LAKE ERIE

DEMONSTRATION PROJECTS

Evaluating Impacts of

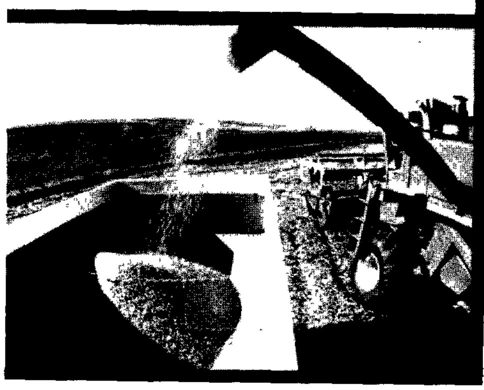
CONSERVATION TILLAGE

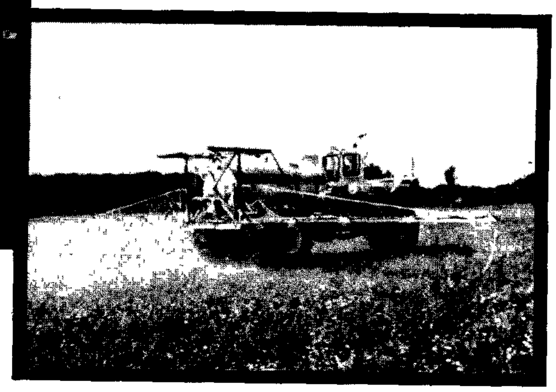
on

COST

YIELD

ENVIRONMENT





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Lake Erie Conservation Tillage Demonstrations

The practice of conservation tillage may very well be one of those happy circumstances in which seemingly conflicting priorities are resolved to the benefit of everyone.

Cropland agriculture, with its ever growing reliance on increased production efficiency, chemical pest control, and heavy fertilization, is often viewed as a threat to water quality and the health of lakes, rivers, and streams. Crop farmers, despite economic relief produced by federal farm programs, and dwindling surpluses of major cash crops, view with suspicion environmental management programs which could cut into thin profit margins.

In conservation tillage, farmers can find a way to reduce production costs without sacrificing crop yields, and environmentalists can take comfort in adoption of farming methods which reduce soil loss and the related loss of nutrients and other pollutants.

Conservation tillage then could offer one means to a healthier environment and a healthier agriculture.

Where's the catch?

If there is one, the catch will relate to one or more of the following questions:

1. Do crop yields really measure up when some form of conservation tillage is used?
2. Are costs really reduced when conservation tillage is used?
3. Are the environmental benefits real or is reduced soil loss offset by increased use of chemicals for pest control so that benefits of reduced nutrient input to lakes and streams are traded for hazards of pesticide residue?

This report is not intended to provide a definitive answer to these questions, but it is intended to shed some light on the discussion by providing data useful to both agriculture and environmental interests.

Background

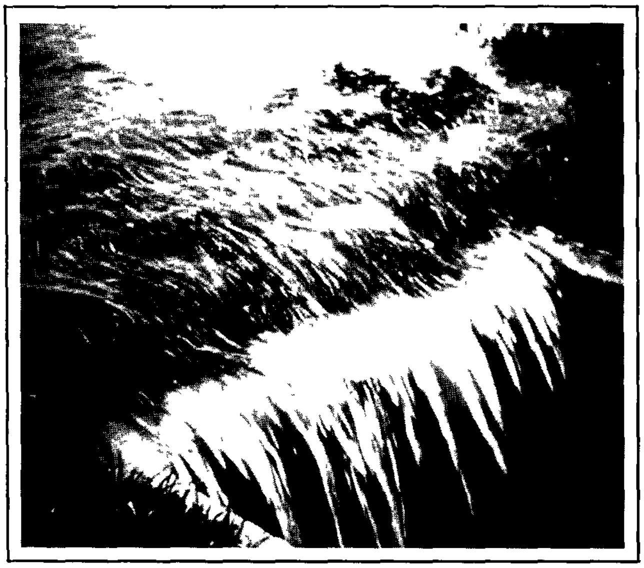
This report covers experience during 1983 in the Tri-State Conservation Tillage Demonstration Projects. The area involved includes farmland in Indiana, Ohio, and Michigan, all located in the Western Basin of Lake Erie. The 31 counties involved in the project are listed in the following table. Their locations are shown in the map on page 3.

Project Counties

	Indiana	
Adams	Allen	Dekalb
Noble	Steuben	Wells
	Michigan	
Hillsdale	Lenawee	Monroe
	Ohio	
Allen	Auglaize	Crawford
Defiance	Fulton	Hancock
Hardin	Henry	Huron
Lorain	Lucas	Medina
Mercer	Ottawa	Paulding
Putnam	Sandusky	Seneca
Van Wert	Williams	Wood
	Wyandot	

The projects are being funded by the Great Lakes National Program office of the United States Environmental Protection Agency. Participating conservation districts in Indiana and Michigan, as well as Allen and Defiance Counties in Ohio, received direct grants from EPA. The Ohio Department of Natural Resources Division of Soil and Water Districts, received a grant for the balance of the Ohio districts and has subcontracted with each district to carry out the projects under its leadership. Numerous USDA agencies are also providing support for the projects through regular programs.

The National Association of Conservation Districts (NACD) is assisting EPA in the coordination of these projects and compiling data so that the information gained can be shared among the districts, agencies, and the farmers. The Conservation Tillage Information Center, with a Field Office in Fort Wayne, Indiana, serves as a vehicle for disseminating information to other areas where it can be used to solve similar water quality or land management problems.

