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Agency

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EPA

Otter Creek Conservation Tillage Demonstration Project (October 1987)

FOREWORD

The U.S. Environmental Protection Agency (**USEPA**) was created because of increasing public and governmental concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimony to the deterioration of our natural environment.

The Great Lakes National Program Office (**GLNPO**) of the U.S. EPA was established in Chicago, Illinois to provide specific focus on the water quality concerns of the Great Lakes. The Section 108(a) Demonstration Grant Program of the Clean Water Act (PL 92-500) is specific to the Great Lakes drainage basin and thus is administered by the Great Lakes National Program Office.

Several sediment erosion-control projects within the Great Lakes drainage basin have been funded as a result of Section 108(a). This report describes one such project supported by this Office to carry out our responsibility to improve water quality in the Great Lakes.

We hope the information and data contained herein will help planners and managers of pollution control agencies to make better decisions in carrying forward their pollution control responsibilities.

Director
Great Lakes National Program Office

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OTTER CREEK WATERSHED CONSERVATION TILLAGE DEMONSTRATION PROJECT

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D I S C L A I M E R

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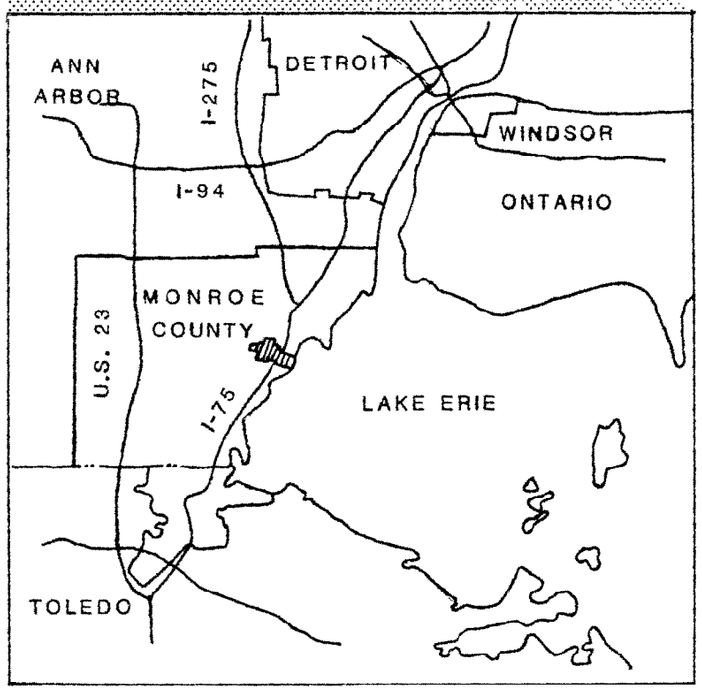


I. INTRODUCTION

The Otter Creek Tillage Project is part of the Tri-State Tillage Project being conducted by thirty-one counties in the Lake Erie Basin. The Monroe County Soil and Water Conservation District administers the project through a grant from the U.S. Environmental Protection Agency (EPA).

Phosphorus is a key nutrient necessary to crop production, but it is also cited as the key nutrient responsible for pollution problems in our streams and lakes. Of all the Great Lakes, Lake Erie is the most threatened by phosphorus pollution. Abnormal amounts of phosphorus entering the Lake have caused excessive plant growth which in turn has depleted oxygen levels in the water and killed or damaged fish and other aquatic life.

The source of phosphorus pollution includes point discharges (such as sewage); atmospheric pollutants; and soil eroded from cropland. Since phosphorus is attached to soil particles, soil erosion contributes not only sediment to our lakes and streams but also phosphorus and other associated pollutants. If soil erosion can be reduced, even on soils that are already below acceptable soil loss levels for long term crop production, then water quality will be a major benefactor.

Our national commitment to improving water quality in Lake Erie is indicated by a mutual agreement between the United States and the Canadian Government. Part of the Great Lakes Water Quality Agreement of 1978 obligates the U.S. to control the diffuse sources of phosphorus that are entering Lake Erie. It is estimated that as much as half of the phosphorus reduction called for in the Great Lakes Water Quality Agreement can be achieved by reducing phosphorus lost from agricultural land. Conservation tillage practices are considered the most effective method for controlling these nonpoint sources of pollution.

The U.S. EPA, whose mission includes the protection of threatened water resources, is concerned with the pollution problems in Lake Erie. The EPA therefore, is supporting conservation districts in their efforts to promote conservation tillage in the Lake Erie Basin. As a result of the joint efforts of local conservation districts and the EPA, conservation tillage demonstration projects have been organized in all of the counties in the Western Basin of Lake Erie.

II. BACKGROUND

Located in south-central Monroe County, the Otter Creek Watershed encompasses 39,193 acres. This land area is over 90% farmland, devoted primarily to the production of corn, soybeans and wheat. A large percentage of the county's tomato and vegetable crops are also produced within this watershed. This is an important factor from the standpoint of water quality due to the more intensive

use of fertilizers and pesticides on these crops than on row crops.

The topography of this area is nearly level to gently sloping, reflecting the recent geologic formation of the landscape from lake plains, glacial outwash, till plains and ground moraines.

The soils in the watershed fall within two broad soil associations; the Oakville-Tedrow-Granby association and the Pewamo-Selfridge-Blount association. These major soils comprise the following percentages of the watershed: Oakville-11%; Tedrow-10.5%; Granby-9%; Pewamo-15.5%; Selfridge-9%; and Blount-5%. The total soil loss which these soils can tolerate each year and still maintain long term crop production ranges between three and five tons per acre. This includes losses from both wind and water erosion.

Wind erosion is a particular concern within the watershed. Sixty-six percent of these soils, if left unprotected, are highly susceptible to erosion by wind. Erosion rates for unprotected soils range from nine tons to 25 tons per acre per year. Water erosion is less severe than erosion from wind. However, twenty-one percent of the soils in the watershed are susceptible to water erosion, and erosion rates range as high as seven tons per acre per year.

Otter Creek, which has a discharge rate of 128 gallons per second, outlets directly into Lake Erie at a point 3-1/2 miles south of Bolles Harbor and 1-1/2 miles north of the City of Luna Pier. Major tributaries into Otter Creek are as follows: South, North, and Middle Branches of Otter Creek, Yarger Drain, Henry Drain, Albain Drain, Duck Pond Drain, Lockwood Drain, Cooper Snell and Ansel Drain, Summerfield and Ida Drain, Peters Drain, West Bates Drain, Hitting Drain, Shobu No. 1 Drain, Rauch Drain, Ida Drain, and Grauf Drain. The numerous drainage ditches in the watershed are spaced, on average, less than one-quarter mile apart. They typically have unstable side slopes of 1:1, are overgrown with trees or shrubs, but are <u>not</u> stabilized with sod. Nearly all the ditches are undergoing moderate ditch bank sloughing caused by erosion around all individual tile outlets (typically on a 75' spacing) which do not have outlet tubes. Tillage operations are generally conducted to within a foot or two of the ditch bank crest.

Relationship to Lake Erie

Monroe has the highest proportion of cropland (64%) of any county adjoining Lake Erie, increasing the potential for sediment, fertilizer and pesticide runoff. The <u>Lake Erie Wastewater Management Study Final Report</u> (Army Corps of Engineers, 9/82) indicates that the flow weighted mean total phosphorus concentration for Monroe County was calculated as 0.3 to 0.4 mg/l, the highest concentration of phosphorus for <u>any</u> Michigan County that directly adjoins Lake Erie (LEWMS pg. 161-162).

The State of Michigan Phosphorus Reduction Strategy also indicates that the available soil phosphorus levels in the Michigan portion of the Lake Erie drainage basin have increased dramatically over the last 10 years. Once the soils reach their maximum P absorbing capacity (90-200 lbs. of P/acre in this area) there is a significant amount of downward movement of P. The median phosphorus soil test levels for Monroe for 1982-83 were the highest (tied with those for Macomb) of all counties within the Michigan portion of the Lake Erie Drainage Basin.

The Land Resource Information Systems data upon which the LEWMS was based, ranks Monroe County fourth among Michigan Counties selected for the implementation of conservation tillage programs to reduce phosphorus transport into Lake Erie. The technical supplement for State of Michigan Phosphorus Reduction Strategy for the Michigan Portion of Lake Erie and Saginaw Bay lists Monroe County as an "alternate" priority county for any conservation tillage programs which are aimed at phosphorus reduction (pg. 47).

Even though those ratings indicate a significant potential for water pollution, the contribution by wind erosion to water pollution, through the movement of soil directly into watercourses, was not considered when Monroe County was given this 'alternative' priority rating. No method currently exists to quantify the impact of wind erosion on water quality. Nevertheless, through the processes of siltation and surface creep, a significant amount of soil (presumably carrying fertilizer and pesticides) can annually be observed entering the extensive system of drainage ditches within the watershed. Since few windbreaks or barriers exist on the 63% of the watershed's cropland which is highly susceptible to wind erosion, and because drainage ditches are on the average less than one-quarter mile apart, the actual occurrence of sedimentation by wind erosion is frequent and widespread.

Climate and Weather

In winter the average temperature is 27.6 degrees F, and the average daily minimum temperature is 20.2 degrees. The lowest temperature on record, which occurred at Monroe on February 5, 1918, is -21 degrees. In summer the average temperature is 71.6 degrees, and the average daily maximum temperature is 81.9 degrees. The highest recorded temperature, which occurred at Monroe on July 24, 1934, is 106 degrees.

The total annual precipitation is 31 inches. Of this 17.91 inches, or 58 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 14.7 inches. The heaviest 1-day rainfall during the period of record was 4.08 inches at Monroe on September 9, 1917. Thunderstorms

occur on about 42 days each year, and most occur in June and July.

Average seasonal snowfall is 32.9 inches. The greatest snow depth at any one time during the period of record was 20.0 inches on December 3, 1974. On an average of 34 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

Deviations from Normal Weather

The growing degree day data in Chart 1 shows the deviation between the years of the project and a comparison to other years on record. The amount of available energy to promote and accelerate plant growth, as measured in growing degree days, can only be considered favorable when the right amount of rain (moisture) and favorable temperatures exist.

The amount of "growing degree days" accumulated thru the crop season is only one indication to the kind of growing conditions that existed on the plots. In order to draw any conclusion as to growing conditions over the various project years, growing degree days, temperature, and precipitation, as well as other cultural and field conditions (not related to weather) must also be considered. Those conditions which may have also increased or depressed crop growth and development are: fertility levels in the soil; water availability; tile drainage systems; soil compaction; and weed control or weed competition.

