Don't Treat Soil Like Dirt

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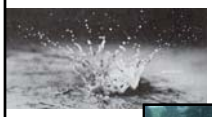
Soil Erosion

- Degradation of the resource
  - Fertility loss
  - Organic matter
  - Tilth degradation
- Water quality
  - Sediment
  - Nutrients
- Program cost
  - Cheaper to prevent
  - Still expensive
- Long-term productivity loss

1939

2013

The Water Erosion Process



Soil erosion is a 3 step process in which soil particles are;
1. Detached from rest of the soil
2. Transported to another location
3. Deposited as overland flow slows down

Universal Soil Loss Equation

Soil Loss (t/a) = R x K x LS x C x P

- R = Rainfall intensity and amount
- K = Soil erosivity
  - Texture
  - Structure
- LS = Slope length, grade, shape
- C = Cultural practices
  - Rotation
  - Tillage
- P = Supporting practices
  - Terraces
  - Contours
  - Buffers

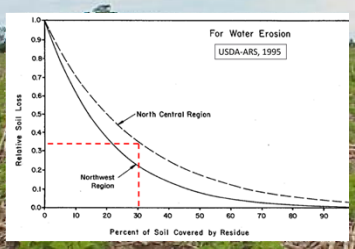
NOTE: USLE has been revised several times and now is called RUSLE 2

Soil Erosion Management Practices

- Contour planting
- Contour buffer strips
- Terraces
- Grassed waterways
- Riparian buffers

- No-till and reduced tillage
  - Cover crops

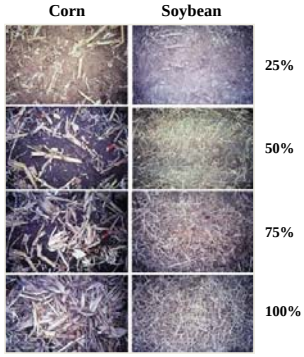
Crop Residue is Still the Best Erosion Prevention Tool



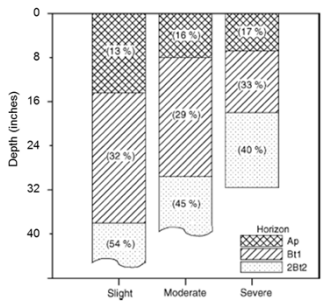
- ✓Reduced detachment
- ✓Hinders overland flow
- ✓Improved infiltration

Percent Residue Cover

- Conventional Tillage
  - (<15% residue)
- Reduced Tillage
  - (15-30% residue)
- Conservation Tillage
  - (>30% residue)

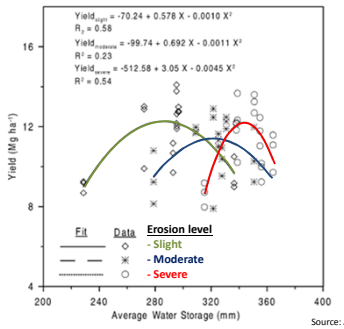


Impact of Soil Erosion



Source: Arriaga and Lowery, 2005

Impact of Soil Erosion cont.



Source: Arriaga and Lowery, 2003a

Tillage Trends: 2000 – 2010

- WDATCP WinTransect Data - **Corn**

Tillage	2000	2005	2010
	---------- % ----------		
No-till	11	22	29
Chisel	39	33	58
Moldboard	49	43	5
Other	1	2	8

Tillage Trends: 2000 – 2010

- WDATCP WinTransect Data - **Soybean**

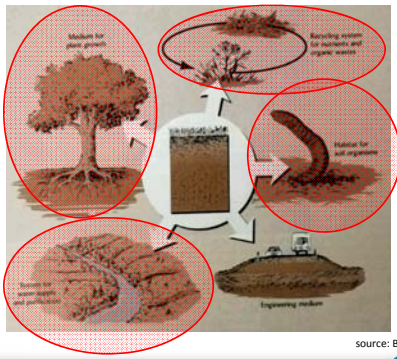
Tillage	2000	2005	2010
	---------- % ----------		
No-till	29	46	49
Chisel	39	34	38
Moldboard	22	19	5
Other	10	2	8

What is Soil Health?

- "the capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation."

(Karlen et al., 1997)

Functions of Soil



source: Brady & Weil, 1996

Soil Functions

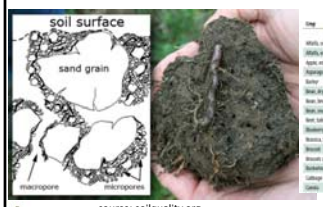
- Medium for plant growth
- Recycle/store nutrients & organic materials
- Habitat for soil organisms
- Water storage & purification

Indicators

- Texture
- Structure
- Infiltration & bulk density
- Water holding capacity
- Aggregate stability
- Soil organic matter
- pH
- Extractable N,P, & K
- Microbial biomass C & N
- Potentially mineralizable N
- Soil respiration

Soil Properties Affected by SOM

- Physical
  - infiltration
  - water retention
  - hydraulic conductivity
  - bulk density
- Chemical
  - CEC
  - nutrient availability
  - buffering capacity