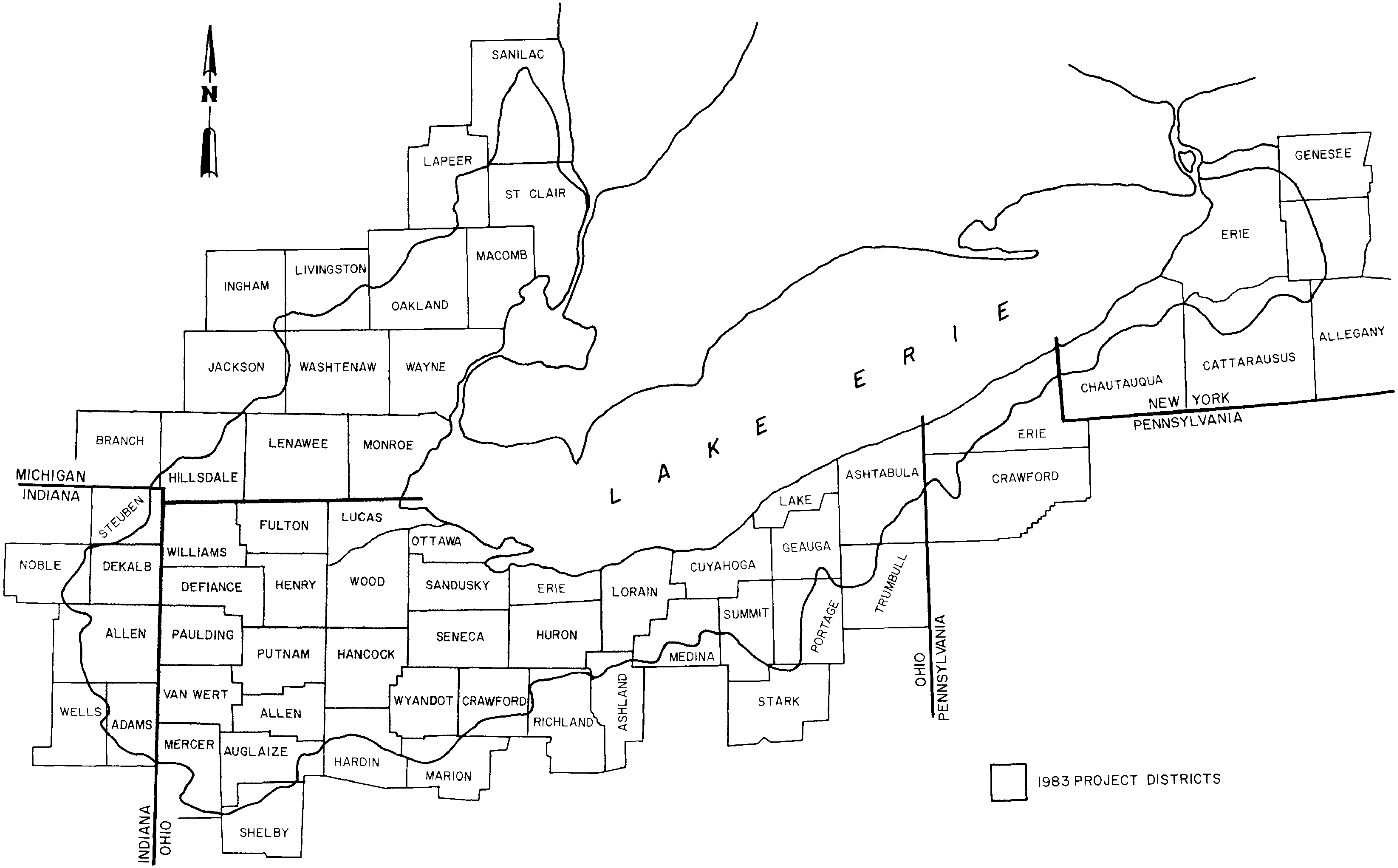


The Role of Agriculture
in
Lake Erie Water Quality

Lake Erie is threatened by eutrophication arising from man's activities in the drainage basin. The key to eutrophication in this lake is phosphorus which enters the lake from point source discharges, the atmosphere, and nonpoint sources, primarily agriculture. When soil particles erode from cropland, they carry with them plant nutrients (including phosphorus). Increased phosphorus produces excessive growth of phytoplankton. This, through a complex chain of events, involving growth, die-off, and bacterial decomposition, results in depletion of the oxygen level in the lake. The critical oxygen depletion rate in Lake Erie's central basin has been exceeded every year since 1960.

The United States is obligated, as the result of an agreement with the Canadian Government, to take steps which will improve the quality of Lake Erie. Among other objectives, the agreement (as reaffirmed in 1983) set a total phosphorus loading objective of 11,000 metric tons per year for Lake Erie. Under the phosphorus load reduction supplement to Annex III of the agreement, the United States must reduce phosphorus loads to the lake by 1,700 metric tons annually. If the target phosphorus loading is achieved, the area of the lake where oxygen depletion is a problem could be reduced by 90 percent in just a few years.

Under the agreement, municipal waste treatment facilities which discharge more than 1 million gallons per day, must achieve an effluent concentration of 1 mg l total phosphorus on a monthly average. This goal has been achieved on Lake Erie so that further significant reductions in phosphorus loadings must come from reduction in nonpoint sources. Conservation tillage practices are considered the most cost effective method for controlling nonpoint source pollution from rural landin the Lake Erie Basin.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LAKE ERIE
MICHIGAN
INDIANA
OHIO
PENNSYLVANIA
NEW YORK
SANILAC
LAPEER
ST CLAIR
MACOMB
INGHAM
LIVINGSTON
OAKLAND
JACKSON
WASHTENAW
WAYNE
BRANCH
HILLSDALE
LENAWEE
MONROE
STEUBEN
FULTON
LUCAS
OTTAWA
NOBLE
DEKALB
WILLIAMS
DEFIANCE
HENRY
WOOD
SANDUSKY
ERIE
LORAIN
CUYAHOGA
GEAUGA
LAKE
ASHTABULA
ALLEN
PAULDING
PUTNAM
HANCOCK
SENECA
HURON
MEDINA
SUMMIT
PORTAGE
TRUMBULL
WELLS
ADAMS
VAN WERT
ALLEN
WYANDOT
CRAWFORD
RICHLAND
ASHLAND
STARK
MERCER
AUGLAIZE
HARDIN
MARION
SHELBY
ERIE
CRAWFORD
CHAUTAUQUA
CATTARAUSUS
ALLEGANY
ERIE
GENESEE
1983 PROJECT DISTRICTS

Impact of Projects

The Lake Erie Conservation Tillage Demonstration Projects involved more than 1800 plots covering more than 23,000 acres in the 31 participating counties in 1983. A summary of project participation is included in the following tables.

