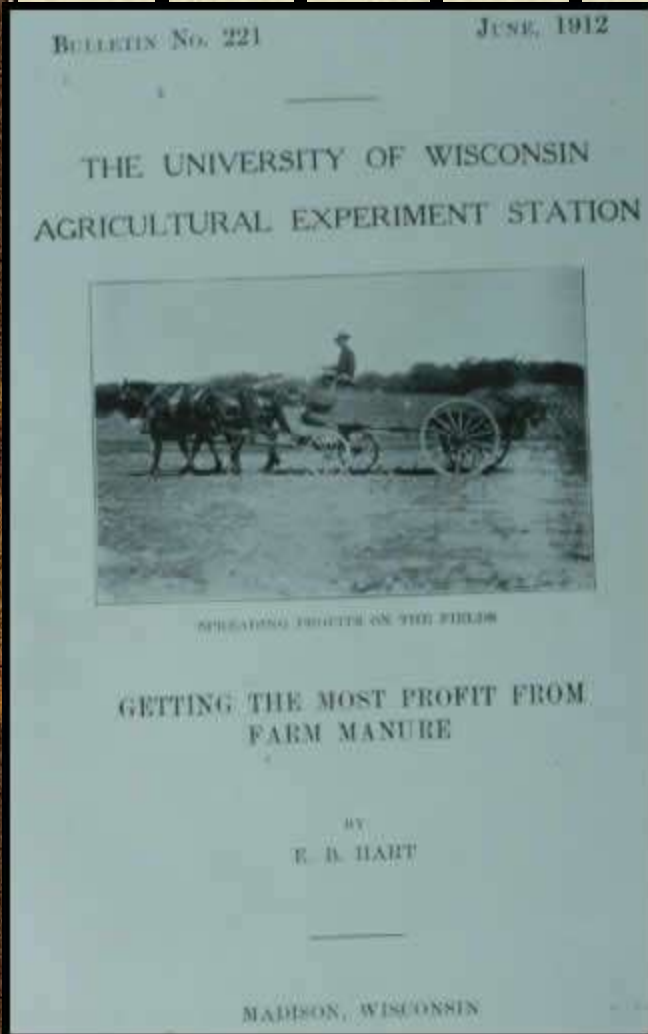


EFFECTIVE RESIDUE- TILLAGE-MANURE MANAGEMENT

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DEPARTMENT OF SOIL SCIENCE
UW-MADISON

MANURE MANAGEMENT ISSUES HAVE EXISTED FOR A LONG TIME

TECHNOLOGY CHANGE IN 90 YEARS



WHAT IS THE GOAL OF MANURE MANAGEMENT

- ✦ **DISTRIBUTE NUTRIENTS EVENLY ON THE FARM**
 - ✦ **AVOID SOIL P BUILDUP**
- ✦ **UTILIZE PLANT NUTRIENTS**
 - ✦ **N BASED MANAGEMENT**
- ✦ **AVOID APPLICATION WHERE LOSSES ARE LIKELY**
 - ✦ **STEEPLY SLOPING LAND**
 - ✦ **FIELDS ADJACENT TO WATER**
- ✦ **BALANCE NUTRIENT USE AND DISPOSAL NEED**

A COMMON WISCONSIN PICTURE



DEVELOP A MANURE SPREADING PLAN

- ✦ PART OF THE NUTRIENT MGT. PLAN
- ✦ UTILIZE ALL SOURCES OF NUTRIENTS
- ✦ PLAN COMPONENTS
 - ✦ ESTIMATE OF MANURE AVAILABLE
 - ✦ FIELD SELECTION BASED ON CROP, SOIL TEST, SOIL TYPE, SLOPE, ACCESS
 - ✦ APPLY AS ACCURATELY AS POSSIBLE
 - ✦ KEEP RECORDS



SPREADER CALIBRATION A MUST

THE CONSERVATION PLAN COMES FIRST

- ✦ DETERMINES CROPS AND ROTATIONS
- ✦ MANY ARE OUTDATED OR WORSE NOT FOLLOWED
- ✦ AGRICULTURE IS MOVING TOWARD CONSERVATION TILLAGE
- ✦ WHICH IS MORE IMPORTANT: THE CONSERVATION PLAN OR THE NMP

