Tillage Management for the Corn/Soybean Rotation on Erodible Soils

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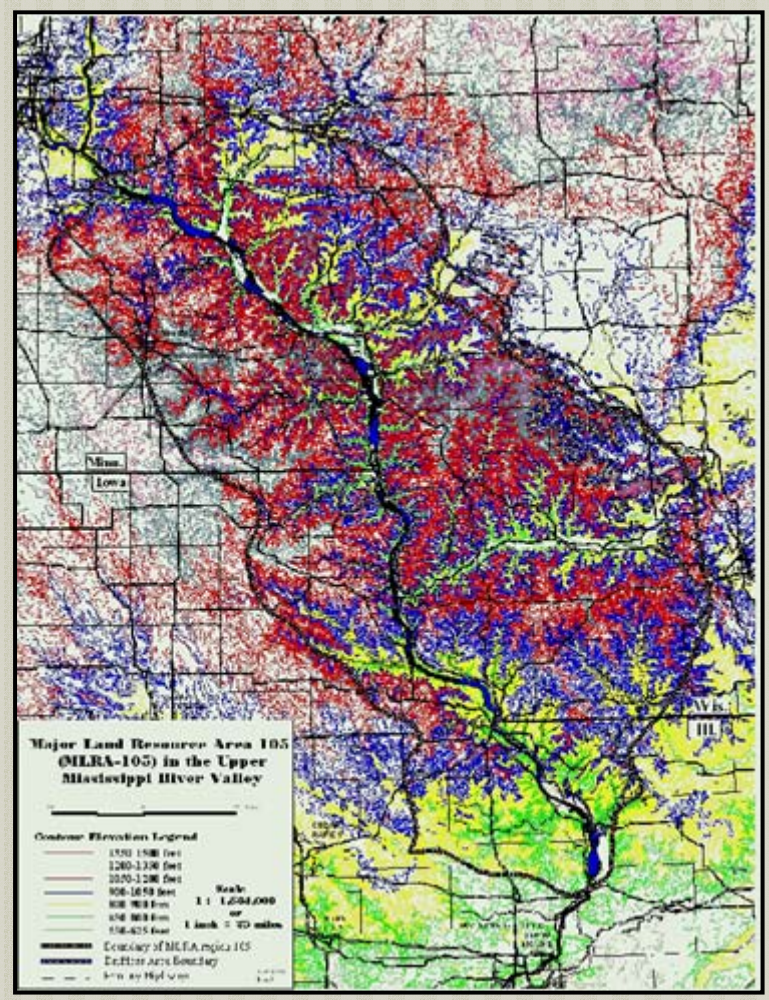
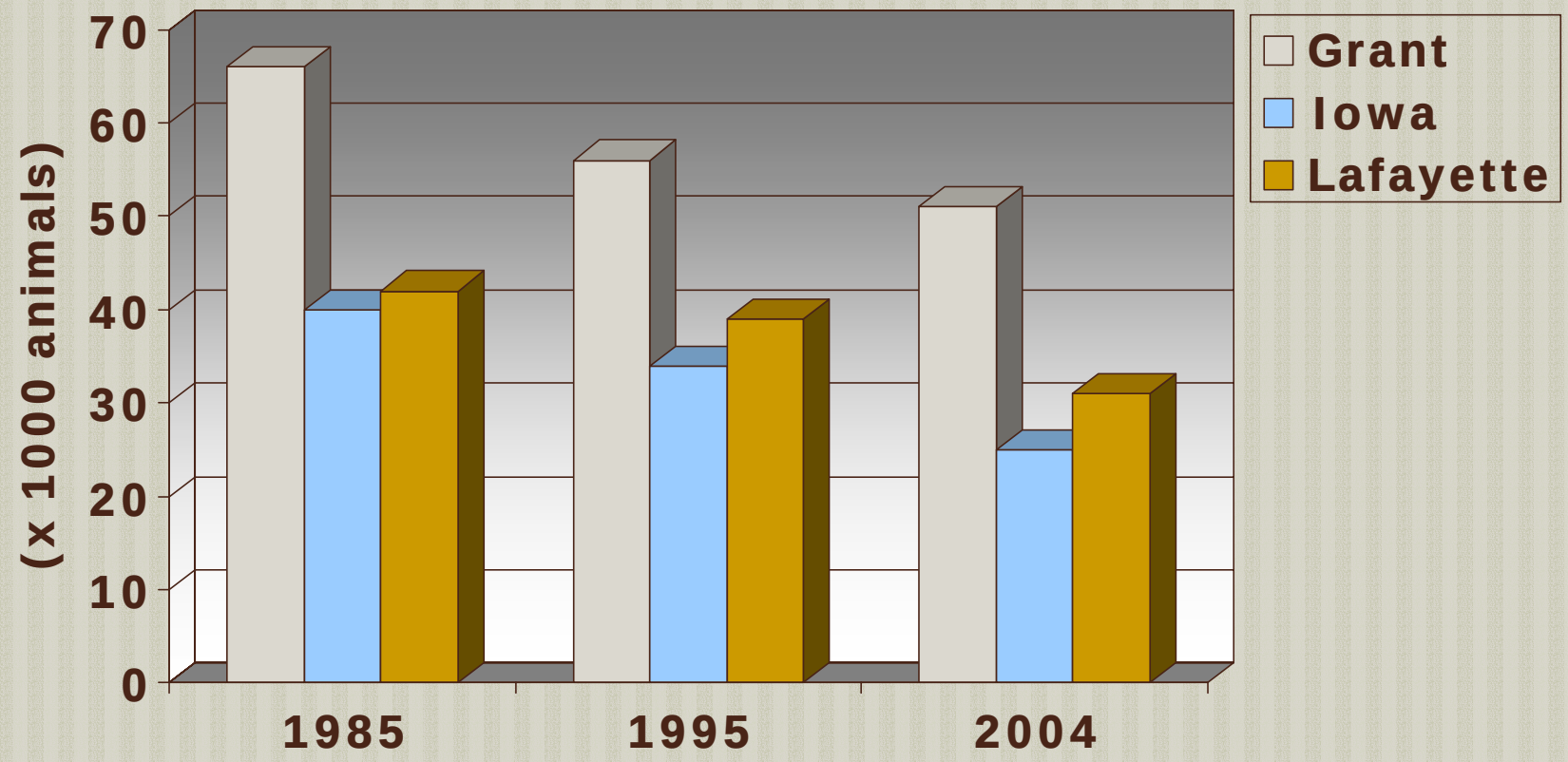
Multi-state (NCR) Project

