Paired Watershed Studies for Nutrient Reductions in the Minnesota River Basin

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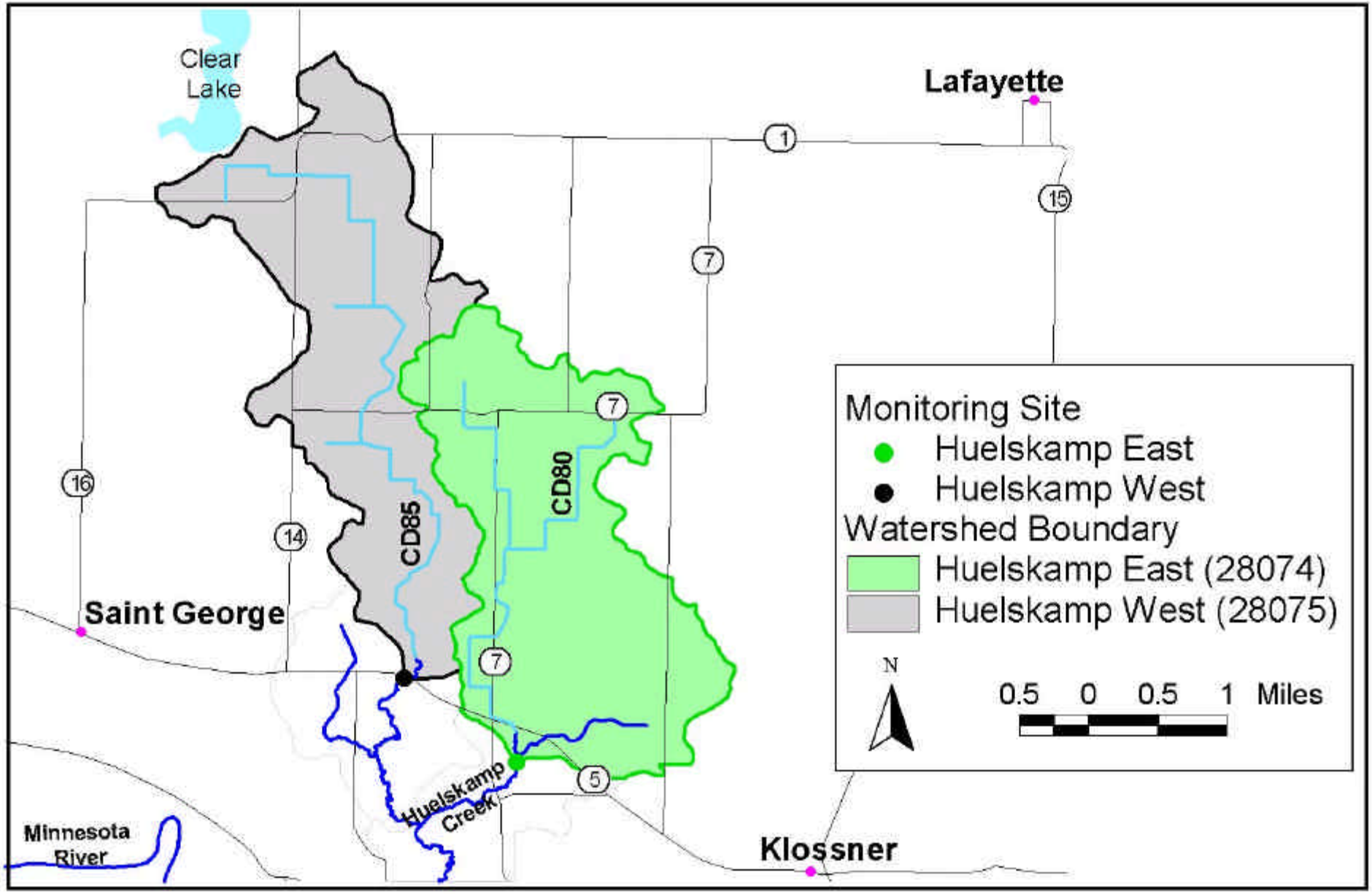
Project Goals

- Accelerate the voluntary adoption of BMPs in MN River Basin
- Achieve measurable improvements in water quality using paired watersheds
- Develop and disseminate farmer led and farmer sanctioned water quality initiatives in the MN River Basin

Huelskamp Creek Watershed



Project Approach

- Farmer led and initiated effort to accelerate voluntary adoption of BMPs
- Survey farmers and develop BMPs
- Measure water quality in paired watersheds before and after implementation of BMPs on treated side
- Estimate costs and benefits of BMPs
- Develop public education to increase adoption of BMPs

