extractable Phosphorus	17	ppm	4-242	low < 20; medium 20-40; high 40-100; excessive >100
	Extractable Potassium	129	ppm	102-1070	low <150; medium 150-250; high 250-800; excessive >800
	Extractable Calcium	1400	ppm	1400-4739	low <1000; medium 1000-2000; high >2000
	Extractable Magnesium	391	ppm	123-874	low <60; medium 60-180; high >180
	pH	6.7		4.8-7.4	Most crops grow best in soil pH between 6.0-7.5

Structure = Aggregates

- Held together by:
  - Fungal hyphae
  - Bacterial “glues”
  - Organic Matter
- Allows for:
  - Water infiltration
  - Healthy soil biology
  - Enough pore space
  - “Happy” roots

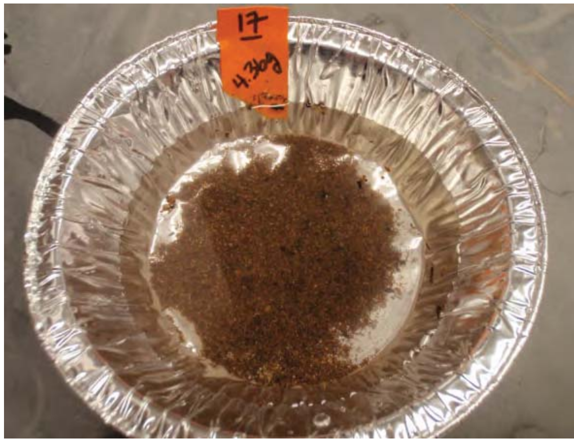


Hands-on FUN!!!

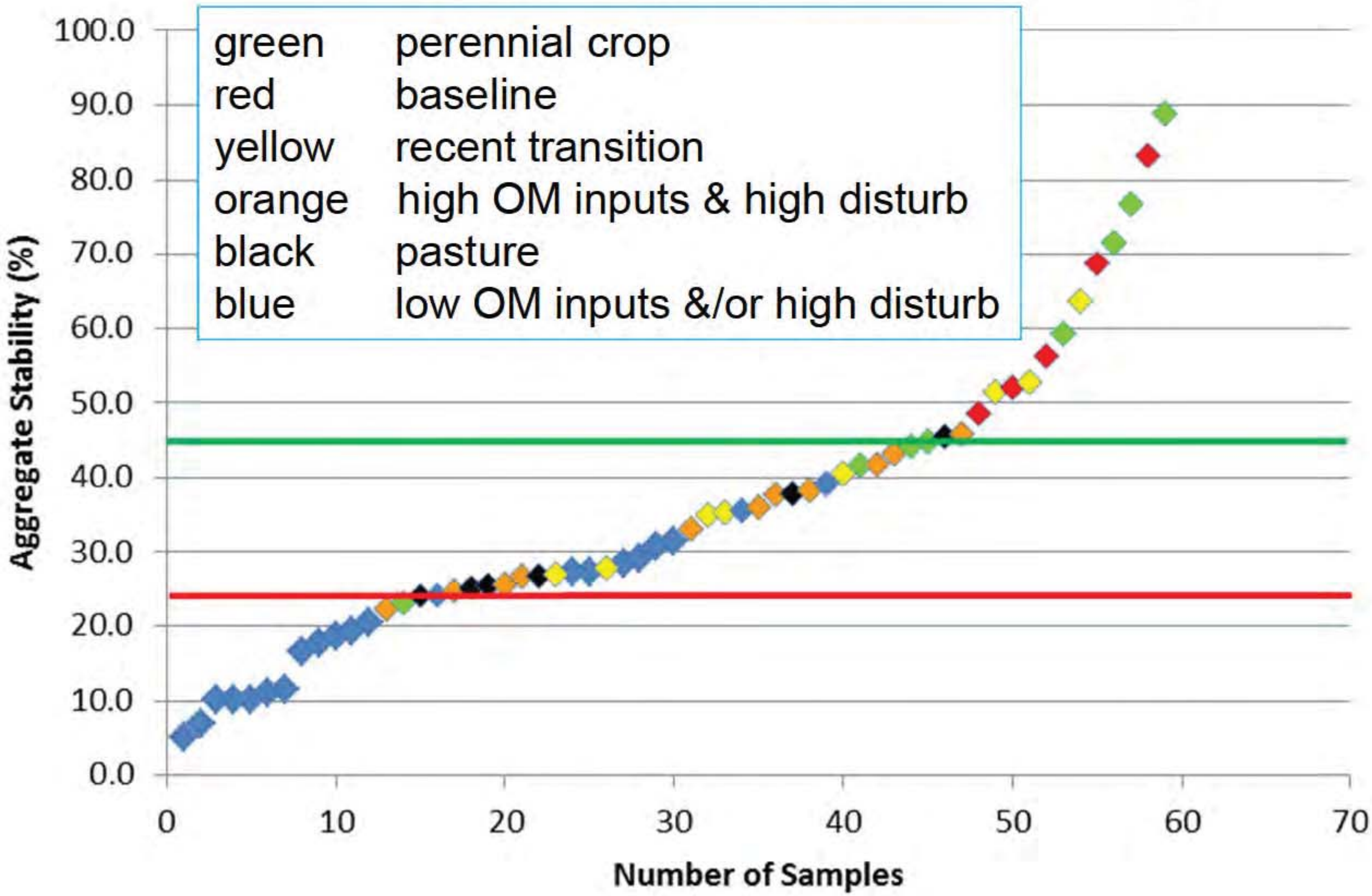
1. Place a ped of two soils, Soil A and Soil B, each on a petri dish or plastic lid.
2. Add enough drops of water to make a pool around the peds.
3. Observe the results.