- Similar soils in parts of IA, IL, MN
- MLRA 105
- Evaluate the effect of the changing farming systems in the region
- Multi-disciplinary project
  - C sequestration
  - Pasture mgt.
  - Livestock feeding alternatives
  - Cover crops integration
  - Tillage and runoff evaluation
- Collaborators
  - Dr. Rick Cruse, Professor, ISU
  - Ms. Hillary Owen, Research Asst., ISU



Change in dairy cow numbers



Source: Wisconsin Ag. Statistics

Change in crop acres since 1985 (x 1000 acres)

Year	Grant		Iowa		LaFayette	
	Corn	Soybean	Corn	Soybean	Corn	Soybean
1985	169	12	124	2	122	4
1995	120	16	57	9	110	10
2004	126	52	56	55	101	54

Source: Wisconsin Ag. Statistics

Procedure – Agronomic

- Contour strip at Lancaster ARS, 8 % slope – Split 50:50 corn and soybean
  - Field soil test pH 6.8, P 38 ppm, K 99 ppm
  - Tillage treatments (main plot)
    - Fall chisel/Spring field cultivator
    - Spring field cultivator
    - Fall strip-till
    - No-till (with residue managers)
  - Fertilizer placement treatments (subplots)
    - None, broadcast, surface band, row
    - 30 and 60 lb K_2O/a