SOIL CONSERVATION IS A SOCIETAL CONCERN

✦ DEGRADATION OF THE RESOURCE

- ◆ FERTILITY
- ◆ ORGANIC MATTTTER
- ◆ TILTH

✦ WATER QUALITY

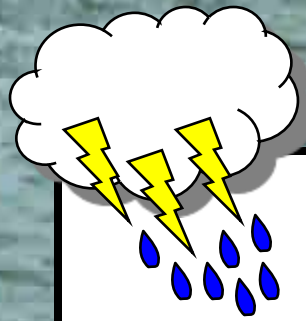
- ◆ SEDIMENT
- ◆ NUTRIENTS

✦ PROGRAM COST

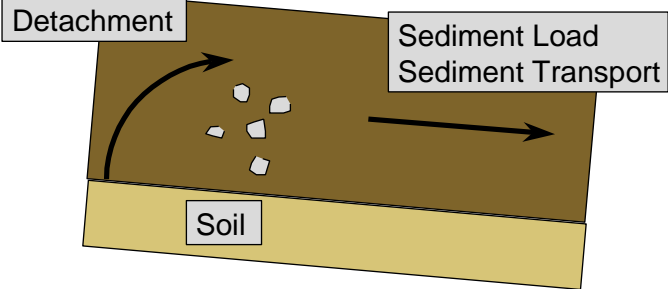
- ◆ EXPENSIVE TO MANAGE
- ◆ CHEAPER TO PREVENT



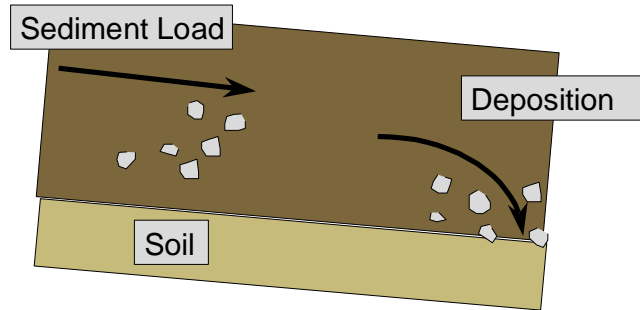
THE SOIL EROSION PROCESS



DETACHMENT



DEPOSITION



CROP RESIDUE IS STILL THE BEST EROSION PREVENTION TOOL

- ✓ REDUCES DETACHMENT
- ✓ HINDERS OVERLAND FLOW
- ✓ IMPROVES INFILTRATION

CONSERVATION PRACTICES ADD FLEXIBILITY



- ✓ CONTOUR BUFFERS
- ✓ ROTATION OPTIONS
- ✓ COST SHARE \$

CONFLICT BETWEEN CONSERVATION AND NMP

- ✦ NMP WILL ALLOCATE MANURE TO MORE FIELDS ON A FARM
- ✦ SOME MAY BE DIRECTED TOWARD SLOPING LAND
- ✦ ROTATIONS AND TILLAGE MAY NOT BE ADAPTABLE TO MANURING
- ✦ PLANTING PROBLEMS
- ✦ MORE TILLAGE = MORE EROSION AND TOTAL P LOSS
- ✦ WHICH IS MORE IMPORTANT: THE CONSERVATION PLAN OR THE NMP