Aggregate Stability

- 0.25 mm – 2 mm aggregates
- 5 min of simulated rainfall
- Measure weight of stable aggregates to calculate % water stable aggregates

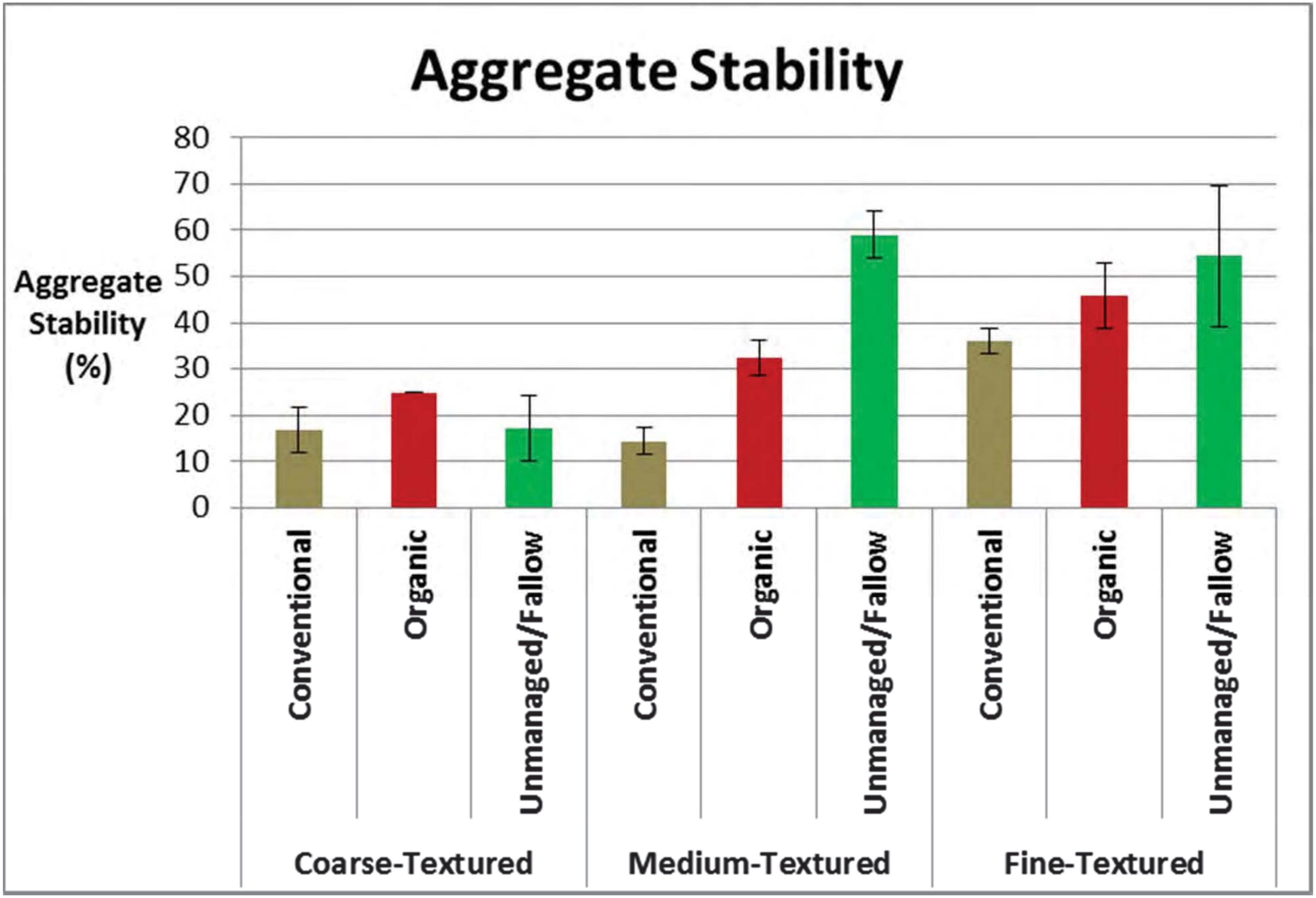


Aggregate Stability



Matteson 01/13/2012

