

Aerator Incorporation of Spring-Applied Dairy Manure versus Chisel Incorporation in Reduced Tillage Systems



Quirine M. Ketterings, Anne Place, Joe Lawrence, Karl Czymmek, Brian Aldrich, Tom Kilcer, Shawn Bossard, Eric Young, Willard DeGolyer



Introduction

Why shallow (aerator) incorporation of manure?

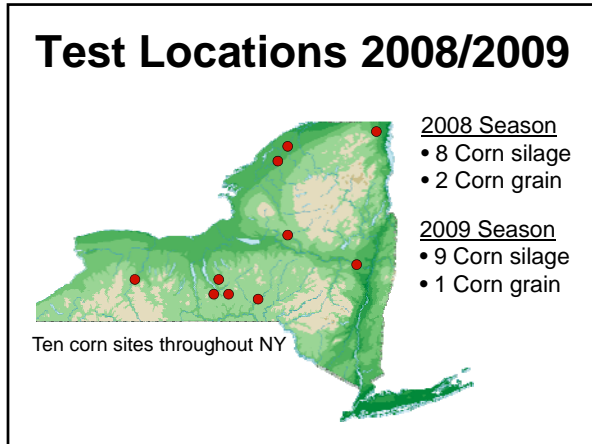
- Reduce manure ammonia emissions (i.e. increase manure N use efficiency)
- Compatible with reduced-tillage systems
- Potential to reduce fuel and labor costs



On-Farm Trials 2008/2009

Objectives

- Evaluate impact of shallow incorporation of manure on:
 - Surface residue conservation
 - Compaction
 - Corn yield and quality
 - N conservation
- Assessment of economic benefits
 - Potential to reduce costs: labor, fuel, time



Methods

Application methods

- Surface applied
 - no incorporation for 5 d
- Chisel incorporation
 - directly after application
- Aerator incorporation
 - directly after application

Surface application

Chisel incorporation

Aerator incorporation

Equipment

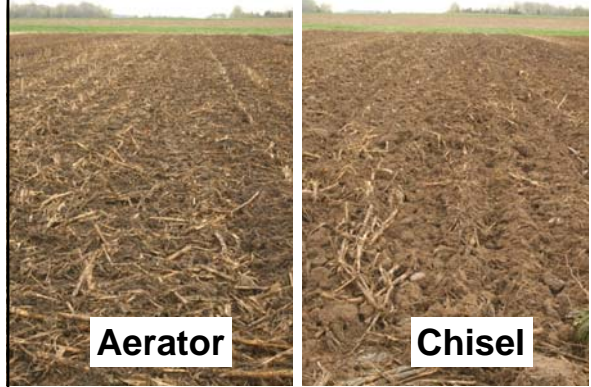
Chisel

Aerator

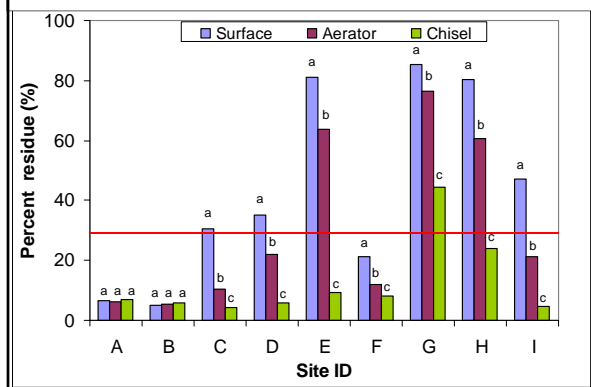
Materials and Methods

- **Baseline sampling**
 - 8 inch soil samples
 - 15 cores/plot
 - Soil moisture
 - Residue measurements
 - 3 measurements/plot
 - Soil compaction measurements
 - 5 measurements/plot
 - Depth: 3, 6, 9, 12 inches
- **Manure application**
 - Manure samples
 - Tillage treatments
 - 2nd residue measurements
- **At planting**
 - 8 inch soil samples
- **At sidedress**
 - 8 and 12 inch soil samples
 - Soil compaction measurements
 - Stand counts
- **At harvest**
 - 8 inch soil samples
 - Yield
 - Forage quality samples
 - Stalk nitrate samples
 - Row lengths

Results: Surface Residue



Results: Surface Residue




Conclusions: Surface Residue

1. The aerator leaves measurably more surface residue than chisel incorporation.
2. This can make the difference for meeting conservation tillage requirements (>30% residue coverage).