WHAT TO DO WITH MANURE



✓ DAILY HAUL STILL VERY COMMON

✓ RATE LIMITED WITH SURFACE APPLICATION

✓ MANURE = RESIDUE



**PROBLEMS WITH DAILY
HAUL APPLICATIONS**

STORAGE INCREASES LAND SPREADING OPTIONS



MANURE AND WATER DON'T MIX

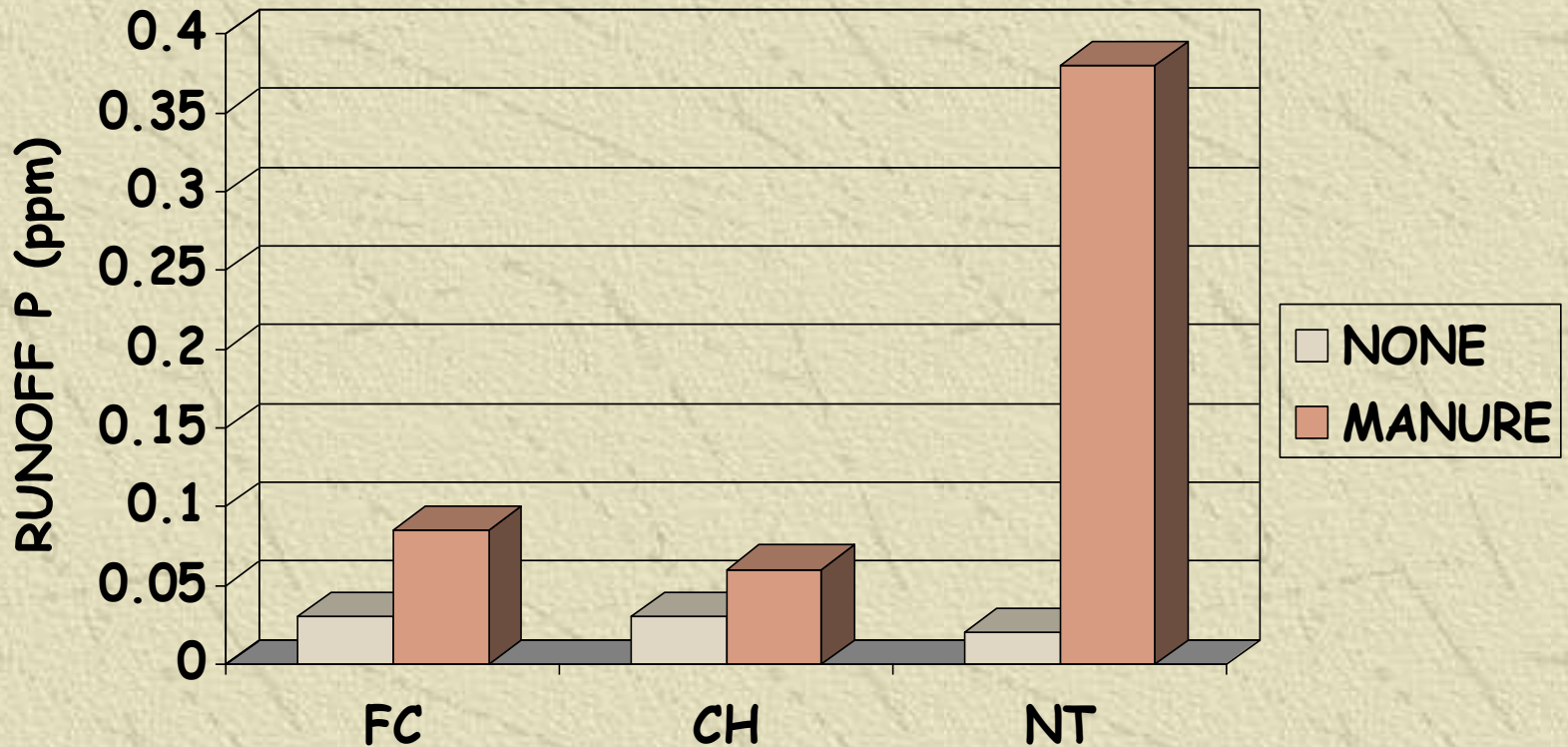
*CRYPTOSPORIDIUM OUTBREAK
MILWAUKEE, APRIL, 1993*