Ag St vs. Texture vs. Manage



Effect of tillage & roots on stability

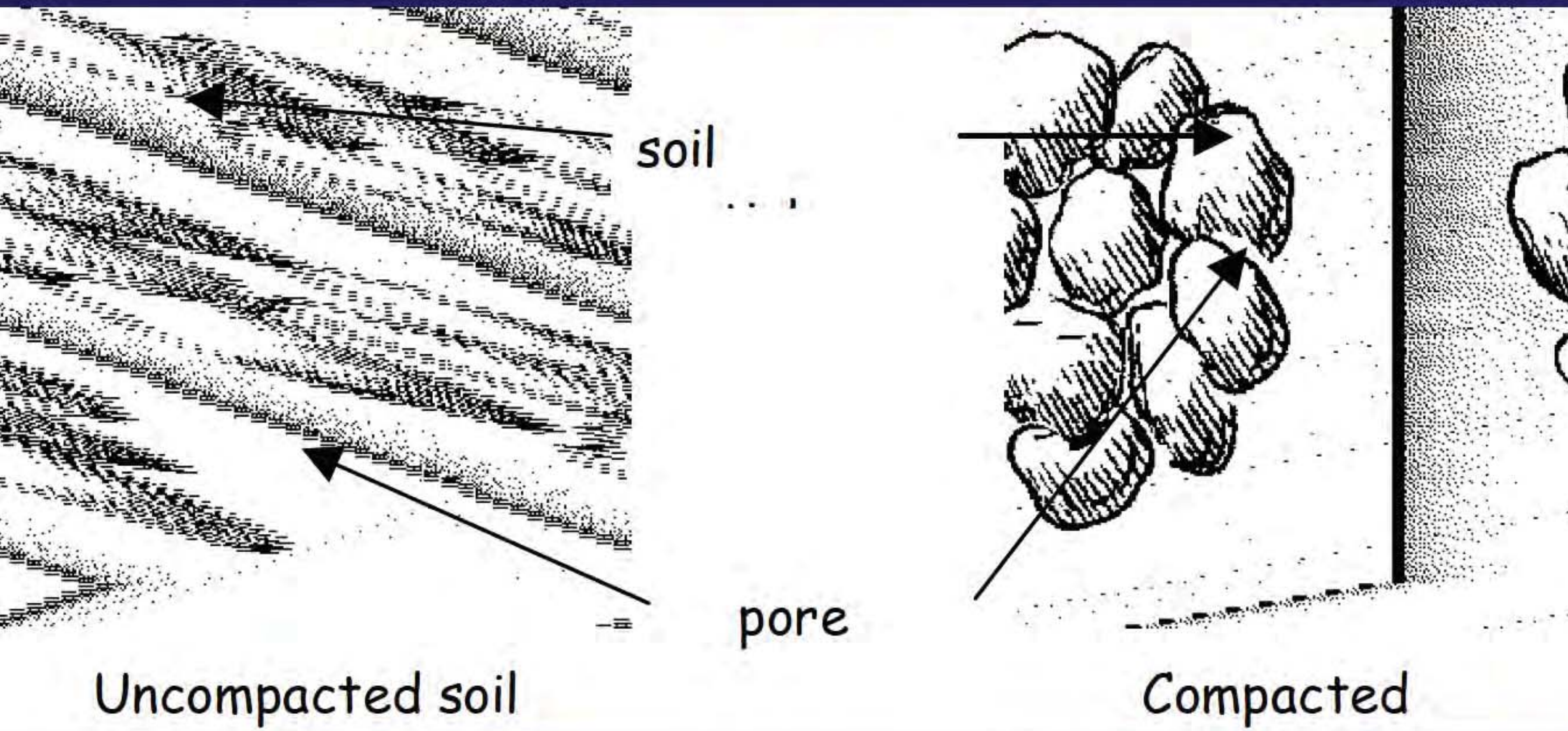
Water Infiltration

1. Reduces erosion
2. Minimizes water pollution
3. Increases irrigation efficiency
4. Prevents flooding
5. Is cost effective