Grand Totals

	Notill		**Ridgetill**		**Other Tillage**	
	Acres	Plots	Acres	Plots	Acres	Plots
Totals	15679	1071	2084	151	5643	632

Total Acres 23406 Total Plots 1854

Corn

	Notill		**Ridgetill**		**Other Tillage**	
	Acres	Plots	Acres	Plots	Acres	Plots
Indiana	**1864.0**	**110**	**405.2**	**18**	**468.9**	**37**
Adams	181.6	11	34.0	2	86.5	7
Allen	1030.2	65	369.7	15	315.9	24
DeKalb	307.4	18	1.5	1	7.5	3
Noble	7.2	1	0.0	0	0.0	0
Steuben	280.9	12	0.0	0	47.0	2
Wells	56.7	3	0.0	0	12.0	1
Ohio	**6646.1**	**472**	**835.5**	**68**	**2383.5**	**303**
Allen	594.9	51	0.0	0	435.0	41
Auglaize	507.0	34	10.0	1	49.3	10
Crawford	254.0	21	0.0	0	25.0	6
Defiance	911.5	68	38.0	2	281.0	35
Fulton	71.0	8	0.0	0	33.5	6
Hancock	423.5	29	0.0	0	123.0	25
Hardin	185.2	12	0.0	0	52.8	9
Henry	332.8	20	216.7	15	118.0	15
Huron	141.0	10	0.0	0	33.0	5
Lorain	461.9	20	1.5	1	21.8	8
Lucas	280.1	12	13.0	2	91.9	7
Medina	649.5	47	0.0	0	372.5	34
Mercer	246.9	18	0.0	0	41.0	5
Ottawa	167.0	10	111.0	9	83.5	8
Paulding	14.3	4	126.4	12	94.3	12
Putnam	410.0	32	6.0	1	175.9	32
Sandusky	172.8	12	25.0	2	48.9	8
Seneca	201.0	15	94.0	5	27.0	6
Van Wert	167.6	20	44.2	5	175.7	18
Williams	126.7	10	40.7	5	64.2	6
Wood	88.2	8	89.0	7	36.2	7
Wyandot	239.2	11	20.0	1	0.0	0
Michigan	**435.7**	**34**	**0.0**	**0**	**136.0**	**17**
Hillsdale	138.5	11	0.0	0	35.5	6
Lenawee	194.2	14	0.0	0	6.0	3
Monroe	103.0	9	0.0	0	94.5	8
Totals	**8945.8**	**616**	**1240.7**	**86**	**2987.4**	**357**

Soybeans

	Notill		Ridgetill		Other Tillage	
	Acres	Plots	Acres	Plots	Acres	Plots
Indiana	**139.4**	**29**	**203.5**	**10**	**123.3**	**15**
Adams	2.0	1	30.0	1	5.0	2
Allen	107.9	25	172.0	8	115.3	11
DeKalb	17.5	2	1.5	1	3.0	2
Noble	0.0	0	0.0	0	0.0	0
Steuben	12.0	1	0.0	0	0.0	0
Wells	0.0	0	0.0	0	0.0	0
Ohio	**6016.9**	**391**	**639.8**	**55**	**2241.6**	**236**
Allen	628.8	46	0.0	0	453.7	47
Auglaize	342.0	19	10.0	1	9.0	2
Crawford	278.0	20	15.0	2	52.0	6
Defiance	856.3	62	140.0	8	601.3	61
Fulton	98.6	8	0.0	0	38.4	8
Hancock	51.0	3	0.0	0	1.0	1
Hardin	338.4	24	0.0	0	48.5	9
Henry	177.0	14	101.8	6	161.8	11
Huron	294.0	15	0.0	0	70.0	2
Lorain	230.0	11	1.5	1	35.5	4
Lucas	497.1	32	0.0	0	106.7	9
Medina	188.0	10	0.0	0	123.0	9
Mercer	198.4	14	0.0	0	4.0	1
Ottawa	533.0	24	85.0	9	245.0	19
Paulding	18.0	1	23.0	4	15.7	4
Putnam	196.5	20	56.0	6	52.0	16
Sandusky	75.0	3	0.0	0	5.0	1
Seneca	254.0	20	87.0	4	36.0	4
Van Wert	0.0	0	0.0	0	0.0	0
Williams	76.0	7	0.0	0	25.9	5
Wood	309.3	15	120.5	14	127.2	15
Wyandot	377.5	23	0.0	0	30.0	2
Michigan	**68.6**	**5**	**0.0**	**0**	**24.0**	**2**
Hillsdale	19.6	2	0.0	0	0.0	0
Lenawee	19.0	1	0.0	0	0.0	0
Monroe	30.0	2	0.0	0	24.0	2
Totals	**6224.9**	**425**	**843.3**	**65**	**2388.9**	**253**

Other Crops*

	Notill		Ridgetill		Other Tillage	
	Acres	Plots	Acres	Plots	Acres	Plots
Ohio	**508.9**	**30**	**0.0**	**0**	**251.3**	**21**
Allen	259.4	15	0.0	0	108.3	8
Auglaize	32.0	3	0.0	0	0.0	0
Crawford	0.0	0	0.0	0	0.0	0
Defiance	149.5	9	0.0	0	136.0	13
Fulton	15.0	1	0.0	0	0.0	0
Hardin	40.0	1	0.0	0	0.0	0
Lorain	13.0	1	0.0	0	0.0	0
Michigan	**0.0**	**0**	**0.0**	**0**	**15.5**	**1**
Monroe	0.0	0	0.0	0	15.5	1
Totals	**508.9**	**30**	**0**	**0.0**	**266.8**	**22**

* *Includes plots for which no crop was reported*

1983 Acres of Notill in Lake Erie Basin *
Project Counties in Bold

Richland OH	32,570	Branch MI	2,700
Huron OH	21,600	Portage OH	2,544
Ashland OH	20,720	**Dekalb IN**	2,500
Crawford OH	18,600	Shelby OH	2,450
Auglaize OH	16,000	Genesee NY	2,400
Seneca OH	15,500	**Paulding OH**	2,300
Wyandot OH	13,000	Summit OH	2,180
Stark OH	10,750	Erie PA	2,150
Noble IN	10,500	Trumbull OH	1,920
Hardin OH	7,850	**Van Wert OH**	1,875
Medina OH	7,155	**Ottawa OH**	1,700
Mercer OH	7,100	**Lucas OH**	1,550
Lorain OH	6,650	**Adams IN**	1,525
Marion OH	6,600	Oakland MI	812
Wells IN	5,747	Sanilac MI	680
Ingham MI	5,200	Ashtabula OH	500
Lenawee MI	4,950	Chautauqua NY	480
Allen OH	4,700	Cattaraugus NY	480
Putnam OH	4,600	Livingston MI	405
Crawford PA	4,500	Lapeer MI	400
Defiance OH	4,350	Washtenaw MI	400
Williams OH	4,300	Wyoming NY	320
Henry OH	4,300	Erie NY	300
Fulton OH	4,175	Geauga OH	285
Allen IN	3,887	Macomb MI	173
Jackson MI	3,751	St Clair MI	120
Wood OH	3,300	Allegany NY	110
Hancock OH	3,300	**Monroe MI**	100
Erie OH	3,269	Cuyahoga OH	13
Steuben IN	3,250		
Hillsdale MI	3,125	Total	301,649
Sandusky OH	2,923		