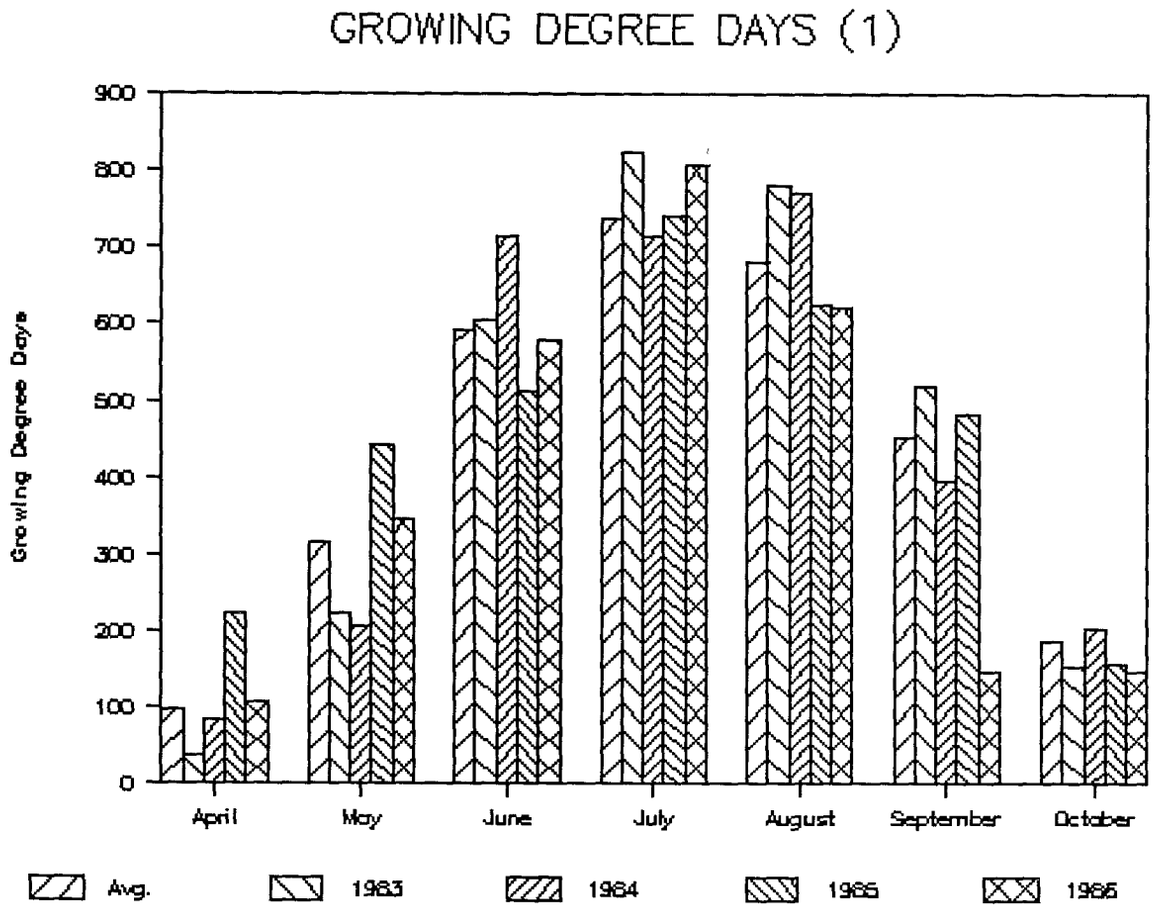
Precipitation and temperature charts for the years 1983 - 1986 are shown in Chart 2. Yearly totals of precipitation for 1983-1986 are shown in Table 1.

In 1983 we experienced a wetter than normal planting season. April was 1.67 inches above normal and May was 2.46 inches above normal. Harvest season was also excessively wet in 1983. In October and November, rainfall exceeded the normal average by 4.93 inches.

The yearly average temperature and precipitation recorded in Monroe for 1984 were very close to those reported for the 29 year period, 1949-78. However, within the growing season there were some important variations from the average. The spring, March through May, was 1.6 inches above average in precipitation and cooler than the average. The summer months, June through August, were 2.6 inches below average in precipitation and warmer than the average.

The extremely wet harvest conditions in both 1985, 3.2 inches of rain above normal, and 1986, 6.7 inches of rain above normal, had several significant negative impacts on the Project.

CHART 1



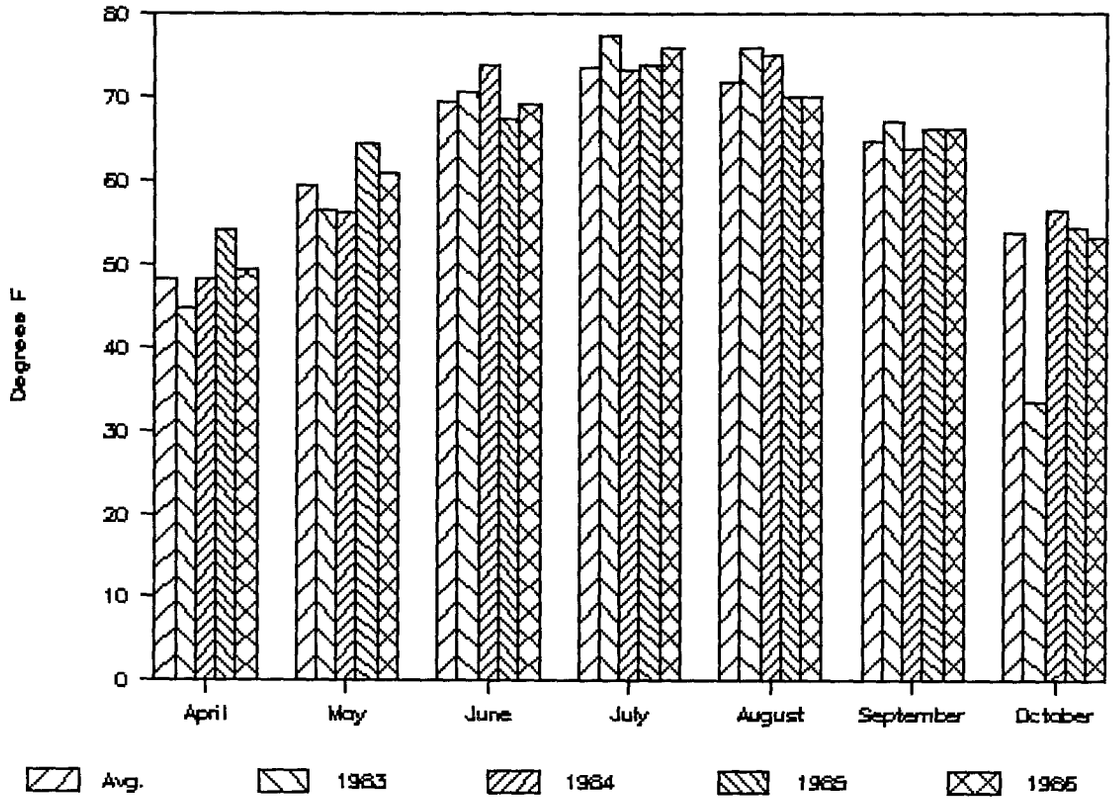
(1) A growing degree day is a unit of heat available for plant growth. It is calculated by adding the maximum and minimum daily temperatures, dividing the sum by two, and subtracting the temperature below which growth is minimal for the principle crops in the area (in this case 50^{o} F).

Average = 1949-1978

Source...Official U.S. Weather Bureau data recorded at Monroe, Michigan

CHART 2

AVERAGE DAILY TEMPERATURE



PRECIPITATION DATA

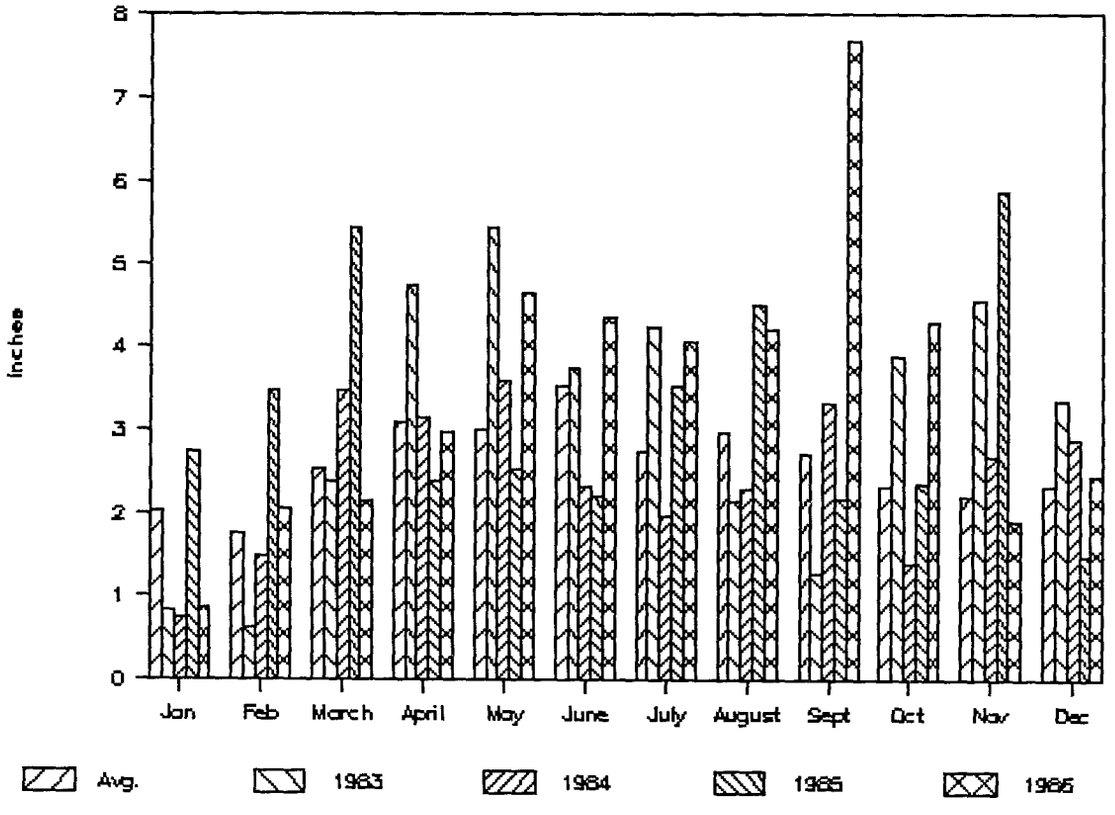


TABLE 1

Yearly Precipitation Totals
(Inches)

Average	1983	1984	1985	1986
31.00	37.17	29.20	38.55	41.57

III. PROJECT PURPOSE

The purpose of this Project was two-fold. It was designed to demonstrate to farmers the successful application of conservation tillage by other farmers in their community. It was also designed to demonstrate the effectiveness of conservation tillage for controlling soil erosion and thus preventing the runoff of soil and nutrients into Lake Erie.