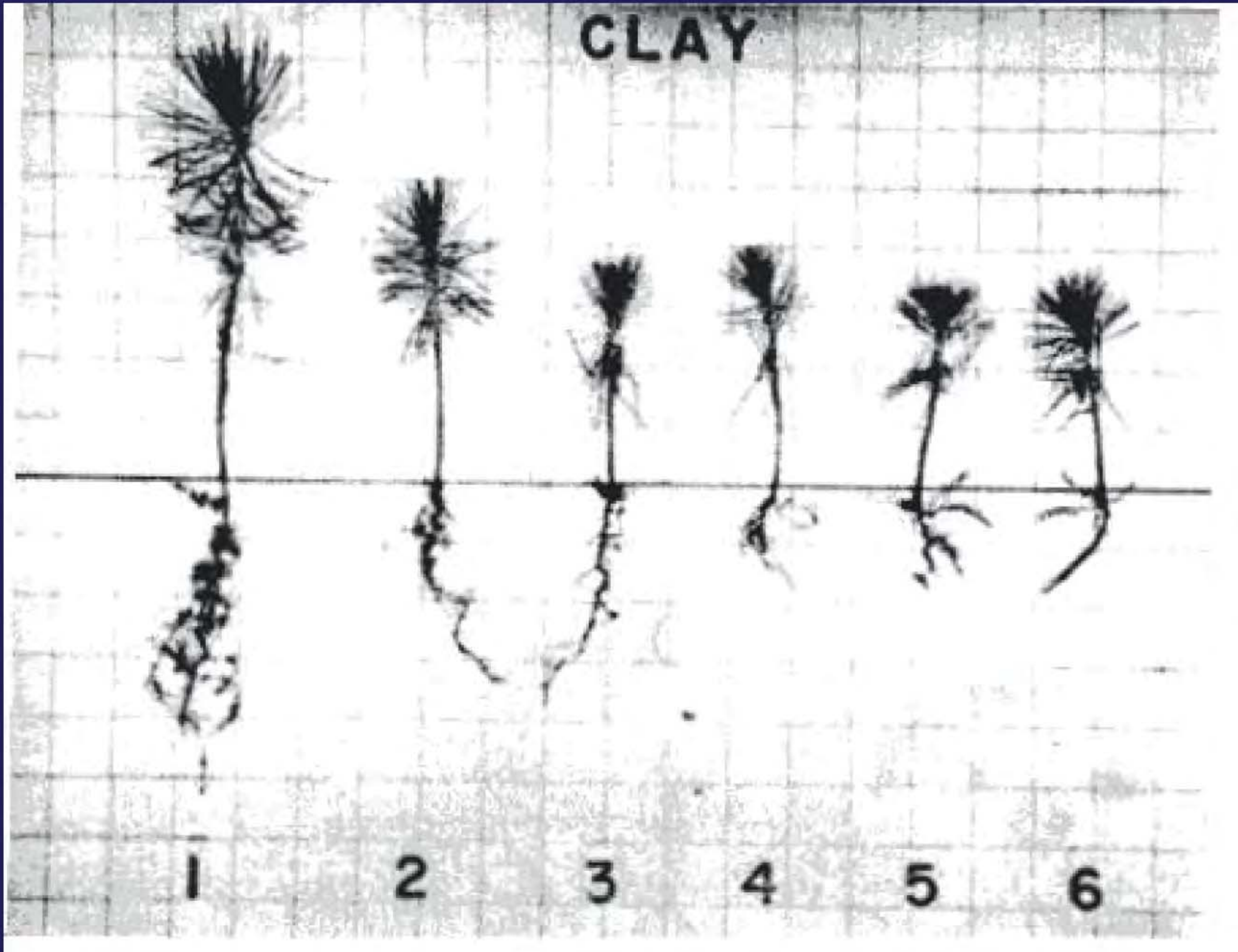
Compaction

Pore spaces are where plants get air, water, and nutrients.

Soil compaction decreases valuable pore space between soil particles.



