

# Responsible Harvest of Crop Residue for Biomass Energy Production



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February 15, 2007



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# Residue harvest:

- Improved conversion technology
- Inexpensive for energy producer
- Added farmer income
- Abundant in some systems

US Grain and Residue Production for Four Crops, 2000-2002 average

	<b>Corn</b>	<b>Winter Wheat</b>	<b>Spring Wheat</b>	<b>Grain Sorghum</b>
<b>Grain</b> (mill. bu)	9,477	1,357	488	452
<b>Residue</b> (mill. tons)	<b>265.3</b>	<b>69.2</b>	<b>19.0</b>	<b>13.5</b>
<b>Energy</b> (quads)	4.0	1.0	0.3	0.2

# Residue Ecosystem Services

- Protection from soil erosion
- Increased soil organic matter (SOM) and plant-available nutrients
- Increased biological activity
- Increased or sustained yields

-after Hargrove, 1991

# Effects Summary

## General Benefits of Crop Residues to Soil Quality

### Primary Effect

### Secondary Effect

### Tertiary Effect

Provides physical protection

→ Reduces raindrop impact and wind shear

→ Reduces soil erosion and runoff

Contributes to soil organic matter & nutrients

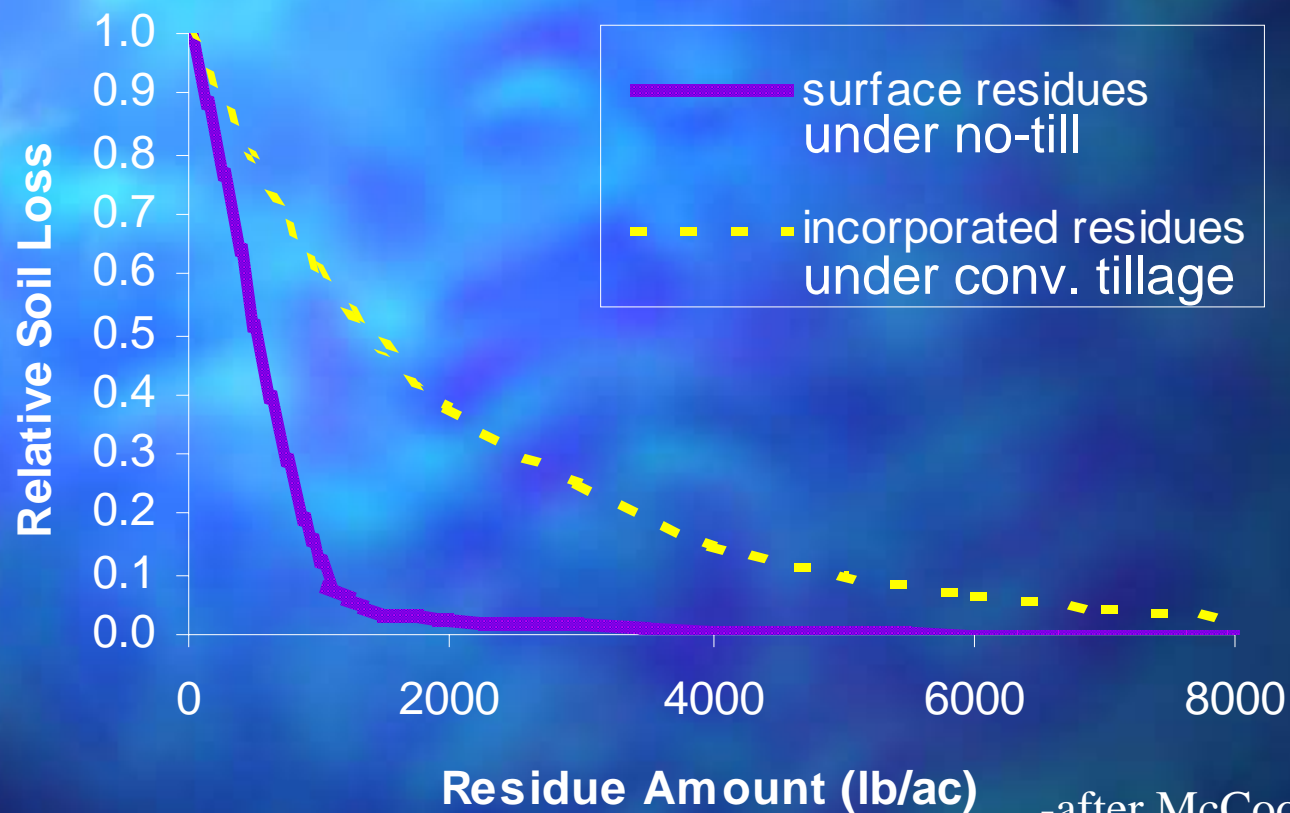
→ Improves chemical, physical & biological properties & processes

→ Increases yield and yield stability

- after Larson, 1979

**All moderated by climate, soil, crop, and management**

# Tillage Effects: Erosion



Residue removal will require conservation tillage!

# Economic Effects: Trade-offs

- More fertilizer, field passes & fuel use
- Potential long-term yield loss
- Opportunity Costs:
  - C trading
  - Conservation Programs
  - Other uses



# Recommendations: Conservation



- No Till
- Cover crops



- Dedicated Perennials



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# Recommendations: Removal Guidelines

Sustainable harvest amounts will vary by:

- Management practice →
- Crop & yield →
- Climate →
- Topography →
- Soil type →

Harvest rates need to decrease with:

- Increased soil disturbance
- Lower yield or lower C:N
- Warmer, wetter climate
- Greater slope
- Coarser soil texture

# Research Needs

## Guidelines for Residue Removal

- Practical to apply
- Based on crop, climate, soil and management
- Multiple decision aids
  - Educational pamphlets & websites
  - Precision harvest GPS tools



“HOW MUCH? WHEN? WHERE?”



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