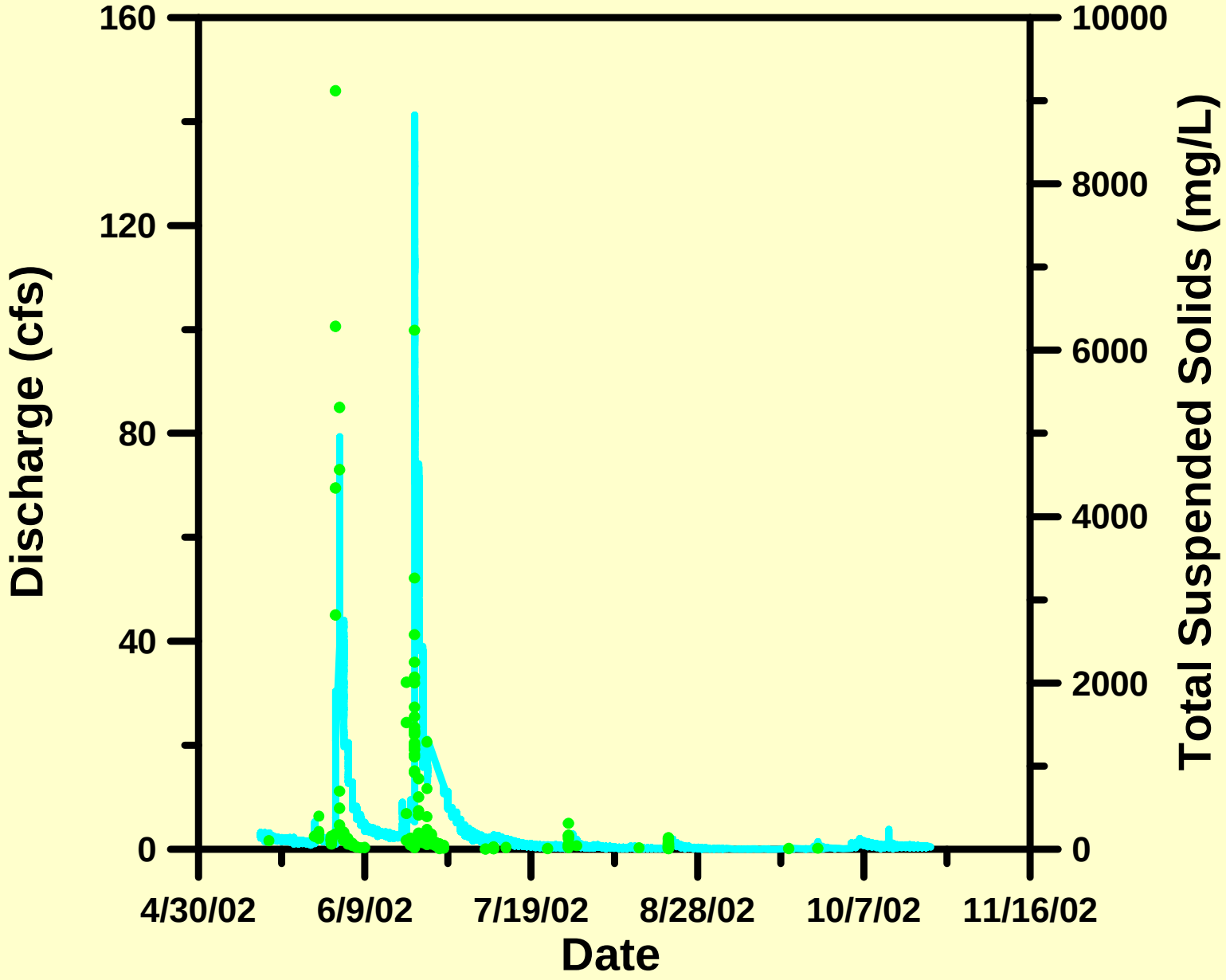
Project Advisory Team

- Farmers
- Co-op agronomist
- Staff from Minnesota Dept. Agriculture
- Staff from Nicollet County and SWCD
- Extension Service

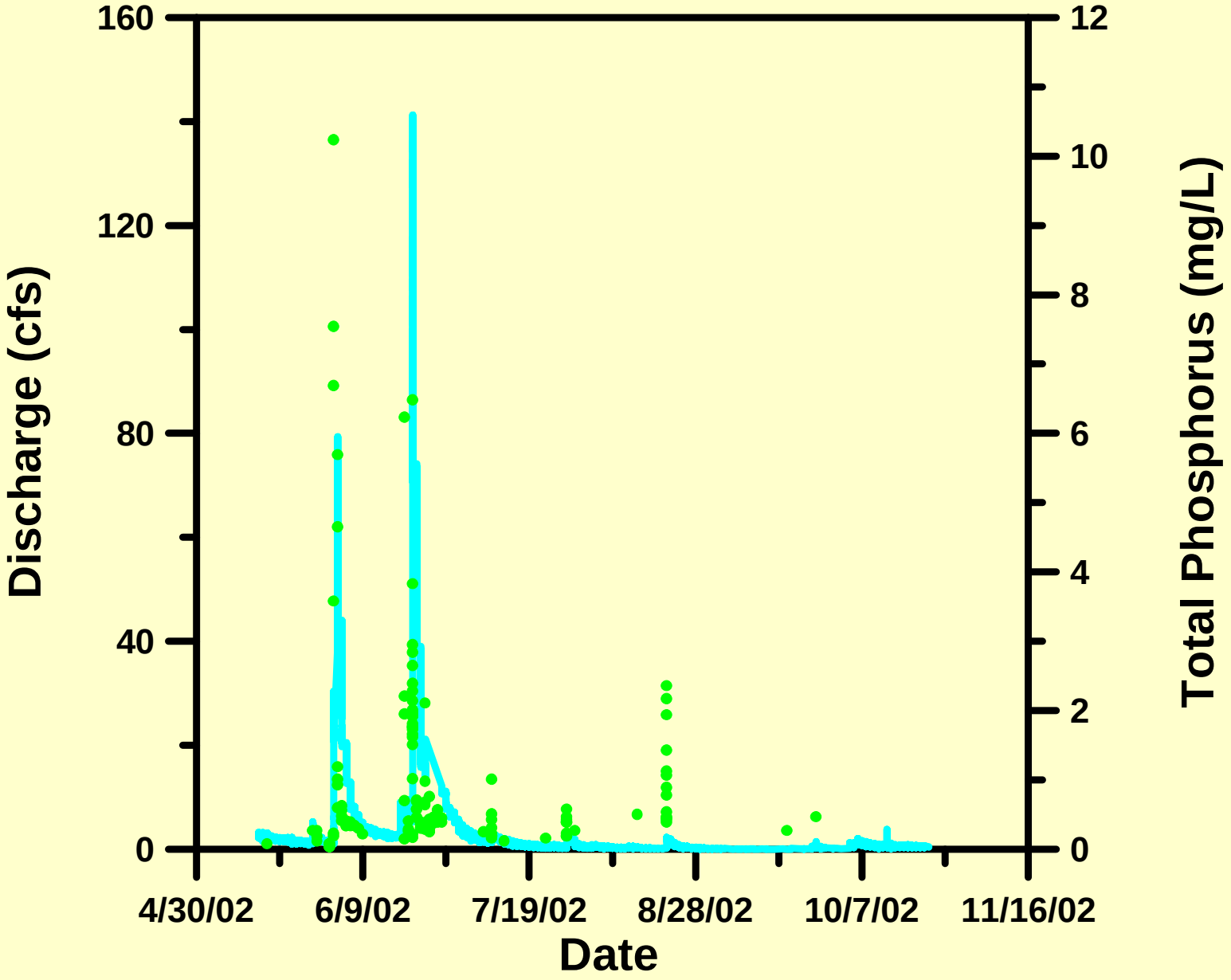
Water Quality Guidelines

- Turbidity, a measure of sediment content, should not exceed 90 mg/L
- Phosphorus guideline for lakes and streams is 0.1 mg/L
- Nitrate-N in drinking water should not exceed 10 mg/L