Results: Silage yields

Site ID	Yield			Forage quality			Milk estimate		
	ton/acre			Crude Protein (%)			lbs/acre		
	Surface	Aerator	Chisel	Surface	Aerator	Chisel	Surface	Aerator	Chisel
A	17.4 b	19.4 a	19.4 a	5.9 a	6.4 a	6.4 a	20,937 b	23,402 a	23,247 a
B	27.6 a	27.1 a	27.1 a	7.2 a	7.1 a	7.2 a	34,472 a	33,606 a	33,672 a
C	11.8 a	13.5 a	12.9 a	6.0 a	5.9 a	6.1 a	14,914 a	17,250 a	16,284 a
D	20.5 a	22.1 a	22.7 a	6.2 a	6.7 a	6.6 a	26,203 a	28,817 a	28,622 a
E	21.2 a	21.6 a	21.7 a	7.4 a	7.4 a	7.7 a	26,617 a	27,263 a	27,394 a
F	20.7 a	21.1 a	20.1 a	7.1 a	7.3 a	7.3 a	23,928 a	24,806 a	23,917 a
I	12.7 b	14.9 a	15.2 a	6.3 a	6.7 a	6.8 a	14,488 b	17,327 a	17,536 a
All	18.9 b	20.0 a	19.8 a	6.6 b	6.8 ab	6.9 a	23,147 b	24,616 a	24,338 a


 1 ton/acre yield increase with incorporation
 No difference between aerator and chisel incorporation

Results: Silage yields

Site ID	Yield			Forage quality			Milk estimate		
	ton/acre			Crude Protein (%)			lbs/acre		
	Surface	Aerator	Chisel	Surface	Aerator	Chisel	Surface	Aerator	Chisel
A	17.4 b	19.4 a	19.4 a	5.9 a	6.4 a	6.4 a	20,937 b	23,402 a	23,247 a
B	27.6 a	27.1 a	27.1 a	7.2 a	7.1 a	7.2 a	34,472 a	33,606 a	33,672 a
C	11.8 a	13.5 a	12.9 a	6.0 a	5.9 a	6.1 a	14,914 a	17,250 a	16,284 a
D	20.5 a	22.1 a	22.7 a	6.2 a	6.7 a	6.6 a	26,203 a	28,817 a	28,622 a
E	21.2 a	21.6 a	21.7 a	7.4 a	7.4 a	7.7 a	26,617 a	27,263 a	27,394 a
F	20.7 a	21.1 a	20.1 a	7.1 a	7.3 a	7.3 a	23,928 a	24,806 a	23,917 a
I	12.7 b	14.9 a	15.2 a	6.3 a	6.7 a	6.8 a	14,488 b	17,327 a	17,536 a
All	18.9 b	20.0 a	19.8 a	6.6 b	6.8 ab	6.9 a	23,147 b	24,616 a	24,338 a
All -*	15.6 b	17.5 a	17.5 a	6.1 b	6.4 a	6.5 a	19,165 b	21,705 a	21,387 a


 2 ton/acre yield increase with incorporation if high N sites are excluded
 No difference between aerator and chisel incorporation

* Corn stalk nitrate test > 5000 mg/kg (>2000 mg/kg = excess)

Conclusions: Yield and Quality

1. Yield can be increased by 1-2 ton/acre with incorporation.
2. No yield or quality cut with aerator (shallow) incorporation compared to chisel plowing.
3. Aerator incorporation is cheaper.

Overall Conclusions:

- Shallow incorporation is suitable method for incorporating manure in reduced tillage systems:
 - Greater retention of surface residue.
 - Reduced fuel and time investment.
 - 1-2 ton increase in yield with incorporation.



Injection?

Treatment	Stand density at sidedress time plant/acre	Corn silage yield (35% DM) tons/acre	Moisture content at harvest %
2009			
Surface	33,019 a	13.7 b	64.1 a
Aerway incorporation	33,219 a	14.1 b	64.4 a
Direct injection	32,612 a	18.2 a	63.7 a
Average	32,950	NA	64.1
2008			
Surface	30,574 a	22.4 b	68.2 a
Aerway incorporation	28,428 a	22.9 b	68.3 a
Direct injection	30,538 a	27.0 a	67.9 a
Average	29,847	NA	68.1



Funding

**Northern New York Agricultural
Development Program (NNYADP)**

New York Farm Viability Institute (NYFVI)

Federal Formula Funds