

# Re-integrating cover crops, low-disturbance tillage and manure to build soil quality and health

Tim Harrigan

Biosystems and Agricultural Engineering  
Michigan State University

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# Soil quality—physical characteristics

- Optimal structure for stand establishment and crop/root growth.
- Minimize wind or water erosion.
- Provide for water infiltration, drainage and aeration.
- Retain crop-available moisture.
- Maintain aggregate structure.

# Soil quality—biological functions

- Maintain balance of pests and pathogens.
- Mobilize nutrients when needed for crop growth, but minimize leaching loss.

# Manage the farming system to build soil quality

- Soil test (chemical balance).
- Low-disturbance tillage (physical balance).
- Traffic (physical balance).
- Cover crops (biological balance).
- Organic inputs (biological balance).
- Crop rotation (biological balance).

# Avoid the over-tillage trap

- Tillage is a fast way to increase pore space, infiltration and drainage.
  - But tillage induced pores are not stable, do not resist re-compaction
- Biological processes build soil quality, aggregation and tilth.
  - root growth
  - microbial activity
  - earthworm activity



# Enhance biological processes with organic inputs--manure and cover crops

- Increase
  - organic matter
  - water holding capacity
- Improve
  - aggregate stability
  - water infiltration
- Decrease
  - evaporation
  - soil bulk density





# Nitrogen cycling for corn production

- 8000+ acres
- Corn-beans-wheat
- Built a hog finishing facility for manure (soil quality).
- Integrated precision ag technologies
  - 20 years grid sampling
  - Many years VRA, including manure
- Attitude of experimentation



## 2010 Corn Crop

- Parkhill Loam soil
- Swine manure, 4,000 gpa
  - 43.4 lb/1000 gal (175 lbs total N)
  - 38.2 lb  $\text{NH}_4\text{-N}$  (150 lbs)
  - 23.4 lb  $\text{P}_2\text{O}_5$
  - 32.9 lb  $\text{K}_2\text{O}$
- Target N was 198#/ac
  - Manure N credit based on first year available  $\text{NH}_4\text{-N}$
  - Assume 30% loss



# Inject, air seed OSR



No manure



4,000 gpa swine slurry



## 2010 Corn Crop N

- 1. Check, no OSR, no manure 198# N
- 2. Drill OSR, no manure 198# N
- 3. AerWay manure, no OSR 92# N, 106# manure N?
- 4. Inject manure, no OSR 92# N, 106# manure N?
- 5. AerWay manure, OSR 54# N, 144# manure N?
- 6. Inject manure, OSR 54#N, 144# manure N?

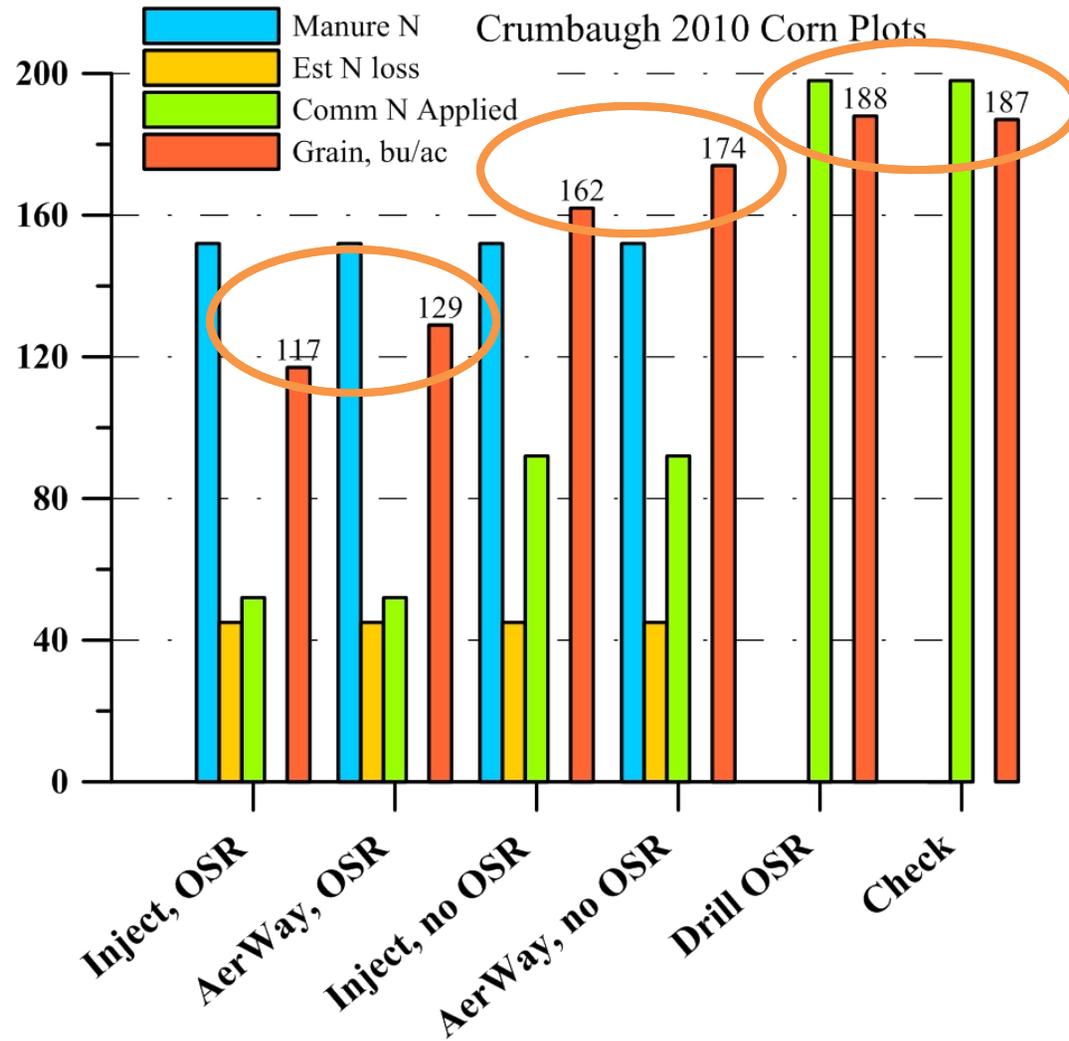
Oil seed radish variety Colonel, 12 lb PLS/acre

Commercial N as 80% urea, 20% esn



# Corn Harvest, Sept. 9, 2010





## Observations...

- Oil seed radish is an excellent cover crop for **capturing** manure nitrogen.
- The challenge is to select a cover crop combination that will capture N and **release** it in synchrony with corn crop demand.
- Rate, timing, pathways of N loss are complex. Simple guidelines are likely to be wrong.
- Develop an attitude of experimentation and refine your nutrient management program.