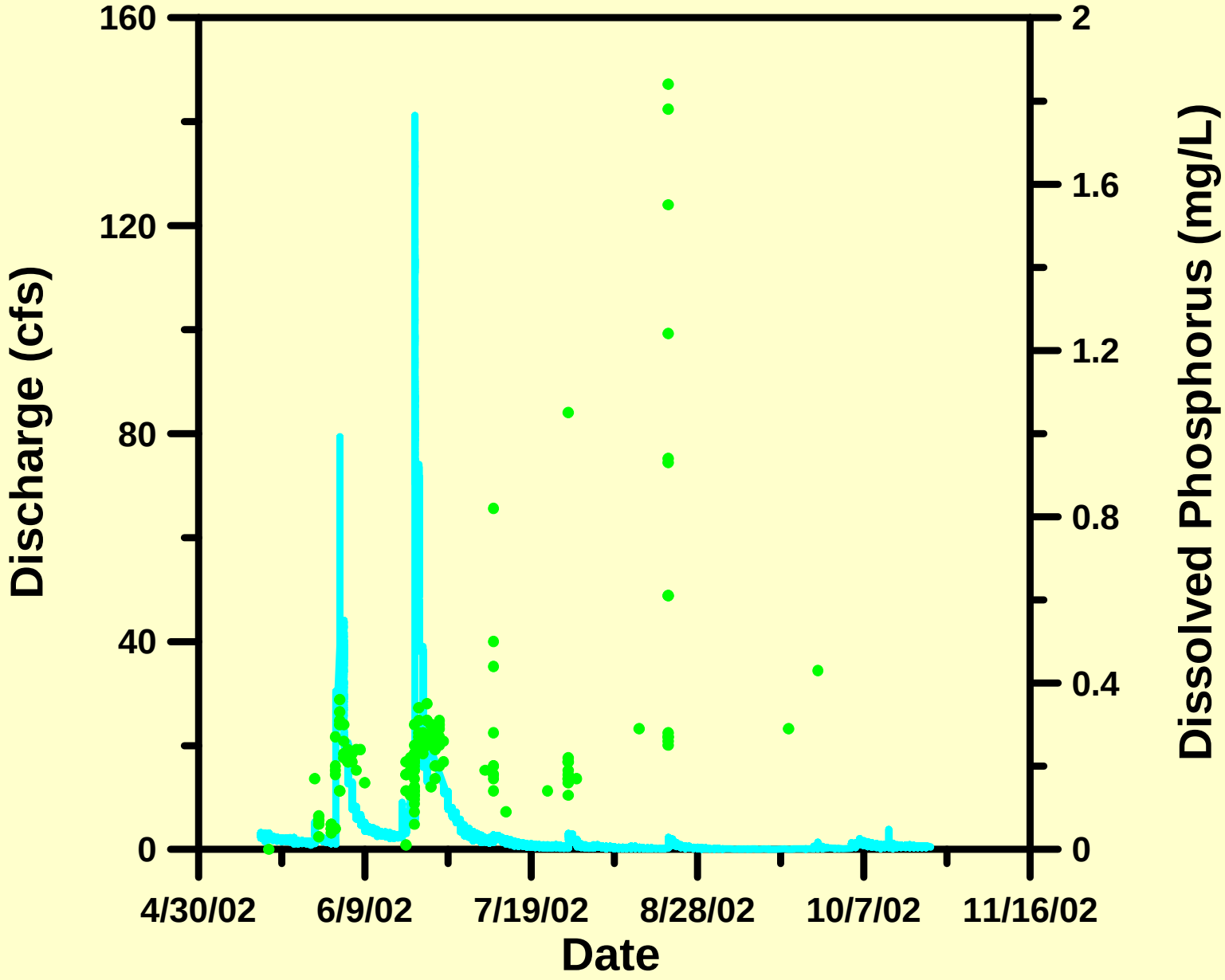
Huelskamp East
Total Suspended Solids

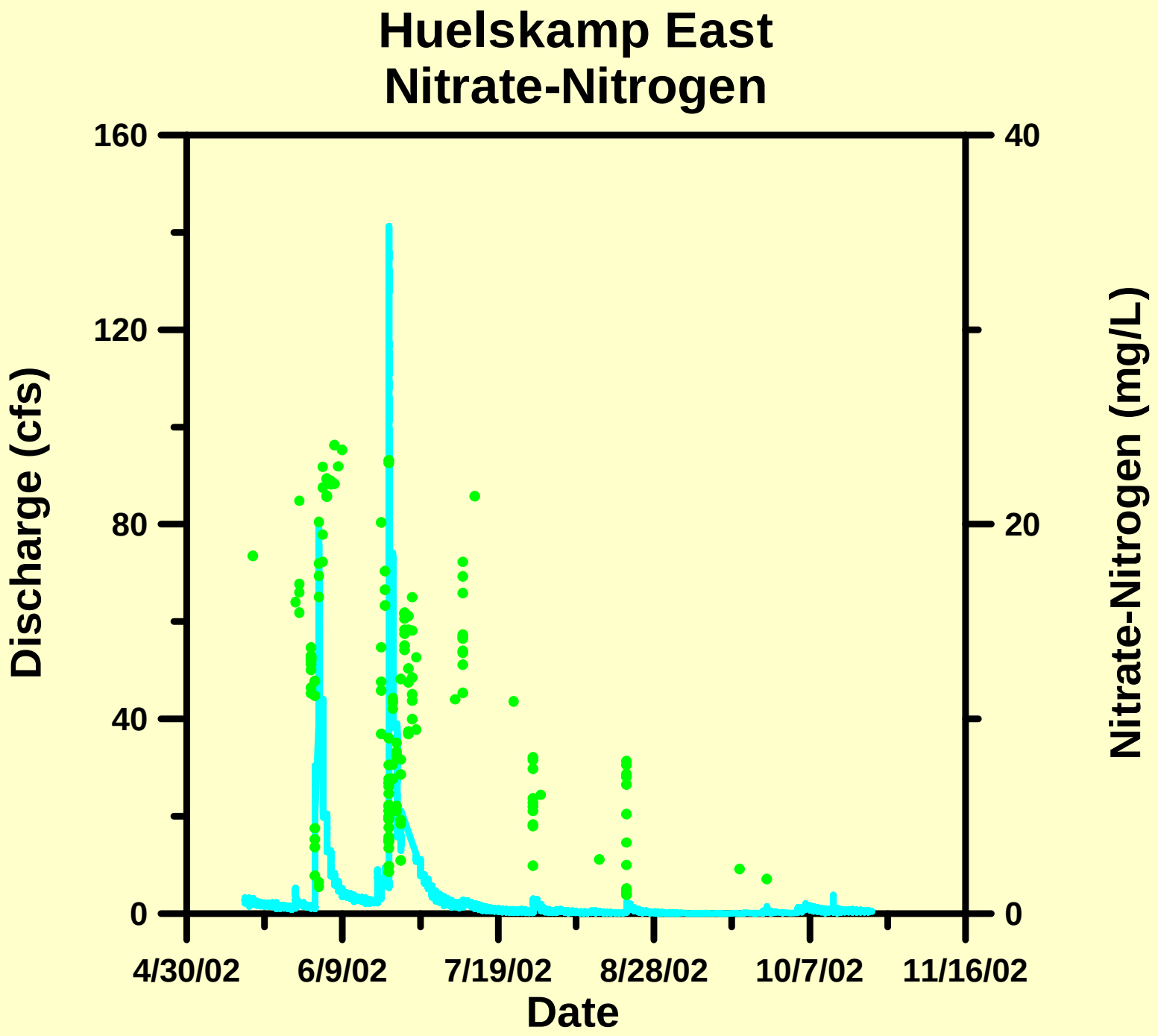


Huelskamp East
Total Phosphorus



Huelskamp East
Dissolved Phosphorus




Huelskamp East
Nitrate-Nitrogen
160
120
80
40
0
Discharge (cfs)
40
20
0
Nitrate-Nitrogen (mg/L)
4/30/02
6/9/02
7/19/02
8/28/02
10/7/02
11/16/02
Date

Water Quality Summary

- Water quality monitoring shows both watersheds to transport significant amounts of sediment, phosphorus, nitrate, and ammonium
- The concentrations of these substances often exceed EPA water quality standards and guidelines