Sixty-one counties in five states have all or part of their cropland acreage in the Lake Erie Basin. In these counties, there are nearly 8 million acres of cropland. About 22 percent of this cropland was in some form of conservation tillage in 1983, according to *The 1983 National Survey of Conservation Tillage Practices* produced by NACD CTIC. The majority of the cropland, (more that 5,200,000 acres) is located in the Western Basin.

The percentage of cropland being farmed by some form of conservation tillage in the basin is somewhat less than the national average, a condition which is hardly surprising since wind and water erosion in the relatively flat lands of the western basin have only recently been recognized as a serious environmental problem. In addition, soils of the basin, particularly those of the western basin, have until quite recently, been considered unsuitable for major forms of conservation tillage.

The two tables on this page give some indication of the status of notill and ridgetill in the basin and in the project area.

Farmers in the Lake Erie Basin have been receiving considerable information on conservation tillage, so that adoption rates have been rapid in the past two to three years. In considering the tables, which rank counties in the basin on the basis of acres of notill and acres of ridgetill, it should be noted that of the 24 counties reporting more than 4,000 acres of notill, 14 are from the project area. For ridgetill, all counties reporting more than 1,000 acres are from the project area.

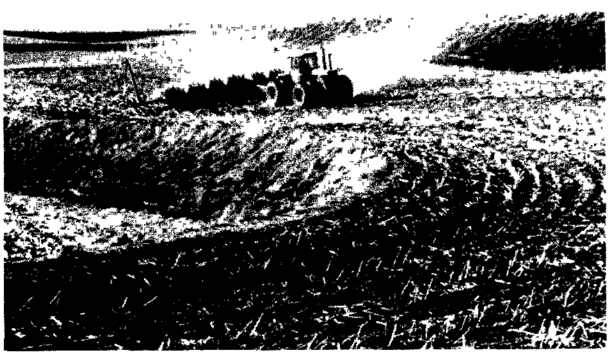
It should also be noted that conservation tillage received a head start in the eastern basin of the lake, particularly since soils there, particularly in eastern Ohio, have been more traditionally recommended for tillage practices such as notill.

1983 Acres of Ridgetill in Lake Erie Basin *
Project Counties in Bold

Paulding OH	3,500	**Ottawa OH**	202
Seneca OH	1,300	Lapeer MI	200
Wyandot OH	1,290	**Lenawee MI**	200
Allen IN	1,065	Shelby OH	200
Wood OH	1,000	Genesse NY	150
Defiance OH	802	**Auglaize OH**	150
Hancock OH	800	Ashtabula OH	100
Trumbull OH	700	Ingham MI	100
Oakland MI	700	**Crawford OH**	100
Adams IN	664	Macomb MI	100
Sandusky OH	644	Branch MI	80
Henry OH	600	Washtenaw MI	70
Dekalb IN	500	**Erie OH**	60
Putnam OH	400	**Medina OH**	55
Stark OH	400	**Lucas OH**	50
Williams OH	350	Crawford PA	28
Hardin OH	300	**Mercer OH**	20
St. Clair MI	260		
Noble IN	250		
Van Wert OH	225	Total	17,837
Sanilac MI	222		

* Source *1983 National Survey Conservation Tillage Practices* National Association of Conservation Districts (1984)

Yields for Conservation Tillage Systems



A question immediately asked by those who produce our nation's food and fiber concerns the impact of various tillage systems on crop yields.

Yields were calculated for all plots in the Lake Erie Conservation Tillage Demonstration Projects for corn and soybeans according to the following criteria.

1. Plots were only included in the calculations if a yield was reported, and if the tillage type was specified.
2. For purposes of this report, tillage other than notill or ridgetill was considered conventional tillage

As can be seen from the tables on the next four pages, yields were comparable for the various tillage types considered. Differences among yields for corn were not statistically significant for the project area. For soybeans, ridgetill production was slightly favored over either notill or conventional tillage.

Tables are provided giving project totals and county totals for both corn and soybeans. Headings within the tables should be interpreted as follows:

1. Plots (the number of plots which met the criteria for inclusion)
2. Acres (the total number of acres of that crop grown in that county under that tillage type which met the criteria for inclusion)
3. Yield (the average yield calculated by dividing the sum of the average yields reported by the number of plots)
4. Wt. Av. (The weighted average yield, figured by dividing the total bushels produced on the demonstration plots by the number of acres involved)
5. S.D (The standard deviation calculated on the basis of the averages reported under yield. This statistic gives an indication of the variation in yields. The larger the number, the greater the average deviation)

With each county name is the 1983 yield for that county as reported by the USDA Statistical Reporting Service.

