Soil Management Practices to Reduce Erosion and Improve Soil Quality

Randall Reeder, Extension Ag. Engineer
Ohio State University
Columbus, Ohio

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Principles and Goals for Environmental Quality

- Keep every soil particle in place
- Keep every rain drop and snowflake where it lands
- Remove highly erodible land from crop production
- Maximize water use efficiency
- Build soil quality, not just maintain it
Goals of a Soil Management Program

**Environmental Quality:** to meet or exceed environmental standards for improving soil, water and air quality

**Agronomic Production:** to maintain or increase crop yields and total crop production
Best Soil Management Practices
Recommendations

- Continuous no-till cropping systems
- Use cover crops following low-residue crops (cotton, soybeans, corn silage)
- Use ‘precision tillage’ as needed (strip-till, variable depth subsoiling)
- Use vegetative buffers as protection against extreme erosion events
If **ALL** our cropland was **NO-TILLED**...
If ALL our cropland was NO-TILLED…

Wind Erosion?  
Water Erosion?  
Runoff?  
Water quality?  
Soil Carbon?  

Nutrient loss?  
Buffer strips?  
Terraces?  
Grass Waterways?  

Crop yields?
Key Questions

- If research shows excellent results for no-till (and other conservation practices) why don’t farmers adopt them?
- If good practices are successful and profitable on individual farms, why doesn’t everyone in the area adopt them?
- Why do good people use bad practices?
U.S. Tillage Practices

- In 1990
  - 73 million (26%) acres Conservation Tillage
  - 17 million (6%) acres No-till

- In 2004
  - 112 million (40%) acres Conservation Tillage
  - 62 million (23%) acres No-till

(CTIC, 2004)
Conservation Tillage Benefits (Residue Management)

- Increases crop residues to protect soil surface
- Reduced soil erosion has positive impact on soil and water quality
- Increases soil carbon content
- Reduces potential wind erosion
- Increases water infiltration and storage
No Tillage means...

Cleaner Streams
No-till in the Midwest
The Palouse Region
In the Palouse...
No-till ~ 10%
Why not 90%?
Continuing Machinery Innovation
Grass waterways and buffers
Grass waterways and buffers
Tillage overwhelms other conservation practices.
Water Erosion Control Practices

Contour Farming

Field borders

Vegetative barrier
Trees, grass buffer

Additional grass buffer (CREP, 200 feet wide)

Corn
Cover Crop
(& Other Conservation Practices)

Facilitates sustainability of production systems

- Providing protective soil cover
- Enhancing soil physical and chemical properties
- Improving soil fertility and plant nutrition
- Facilitating pest management
- Reducing soil water evaporation
- Competing with weeds
Cover Crop: Austrian Pea
Cover Crop Issues

- Extra costs
- Lack of time for establishment
- Lack of adequate equipment
- Synchrony of N release
- Management required
- Suitable plant species
Cover Crop Research Needs
(to encourage widespread use)

- Adaptation to semi-arid and arid climates
- Adaptation to colder climates
- Quantifying nutrient cycling
- Quantifying effects on diseases, pests and other soil microorganisms
- Quantifying benefits for soil carbon
Tillage over time reduces soil carbon

**Morrow Plots**: Illinois
- Corn-Oats-Hay Rotation
- Corn-Oats (1885-1953, Corn-Soybeans (1954-Present)
- Continuous Corn

**Sanborn Field**: Missouri
- Wheat, 6 Tons Manure/year
- Corn, 6 Tons Manure/year
- Continuous Wheat
- Continuous Corn

Estimated at 4% in 1888
Wagner (1989)

*Long Term Effects of Various Crop Rotations*

D.C. Reicosky
Wooster, Ohio: Carbon (0-2 inches)

Wooster 1962-1998

Organic C Content (g kg⁻¹)

No-tillage → Plow Tillage

Continuous corn

NT 34.5% > PT
0.35 g C per year

(W.A. Dick)
RTK Networks and widespread use of Conservation Practices
Auto-steering systems
(precise, consistent tracking)
Strip-till (for corn)
Controlled traffic
(minimizes soil compaction)
No need to till
Continuous No-Till
Auto-steering systems
  (precise, consistent tracking)
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Controlled traffic
  (minimizes soil compaction)
No need to till
Continuous No-Till
Other Issues...

- Targeting watersheds with most erodible land?
- Equal payments per acre, or trying to provide equal “payments” per ton of prevented erosion?
- Commodity payments or Conservation payments
Summary
Principles and Goals

- Keep every soil particle in place
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- Remove highly erodible land from crop production
- Maximize water use efficiency
- Build soil quality, not just maintain it
Conclusions/Recommendations

- Continuous no-till cropping systems
- Use cover crops after low-residue crops
- Use ‘precision tillage’ as needed
- Use ‘vegetative buffers’ as protection against extreme erosion events
- Use irrigation practices that minimize erosion and maximize water conservation
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Water Erosion Conservation Practices – Key Factors

- Ease of establishment & management
- Effectiveness (sediment vs. soluble)
- Impact on other farm operations
- Economics
- Aesthetics
Summary
Soil Management - Key Points

- Practices on-field most effective
- Long term commitment; consistency
- Optimum system for each environment (geographic region, soil, slope, crop, climate)
- Target areas for protection
- Short term vs. long term goals
- Commodity vs. conservation goals
- Society benefits