Farm Practices Survey

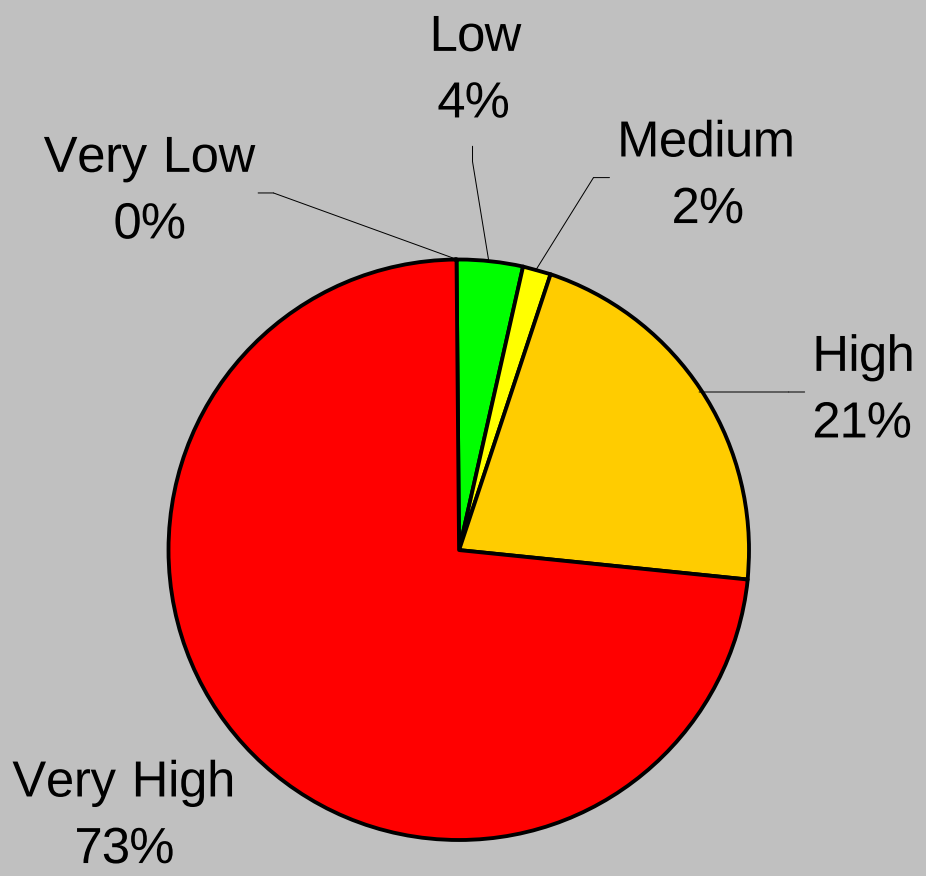
- Items surveyed
  - Land ownership and labor
  - Machine and livestock inventory
  - Manure and fertilizer management
  - Crop rotations, yield goals, long-term yields
  - Soil management, tile drainage

Survey Participation Rates

- Completed surveys with 25 of 42 operators (fields bigger than 40 ac)
  - Accounts 90% of study area
  - Cost of $2500
- The high rate of participation was directly related to involvement of farmers and agronomist on project advisory team