Corn

Project Totals	Plots	Acres	Yield	Wt. Av	S.D
Notill	583	8517.5	91.9	93.0	1.6
Ridgetill	86	1240.6	91.9	94.2	3.4
Other	345	2882.3	93.5	92.5	1.8

Adams (81 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	11	181.6	89.5	96.3	7.5
Ridgetill	2	34.0	86.0	102.1	55.2
Other	7	86.5	96.9	85.2	13.1

Allen IN (80 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	59	954.0	60.2	59.5	3.4
Ridgetill	15	369.7	76.0	82.5	7.6
Other	24	315.9	69.7	69.2	5.6

DeKalb (74 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	18	307.4	67.7	66.0	8.0
Ridgetill	1	1.5	77.3	77.3	0.0
Other	3	7.5	79.6	78.5	5.6

Noble (74 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	1	7.2	95.0	95.0	0.0

Steuben (81 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	12	280.9	76.3	74.7	4.3
Other	2	47.0	86.1	85.7	4.1

Wells (77 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	3	56.7	85.9	89.2	6.1
Other	1	12.0	77.3	77.3	0.0

Allen OH (70 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	51	594.9	59.4	64.9	4.0
Other	41	435.0	51.5	51.6	3.7

Auglaize (45 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	32	471.0	35.8	34.3	3.4
Ridgetill	1	10.0	38.0	38.0	0.0
Other	10	49.3	36.9	40.6	5.6

Crawford (98 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	21	254.0	108.5	103.0	5.2
Other	6	25.0	124.2	124.2	12.4

Defiance (84 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	64	864.5	87.2	91.2	4.0
Ridgetill	2	38.0	95.2	96.6	37.9
Other	32	259.0	92.9	99.4	4.9

Fulton (118 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	7	63.0	124.6	126.9	6.7
Other	5	25.5	126.7	132.5	6.3

Hancock (87 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	29	423.5	103.0	103.3	4.4
Other	25	123.0	102.9	104.5	4.8

Hardin (59 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	11	179.2	59.3	58.1	6.8
Other	8	50.8	54.8	55.4	9.0

Henry (117 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	20	332.8	124.7	125.9	7.0
Ridgetill	15	216.7	110.7	110.2	9.7
Other	15	118.0	119.3	112.2	8.9

Huron (111 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	10	141.0	134.9	133.9	5.3
Other	5	33.0	123.4	111.1	12.7

Lorain (95 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	20	461.9	112.3	113.0	6.5
Ridgetill	1	1.5	71.4	71.4	0.0
Other	8	21.8	107.1	107.6	5.9

Lucas (119 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	11	260.1	139.5	148.2	6.5
Ridgetill	2	13.0	113.2	102.0	22.9
Other	6	81.9	127.4	130.0	7.7

Medina (105 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	47	649.5	128.4	130.5	3.6
Other	34	372.5	118.5	119.2	3.6

Mercer (56 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	3	32.0	58.8	52.8	11.4
Other	1	1.0	57.3	57.3	0.0

Ottawa (103 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	8	149.0	113.9	106.5	9.2
Ridgetill	9	111.0	97.7	97.4	5.2
Other	7	73.5	107.0	109.1	9.1

Paulding (87 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	4	14.3	89.6	103.4	14.1
Ridgetill	12	126.4	73.5	72.4	4.3
Other	12	94.3	77.9	74.7	5.9

Putnam (84 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	32	410.0	96.6	99.4	4.3
Ridgetill	1	6.0	109.4	109.4	0.0
Other	32	175.9	98.4	103.5	4.4

Sandusky (118 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	12	172.8	134.9	138.9	6.1
Ridgetill	2	25.0	71.8	114.8	101.4
Other	8	48.9	130.4	133.4	7.7

Seneca (105 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	15	201.0	109.8	110.9	3.9
Ridgetill	5	94.0	117.5	111.6	8.6
Other	6	27.0	105.4	106.7	4.3

Van Wert (93 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	20	167.6	109.5	106.3	4.1
Ridgetill	5	44.2	101.2	100.1	9.3
Other	18	175.7	108.2	110.7	4.1

Williams (104 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	10	126.7	108.2	124.2	11.6
Ridgetill	5	40.7	79.4	87.8	13.3
Other	5	50.2	85.3	88.8	12.2

Wood (103 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	8	88.2	124.9	126.2	4.7
Ridgetill	7	89.0	100.4	100.8	7.5
Other	7	36.2	96.2	80.2	10.4

Wyandot (79 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	11	239.2	73.7	70.6	13.4
Ridgetill	1	20.0	122.0	122.0	0.0

Hillsdale (95 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	11	138.5	104.2	102.8	6.0
Other	6	35.5	106.4	109.1	6.7

Lenawee (110 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	13	192.0	109.2	111.3	6.9
Other	3	6.0	110.3	110.3	25.5

Monroe (108 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	9	103.0	99.8	94.9	12.2
Other	8	94.5	117.7	119.2	8.0

Soybeans

Project Totals

	Plots	Acres	Yield	Wt. Av	S.D
Notill	405	5917.8	33.5	34.5	0.7
Ridgetill	65	843.3	40.1	37.5	3.1
Other	237	2213.1	34.0	34.8	0.7

Adams (30 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	1	2.0	21.0	21.0	0.0
Ridgetill	1	30.0	27.0	27.0	0.0
Other	2	5.0	23.0	22.0	7.1

Allen IN (30 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	25	107.9	22.5	23.9	1.5
Ridgetill	8	172.0	27.6	28.8	3.6
Other	11	115.3	26.3	26.7	2.3

DeKalb (27 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	2	17.5	30.5	28.4	3.5
Ridgetill	1	1.5	28.5	28.5	0.0
Other	2	3.0	27.0	27.0	16.3

Steuben (25 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	1	12.0	30.0	30.0	0.0

Allen OH (29 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	46	628.8	27.0	26.2	1.6
Other	46	432.2	28.3	27.6	1.2

Auglaize (25 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	18	322.0	23.9	25.0	1.7
Ridgetill	1	10.0	26.0	26.0	0.0
Other	2	9.0	24.6	23.6	12.2

Crawford (35 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	20	278.0	39.7	39.3	1.9
Ridgetill	2	15.0	51.2	51.4	0.5
Other	6	52.0	36.5	36.3	4.6

Defiance (28 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	50	695.3	29.0	30.0	1.2
Ridgetill	8	140.0	64.8	43.7	23.7
Other	47	452.0	34.3	36.1	1.4

Fulton (43 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	8	98.6	44.5	45.3	3.3
Other	7	33.4	44.8	44.2	3.2

Hancock (35 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	3	51.0	38.8	37.3	1.7
Other	1	1.0	38.0	38.0	0.0

Hardin (27 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	24	338.4	27.3	24.3	6.5
Other	9	48.5	24.9	24.3	3.1

Henry (39 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	14	177.0	39.0	38.7	2.1
Ridgetill	6	101.8	37.2	36.7	1.4
Other	11	161.8	36.5	37.8	2.6

Huron (36 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	15	294.0	44.4	44.7	2.2
Other	2	70.0	45.7	45.1	1.8