The demonstration plots were not intended to be research plots, although information obtained does point the way to needed research efforts. They are intended to provide farmers a chance to experiment with various tillage systems at a low cost and to allow others to benefit from their experiences.

Grant Application

In June of 1982, the board of directors submitted a proposal including a plan of work and a budget to U.S. EPA. In September of 1982 the District was awarded a grant of $32,000 from the U.S. EPA to be matched with $22,625 of local funds for a three-year project. In March of 1983 an amendment was made to reduce the matching local funds to $10,667.

At the end of 1985, the board of directors decided that work could continue through December 31, 1986 without additional funding from U.S. EPA. They requested and received the extension of the Project to December 31, 1986 without an increase in US. EPA funding.

Agency Roles and Responsibilities

The agencies and groups most directly involved with the Project are the Monroe County Soil and Water Conservation District, the Soil Conservation Service, the Agricultural Stabilization and Conservation Service, and the Cooperative Extension Service.

The Monroe County SWCD, being the grantee and one of the local agencies involved, was responsible for the overall administration and daily operation of the Project. To assist the District, a technician was employed starting in March 1983. The duties of the technician did not encompass the compilation of tillage data or the writing of the quarterly, annual, or final reports. The District's Administrative Assistant managed the Project funds,

scheduled the no-till equipment use and compiled the data which was provided to her.

The Soil Conservation Service worked closely with the District. SCS personnel were instrumental in getting the Project initiated and in serving in an advisory capacity to the District. The District Conservationist as part of his/her normal conservation planning activities, provided training to the District's Technician, met with farmers to answer agronomic questions, conducted tours of the plots, assisted the Technician with scouting, evaluated the technical data on the plots, and organized and wrote the reports.

The Agricultural Stabilization and Conservation Service was involved by providing Agricultural Conservation Program (ACP) payments to cooperators qualifying for such payments when applying conservation practices to the land.

Funding Mechanisms

With the Monroe County SWCD being the grantee, all funding for the Project was administered by the District. Matching monies for costs incurred in the Project came from in-kind services. In-kind services are services performed by individuals or local units of government as contributions to the attainment of Project goals at no direct cost to the Project. An example would be a cooperator planting a no-till demonstration plot with his own equipment. Expenses were referred to the Board of Directors for approval before payments were made.

IV. OPERATING PROCEDURES

Selection of Project Coordinator

A new employee to serve as a "Project Coordinator" was not hired by the District. Instead a Conservation Tillage Technician was hired under a personal services contract. The first Conservation Tillage Technician was located through an advertisement placed for three days in the local newspaper. The ad read as follows: "Conservation Tillage Technician. Responsible for supervising and planting no-till plots. Farm background required." Eleven applicants were interviewed.

The person who was hired in March of 1983 for the position had some horticultural experience, 20 years experience in farming and in working with equipment, and over a year's experience working as a horticulture assistant at the Cooperative Extension Service. Unfortunately in the midst of the first planting season the new technician experienced health problems, and a temporary replacement was located.

Later a new Conservation Tillage Technician with a working-farm background was hired under a personal services contract. The contract stipulated the particular duties to be performed during

the year and the payment for each totaling $3,500 (see Appendix B).

The District's full time administrative assistant managed the project funds, scheduled the no-till equipment use and compiled the data which was provided to her.

The District Conservationist as part of his/her normal conservation planning activities, provided training to the District's Technician, met with farmers to answer agronomic questions, conducted tours of the plots, assisted the Technician with scouting, evaluated the technical data on the plots, and organized and wrote the reports.

Accounting

The District Administrative Assistant was responsible for managing the funding of the Project under guidelines established by the grant proposal, as directed by the District Board of Directors. Funds received from the U.S. Environmental Protection Agency were deposited into the District savings account and expenses were paid by check for bills approved for payment by the Board of Directors.

As funds were needed and upon the direction of the Board of Directors, the Administrative Assistant prepared a "Request for Advance or Reimbursement" form and submitted it to the U.S. EPA. This form included total program outlays to date, estimated outlays for the advance period, funds previously requested, and funds requested for the advance period.

Equipment

The purchase of the planter, valued at over $2,500, was advertised for sealed bids. Invitations to bid, specifications and bid sheets were sent to dealers in the area who might be able to supply the needed equipment. The bids were publicly opened on the specified date and read aloud by the chairman of the Board of Directors. The lowest bid submitted was awarded the sale. The successful bidder was notified in writing. A second piece of equipment, a small used drill, was purchased. Project funds were used for a portion (43%) of the purchase price of the drill. The cost to the Project was under $2,000 therefore, the bid process was not used.

The District's large soybean drill was leased to the Project thus assisting the District in its purchase. Tractors for the equipment were leased from a local dealer. All of the District's equipment was offered for lease/rental at a nominal charge. In all cases priority was given to Project participants. The first year saw the rental program used by a substantial number of farmers. Each succeeding year witnessed a decline in rentals as participants in the Project purchased their own equipment.

The Project permitted the purchase and subsequent lease/rental of no-till equipment that otherwise would not have been possible for the District to purchase.

Selection of Project

At a special meeting March 24, 1982 the board of directors decided to apply for grant funds for a conservation tillage demonstration project. Representatives from the County Board of Commissioners were invited to a meeting held March 30, 1982 to select a watershed. The Otter Creek Watershed was selected. Fifty-eight percent of the Otter Creek Watershed's area contain soils susceptible to erosion by water run-off. The remaining 42 percent are vulnerable to wind erosion. Taking these statistics into consideration, conservation tillage is an effective practice in reducing erosion caused by wind and water on the soils of the Otter Creek Watershed.

Subsequent to the meeting and prior to submission of the application the District received letters of support from the Monroe County Board of Commissioners, ASCS, Monroe County Drain Commissioner and Cooperative Extension Service. In June the grant application was submitted and approved.

Guidelines for Project Participation

The basic guidelines requested of the participants were to set aside a 20 acre block of cropland for two 10 acre side-by-side comparison plots, keep accurate records, take yield checks, permit tours of fields and permit publication of data and yields collected on fields in the project.

Technical Assistance

The Project Technician provided specific services which encompassed maintaining the District's equipment, operating the tillage equipment, reviewing the equipment use with the farmers, answering general questions about fertility and pest management, keeping records of equipment use, and assisting SCS staff in collecting tillage data and yield data.

Information and Education

Educational activities, which included tours, news releases, oral reports at annual meetings and annual project reports were normally organized and prepared by the SCS District Conservationist working with the District's Administrative Assistant. No information program was designed or formally planned prior to the initiation of the Project.

Incentives for Participants

Incentives available to Project participants and for potential participants were rather limited. Most had already exceeded

either their three years for ACP tillage cost-share or had exceeded their 60 acre ACP limitation. No special cost-sharing funds were approved by ASCS to accelerate erosion control in the project area. Therefore participants did not have any economic advantage over any other farmers in the county, with the exception that District equipment was available to them to use "at cost".

The problem with this arrangement was that most of those interested in participating (at least by the second year) had equipment of their own which was suitable for no-till. Hence the advantage to accrue to the individual was nil. Furthermore, many potential participants saw the public attention as a disadvantage. After the first year several participants declined to continue after they had undergone the experience of having their crop yields distributed in the Annual Report and publicized in news releases.

Reporting System - Data Collection

One of the more challenging tasks of the Project was obtaining plot data from cooperators. For many farmers, the data was more specific than was normally kept in their records. Forms were developed for their use, but during the rush of the planting season they were often not completed. Repeated visits or phone calls by staff persons were often required to obtain the needed information.

Even when data was collected, it was often of limited value. In some cases data was not complete or was based upon the cooperators best recollection or estimate. In other cases valid comparisons could not be made because the cooperator had altered the inputs or some factor on one plot but not the other (i.e. planting date or fertilizer rates). Additionally, extremely wet harvest conditions in both 1985 and 1986 greatly limited the cooperator's time available to do harvest checks. To some participants the necessity of harvesting their fields as rapidly as possible conflicted with completion of the harvest checks.

Charts in Appendix A summarize the plot data and results compiled in the four years of the Project 1983 to 1986. This information was provided to the U.S. EPA as a part of quarterly and annual reviews of Project activities conducted by the District

V. PROJECT ACCOMPLISHMENTS

Number of Participants

A total of 15 different farmers participated in the Project in the four crop seasons 1982-1986. This number included: 10 participants in 1983; 6 participants in 1984; 7 participants in 1985; and 6 participants in 1986.

Acreages in Demonstration Plots

A total of 657.4 acres were included in the demonstration plots. The yearly acreages were as follows: 1983, 239 acres; 1984, 128.8 acres; 1985, 90 acres; and 1986, 199.6 acres.

Included in this total 337.7 acres of no-till were planted on the demonstration plots; 118 acres in 1983, 67.9 acres in 1984, 54 acres in 1985, and 97.8 acres in 1986.

All of the demonstration plots involved a comparison between no-till and another form of tillage which the farmer either used on his farm or had used previously. On 59% of the plots the comparison plot was planted using a form of minimum tillage which left more than 30% residue on the surface. On 41% of the plots the comparison used was some form of maximum tillage which left less than 30% residue cover on the surface.

On 83% of the plots corn was the crop planted. Soybeans were planted only on 17% of the plots. This selection of corn over soybeans is attributable to the lesser acceptance and understanding of no-till soybeans as compared to no-till corn.

Each plot was identified as part of the Otter Creek Project with a sign visible from the road. The signs included specific information on crop residue, tillage, crop planted, date planted, herbicides, insecticides, and fertilization.