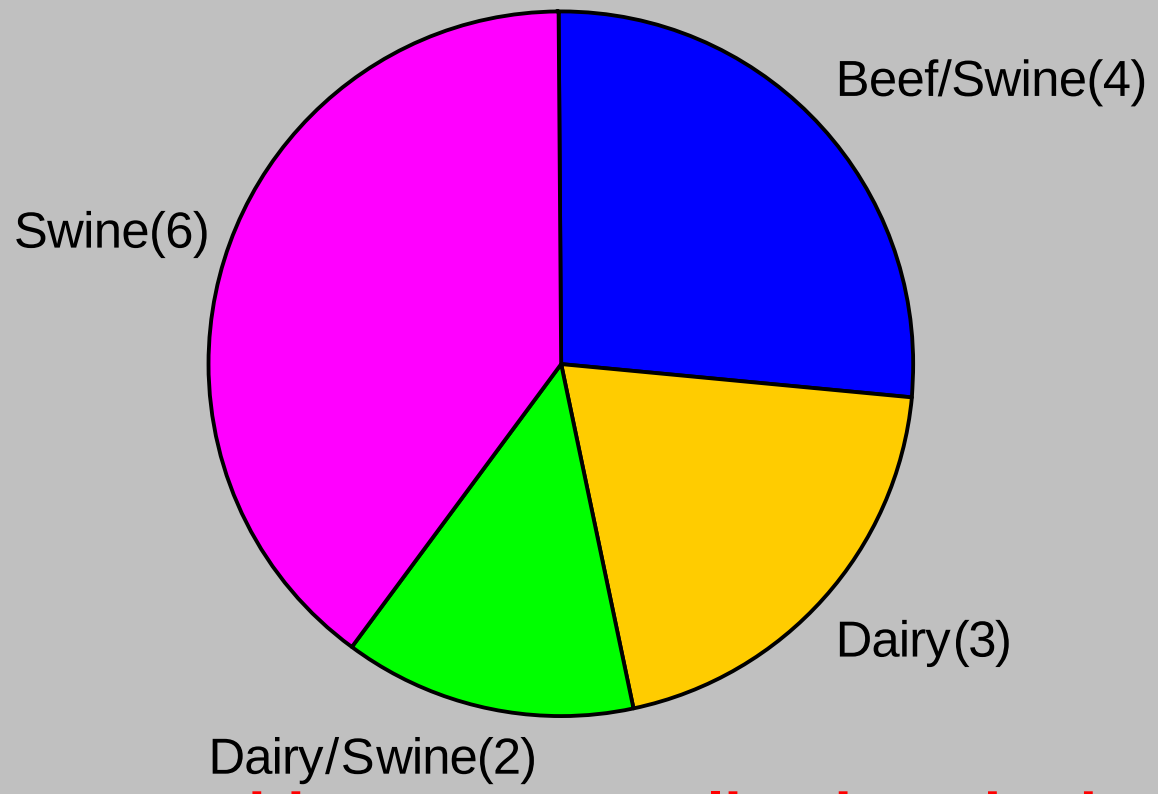
Residue cover summary for the paired watersheds

Residue class	Number of observations	Percentage of observations
0-15%	33	41.3
16-30%	39	48.8
31-50%	7	8.8
51-75%	1	1.3
Total	80	100