Lorain (34 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	11	230.0	45.5	46.1	8.0
Ridgetill	1	1.5	51.8	51.8	0.0
Other	4	35.5	47.9	47.4	5.2

Lucas (39 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	32	497.1	36.0	36.4	1.5
Other	9	106.7	40.4	34.8	3.9

Medina (35 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	10	188.0	37.3	40.3	3.1
Other	9	123.0	40.4	39.0	1.9

Mercer (26 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	7	72.4	21.6	23.9	3.2
Other	1	4.0	23.0	23.0	0.0

Ottawa (34 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	24	533.0	35.3	35.7	1.9
Ridgetill	9	85.0	34.2	34.2	3.1
Other	19	245.0	36.6	37.3	1.9

Paulding (32 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	1	18.0	28.8	28.8	0.0
Ridgetill	4	23.0	23.0	22.2	2.6
Other	4	15.7	26.8	28.3	4.9

Putnam (32 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	20	196.5	33.5	32.8	3.0
Ridgetill	6	56.0	38.7	38.1	3.4
Other	16	52.0	33.2	30.9	2.8

Sandusky (40 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	3	75.0	49.2	53.1	4.8
Other	1	5.0	41.0	41.0	0.0

Seneca (36 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	20	254.0	41.6	41.6	1.4
Ridgetill	4	87.0	41.8	46.9	4.0
Other	4	36.0	36.7	37.4	4.3

Williams (32 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	7	76.0	31.7	29.4	3.9
Other	5	25.9	33.5	28.0	5.4

Wood (38 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	15	309.3	40.0	39.6	1.8
Ridgetill	14	120.5	43.7	43.0	2.4
Other	15	127.2	40.4	41.5	2.6

Wyandot (32 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	23	377.5	40.0	37.2	2.7
Other	2	30.0	43.3	45.0	7.4

Hillsdale (31 bu/ac)

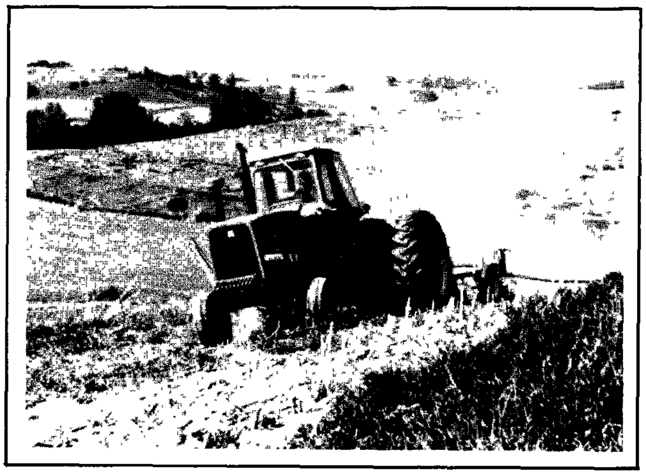
	Plots	Acres	Yield	Wt. Av	S.D
Notill	2	19.6	33.3	33.3	1.1

Lenawee (36 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	1	19.0	33.0	33.0	0.0

Monroe (34 bu/ac)

	Plots	Acres	Yield	Wt. Av	S.D
Notill	2	30.0	43.3	43.3	6.6
Other	2	24.0	46.6	46.6	0.0



Weather and The Market Influence Farmer Decisions

Weather, the markets, and government policy combined to make the 1983 crop year totally different than 1982.

In 1982, American farmers had near-perfect growing weather for crop production. Record crops were produced for corn, soybeans, and wheat. U.S. policymakers were faced with record supplies of 10 billion bushels of corn, 2.5 billion bushels of soybeans, and 4 billion bushels of wheat.

By fall of 1982, prices had fallen below the cost of production, export demand was sluggish because of the dollar's strength in foreign exchange markets, and recovery was slow in the economy of our major importing countries.

In December of 1982, the Payment-in-Kind (PIK) program was announced for corn, grain sorghum, wheat, cotton, and rice to reduce the 1983 acreage. The generally poor financial situation in agriculture led to large participation. With the farmers' option of retiring all of their corn acreage, many counties had the maximum of 45 percent of their corn acreage in the PIK program

Weather combined with PIK to further reduce crop production. A cool, wet, late spring delayed planting. Then many crop producing areas experienced the hottest and driest weather conditions in 50 years.

Nationally, harvested corn declined 21 million acres through PIK. The U.S average yield was 80.5 bushels per acre 34.3 bushels per acre below 1982's record yield.

PIK influenced soybean acreage indirectly. The same land can be used in the Corn Belt to grow either corn or soybeans, and either cotton or soybeans in the Southern states. The PIK program boosted price prospects for corn and cotton to the point where it was considered less profitable to grow soybeans than to participate in the program or grow other crops. Double crop soybeans (following wheat) were reduced due to the lack of moisture in July when they would normally have been planted in much of the Corn Belt.

These conditions boosted corn prices, which rose from a low in 1982 of about $1.80 per bushel to a peak in 1983 of $3.80. The U.S. average price was $2.70 per bushel compared to $2.45 the previous year. Soybeans sold, on the average for $5.51 per bushel during 1983. Thus, for farmers to have a chance to produce at a profitable level, they were required to keep production costs below $2.70 per bushel for corn and $5.51 per bushel for soybeans.

Farmers in the demonstration project area managed to produce corn and soybeans in a way which should have produced a profit during 1983. Notill corn production and ridgetill soybean production had most favorable costs according to these calculations.

Cost of production estimates were made as follows:

1. Cost estimates prepared by the Economic Research Service for the Northeast Indiana Erosion Study were used to estimate average costs of machinery use for each tillage type.
2. Since no significant differences were found in fertilizer use among the tillage types, fertilization intended to produce 120 bushels of corn and 45 bushel of soybeans per acre were used.
3. Herbicide costs were based on the actual average amounts of herbicide used for the various tillage types in the projects.
4. Drying and hauling costs were modified to reflect the actual average yield data for the tillage type in the county.
5. A 14.5 percent interest rate was used to calculate interest cost on operating capital (cost of seed, fertilizer, and herbicide)
6. A mangement cost, based on 12 percent of total production cost was included.

7. Returns to land, taxes, and interest on long-term debt were *not* included.
8. The total production cost, calculated on a per acre basis was divided by the average yield for that crop and tillage type in that county. Thus, the cost of producing each bushel was reduced when yields were high and magnified when yields were low.