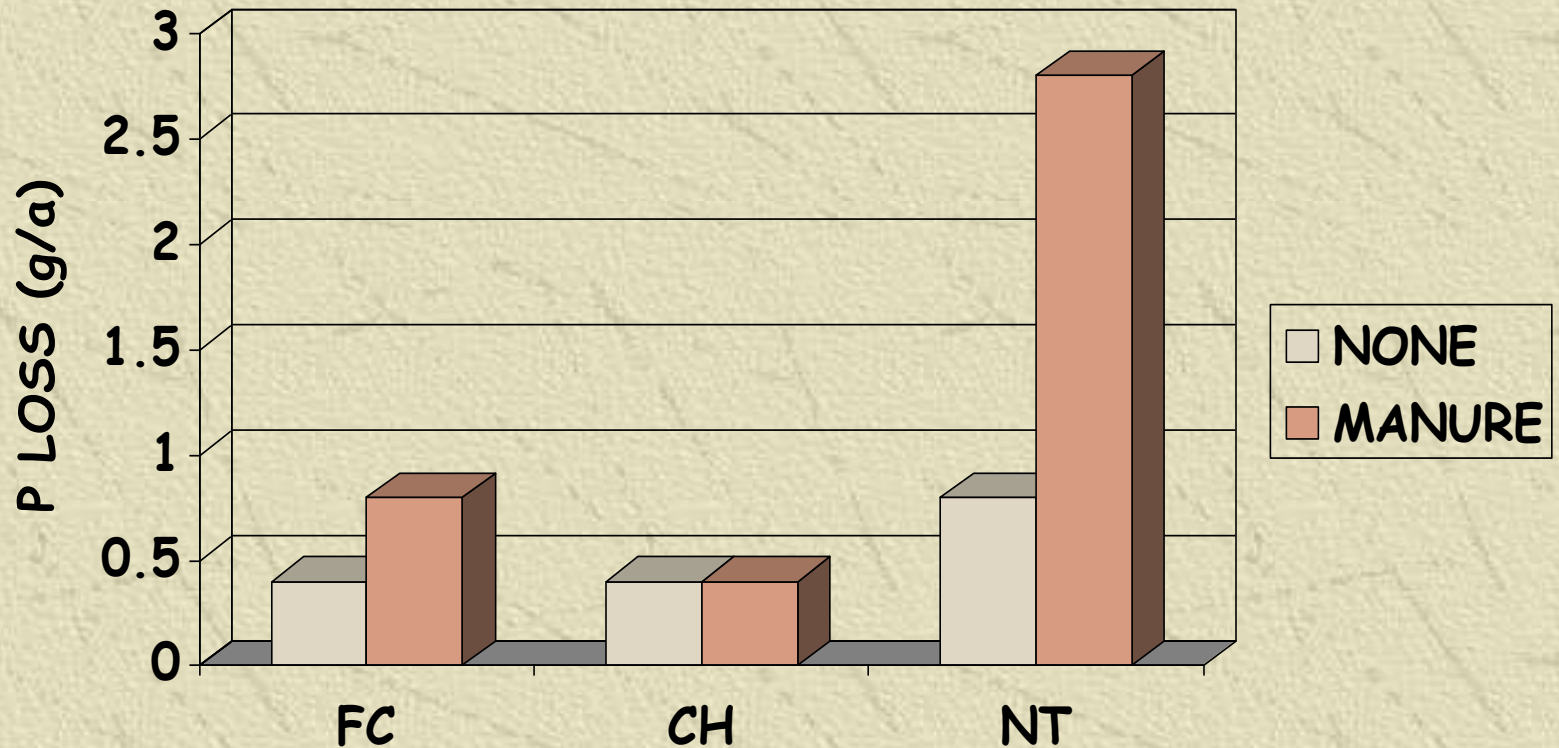
**COMMON SENSE:
SHUT OFF SPREADER
IN WATERWAY**

