Addressing Grain Farmers' Concerns: Manure spreading, soil compaction and crop yield

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Introduction

Encourage better nutrient management and improved profitability on farms in the Upper Midwest by incorporating manure into cash-grain rotations

- Benefits:
  - Plant nutrients
  - Improved soil properties
  - Economic incentives
- Despite these benefits, many farmers are hesitant to use manure largely because of potential soil compaction

How does Manure Spreading Equipment Compare?

Make / Model	Description	Capacity	Tire psi	Axle #	Axle Wt. in lbs
Husky 4000	Truck Mounted Manure Tanker	4000 gal.	60-90	3	19,880
Balzer 5700	Tractor Pulled Manure Tanker	5700 gal.	23	2	30,995
JD 9660	Combine	250 bu.	35	2	24,200
Killbros 1150	Grain Cart	500 bu.	20	1	31,350

Research Questions

1. Does the compaction caused by the application of manure result in lower corn yields?
2. Does manure help to mitigate the effect of compaction due to its general benefits?
3. Do multiple traffic passes adversely affect yield?

2 Experiments Established (2005)

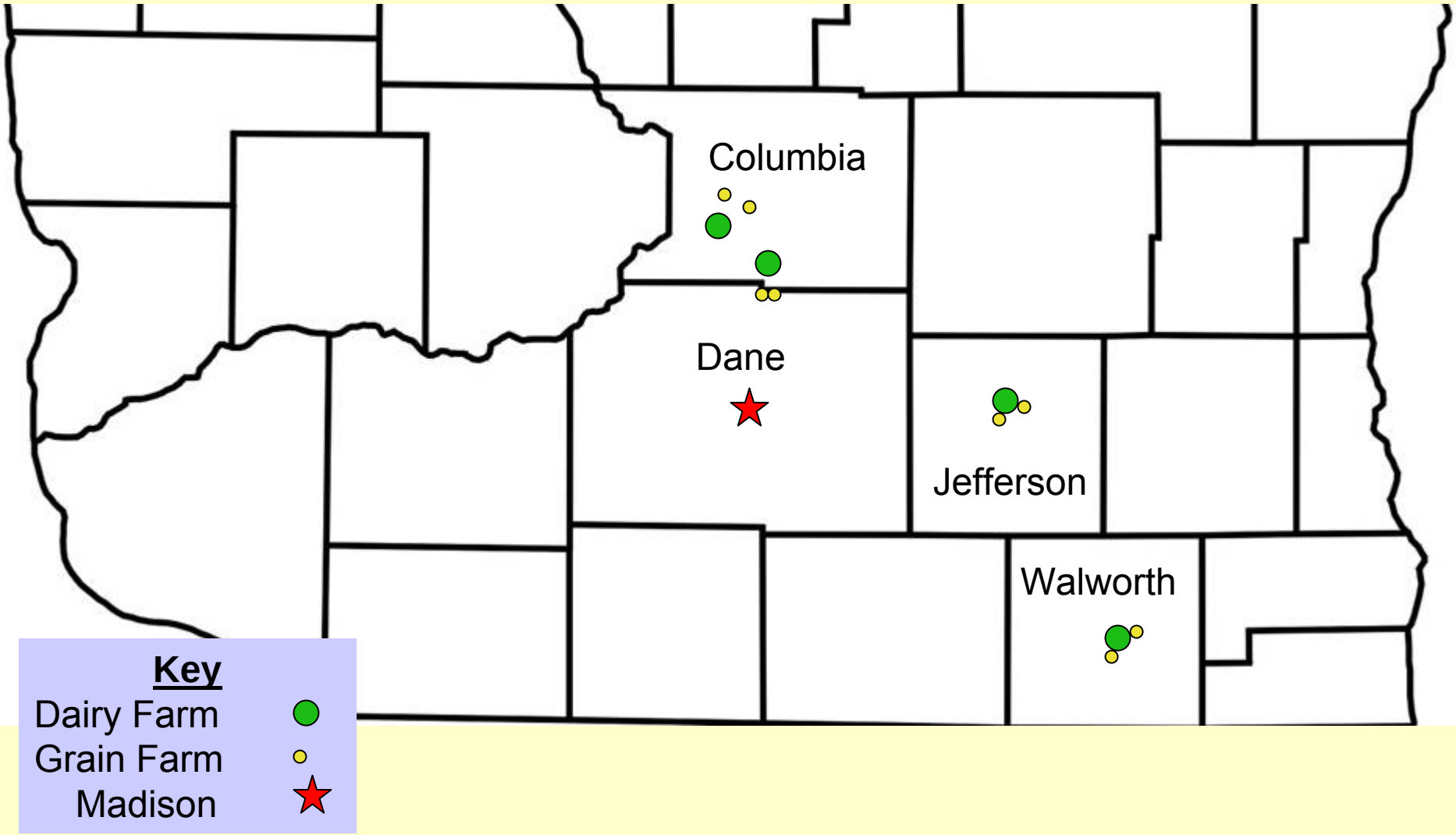
Experiment #1: On-Farm

Experiment #2: On-Station “Headlands Study”

Exp #1: On-Farm Research

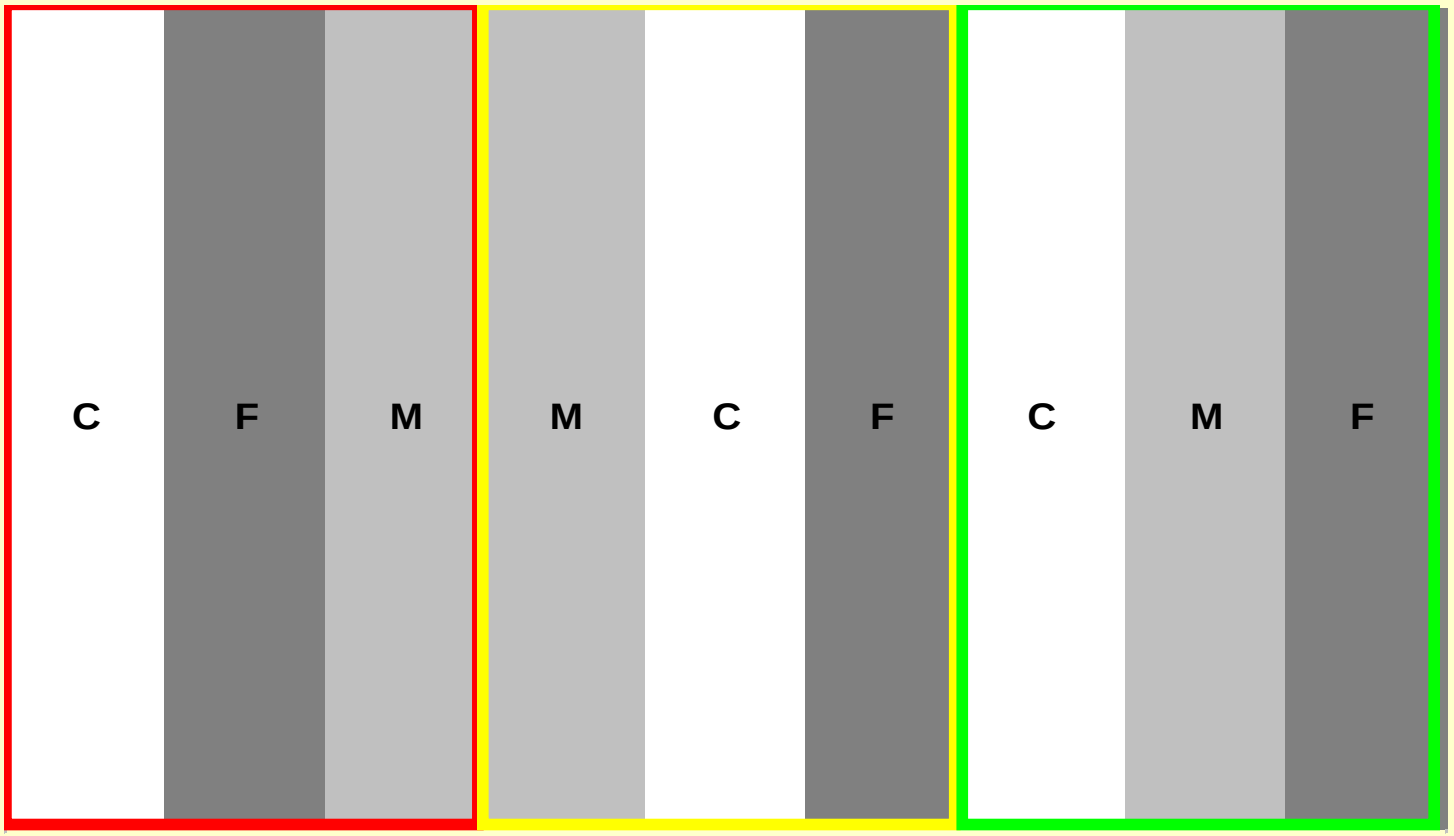
- 8 on-farm research sites
- Slurry was fall applied and then incorporated at most sites
- Corn following: Corn, Soybean, Wheat, and Alfalfa