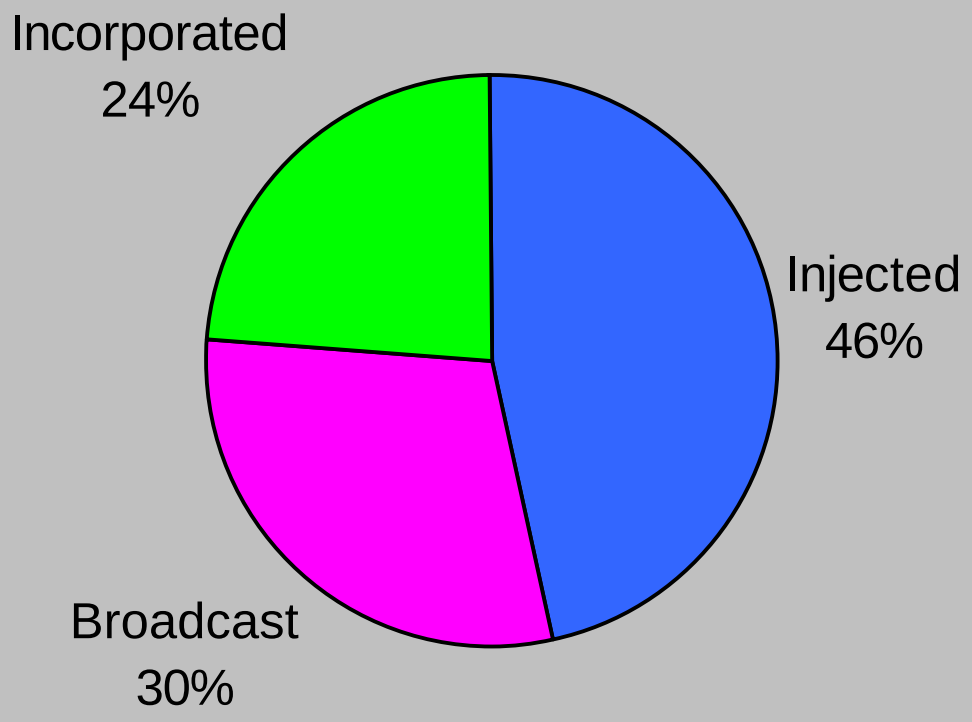


Soil test results for Phosphate levels

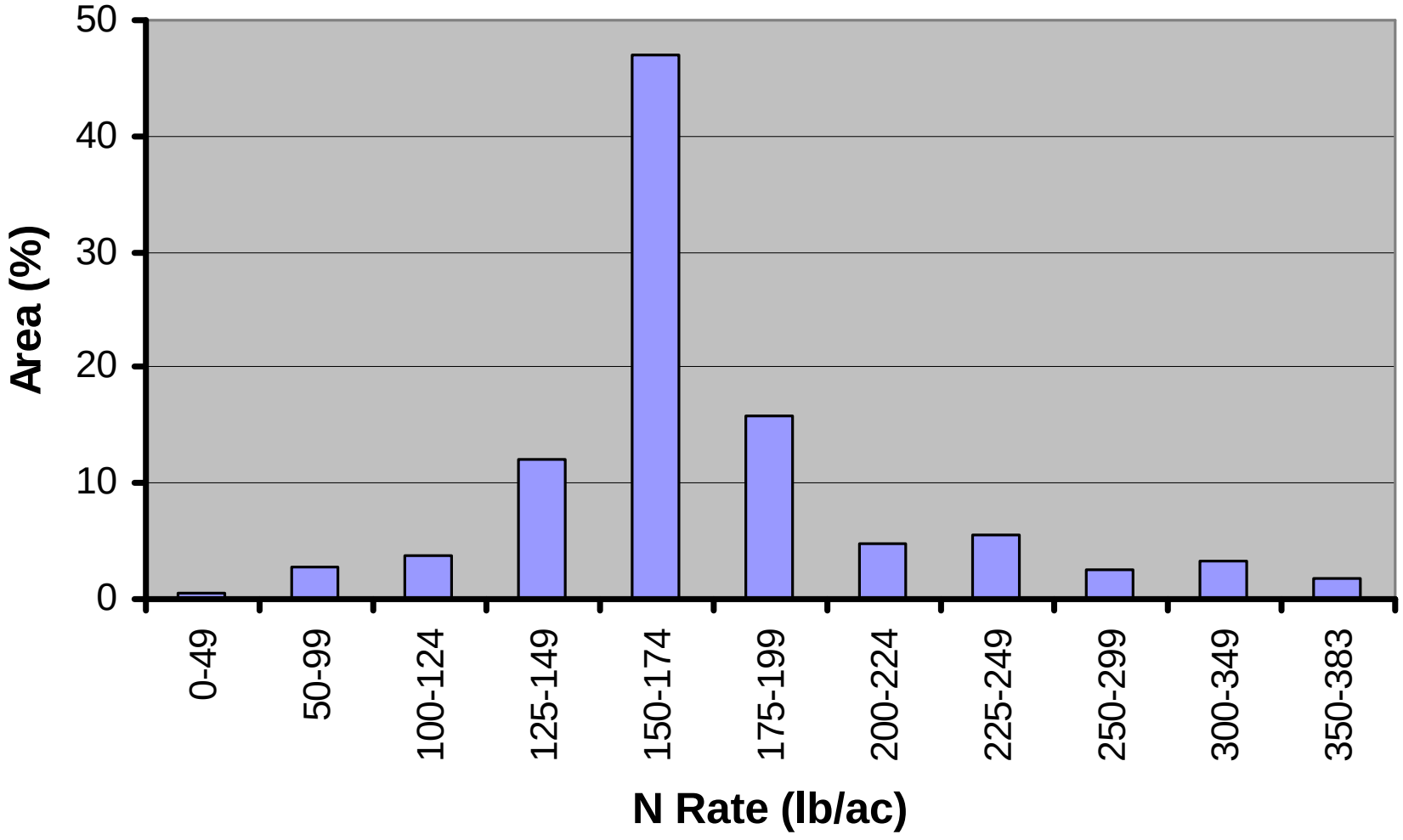
21% of the cropland received manure

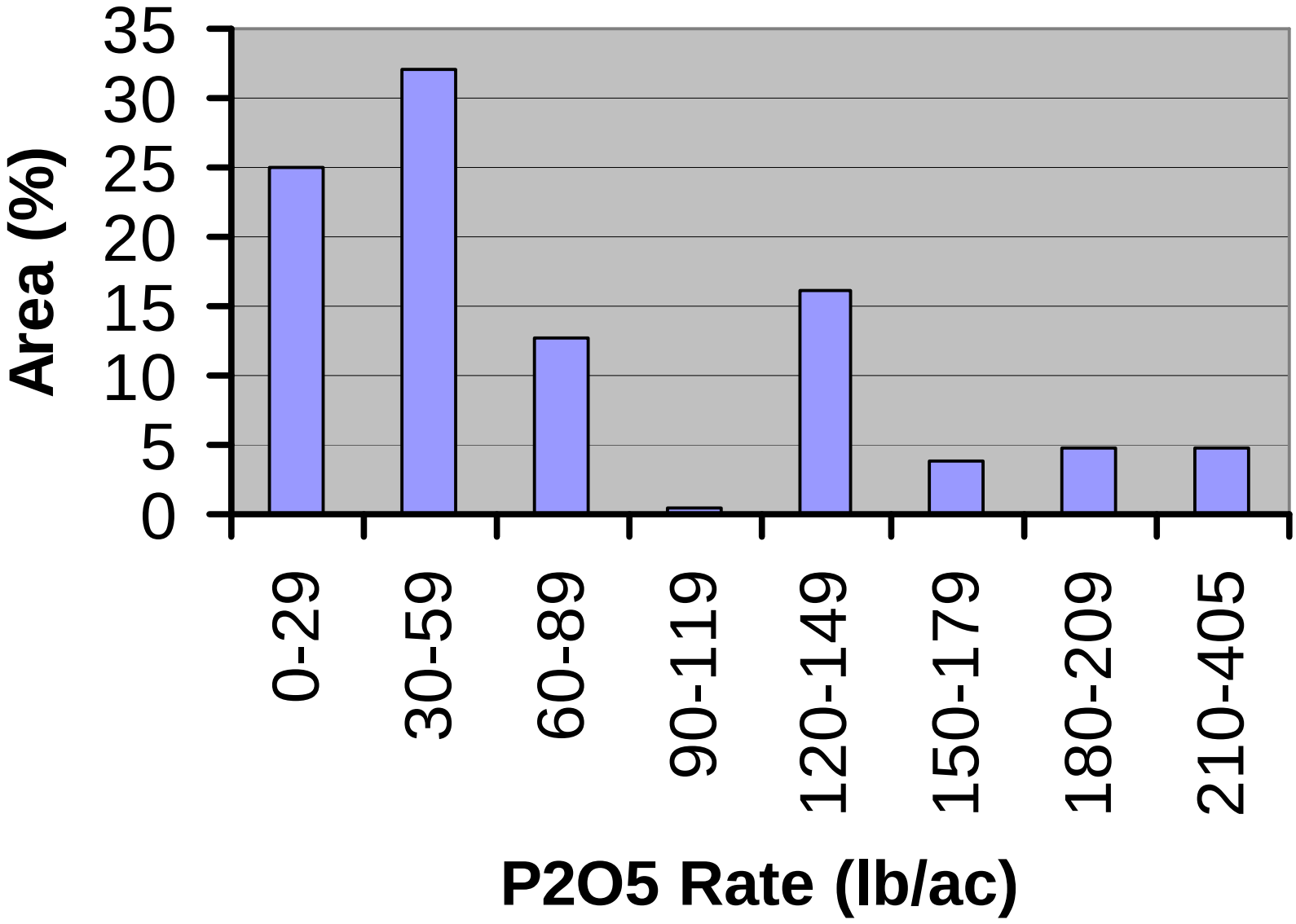


Feedlot types with manure applications in the paired watersheds



Method of manure N applications


Area (%)
50
40
30
20
10
0
0-49
50-99
100-124
125-149
150-174
175-199
200-224
225-249
250-299
300-349
350-383
N Rate (lb/ac)


Area (%)
35
30
25
20
15
10
5
0
0-29
30-59
60-89
90-119
120-149
150-179
180-209
210-405
P2O5 Rate (lb/ac)

Summary of Survey Results

- Residue Cover
  - Moldboard plow used on half of corn acres
  - Conservation tillage used on 22% of land
- Manured corn land (20% of all land)
  - Half receives more than 210 lb N/ac
  - Half receives more than 140 lb P_2O_5/ac
- Un-manured corn land
  - Half receives more than 152 lb N/ac
  - Half receives more than 39 lb P_2O_5/ac

Implementation of BMPs

- 12 of 22 operators in Treatment Watershed implemented a BMP
  - Accounts for 2123 of 2624 cultivated acres (81% of study area)
  - Cost of ~$21,150