SOLUBLE P LOSS AND MANURE APPLICATION



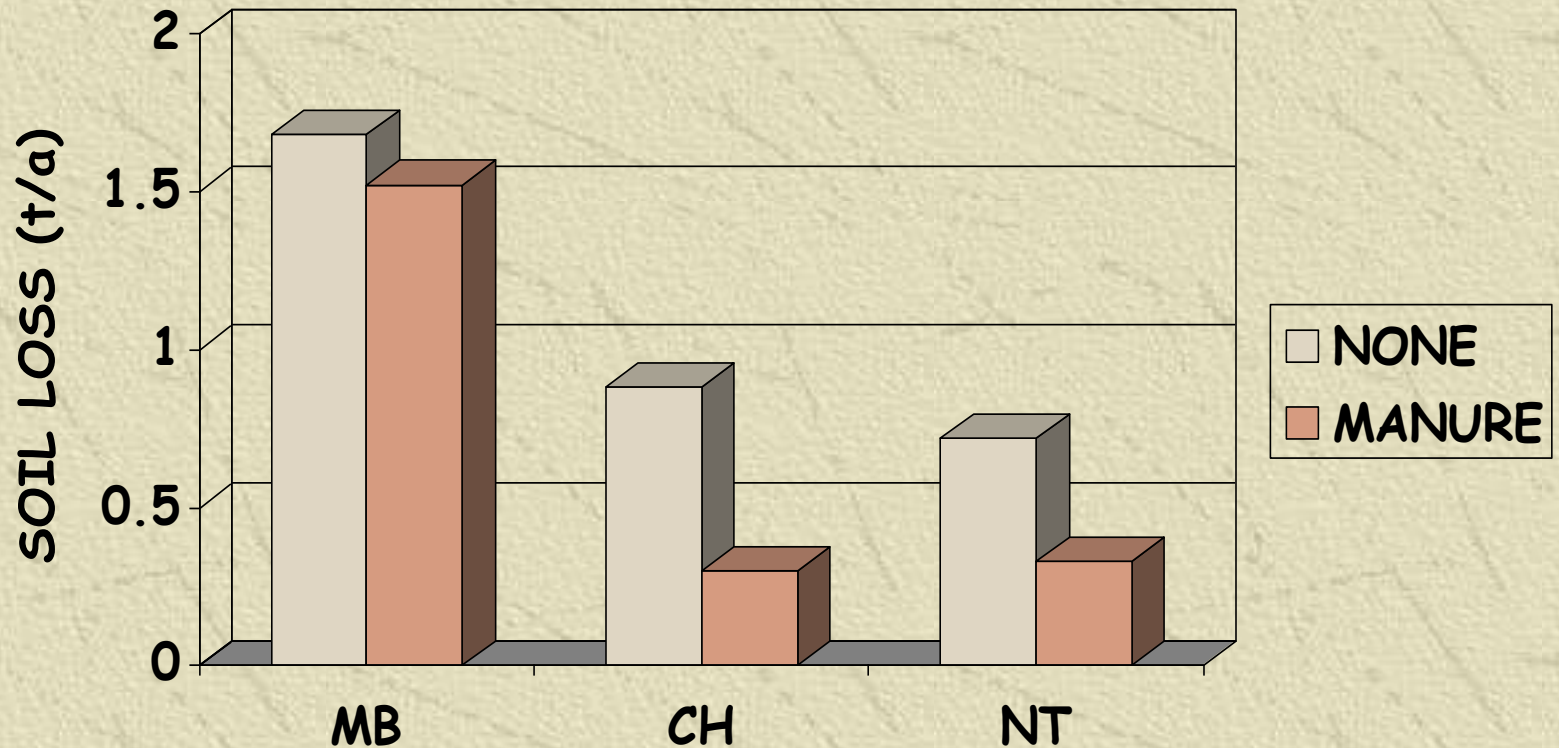
BUNDY et al., 2000

SOLUBLE P LOSS AND MANURE APPLICATION



BUNDY et al., 2000

SOIL LOSS AND MANURE APPLICATION



MUELLER et al., 1984

HOW MIGHT RUSLE 2 INTERACT WITH MANURE MANAGEMENT

- ✦ FARMS NEED A CONSERVATION PLAN WITH FIELDS AT "T" FIRST
- ✦ SATISFY "T" MAINLY BY ROTATION AND TILLAGE
- ✦ THIS WILL DICTATE HOW MANURE IS MANAGED IN FIELDS
- ✦ MANURE MAY SERVE AS RESIDUE
- ✦ THE P INDEX MAY BE PART OF THE RUSLE 2 MODEL IN THE FUTURE

RUSLE 2 - "NEW" TOOL FOR CONSERVATION PLANNING

Profile: start with this profile*

STEP 1: Choose location to set climate: Location

STEP 2: Choose soil type: Soil

STEP 3: Set slope topography: Length along slope, ft
Avg. slope steepness, %

STEP 4: Choose management: Base management

STEP 5: Set Supporting practices:

Contouring	<input type="text" value="d standard contouring"/>	Row grade, %	<input type="text" value="0.60"/>
Strips/barriers	(none)	Surf. cov. values	<input type="text" value="Surf. cover"/>
Diversion/terrace, sediment basin	(none)		
Subsurface drainage system	(none)		

RESULTS

Soil loss erod. portion, t/ac/yr	3.6	Info	<input type="text"/>
Detachment on slope, t/ac/yr	3.6		
Soil loss for cons. plan, t/ac/yr	3.6		
Sediment delivery, t/ac/yr	3.6		

RUSLE 2 - "DRILL DOWN" TO FINE-TUNE PRACTICES

Profile: start with this profile*

Management: Continuous\Corn grain; chisel twisted show, fall*

Graphic Long-term natural rough., in. 0.24
 Rel. row grade, % Normally used as a rotation? Yes