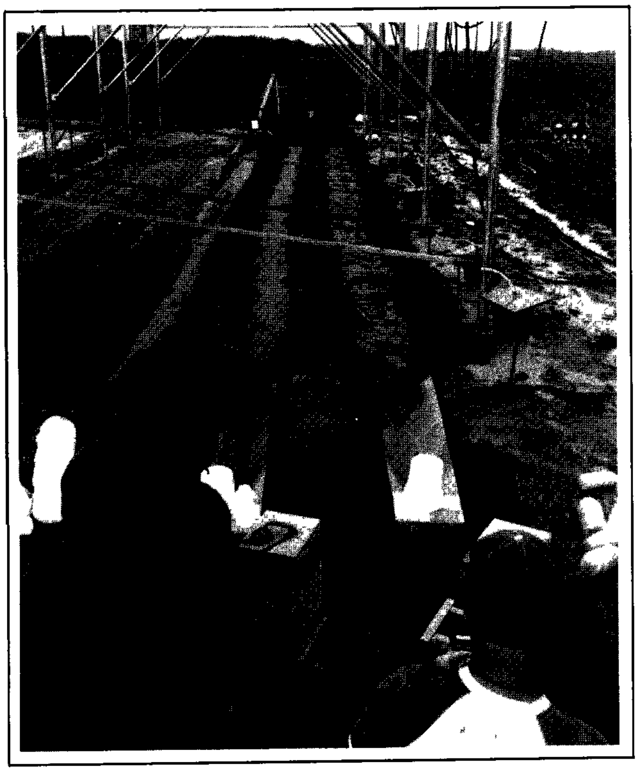
Results of this analysis are included in the table on page 14.

Cost of Production

(Dollars per Bushel)

County	Corn Conventional	Corn Notill	Corn Ridgetill	Soybeans Conventional	Soybeans Notill	Soybeans Ridgetill
Adams	2.59	2.57	2.72	6.37	5.43	4.82
Allen IN	3.55	3.75	3.15	5.57	4.96	4.24
Dekalb	3.12	3.34	3.05	5.43	4.43	4.35
Steuben	2.90	2.96	--	--	--	--
Wells	3.21	2.69	--	--	--	--
Allen OH	4.76	3.51	5.18	4.73	--	--
Auglaize	5.73	7.05	5.61	6.21	4.87	--
Crawford	1.95	3.32	--	4.01	3.21	2.31
Defiance	2.56	2.50	2.47	4.06	3.96	2.76
Fulton	2.00	1.88	--	3.27	2.93	--
Hancock	2.41	1.85	--	3.86	3.08	--
Hardin	4.44	4.33	--	5.88	4.54	--
Henry	2.25	1.84	2.17	4.01	3.07	3.33
Huron	2.27	1.74	--	3.21	3.29	--
Lorain	2.34	2.08	3.27	3.06	2.66	2.33
Lucas	1.86	1.82	--	3.63	3.55	--
Medina	2.21	1.82	--	3.63	3.55	--
Mercer	3.87	4.55	--	6.37	5.46	--
Ottawa	2.31	2.14	2.45	4.00	3.51	3.83
Paulding	3.32	2.14	3.34	5.47	3.89	5.46
Sandusky	1.91	1.71	2.07	3.57	2.42	--
Seneca	2.36	2.13	2.28	3.99	2.96	3.49
Van Wert	2.28	2.13	2.39	--	--	--
Williams	2.81	1.77	2.69	4.37	4.06	--
Wood	3.10	1.77	2.29	4.00	3.24	--
Hillsdale	2.31	2.07	--	--	--	--
Lenawee	2.29	2.07		--	--	--
Monroe	2.21	2.40	--	3.24	2.81	--
TOTALS	2.68	2.48	2.62	4.31	3.61	3.18

Environmental Impacts Of Lake Erie Demonstration Projects



In evaluating the environmental impact of the demonstration projects, we have considered the following:

1. Impacts of the projects themselves on the environment
2. Impacts that practices demonstrated in the projects might have on Lake Erie if adopted basin wide.

It is generally agreed that adoption of conservation tillage on 40-50 percent of the farmland in the basin would result in a reduction in phosphorus loadings consistent with the goals set forth in the international agreement on great lakes water quality. The plot acreage (about 23,000 acres) is small in comparison to the basin, representing about 1/300 of the basin area. In spite of its small size, the project did have an impact on water quality.

Phosphorus reduction directly resulting from the project is estimated at 12 metric tons in 1983 of which 9.5 metric tons is particulate phosphorus. This estimate is based on the following assumptions.

1. The 18,000 acres of notill and ridgetill in the project would have been conventionally tilled if the project had not been present.
2. Delivered sediment from the types of soils in the project area would have been about 2 metric tons per acre under conventional tillage.
3. Under conservation tillage, delivered sediment would have been about 50 percent of conventional tillage or no more than 1 metric ton per acre.

Using an estimate of 1 metric ton per acre and applying an equation developed during the Black Creek project by Dr. Darrell Nelson predicts a reduction in particulate phosphorus of slightly more than .5 kg acre. Particulate phosphorus represents about 80 percent of total phosphorus.

This estimate, while rough, is consistent with estimates resulting from other studies and would suggest that a 3,600 metric ton reduction in phosphorus loadings could be achieved by applying conservation tillage to all of the farmland in the basin. The 1,700 metric ton annual reduction in phosphorus needed from basin agriculture could thus be achieved by applying conservation tillage to about 47 percent of the basin.

The estimate of phosphorus reduction presented here makes certain assumptions concerning soil detached and delivered to the lake which could be better handled with a more complex model. Application of the ANSWERS model to data from the tillage plots will be made during 1984 as a part of Dr. David Beasley's project to analyze the results of the tillage demonstrations.