- 15 of 24 operators in Control Watershed agreed not to change management
  - Accounts for 1984 of 2577 cultivated acres (77% of study area)
  - Cost of ~$9,920

Next Steps

- Implement BMPs in treatment watershed
- Continue water quality monitoring for two more years
- Conduct economic analysis of BMPs
- Evaluate effect of individual BMPs on water quality as a function of rate of adoption and location of adoption using water quality modeling

Commercial fertilizer rates on corn acres (lb/ac)

Statistic	N	P_2O_5	K_2O
Mean	144	41	50
Median	152	39	51
25th percentile	145	27	38
50th percentile	152	39	51
75th percentile	162	57	68
100th percentile	200	75	98
Count	44	43	41

1st year available manure N and P_2O_5 rates and commercial fertilizer rates on manured corn acres (lb/ac)

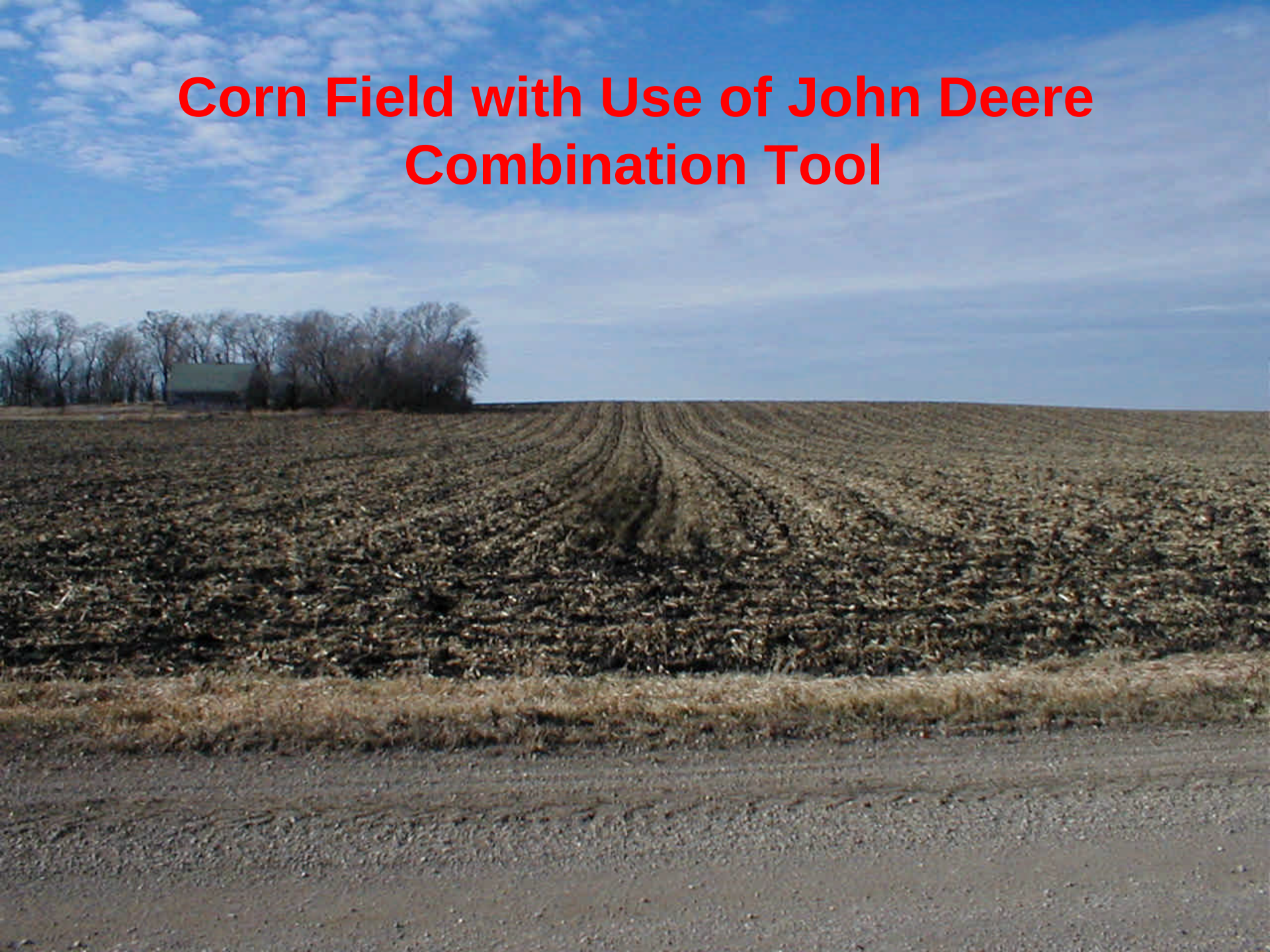
Statistic	Fert. N	Fert. P_2O_5	Man. N	Man. P_2O_5
Mean	128	38	103	139
Median	145	31	65	109
25th percentile	85	27	38	81
50th percentile	145	31	65	109
75th percentile	157	42	122	173
100th percentile	200	75	314	374
Count	35	35	35	35