Rotation builder open

Operations Info

Management Operations

Date, m/d/y	Operation	Vegetation	Yield (# harv. units)	Op. depth, in.	Op. speed, mph	External residue	Res. add./ remove, lb/ac	Cover from addition, %	Veg. ret
10/21/1	no operation								
11/1/1	chisel, twisted shovel			7.0	5.0				
5/1/2	Manure spreader			3.0	5.0	.edding	0	0	
5/5/2	cultivator, field 6-12" sweeps			4.0	6.0				
5/5/2	planter, double disk opnr	com\Corn, grain	112	2.5	5.0				
10/10/2	harvest killing crop								

Soil loss for cons. plan, t/ac/yr 3.2
 Sediment delivery, t/ac/yr 3.2

- lentils
- lettuce
- manure open lots
- manure poultry litter
- manure settling basin
- manure with bedding
- muskmelon
- mustard
- okra
- onion

INCORPORATION AFFECTS MANURE MANAGEMENT

- ✦ CHANGES MANURE ALLOCATION
 - ✦ VIOLATE CONSERVATION PLAN
 - ✦ HIGHER RATE POSSIBLE
- ✦ AFFECTS TIME MANAGEMENT
- ✦ DIFFICULT WITH DAILY HAUL
- ✦ APPLICATION IN SPRING AND FALL
 - ✦ STORAGE WOULD IS NEEDED
 - ✦ RELIANCE ON CUSTOM APPLICATORS
- ✦ RESIDUE FRIENDLY APPLICATION