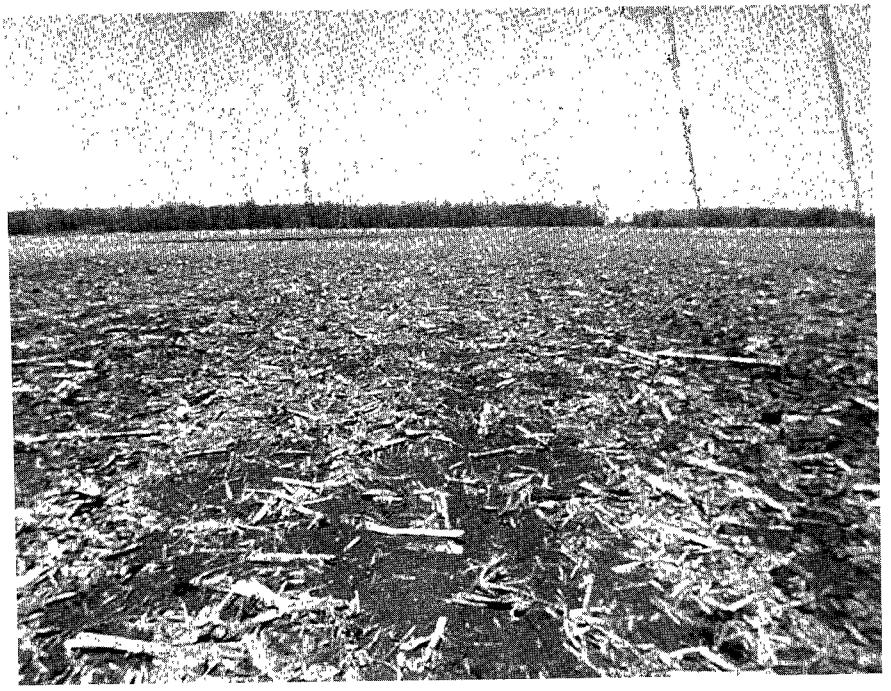
Information and Education

Tours give people the opportunity to see what conservation tillage looks like. Each summer demonstration tillage plots were toured. The average attendance for each tour was 25 people. During 1985 and 1986 the Agricultural Agent for the local Cooperative Extension Service assisted with the tours.

Additionally, in 1985 and 1986 county-wide meetings on conservation tillage were held during the winter months at which approximately 100 were in attendance. Otter Creek participants were especially invited to attend these meetings to improve their management.

Newsletters have been an important method of communication. They covered current topics of importance such as plot sign up, equipment availability, and upcoming tours and meetings. A mailing list was compiled of Project cooperators and those who owned or farmed land in Monroe County. Seven newsletters were prepared covering the Project and distributed to the mailing list of 2400 people. On two occasions articles were also published in the Michigan Department of Agriculture newsletter.

Landowners viewing the Project's no-till plots in 1983.



Greater than 30% of the surface was covered with crop residue on 59% of the comparison plots. Because residue left on the soil surface (as shown above and in no-till, as shown below) reduced wind erosion and the rate of surface water runoff, fertilizers and pesticides removed from the fields were also reduced. This resulted in improved water quality in the Project area.

Soybeans are growing up through corn and weed residue which has not been touched with any tillage implements. The amount of corn stalks left on the soil surface as a protective mulch can be seen between the soybean rows.

A good working relationship with the farm editor of the local newspaper resulted in excellent coverage of tours and meetings, as well as publication of articles and news photos. During the life of the Project 12 news releases pertaining to the Project were published. The District's Annual Report, which is published as a tabloid in the local daily newspaper, also provided an excellent method of informing the public of the Project, resulting data, and equipment availability.

Demonstration Project Annual Reports were published that included data on tillage operations performed, herbicide and insecticide usage, seed varieties, and yields. Reports were distributed to many interested farmers and others.

Erosion and Sediment Loading Reduction

Based upon calculations using the Universal Soil Loss Equation (USLE) for sheet and rill erosion and the Wind Erosion Equation (WEE) soil savings on the plots totaled 2,298 tons over the four year period.

TABLE 2

Soil Saved on No-Till Plots

	Tons
1983	697
1984	564
1985	483
1986	554
Total	2,298

TABLE 3

Average Soil Loss on Comparison Plots

	Tons
1983	81
1984	87
1985	71
1986	56
Total	295

It should be noted that, contrary to pre-Project evaluation, these soil losses include the calculated erosion rates for both

water erosion and wind erosion. Normally, when sediment loading of streams and lakes is considered wind erosion is not thought to play a major role. Wind erosion, however, was included in our calculations because of several unique features of Monroe County and of the Otter Creek Watershed.

First, the severity of wind erosion must be examined. Two-thirds of the soils in the watershed fall within wind erodibility groups one and two (those most susceptible to wind erosion). These wind erosive soils, rather than being concentrated in certain areas are interspersed with the less erodible soils throughout the watershed. Additionally, fields in the area are larger open crop fields with few tree lines and fence rows. Under these circumstances, wind erosion rates often reach the maximum rates of 25 tons per acre.

Even extremely high wind erosion rates can have little impact upon water quality. However, several peculiar topographic features of Monroe County contribute to the significant water quality impact of wind erosion here.

The unusually flat poorly drained, lakebed soils in this area have necessitated the installation of comprehensive surface and subsurface drainage systems throughout the watershed. Surface drains can normally be found from 1/8 to 1/4 mile apart.

When wind erosion occurs 90% of the eroded soil rolls and bounces across the soil surface until it hits an obstacle. In most cases in this watershed the obstacle that stops the moving soil is the edge of a ditch bank. Consequently most of the soil is deposited directly in the surface drains or along its edge.

Frequently after a heavy windstorm, not only will newly deposited soil be visible in the drainage ditch, but grains of fertilizer are also seen deposited on the ditch edges. After very severe windstorms in April and May, some drainage ditches have been filled entirely full with sediment. During the spring of 1984 and 1985 Monroe County experienced some of its most severe windstorms in recent history.

The Otter Creek Watershed's proximity to Lake Erie is another factor which influenced the importance of the soil savings which were obtained. Despite relatively low sheet and rill erosion rates, a large percentage of the soil eroded from unprotected fields will ultimately reach Lake Erie. This is because the distance to the nearest watercourse is short (typically 1/8 to 1/4 mile), and the distance of the eroding cropland to Lake Erie is small (the maximum distance to the upper end of the watershed is only 16 miles). Meanwhile, the sediment delivery ratio increases as distance to a watercourse decreases. Additionally, the delivery ratio is greater for phosphorus than for sediment in general, since the fine sediment fraction is phosphorus-enriched and does not readily settle out in the crop field.

Phosphorus and Other Pollutant Reductions

Soil savings calculations can be utilized to a certain extent to calculate the phosphorus load reductions that may have been achieved, as well as the nitrogen and potash savings that may have been accrued. Based upon calculations that 2 pounds of Nitrogen (N), 3 pounds of Phosphate (P_2O_5) and 30 pounds of Potash (K_2O) are lost with each ton of soil lost to erosion.1 We can estimate the following reductions in pollutants.

Table 4

Total Nutrients Saved On No-Till Plots

	1983 lbs.	1984 lbs.	1985 lbs.	1986 lbs.	Total lbs.
Nitrogen (N)	1,390	1,130	966	1,108	4,594
Phosphate (P_2O_5)	2,091	1,695	1,449	1,662	6,897
Potash (K_2O)	20,910	16,947	14,490	16,620	68,967

Beyond the important water quality benefits that resulted by retaining the soil and nutrients in place, a monetary value can also be calculated for the farmers who saved these valuable nutrients. The estimated value of the nutrients saved over the four years of the Project totaled $9,088.

Additionally, some sources estimate that when soil erosion occurs, an equal value of organic matter is saved for each dollar of nutrients saved.2

VI. CONCLUSIONS

Project Impacts

One positive impact of the tillage project was that the District has been able to make the no-till equipment purchased through the Project (International planter and a Tye drill) available to other interested farmers throughout the county. Additionally the lease arrangement on the Lilliston Drill has made it less of an economic hardship for the District to make such a drill available to farmers throughout the county. The results of this arrangement has been an increase in no-till acres county-wide over the last four years.

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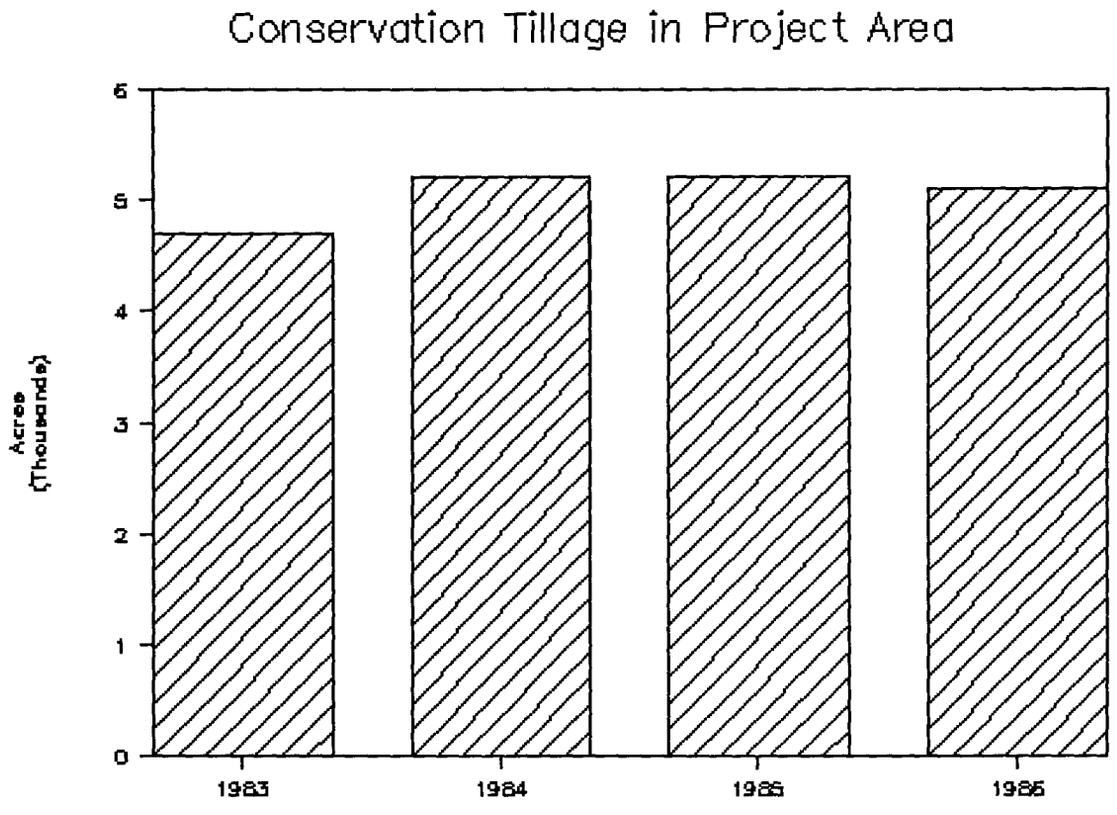
1 Beasley, Erosion and Sediment Control, page 15.