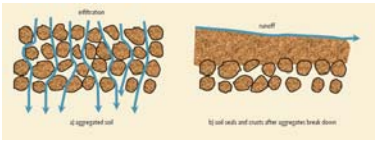


source: soilquality.org

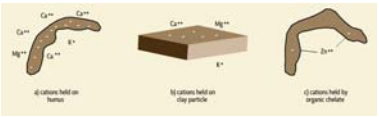
A2809 Table 6.3

Role of Soil Organic Matter

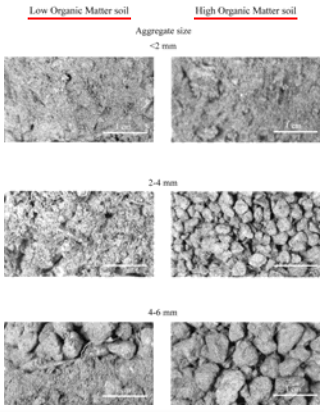
Physical soil properties



Chemical soil properties

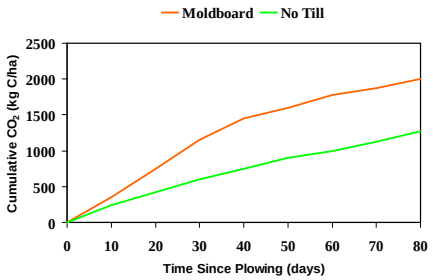


Source: Magdoff and van Es, 2009



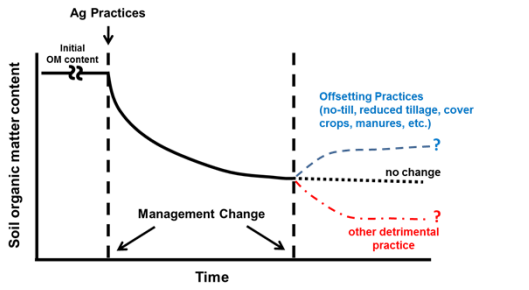
(Lado, Paz and Ben-Hur, 2004)

How is Soil Organic Matter Lost?



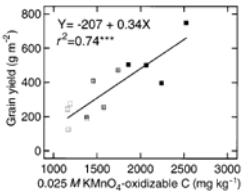
(Rochette and Angers, 1999)

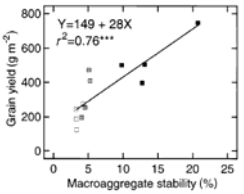
Farming for Soil Organic Matter



(adapted from National Academy of Sciences, 2009)

Corn Yield

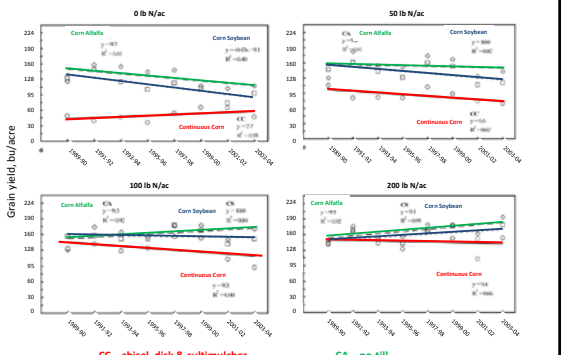




Tillage:
- conventional
- reduced
- no-till

(Stine & Weil, 2002)

Rotation & Tillage Effect on Corn



CC – chisel, disk & cultimulcher

CA – no-till
CS – no-till

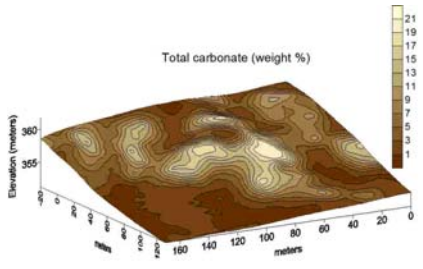
(Stanger & Lauer, Agron. J. 2008)

Why Does Soil Health Matters?

- Eroded field example:

source: S. Papiernik, 2013

Why Does Soil Health Matters?



source: S. Papiernik, 2013

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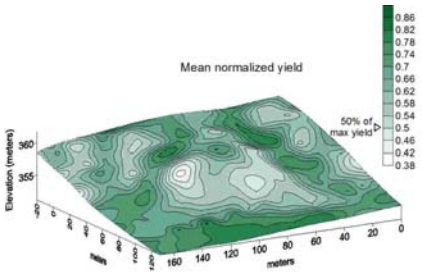

source: S. Papiernik, 2013

How Can the Health of a Soil be Improved?

Measurement	Process Affected
Organic matter	Nutrient cycling, pesticide and water retention, soil structure
Infiltration	Runoff and leaching potential, plant water use efficiency, erosion potential
Aggregation	Soil structure, erosion resistance, crop emergence, infiltration
pH	Nutrient availability, pesticide absorption and mobility
Microbial biomass	Biological activity, nutrient cycling, capacity to degrade pesticides
Forms of N	Availability to plants, leaching potential, mineralization and immobilization rates
Bulk density	Root penetration, water/air filled pores, biological activity
Topsoil depth	Rooting volume, water and nutrient availability
Available nutrients	Capacity to support plant growth, environmental hazard

(adapted from Karlen et al. SSSAJ, 1997)

It is About Management!

Final Thoughts

Productive soils are about managing SOM…

Old woods

Kewaunee B horizon

Hay (2009-12); Corn (2013)

Corn silage-2 years

Corn silage-2 years