BMP	Number of Participants	Number/ Acres
Install Rock Inlets	5	19
Soil Test	3	230 ac
Grid Soil Test @ 2.2 ac/sample	2	229 ac
Variable Rate Fertilizer Application	2	229 ac
Stalk Chop	1	93 ac
Multi-Tool (DMI)	4	398 ac

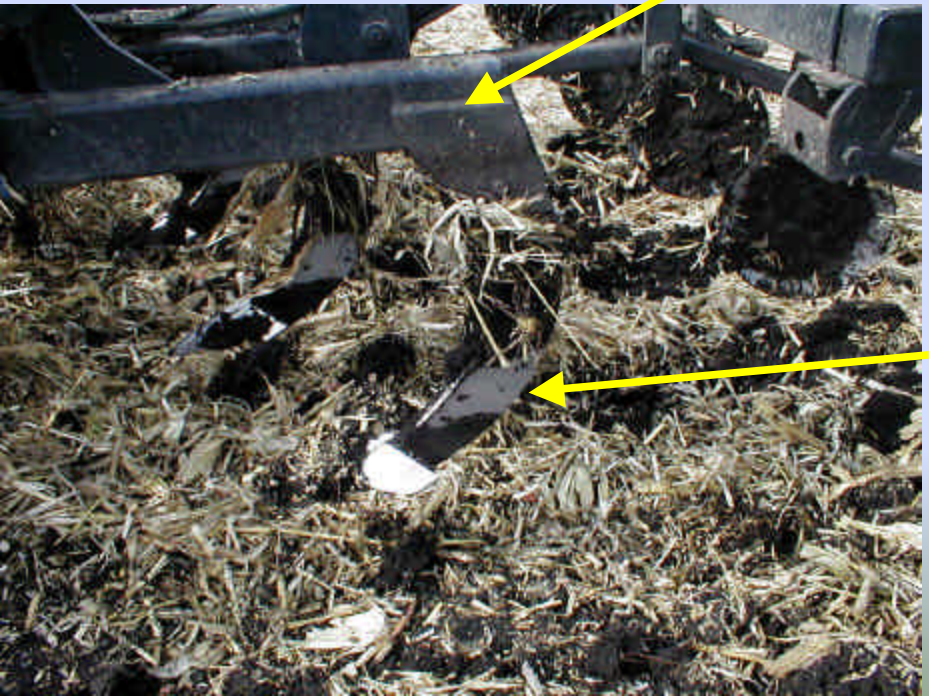
BMP	Number of Participants	Number/ Acres
Manure Test	4	80 ac
Manure Hauling	1	~500,000 gal
No-Till Soybean Residue	3	93 ac
Remove Cover Board from DMI on Corn Residue	3	183 ac
Remove Cover Board and Raise Discs from DMI on SB Residue	1	68 ac
Take Field Out of Corn on Corn Rotation	1	58 ac
Enroll Land in CRP Along Ditch	2	?

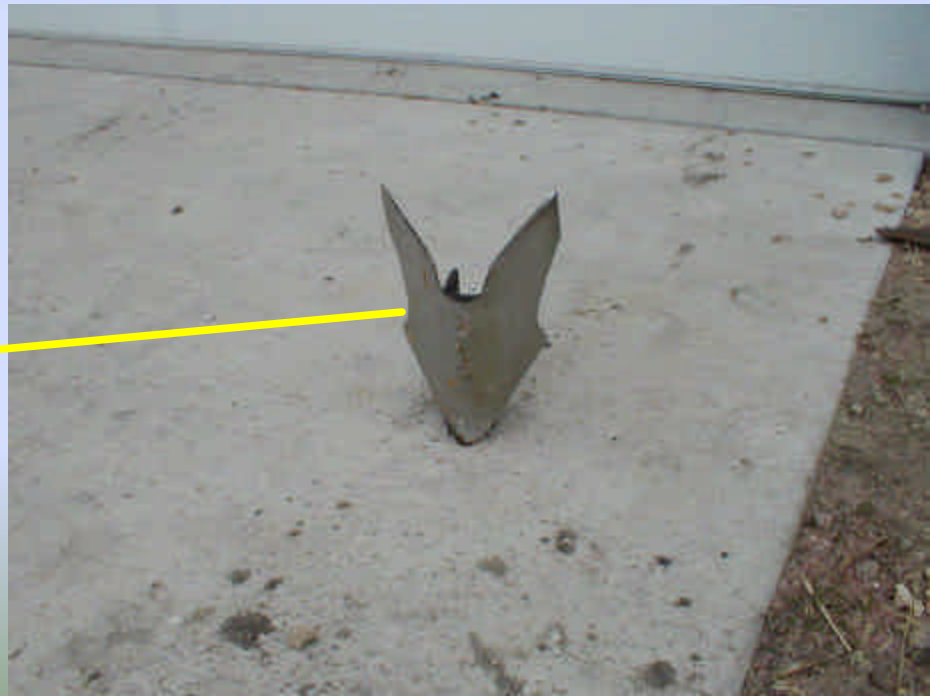
Soybean Field with No Fall Primary Tillage

Corn Field with Use of John Deere Combination Tool



DMI with Cover Boards Removed from Standards





Corn Residue After Primary Tillage with DMI

Without Cover Boards

With Cover Boards