2 Dr. Lynn Robertson, Soil Physicist formerly with MSU.

CHART 3


Conservation Tillage in Project Area
Acres (Thousands)
0
1
2
3
4
5
6
1983
1984
1985
1986

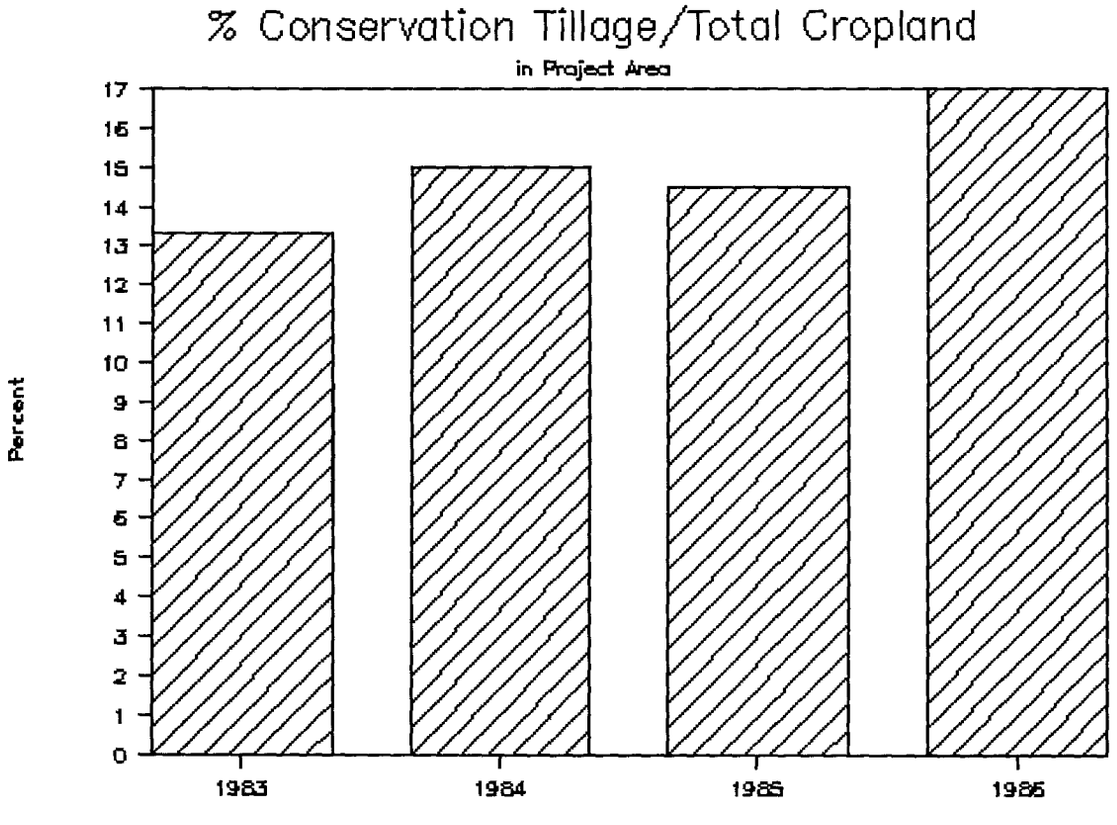
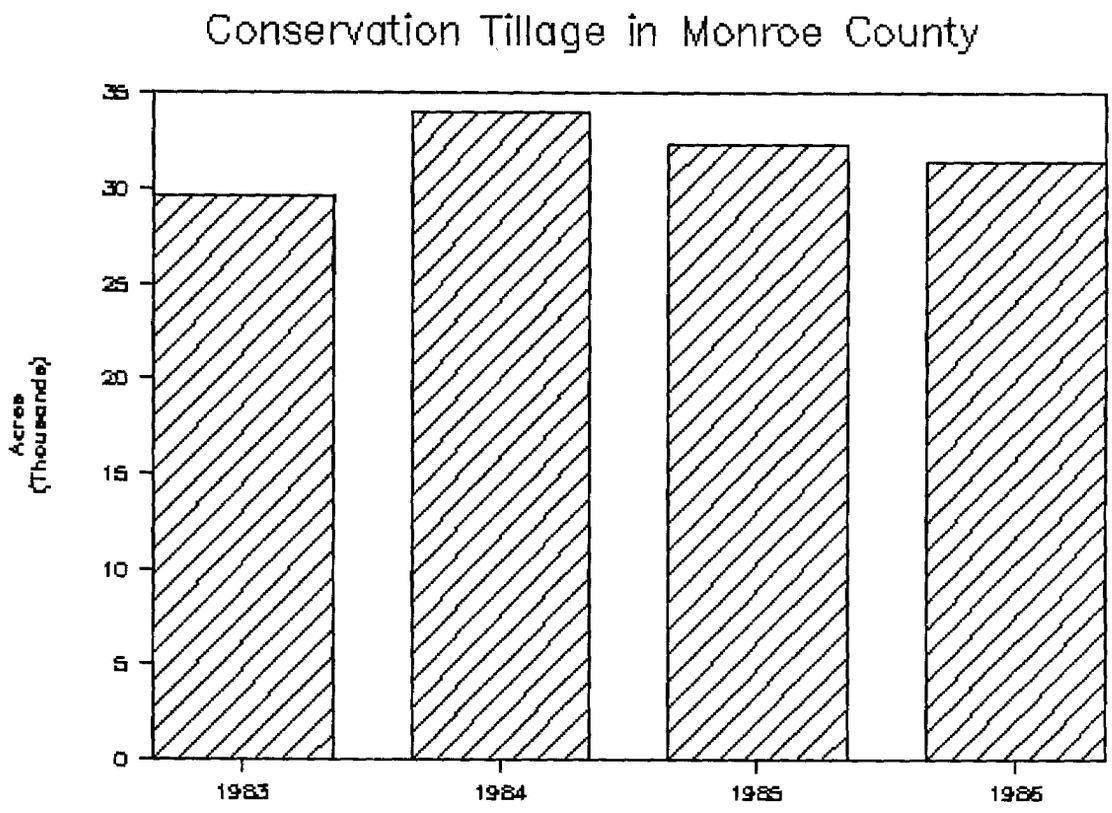
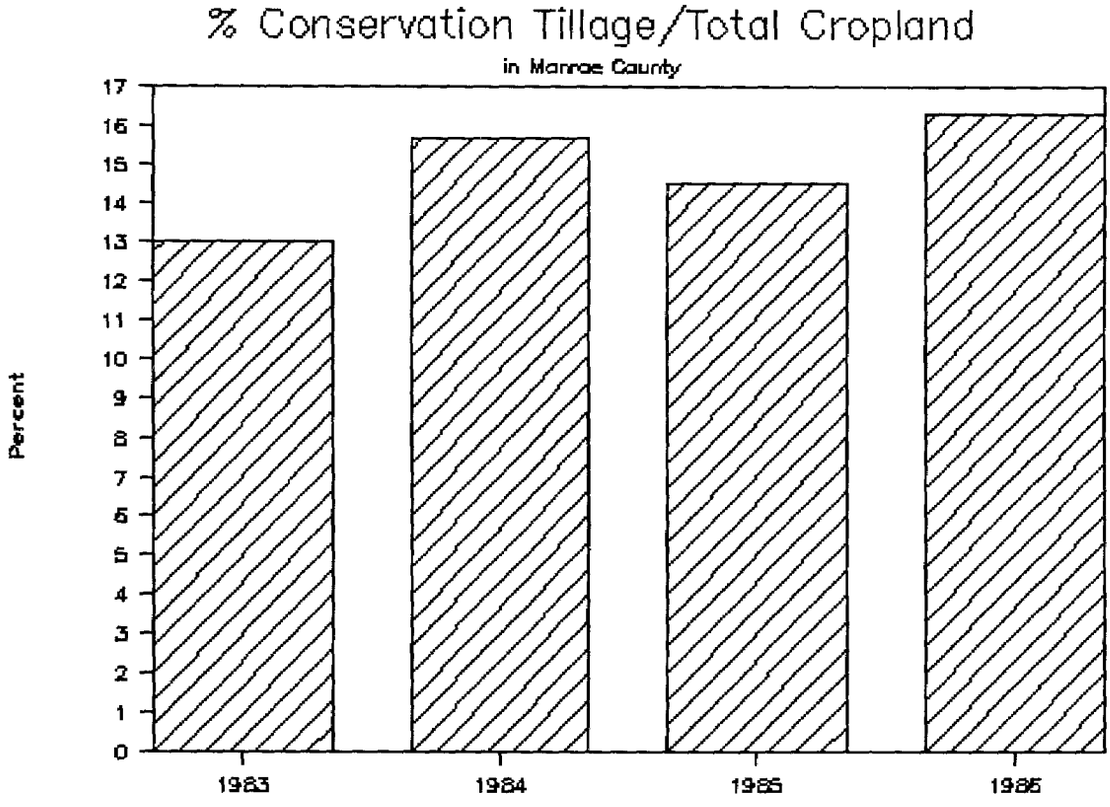

% Conservation Tillage/Total Cropland
in Project Area
Percent
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
1983
1984
1985
1986

CHART 4


Conservation Tillage in Monroe County
Acres (Thousands)
35
30
25
20
15
10
5
0
1983
1984
1985
1986


% Conservation Tillage/Total Cropland
in Monroe County
Percent
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1983
1984
1985
1986

Another impact of the project has been an increased use of no-till within the watershed by farmers who were not participating in the Project. There appear to be several reasons for this: 1) many farmers already interested in no-till and who planted no-till did not want to "be bothered" with planting side-by-side comparisons (they just wanted to plant whole fields), or they did not want to keep track of the data we needed, to "fool" with harvest checks when they were busy, etc.; 2) some potential participants who were doing no-till in the watershed did not want the publicity or the attention that participating in the Project would bring; 3) other farmers in the vicinity apparently adopted no-till after being impressed with the no-till results of their participating neighbors. SCS staff have observed (but not measured) that a larger percent of farmers use no-till in the vicinity of the Project than in other parts of the county. Heavy winds in the spring of 1984 and 1985 resulted in severe wind erosion, especially in the Project area which has a high concentration of soil susceptible to wind erosion. The crop protection provided by no-till visibly illustrated to neighbors of the Project participants one of the most important benefits of no-till.

Involvement of SWCD

One key factor affecting the extent to which the SWCD has been involved with the Project has been the availability of District personnel to carry-out the various duties necessary to accomplish project goals.

The first Conservation Tillage Technician, hired under a personal services contract was located through an advertisement placed for three days in the local newspaper. Unfortunately, in the midst of the first planting season the new technician experienced health problems, and a replacement had to be urgently located. Gerald Rogers, an active farmer and one of the District Board of Directors, agreed on short notice to complete the field work for the spring season and in September Marlene Rogers was hired to complete the fall harvest checks.