Procedure – Soil loss

- Contour strip at Lancaster ARS, 8 % slope
  - Chisel and strip-till only
  - ISU Passive runoff collectors
    - Collection area 5 x 20 ft.
    - 1:1000 collection ratio
    - Sample after every runoff event
    - Back-calculate to estimate soil loss
    - In-season measurements only

Photo Album - Tillage

Remlinger strip-till tool

Following strip-tillage

LARS coulter chisel w/ sweeps

Following chisel plowing

Photo Album – Soil loss

Runoff collector in strip-till

Rick Cruse and Hillary Owen

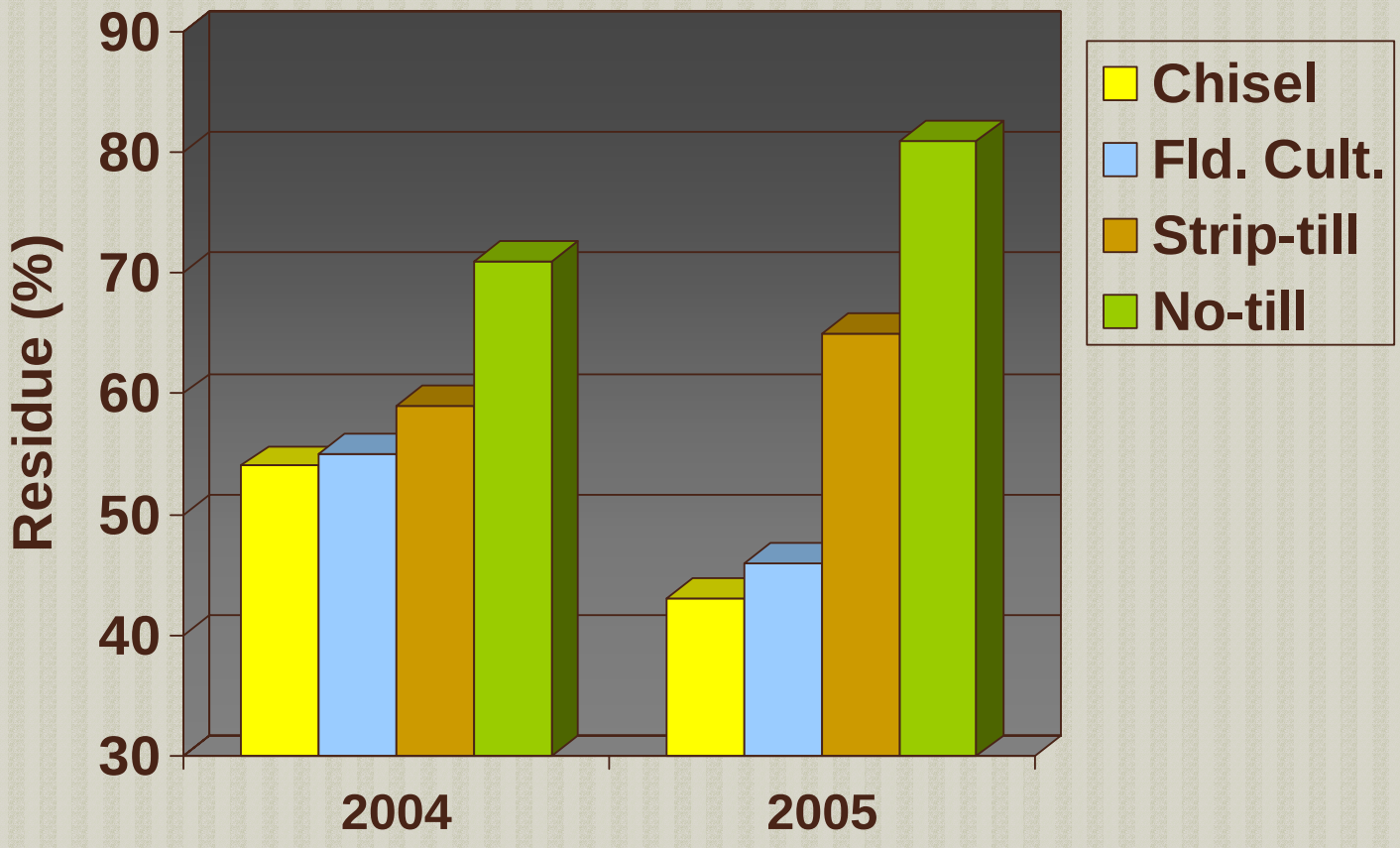
Sediment in chisel

Collecting sediment

Measurements

- Emergence
- Surface residue
- Estimated soil loss
- Early season dry matter accumulation and nutrient uptake
- Silage and grain yield

Surface Residue 2004-2005



V6 K uptake (main effects)

Treatment	2004	2005
	---------- lb K_20/a ----------	
Chisel	59	30
Fld. Cult.	54	33
Strip-till	70	35
No-till	78	39
Surf. Strip	61	32
Broadcast	67	33
2 x 2	67	37
30	65	35
60	65	33

Grain yield (main effects)

Treatment	2004	2005
	---------- bu/a ----------	
Chisel	203	195
Fld. Cult.	198	183
Strip-till	200	187
No-till	195	186
Surf. Strip	200	182
Broadcast	197	190
2 x 2	201	192
30	199	185
60	200	191

STIR (Soil Tillage Intensity Rating)

Calculated STIR for Lancaster: C MT, SB NT

Chisel	Fld. Cult.	Strip-till	No-till
82	36	12	5

STIR values are moderately high and typical of Mulch-till and conventional systems with several full width soil disturbing operations such as disking, chiseling or field cultivations. **Soil loss rates are likely to be excessive** on sloping or wind erosion prone soils unless supporting practices such as terraces