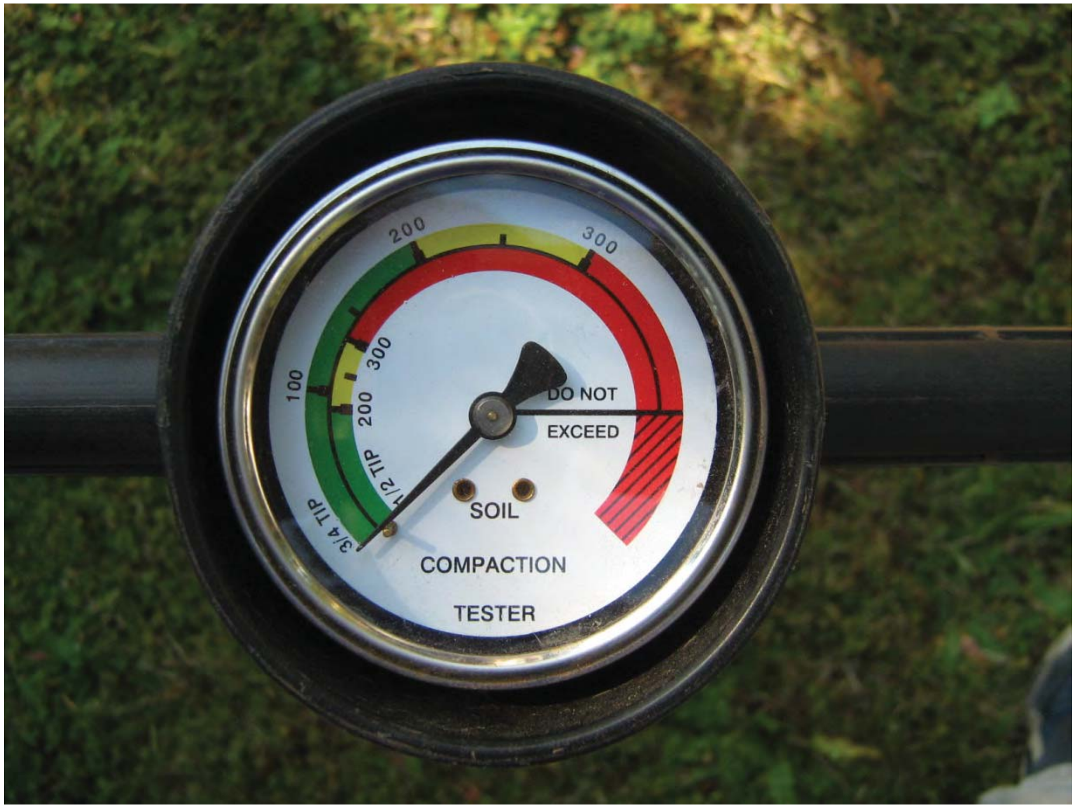
Adapted from Sulzman and Frey, 2003



Compaction

Less Greater

Compaction



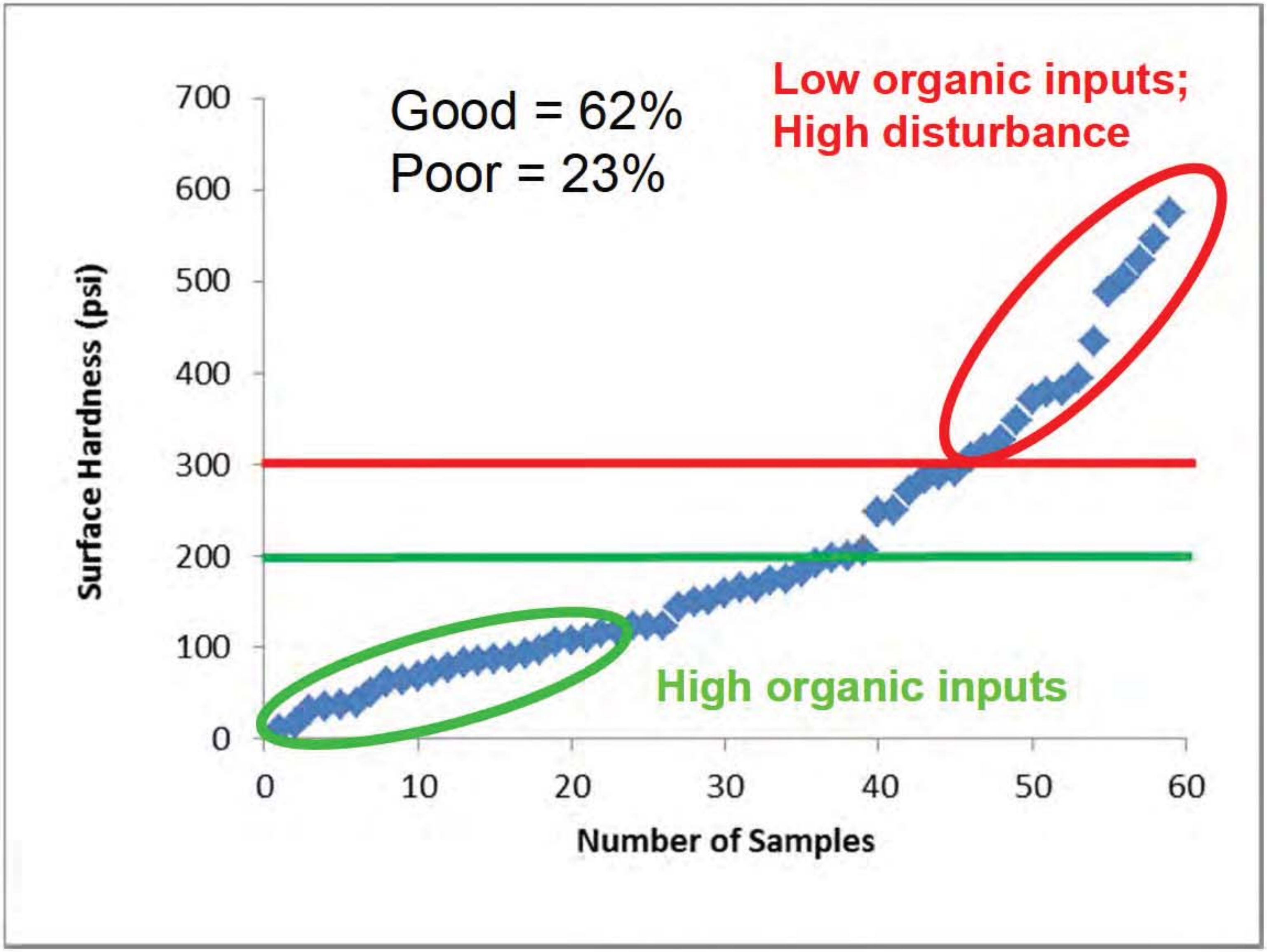
Dickey-john compaction tester

0-6 inches
6-18 inches
18-24 inches

Results impacted by:

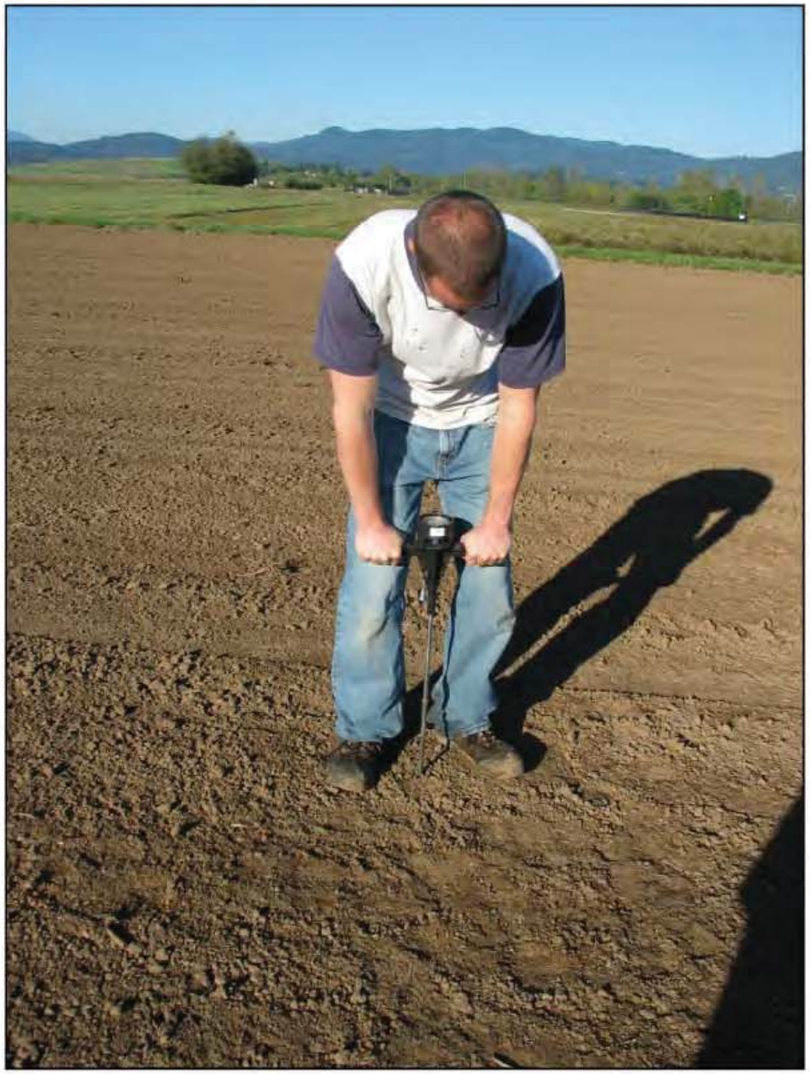
- Soil moisture content
- Equipment training