The District succeeded under these difficult circumstances in keeping their no-till equipment going and in completing the necessary harvest checks. The District owes this success to the efforts of Director Rogers and his wife Marlene, since they agreed, with little notice, to take time from their own farming operations to assist the participants with the planting and harvest of the plots.

A new Conservation Tillage Technician was hired under a personal services contract which stipulated the particular duties to be performed during the year and the payment for each.

The technician provided specific services which basically encompassed maintaining the District's equipment, operating the tillage equipment, reviewing the equipment use with the farmers,

answering general questions about fertility and pest management, keeping records of equipment use, and assisting SCS staff in collecting tillage data and yield data. The duties of the technician did not encompass the compilation of tillage data or the writing of the quarterly, annual or final reports. The understanding was that this portion of the project activities could be handled by the SCS District Conservationist and the District's Administrative Assistant.

The District's full-time Administrative Assistant managed the project funds, scheduled the no-till equipment use and compiled the data which was provided to her. The District Conservationist as part of his/her3 normal conservation planning activities, provided training to the District's Technician, met with farmers to answer agronomic questions, conducted tours of the plots, assisted the Technician with scouting, evaluated the technical data on the plots, and organized and wrote the reports.

There are several observations that can be made about the results of this particular staff arrangement. First, because of the first technician's unanticipated health problems, District Board members (out of necessity) became directly involved with the Project. These circumstances allowed the Board to become directly familiar with the Project, but at the same time placed unexpected demands on the director's farming time. In similar situations, it would be prudent to make plans for contingencies such as employee injuries, an employee resignation, or an employee being dismissed. Potential substitutes should be available, since planting season cannot be delayed.

A second observation on the District involvement in the Project pertains to the decision to handle Project activities with a part-time technician working under a personal services contract. Since the duties of this technicians position where limited basically to data gathering in the field and to working with the equipment, a large portion of the District's responsibilities for the Project became the responsibility of the staff which the District had already in their employ. The District's permanent staff is not technical but administrative/clerical and therefore many of the technical aspects of the Project not within the specified field duties of the District Technician had of necessity to be completed by the SCS District Conservationist.

The success of this arrangement was essentially dictated by the SCS's current staffing (i.e., vacancies, and staffing varying between one and two) and workload demands from other programs. As a result, the District's involvement in the Project was at times limited by the level of involvement of the SCS staff.

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3 During the Project years, the SCS District Conservationist position underwent a change in personnel. Also the office changed from a single person office in 1984 to a two person staff. However, this staff position also underwent a change in personnel and a vacancy for nine months in 1985.

Since the District did not hire District staff to carry-out all aspects of the Project, but planned to utilize the technical assistance of the SCS staff to complete some aspects, this problem appears, in retrospect, to have been inevitable.

Interagency Cooperation

Positive attitudes between the agency personnel involved with a project at the local level are essential for the success of any project similar to Otter Creek. This is made easier by existing working relationships with other local agency personnel.

However, more than positive attitudes are needed. For example, since the bulk of agricultural educational activities have historically been handled by the Cooperative Extension Service (CES) the strong participation of the CES in any agricultural information program can strongly effect its visibility and success. Unfortunately, during 1983 when the project was organized, Michigan State University was not as supportive of no-till farming as it is now. The local offices of the CES, an extension of the University, did reflect some of this perspective. Consequently, during the early stages when the project was first set-up, valuable CES input and assistance was tempered by the University's attitude.

As this Project, and many similar tillage projects throughout the nation progressed, perspectives changed and CES support became more visible. Although the Project's information program was not notably expanded, some changes did occur in 1985 and in 1986 which increased CES involvement. An additional Agricultural Agent was added to the Monroe CES staff in 1985. As a result CES had more time to work with the District on projects. Additionally, the new Agent brought to his job a strong enthusiasm for soil conservation and an interest in working with Districts. Consequently CES co-sponsored and provided speakers at the plot tours in both 1985 and in 1986, and assisted with the publicity for the tours.

A spin-off of local CES interest in continuing their work with conservation tillage has been a new joint effort by the CES, the SWCD, the SCS, and MSU. Starting in 1986, the four agencies began work together on a Tillage Evaluation Plot which will evaluate four different forms of tillage in a single plot over a three year period.

Physical and Economic Adaptability of No-Till Application to the Land

One of the major obstacles to the adoption of no-till in Monroe County has been the physical limitations of the county's soil type. Fifty-five percent of the soils in the county fall within capability class 2W, thirty-four percent within class 3W, and one-half percent within class 4W. This obstacle can be overcome by applying subsurface (tile) drainage and/or surface drainage to

these wet soil types. In addition, nearly all of the soils found in Monroe County are susceptible to wind erosion. By planting crops using the no-till method, this problem can be virtually eliminated.

The additional cost of herbicides, that are used to control weeds, with no-till can be drastically reduced after the second or third year of using this practice. By not tilling the ground weed seeds are not brought back up to the surface where they can germinate. Also, by continually using no-till, weeds, especially annuals are brought under control so that rates of herbicides can be reduced. In this project the only difference in the herbicide costs was the use of a burndown in the no-till plots, and this cost was more than made up when we look at the cost of the several tillage operations that were done in the comparison plots (see Appendix A).

VII. RECOMMENDATIONS

Institutional Arrangement

It became clear as the project progressed and as new personnel became involved with the project, that a clear understanding and agreement as to the various agency roles and responsibilities had not been adequately worked out before the project began. A work plan had not been developed and agreed upon in advance. Without a clear written statement of responsibilities and without a work plan that includes all agencies involved, changes in agency priorities have the potential to negatively effect the implementation of similar projects.

A clear and complete long range work plan, an annual work plan and a workload analysis should be developed before any similar project is started. In the case of the Otter Creek Project, a written commitment of staff time and responsibilities should have been made by all agencies involved, and approved not just by field staff but also by agency administrators. More effective implementation may have resulted had this been done.

Ideally, staff commitments should also stipulate the educational background and experience required by each individual with project responsibilities. A description of the duties and responsibilities of each staff person involved with the project should be clearly spelled out in writing. A training program for project staff should be developed (in written form) and carried out within the first six months of the project (if it is to be a short term project). The job descriptions would be most useful if developed after completion of the work plan and workload analysis for the Project.

With this information, the District Board can then evaluate whether or not they have a person(s) capable of fulfilling the requirements and time to do the job well. If a new employee is to be hired, then the issue of availability and funding can next

be evaluated. Are people with the necessary qualifications available in the District's vicinity? Can they be attracted to the position the District is offering? Most importantly, are adequate funds available to pay them throughout the entire project?

It is a challenge for any agency or group to sufficiently address these questions before applying for grant funding, since application times are frequently very short. Once grant monies are approved projects are normally expected to be started immediately. The time required for careful analysis is frequently not available, and staff availability to conduct such analysis is usually limited. Properly addressing these issues before a project is started can help avoid otherwise inevitable problems during implementation and/or evaluation.

Agency Programs

Numerous USDA programs now strongly support the nation's efforts to control soil erosion and improve water quality. The most comprehensive of these is the recently implemented Food Security Act of 1985. This program combined with the long standing nationwide Agricultural Conservation Program (ACP) and special programs such as the Rural Clean Water Program to pave the way toward fulfillment of our national commitment to improving water quality in Lake Erie. On the other hand, these programs have expanded the responsibilities of our federal conservation agencies, thus placing a greater challenge before local and state agencies. These agencies are increasingly being asked to provide assistance in meeting the conservation demands of their community. Therefore, it is important when projects such as that for the Otter Creek Watershed are considered by local agencies, that previous program commitments of federal agency personnel are fully considered. The availability of the current staff of participating agencies to assist with project activities needs to be evaluated, as does the potential for additional staff to provide assistance to the local project sponsors.

In the same light, federal agencies with a strong commitment and interest in water quality must evaluate previous staff commitments before accepting the challenge of new projects. Even field staff willingness to accept the new responsibilities of a demonstration project needs to be weighed against the realities of potential staff reductions, personnel changes, and expanding commitments in other program areas. Such evaluations can most realistically be made at upper management levels in federal agencies where the long range planning considerations are better understood.

Future Programs

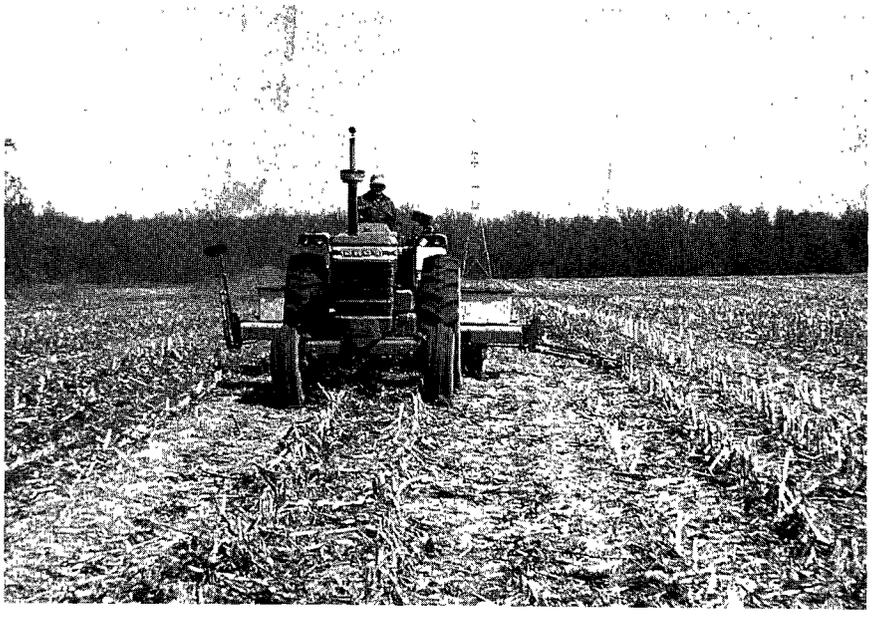
One clear impact of the Project on the District has been to make the Board of Directors more judicious in the selection and development of future conservation projects. The Board's reason

for caution is that in the Otter Creek Project there was confusion over the roles and responsibilities of the participating agencies. As a result recruitment of new participants, public information campaigns and preparation of reports were not as efficient as the Board had hoped they would be.

In the future, when similar projects are considered by the District, a clear understanding of each agency's responsibilities, and a realistic evaluation of each agency's ability to perform (i.e. staff time, training and funding) will be completed before beginning the initial phases of the project.

How Will Project Accomplishment Be Maintained?