and contouring or long term hay based crop rotations are practiced. **Tillage operations release carbon** from the soil and decrease organic matter levels over time. Soil organic matter levels are likely to be declining unless offset by returning residues from high residue crops to the soil surface, or by additions of manure or compost. **Consider reducing the number of tillage passes, switching to less aggressive tillage** operations or to minimal disturbance systems like No-till. Contact your local NRCS office for a more precise evaluation of your farming system.

Soil loss – A tale of two years

2004				2005			
		Soil loss				Soil loss	
Date	Precip	Chisel	Strip	Date	Precip	Chisel	Strip
5-14	0.95	0.12	0.006	6-6	0.96	0.05	0.02
5-21	0.50	0.14	0	6-27	5.00	0.08	0.01
5-24	3.09	2.82	0.23	7-26	3.60	0.001	0
6-1	4.85	0.39	0.39	7-29	1.30	0.10	0.12
6-17	2.51	0.71	0	8-19	3.28	0.05	0.01
7-12	1.24	0.27	0.009	9-19	1.44	0.02	0
8-4	1.11	0.22	0				
Total		4.67	0.28			0.30	0.16

A partial budget for tillage

Item	Chisel	Fld. Cult.	Strip-till	No-till
Cost	---------- $/a ----------			
Primary tillage	13.00	--	--	--
Secondary tillage	10.30	10.30	10.00	--
Planting	14.00	14.00	14.80	14.80
Total	37.30	27.30	24.80	14.80
Return	---------- $/a ----------			
Avg. Yield (bu)	199	190	194	191
Value @ $2.50/bu	498	475	485	478
Net	461	448	460	463

Source: Wisconsin Ag. Statistics

Summary

- Tillage practices in first-year corn had a minimal affect on yield
- K fertility was not an issue
- Soil loss was impacted by heavy early-season rainfall
- Substantial residue in mulch-till did not prevent erosion
- Economics question the need for full-width tillage on these soils