MANURE INCORPORATION TOOLS: USDA-DFRC FIELD DAY, AUGUST, 2001



**NARROW POINT INJECTOR
ROLLING TINE COVERAGE**

**SMOOTH SEEDBED
RELATIVELY AGGRESSIVE**



MANURE INCORPORATION TOOLS: USDA-DFRC FIELD DAY, AUGUST, 2001



SWEEP INJECTOR

**ROUGHER SURFACE, MORE
RESIDUE
WATCH YOUR STEP!!**



MANURE INCORPORATION TOOLS: USDA-DFRC FIELD DAY, AUGUST, 2001

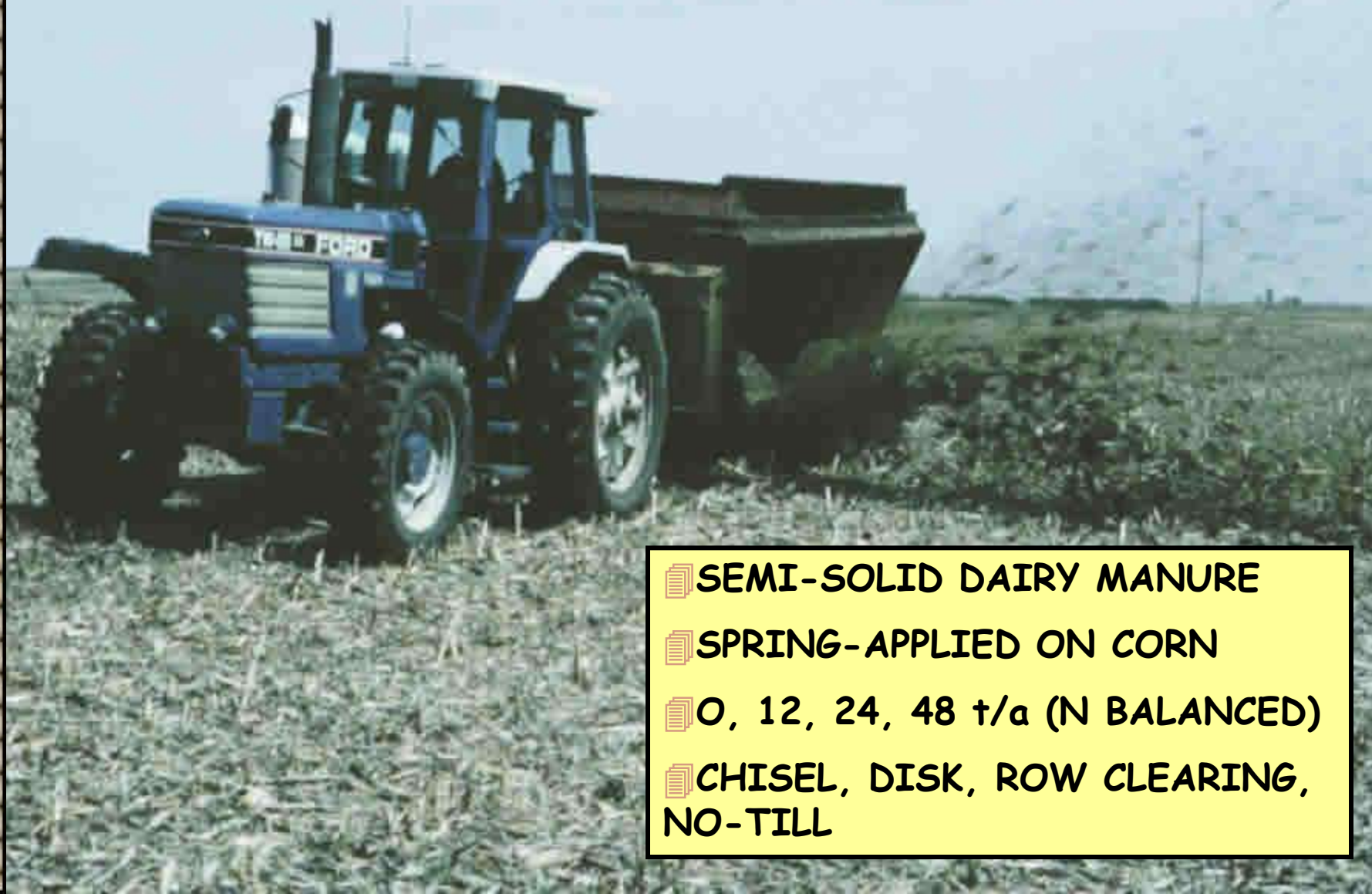


**HOSE SYSTEM
NURSE TANK**

**SWEEP INJECTOR
GOOD RESIDUE COVERAGE
NOT SUITED TO SMALL FIELDS**



ARLINGTON TILLAGE/MANURE STUDY, 1995-1996



- SEMI-SOLID DAIRY MANURE
- SPRING-APPLIED ON CORN
- O, 12, 24, 48 t/a (N BALANCED)
- CHISEL, DISK, ROW CLEARING,
NO-TILL