Currently the SWCD, the CES, MSU and the SCS are working together on a three-year Tillage Evaluation Plot. This plot which is designed to evaluate no-till, ridge-tillage, chisel tillage, and moldboard plowing will help to carry out some of the objectives of the Otter Creek Tillage Demonstration Project. This new evaluation plot, although not in the Otter Creek Watershed, will continue to demonstrate to farmers the local application of conservation tillage practices and demonstrate the effectiveness of conservation tillage for controlling soil erosion. The Tillage Evaluation Plot will also help serve, as the Otter Creek Project has served, as a focus for increased interagency support and cooperation in the effort to preserve and protect our soil and water resources.



The planter, shown here planting one of the Project's no-till plots was purchased with Project funds. The SWCD will continue to promote no-till by offering the use of the planter and a no-till drill to Monroe County farmers who are interested in no-till.

A P P E N D I X A

PLOT DATA AND RESULTS

MONROE COUNTY SOIL AND WATER CONSERVATION DISTRICT

1983 Otter Creek Demonstration Project.....

	Cooperator: Plot Size; Crop	Planting; Date; Variety	Seed Drop --- Stand	Row Width and Planter	Tillage Equipment	Residue or Cover	Soil Type (1)	Drainage Class (2)	Herbicides (rate/ac)
No-Till	Lynn Albring 10.0 ac. Corn	5-14-83 Jacques 179	25,000 --- 23,000	30 in. Intern'tl 800	None	Soy-beans	Selfridge ls Pewamo cl	S.W. Poor Poorly	Pre-emerge: Bladex 1 lb. Atrazine 1 lb. Lasso 2 qt. Post: Atrazine 1 lb. 2,4-D 1/2 pt.
Compari-son	16.0 ac.	5-14-83 Jacques 179	25,000 --- 23,600	30 in. Intern'tl 800	Plow,Disk	Cabb-age	Oakville fs	Mod. Well	Pre-emerge: Atrazine 1 lb. Lasso 2 qt. Post: Atrazine 1 lb. 2,4-D 1/2 pt.
No-Till	David Anteau 14.5 ac. Corn	5-26-83 Leader	24,000 --- 19,500	30 in. Intern'tl 800	None	Corn	Selfridge ls Del Rey sil Selfridge ls-Pewamo cl	S.W. Poor S.W. Poor S.W. Poor/ Poor	Lasso 1 qt. (8) Bladex 1 qt. Atrazine 2 pt.
Compari-son	14.5 ac.	5-26-83 Leader	24,000 --- 23,500	30 in. Intern'tl 800	Disk	Corn	Selfridge ls Del Rey sil Selfridge ls-Pewamo cl Lenawee sicl	S.W. Poor S.W. Poor S.W. Poor/ Poor Poorly	Lasso 1 qt. (8) Bladex 1 qt. Atrazine 2 pt.
No-Till	Diesing Brothers 10.0 ac. Corn	5-11-83 Pioneer	25,670 --- 25,100	30 in. Intern'tl 800	None	Corn	Corunna sl	Poorly	Paraquat 3/4 pt. Atrazine 3 qt.
Compari-son	10.0 ac.	5-11-83 Pioneer	25,670 --- 23,600	30 in. Intern'tl 800	Plow Disk	Corn	Corunna sl	Poorly	Atrazine 3 qt.
No-Till	William Heck 6.0 ac. Corn	5-18-83 Pioneer 3747	25,800 --- 18,100	30 in. Intern'tl 800	None	Corn	Selfridge ls Selfridge ls-Pewamo cl	S.W. Poor S.W. Poor/ Poor	Lasso 5 pt. Bladex 1-1/2 qt.
Compari-son	6.0 ac.	5-18-83 Pioneer 3747	25,800 --- 21,000	30 in. Intern'tl 800	Disk Finishing Disk	Corn	Selfridge ls Selfridge ls-Pewamo cl	S.W. Poor S.W. Poor/ Poor	Lasso 5 pt. Bladex 1-1/2 qt.

Plot Data and Results.....

Insecticides (rate/ac)	Fertilizer N-P-K (lbs/ac)	Nitrogen Source/s	Yield Dry Bushels (3)	Soil Loss Avg/ac/yr (Wind + Water)	Tot.Soil Saved on Plot	Change in Net Profit per/ac (4)	$ Nutrients (N-P-K) Saved/ac (5)	$ Organic Matter Saved/ac (6)	Time Saved per ac (7)
None	170-80-40	28% and Starter	139 bu.	1 Ton	220 Ton	-$13.40	$28.96	$28.96	35 min.
None	170-80-40	28% and Starter	150 bu.	23 Ton					
Dyfonate 5 lbs.	126-64-232	Urea and Starter	63 bu. (8)	1 Ton	49 Ton	-$57.58	$13.21	$13.21	27. min
Dyfonate 5 lbs.	126-64-232	Urea and Starter	87 bu. (8)	4 Ton					
Dyfonate 7 lbs.	238-92-424	Anhydrous and Starter	139 bu.	1 Ton	61 Ton	+$11.74	$23.71	$23.71	27 min.
Dyfonate 7 lbs.	238-92-424	Anhydrous and Starter	142 bu.	7 Ton					
Dyfonate 7 lbs.	172-48-48	28% and Starter	122 bu.	1 Ton	49 Ton	$74.46	$31.90	$31.90	23 min.
Dyfonate 7 lbs.	172-48-48	28% and Starter	105 bu.	9 Ton					

1983 Otter Creek Demonstration Project.....

	Cooperator Plot Size; Crop	Planting; Date Variety	Seed Drop ------ Stand	Row Width and Planter	Tillage Equipment	Residue or Cover	Soil Type (1)	Drainage Class (2)	Herbicides (rate/ac)
No-Till	Glenn & Dave Lassey 15.5 ac. Corn	6-14-83 DeKalb 25A	24,500 ------ 15,000	30 in. Intern'tl 800	None	Soy-beans	Randolph cl Channahon l	S.W. Poor Well	Roundup 1 qt. Atrazine 2 lb. Lasso 2 qt. 2,4-D 1 pt.
Compari-son	15.5 ac.	6-14-83 DeKalb 25A	24,500 ------ 20,000	30 in. Intern'tl 800	Chisel Disk	Soy-beans	Randolph cl Channahon l	S.W. Poor Well	Atrazine 2 lb. Lasso 2 qt. 2,4-D 1 pt.
No-Till	Wilbert Matthes 7.5 ac. Corn	6-15-83 Great Lakes 422	22,700 ------ 20,000	30 in. Intern'tl 800	None	Soy-beans	Thetford ls Ottokee fs	S.W. Poor Mod. Well	Roundup 2 qt. Atrazine 2 qt. Lasso 2-1/2 qt.
Compari-son	7.5 ac.	6-15-83 Great Lakes 422	22,700 ------ 22,000	30 in. Intern'tl 800	Plow Disk	Soy-beans	Granby lfs Thetford ls Ottokee fs	Poorly S.W. Poor Mod. Well	Atrazine 2 qt. Lasso 2-1/2 qt.
No-Till	John Metz 12.0 ac. Corn	5-21-83 DeKalb XL42	22,500 ------ 21,000	30 in. Intern'tl 800	None	Soy-beans	Selfridge ls Pewamo cl	S.W. Poor Poor	Roundup 2 qt. Atrazine 1-1/2 qt. Lasso 2-1/2 qt.
Compari-son	12.0 ac.	5-21-83 DeKalb XL42	22,500 ------ 21,000	30 in. Intern'tl 800	Vibra-shank	Soy-beans	Pewamo cl	Poor	Atrazine 1-1/2 qt. Lasso 2-1/2 qt.
No-Till	Donald Newell 10.0 ac. Corn	5-10-83 Pioneer R26 3780	25,567 (10) ------ 23,500	30 in. Intern'tl 800	None	Corn	Granby lfs Thetford ls Belleville ls	Poorly S.W. Poor Poorly	Paraquat 3/4 pt. Dual 1-1/4 qt. Atrazine 1-1/4 qt.
Compari-son	10.0 ac.	5-10-83 Pioneer R26 3780	25,567 (10) ------ 24,000	30 in. Intern'tl 800	Disk Chisel Drag	Corn	Granby lfs Thetford ls Belleville ls	Poorly S.W. Poor Poorly	Dual 1-1/4 qt. Atrazine 1-1/4 qt.

Plot Data and Results.....

Insecticides (rate/ac)	Fertilizer N-P-K (lbs/ac)	Nitrogen Source/s	Yield Dry Bushels (3)	Soil Loss Avg/ac/yr (Wind + Water)	Tot.Soil Saved on Plot	Change in Net Profit per/ac (4)	$ Nutrients (N-P-K) Saved/ac (5)	$ Organic Matter Saved/ac (6)	Time Saved per ac (7)
None	151-166-66	Urea and Starter	45 bu.	1 Ton	42 Ton	-$37.58	$10.49	$10.49	31 min.
None	151-166-66	Urea and Starter	66 bu.	4 Ton					
Seed Treat	203-18-24	Anhydrous and Starter	69 bu. (9)	2 Ton	58 Ton	-$56.97	$29.92	$29.92	43 min.
Seed Treat	203-18-24	Anhydrous and Starter	100 bu. (9)	9 Ton					
None	180-24-24	Urea and Starter	118 bu.	1 Ton	23 Ton	-$11.72	$7.42	$7.42	30 min.
None	180-24-24	Urea and Starter	126 bu.	3 Ton					
Dyfonate 7 lbs.	204-104-180	Anhydrous and Starter	111 bu. (10)	2 Ton	79 Ton	-$33.99	$30.71	$30.71	29 min.
Dyfonate 7 lbs.	204-104-180	Anhydrous and Starter	122 bu. (10)	10 Ton					

	Cooperator; Plot Size; Crop	Planting; Date; Variety	Seed Drop ------ Stand	Row Width and Planter	Tillage Equipment	Residue or Cover	Soil Type (1)	Drainage Class (2)	Herbicides (rate/ac)
No-Till	William Whittaker 17.5 ac. Corn	5-17-83 Super Cross 1940	27,000 ------ 25,000	30 in. Intern'tl 800	None	Soy-beans	Selfridge ls Selfridge ls- Pewamo cl Pewamo cl	S.W. Poor S.W. Poor/ Poor Poor	Lasso 2 qt. Atrazine 1 qt.
Compari-son	17.5 ac.	5-17-83 Super Cross 1940	27,000 ------ 25,000	30 in. Intern'tl 800	Disk Cultivator	Soy-beans	Selfridge ls Selfridge ls- Pewamo cl Pewamo cl	S.W. Poor S.W. Poor/ Poor Poor	Lasso 2 qt. Atrazine 1 qt.
No-Till	Daniel Secord 15.0 ac. Soybeans	5-28-83 Pride 8220	104,000 ------ 104,000	30 in. Intern'tl 800 &	None	Corn	Selfridge ls Randolph cl	S.W. Poor S.W. Poor	Paraquat 2 pt. Lasso 3 qt. Lorox 3 pt.
		5-28-83 Pride 8220	200,000 ------ 186,057	10 in. Tye Pasture Pleaser					
Compari-son	12.0 ac. Soybeans	5-28-83 Pride 8220	104,000 (11) ------ 97,763	30 in Intern'tl 800 &	Plow Field Cultivator Cultivate	Corn	Randolph cl Ottokee fs Selfridge ls	S.W. Poor Mod. Well S.W. Poor	Lasso 3 qt. Lorox 3 pt.
		5-28-83 Pride 8220	200,000 ------ 150,000	10 in. Tye Pasture Pleaser					

**** Reference to commercial products or trade names does not imply endorsement by the Monroe County Soil and Water Conservation District or bias against those not mentioned.