Location of Eight On-Farm Research Sites and Corresponding Dairies



Exp #1: On-farm Research Sites

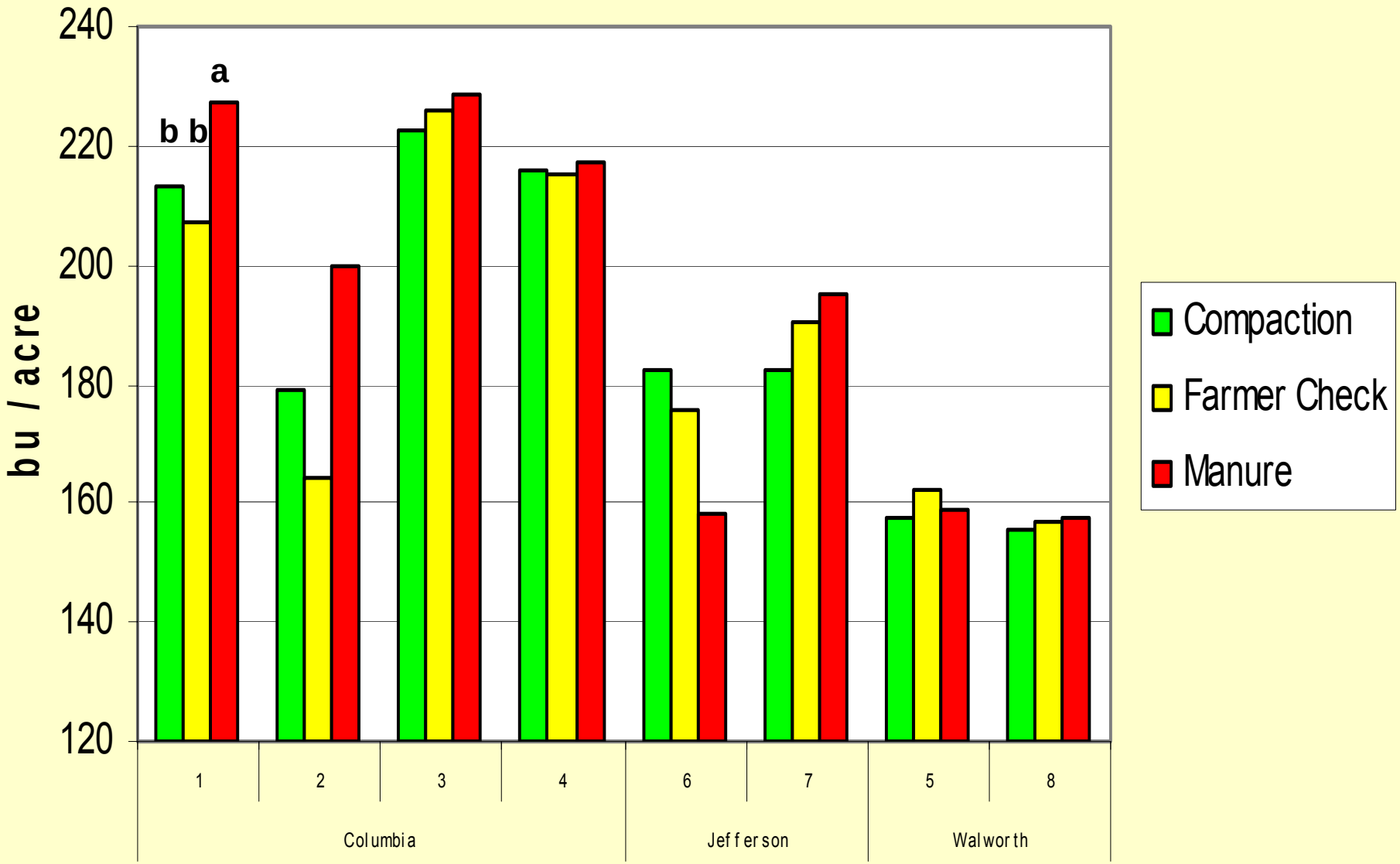
- Three treatments: Farmers Check (F), Manure (M), Compaction-only (C)
- Three randomized replicates
- 0.2 – 0.5 acre plots