Surface Hardness

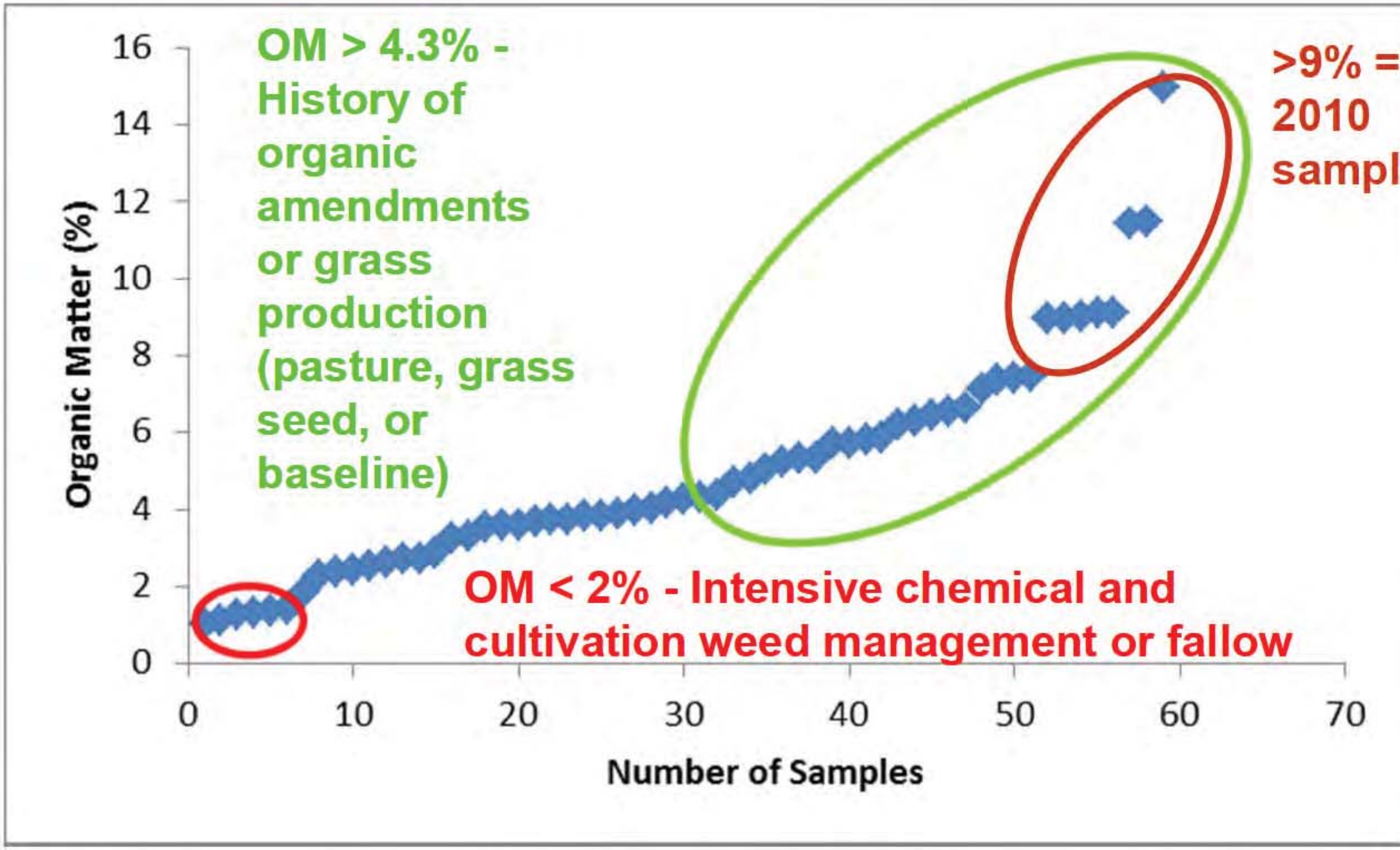


Compaction Results

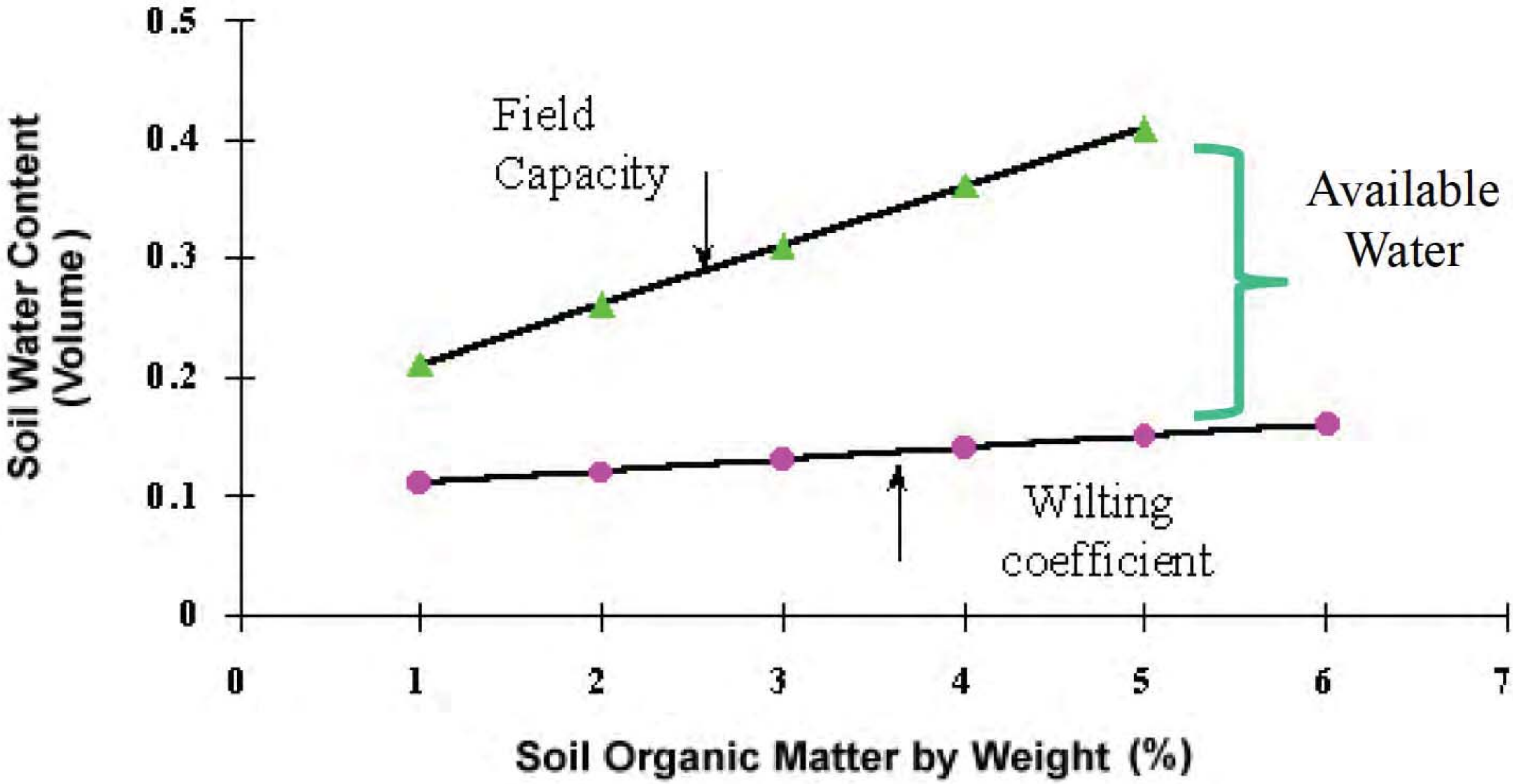
- Farmer awareness varied.
- Recommend decimal format for geolocation data.
- Importance of equipment training.