ARLINGTON TILLAGE/MANURE STUDY, 1995
48 t/a MANURE, CHISEL PLOWED



ARLINGTON TILLAGE/MANURE STUDY, 1995
48 t/a MANURE, DISK



ARLINGTON TILLAGE/MANURE STUDY, 1995
48 t/a MANURE, NO-TILL



MANURE APPLICATION AND TILLAGE

✓ **48 t/a STRAW DAIRY
MANURE**

✓ **NO-TILL**

✓ **~90 % RESIDUE**

MANURE APPLICATION AND TILLAGE

- ✓ **48 t/a STRAW DAIRY MANURE**
- ✓ **INCORPORATION BY LIGHT DISKING**
- ✓ **60-70 % RESIDUE**

MANURE APPLICATION AND TILLAGE

- ✓ **48 t/a STRAW DAIRY MANURE**
- ✓ **INCORPORATION BY PLANTER ROW CLEANERS**
- ✓ **~80 % RESIDUE**

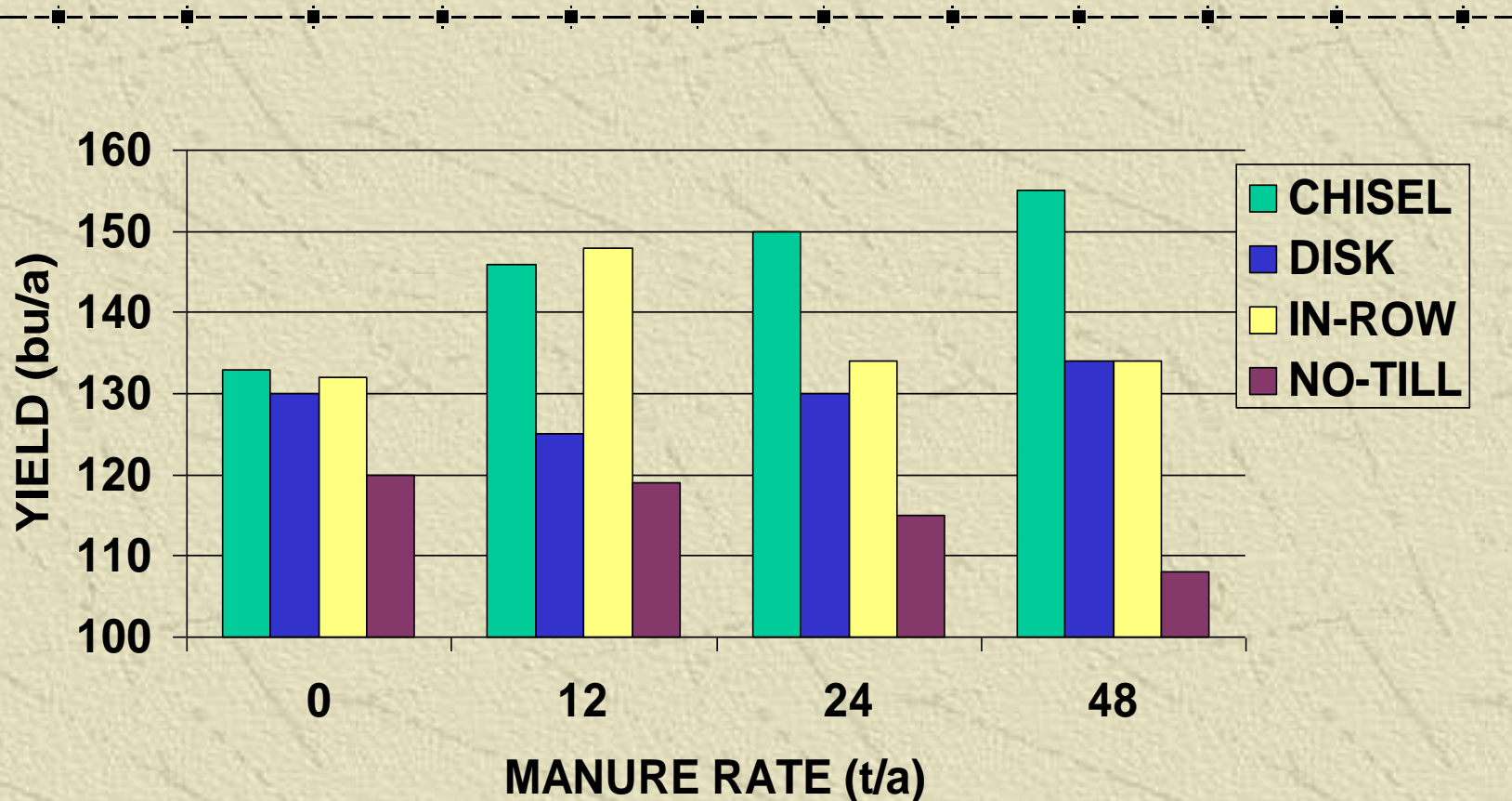
MAIN EFFECT OF MANURE RATE ON SURFACE RESIDUE AND EMERGENCE

MANURE (t/a)	RESIDUE (%)		EMERGENCE (plt/ft)	
	1995	1996	1995	1996
CH	49	51	1.4	1.3
DK	65	74	1.3	0.6
IR	81	81	1.2	1.0
NT	84	92	1.1	0.4

MAIN EFFECT OF TILLAGE ON SURFACE RESIDUE AND EMERGENCE

TILLAGE	RESIDUE (%)		EMERGENCE (plt/ft)	
	1995	1996	1995	1996
0	61	64	1.4	1.0
12	69	68	1.3	0.8
24	72	78	1.2	0.7
48	77	88	1.1	0.7

RELATIONSHIP BETWEEN TILLAGE AND MANURE APPLICATION ON CORN YIELD



ARLINGTON, WIS., 1995-1996

MANURE MANAGEMENT IN REDUCED TILLAGE SYSTEMS

- ✦ APPLY MANURE EVENLY
- ✦ CONTROL COMPACTION
- ✦ AVOID SPREADING NEAR CHANNELS OR WATERWAYS
- ✦ USE TOOLS THAT CONSERVE RESIDUE
- ✦ FOLLOW SLOPE CONTOURS
- ✦ ADJUST PLANTING FOR ADDED RESIDUE
- ✦ COMMON SENSE AND EXPERIENCE