Phosphorus Application in Project Counties

(Pounds of Actual P per Acre)

	Corn			Soybeans		
County	Notill	Ridgetill	Conventional	Notill	Ridgetill	Conventional
Indiana						
Adams	49.3	150	62.6	82	46	64
Allen	46.2	55.9	62.6	46.9	39.3	41.7
Dekalb	62	40	40	40	40	40
Noble	51.6	--	--	--	--	--
Ohio						
Allen	43.8	--	54.3	62	--	67
Auglaize	64.5	120	45.8	46.8	33	30
Crawford	50	--	60	51	--	--
Defiance	50.6	--	60.3	38.4	90	39
Fulton	80	--	80	17.8	--	30.3
Hancock	62.5	--	61.8	--	--	--
Hardin	89.5	--	65	45.5	--	37.1
Henry	59	--	73	46	--	30.3
Huron	46	--	60	49.7	--	58
Lorain	87.8	86	51	40.4	70	50
Lucas	--	23	90	--	--	--
Medina	49.5	--	52.2	70.7	67.7	--
Mercer	33.3	--	35	27.5	--	--
Ottawa	47.1	59.3	50.5	34.5	--	10
Putnam	55.2	--	55.2	74	--	33
Sandusky	65	--	42	--	--	--
Seneca	68	96.7	45	51	50	--
Van Wert	39.6	92	46	--	--	--
Williams	46	69	69	20	--	--
Wood	71.3	80.4	38.8	92	72	--
Wyandot	83.5	--	--	69.4	--	--
Michigan						
Lenawee	75	--	--	--	--	--
Monroe	75	--	50	--	--	--
Totals	60.2	76.1	58.9	48.5	60.3	46.8

Perhaps as significant as the phosphorus reduction resulting from reduced soil loss is the indication presented by the demonstration projects of successful nutrient management.

Phosphorus fertility levels in the basin have been increasing annually as a result of applications in excess of replacement requirements. Since erosion of soil with higher phosphorus fertility levels results in proportionally more phosphorus entering the lake, it is desirable to utilize phosphorus at or near the replacement level. Although the recommended rate of phosphorus application varies depending on the crop planted and the yield expected, the rate of application should not exceed the 30-60 pounds per acre range in most of the area of the western basin. Traditional fertility programs have resulted in applications nearer 100 pounds per acre.

As can be seen from the above table, the average range of phosphorus application used by project farmers in 1983 is much closer to this recommended range. Many counties utilized phosphorus application rates near an ideal amount while a few exceeded reasonable application rates.

The rate of application indicates that project farmers utilized soil test and sound management practices. This success should be encouraging to agricultural nonpoint programs where nutrient management will play a key role in achieving water quality goals.

Herbicide Usage

A growing concern about the adoption of notill and other conservation tillage systems involves the use of hericides to control weeds. Much of this concern is a result of the mistaken belief that herbicides are not used in conventional tillage systems. In fact, an analysis of herbicide usage in the tillage demonstration projects indicates that the total usage of herbicides on conservation tillage is not much greater than that used on conventional plots. Differences in herbicide are more associated with the types of herbicide used and the mix of herbicides used than of the amount used.

In order to analyze herbicide usage in the demonstration area, two techniques were used. First, the numbers of herbicide applications for each tillage type were counted. Thus, if a farmer applied four separate herbicides to a plot, or applied the same herbicide at four different times, his application number was four.

Results of this analysis are presented in the following table.

Applications of Herbicides			
Crop	Notill	Ridgetill	Conventional
Corn	3.5	2.9	2.5
Soybeans	3.6	3.0	2.3

This table indicates that farmers average about one additional application of herbicide per plot when using conservation tillage. An analysis of the of the herbicides used indicates that this additional herbicide was most likely a contact weed killer, used to eliminate existing vegetation at planting time. It should be noted, however, that contact herbicides were also used in some conventional tillage operations.

From the standpoint of the environment, the contact hericides most frequently used (Paraquat and Roundup) are not considered to be persistent.

For soybean production, farmers seemed more eager to use a post emergence herbicide in conservation tillage, particularly on ridgetill.

As farmers increased the number of herbicides used, however, they tended to decrease the amount of any given herbicide that was used. Thus, although one more application was made on notill corn than conventional, farmers tended to use only 80 percent as much of any individual herbicide on notill corn. A combination of these factors means that herbicide usage on notill corn was only 12 percent greater in the project than on conventional. Additional results of this analysis for each tillage type are contained in the following table.

Herbicide Usage as a Percent of Conventional			
Crop	Notill	Ridgetill	Conventional
Corn	112.8	112.7	100
Soybeans	103.9	119.1	100

Insecticide usage was also analyzed but no statistically significant differences were found between conservation and conventional tillage.

Summary

Results presented in this report cover one year's experience. They should not be considered definitive and could be changed by different weather conditions and different approaches to management. However, for 1983, the following conclusions can be drawn.

1. Yields with notill and ridgetill were competitive with yields produced under conventional tillage systems.
2. Costs of production for conservation tillage systems were less than or equal to costs of producing the same crops using conventional systems.
3. Conservation tillage systems reduced phosphorus loadings from the project area and did not significantly increase herbicide usage.

Cooperating Agencies

Soil Conservation Service

Cooperative Extension Service

Agricultural Stabilization and Conservation Service

Indiana State Soil Conservation Committee

Ohio Department of Natural Resources
Division of Soil and Water Districts

Michigan Department of Agriculture
Soil Conservation Committee

Project Districts

Indiana

Adams County Soil and Water Conservation District
Allen County Soil and Water Conservation District
DeKalb County Soil and Water Conservation District
Noble County Soil and Water Conservation District
Steuben County Soil and Water Conservation District
Wells County Soil and Water Conservation District

Ohio

Allen Soil and Water Conservation District
Auglaize Soil and Water Conservation District
Crawford Soil and Water Conservation District
Defiance Soil and Water Conservation District
Fulton Soil and Water Conservation District
Hancock Soil and Water Conservation District
Hardin Soil and Water Conservation District
Henry Soil and Water Conservation District
Huron Soil and Water Conservation District
Lorain Soil and Water Conservation District
Lucas Soil and Water Conservation District
Medina Soil and Water Conservation District
Mercer Soil and Water Conservation District
Ottawa Soil and Water Conservation District
Paulding Soil and Water Conservation District
Putnam Soil and Water Conservation District
Sandusky Soil and Water Conservation District
Seneca Soil and Water Conservation District
Van Wert Soil and Water Conservation District
Williams Soil and Water Conservation District
Wood Soil and Water Conservation District
Wyandot Soil and Water Conservation District

Michigan

Hillsdale County Soil Conservation District
Lenawee Soil Conservation District
Monroe Soil and Water Conservation District