Organic Matter



Impact of soil organic matter on soil water



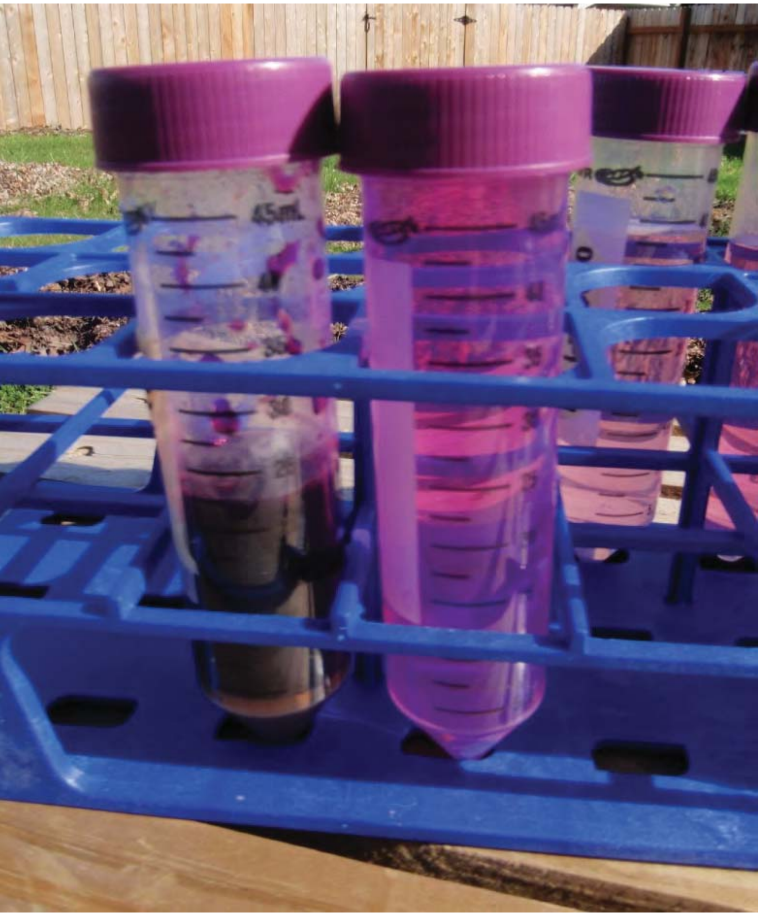
Healthy soils maintain a diverse and active community of soil organisms that:

- **Suppress plant disease, & insect and weed pests**
- **Form beneficial symbiotic associations with plant roots**
- **Recycle essential plant nutrients**
- **Improve soil structure for better water and nutrient retention**

Ultimately, healthy soils increase grower profits and protect the environment

Active Carbon

- **Potassium Permanganate ($KMnO_4$)**
- **Color change reaction = biologically available Carbon**

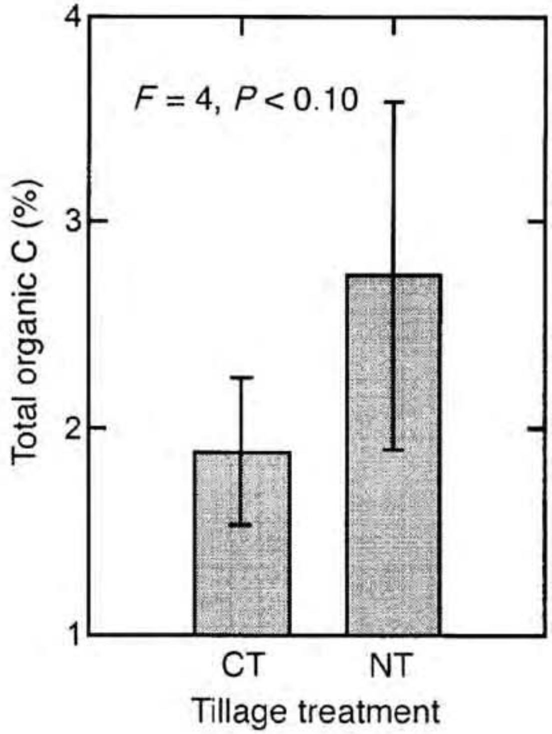


Chemical composition of plant matter

fast

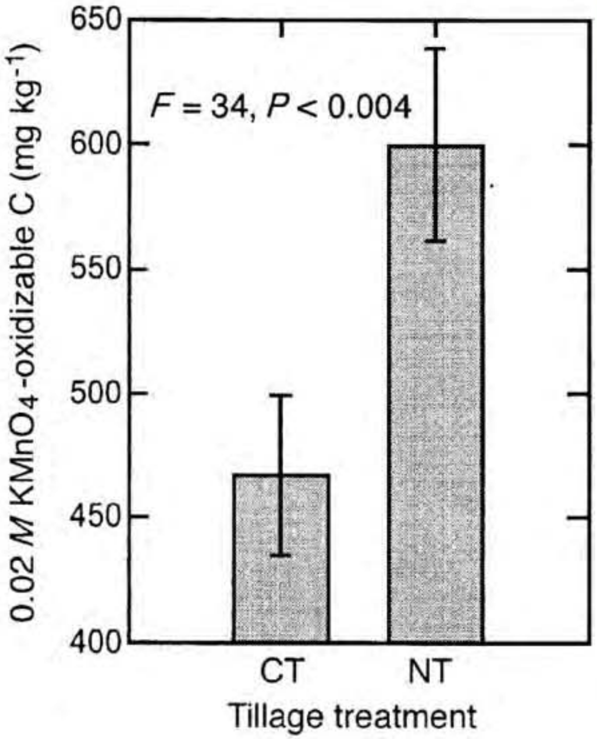
- Sugars, starches, simple proteins
- Crude proteins
- Hemicellulose
- Cellulose
- Fats, waxes
- Lignin

slow



Total organic C,
Comparing conventional till (CT) and no-till (NT)

Active C ($KMnO_4$-oxidizable C) more clearly responds to management than total organic C



KMnO4-oxidizable C ("active C"),
Comparing conventional till (CT) and no-till (NT)

(Source: Weil et al. 2003. Amer J Alternative Agric. 18(1): 3-17)

Courtesy of D. Wolfe, Cornell Univer