Exp #1: Treatments

- Soils: Silt loam, clay loam, loam
- 4 sites - broadcast tanker
- 4 sites - injection tanker
- Compaction-only treatment: same traffic pattern as manure application
- Field conditions were relatively dry
- PSNT

Exp #1: On-Farm Yield Results (2005)



Note: Bars with different letters are significant at α = 0.05

Exp #2: Headlands Study

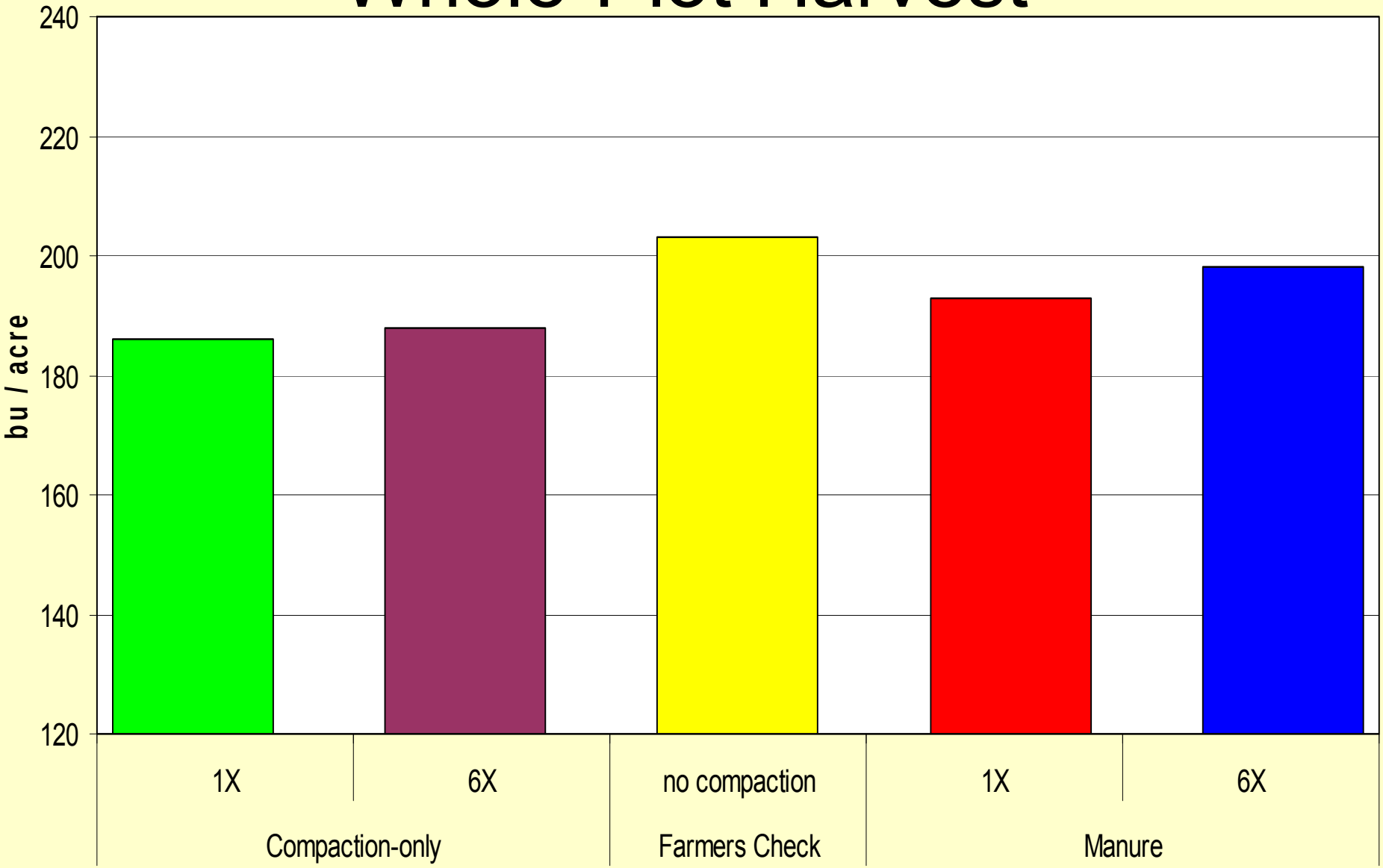
- Field entrances and headlands
- 5 treatments
- Waste Handler 4600
- Corn yields
  - Whole-Plot harvest
  - Hand harvest: distance from tire track

Exp #2: Treatments

- Farmers Check: F
- Manure: M1
- Compaction-only: C1
- Manure with 6 passes: M6
  - Manure spread on 6th pass
- Compaction-only with 6 passes: C6
  - 6 passes with loaded tanker

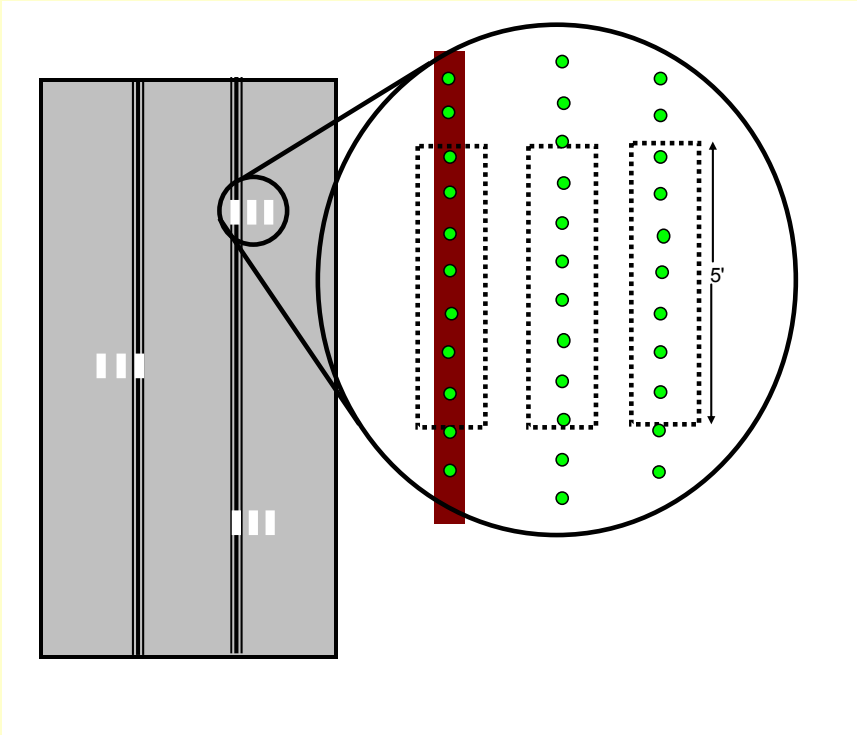
- Soil moisture near field capacity

Exp #2: On-Station Results (2005)
Whole-Plot Harvest



Exp #2: Assessing Yield at Varying distance from tire track

- 3 sampling stations in each plot
- Hand harvests: 5’ sections of 3 corn rows
  - In track
  - 30’’ from track
  - 60” from track



Exp #2: Hand Harvest Results (2005)

Row-by-Row Hand Harvests:

- **1 pass treatments**: No difference in yields (manure and compaction-only)
- **6 pass treatments**: Within-track yields lower (10-16%) than those away from track (manure and compaction-only)

  - Manure Application Equipment: 9% of application width was under tires

Exp #2: Hand Harvest Results (2005)

	1 Pass		6 Pass	
	Manure	Compaction	Manure	Compaction
Within tire track	185	181	168[a]	146[a]
30 in. from tire track	187	188	166[a]	171[b]
60 in. from tire track	179	176	184[b]	176[b]

Note: Columns with differing letters are significantly different at $\alpha=0.10$

Conclusions

- When driving on relatively dry fields, compaction caused by manure spreaders did not significantly reduce corn yields

- Yield reductions occurred in areas with multiple traffic passes (directly in tire track)

Project Continuation

- 7 to 8 On-Farm sites for 2006
- One more year of the headlands study at Arlington
- Penetrometer work

Questions?