(4) "Change in net profit" for the no-till plot vs. the comparison plot is the difference in their gross profit minus the difference in their production costs. Gross profit was calculated by using their yield difference in bushel, times the price per bushel. Prices per bushel were assumed as follows: $3.00/bu. for corn; $6.00/bu. for soybeans. Production costs included the cost of all field operations, fertilizers, herbicides, and insecticides. Costs of field operations were based upon costs published in Custom Work Rates in Michigan, Bulletin E-458 by the MSU Cooperative Extension Service, August 1983. The custom rate for using a spring tooth drag was estimated by Paul Marks, Agricultural Extension Agent, Monroe. Costs used for other items were as reported by each farmer.

(8) Soil pH 5.2. Needed follow-up weed control.

Plot Data and Results.....

Insecticides (rate/ac)	Fertilizer N-P-K (lb/ac)	Nitrogen Source/s	Yield Dry Bushels (3)	Soil Loss Avg/ac/yr (Wind + Water)	Tot.Soil Saved on Plot	Change in Net Profit per/ac (4)	$ Nutrients (N-P-K) Saved/ac (5)	$ Organic Matter *saved/ac (6)	Time Saved per ac (7)
None	207-32-365	Anhydrous and Starter	92 bu.	1 Ton	116 Ton	-$32.21	$25.65	$25.65	24 min.
None	207-32-365	Anhydrous and Starter	110 bu.	8 Ton					
None	0-0-166		39 bu.	1 Ton	45 Ton	+$.20	$11.67	$11.67	38 min.
	0-0-166		48 bu.						
None	0-0-166		47 bu. (11)	4 Ton					
	0-0-166								

(9) Average pH. 5.9. The no-till plot was very wet while the comparison was tiled.

(10) The no-till plot was the first time the district planteer was in operation. Poor stand.

(11) 10 inch and 30 inch rows on comparison plot were harvested together.

	Cooperator; Plot Size; Crop	Planting; Date; Variety	Seed Drop --- Stand	Row Width and Planter	Tillage Equipment	Residue or Cover	Soil Type (1)	Drainage Class (2)	Herbicides (rate/ac)
No-Till	Lynn Albring 8.5 ac. Corn	5-7-84 Jacques 179	24,000 --- 23,600	30 in. Kinzie	None	Corn	Selfridge ls Selfridge ls-Pewamo cl Metea s	S.W. Poor S.W. Poor/ Poor Well	Lasso 2 qt. Bladex 2 lb.
Compari-son	8.5 ac.	5-7-84 Jacques 179	24,000 --- 24,000	30 in. Kinzie	Plow,Disk & Packer	Corn	Selfridge ls Selfridge ls-Pewamo cl Pewamo cl	S.W. Poor S.W. Poor/ Poor Poorly	Lasso 2 qt. 2,4-D 1/2 pint Aatrex 1 lb.
No-Till	Diesing Brothers 10.0 ac. Corn	5-10-84 Pioneer 3780	21,900 --- 20,200	30 in. Intern'tl 800	None	Corn	Corunna sl	Poorly	Atrazine 2 pt. Paraquat 1/2 pt.
Compari-son	10.0 ac.	5-10-84 Pioneer 3780	21,900 --- 21,000	30 in. Intern'tl 800	Plow Disk	Corn & Small Grain	Corunna sl	Poorly	Atrazine 2 pt.
No-Till	Donald Newell 9.5 ac. Corn	5-10-84 Pioneer 3744	25,500 --- 18,200 (8)	30 in. Allis Chalmers 333	None	Corn	Belleville ls Thetford ls Granby lfs	Poorly S.W. Poor Poorly	Lasso 2 qt. Bladex 2 qt. Paraquat 1 qt.
Compari-son	9.5 ac.	5-10-84 Pioneer 3744	25,500 --- 24,000	30 in. Allis Chalmers 333	Disk, Chisel, Drag	Corn	Belleville ls Thetford ls Tedrow ls	Poorly S.W. Poor S.W. Poor	Lasso 2 qt. Bladex 2 qt.
No-Till	Daniel Secord 15.0 ac. Corn	5-12-84 Pioneer 3744	24,200 --- 23,000	30 in. John Deere 7000	None	Soy-beans	Randolph cl	S.W. Poor	Bicep 4 qt. Paraquat 1 1/2 pt.
Compari-son	10.0 ac.	5-12-84 Pioneer 3744	24,200 --- 23,800	30 in. John Deer 7000	Field Culti-vator	Soy-beans	Randolph cl Ottokee-varient fs	S.W. Poor Mod. Well	Bicep 3 qt.

Plot Data and Results.....

Insecticides (rate/ac)	Fertilizer N-P-K (lbs/ac)	Nitrogen Source/s	Yield Dry Bushels (3)	Soil Loss Avg/ac/yr (Wind + Water)	Tot.Soil Saved on Plot	Change in Net Profit per/ac (4)	$ Nutrients (N-P-K) Saved/ac (5)	$ Organic Matter Saved/ac (6)	Time Saved per ac (7)
Lorsban 6 lbs.	145-75-132	28% and Starter	129 bu.	6 Ton	145 Ton	-$23.13	$85.00	$85.00	22 min.
Lorsban 6 lbs.	145-75-132	28% and Starter	144 bu.	23 ton					
Dyfonate 5 1/2 lbs.	170-119-455	Anhydrous & Starter	134 bu.	1 Ton	60 Ton	-$23.83	$30.00	$30.00	22 min.
Dyfonate 5 1/2 lbs.	170-119-455	Anhydrous & Starter	148 bu.	7 Ton					
Counter 7 lbs.	174-108-134	Anhydrous & Starter	100 bu. (8)	1 Ton	89 Ton	-$19.53	$45.00	$45.00	24 min.
Counter 7 lbs.	174-108-134	Anhydrous & Starter	110 bu.	10 Ton					
None	199-96-180	Anhydrous & Starter	129 bu.	1 Ton	45 Ton	-$15.69	$15.00	$15.00	3 min.
None	199-96-180	Anhydrous & Starter	132 bu.	4 Ton					

1984 Otter Creek Demonstration Project.....

	Cooperator; Plot Size; Crop	Planting; Date Variety	Seed Drop ------ Stand	Row Width and Planter	Tillage Equipment	Residue or Cover	Soil Type (1)	Drainage Class (2)	Herbicides (rate/ac)
No-Till	Herbert Smith 10.0 ac. Corn	5-9-84 Funks 4342	25,000 ------ 24,500	30 in. White 5100	None	Soy-beans	Selfridge ls-Pewamo cl Blount l	S.W. Poor/ Poor S.W. Poor	Bladex 2 1/2 qt. Lasso 2-1/2 qt. Banvel 1/2 pt.
Compari-son	9.0 ac.	5-9-84 Funks 4342	25,000 ------ 24,500	30 in. White 5100	Chisel, Mix-N' Till	Soy-beans	Selfridge ls-Pewamo cl Selfridge ls	S.W. Poor/ Poor S.W. Poor	Bladex 1 1/2 qt. Lasso 2 qt. Banvel 1/2 pt.
No-Till	William Heck 5.9 ac. Soybeans	6-16-84 Pioneer 2480	74 lbs. ------ 168,000	7 in. Lilliston 9680	None	Corn	Selfridge ls-Pewamo cl Selfridge	S.W. Poor/ Poor S.W. Poor	Lorox 2 qt. Dual 2 pt. Paraquat 2 pt.
Compari-son	5.9 ac.	6-16-84 Pioneer 2480	74 lbs. ------ 150,000	7 in. Lilliston 9680	Disk (2) Field Cultivator	Corn	Selfridge ls-Pewamo cl Selfridge ls	S.W. Poor/ Poor S.W. Poor	Lorox 2 qt. Dual 2 pt.
No-Till	Herbert Smith 9.0 ac. Soybeans	6-12-84 Funks 2450	101 lbs. ------ 170,000	7 in. Lilliston 9680	None	Corn	Selfridge ls-Pewamo cl Selfridge ls	S.W. Poor/ Poor S.W. Poor	Lasso 2 qt. Sencor 1/2 lb. Roundup 2 qt.
Compari-son	8.0 ac.	6-10-84 Funks 2450	101 lbs. ------ 130,000	7 in. Lilliston 9680	Plow,Disk "Mix-N'Till" Field Cultivator	Corn	Selfridge ls-Pewamo cl	S.W. Poor/ Poor	Lasso 2 qt. Sencor 1/2 lb.

(4) "Change in net profit" for the no-till plot vs. the comparison plot is the difference in their gross profit minus the difference in their production costs. Gross profit was calculated by using their yield difference in bushel, times the price per bushel. Prices per bushel were assumed as follows: $2.90/bu. for corn; $6.00/bu. for soybeans. Production costs included the cost of all field operations, fertilizers, herbicides, and insecticides. Costs of field operations were based upon costs published in Custom Work Rates in Michigan, Bulletin E-458 by the MSU Cooperative Extension Service, August 1983. The custom rate for using a spring tooth drag was estimated by Paul Marks, Agricultural Extension Agent, Monroe. Costs used for other items were as reported by each farmer.

(8) Comments: Donald Newell, "Population on the no-till was thin because I had problems getting my new planter adjusted."

(9) Comments: Herbert Smith, "The no-till plot was planted two days later than the comparison."

Plot Data and Results.....

Insecticides (rate/ac)	Fertilizer N-P-K (lbs/ac)	Nitrogen Source/s	Yield Dry Bushels (3)	Soil Loss Avg/ac/yr (Wind + Water)	Tot.Soil Saved on Plot	Change in Net Profit per/ac (4)	$ Nutrients (N-P-K) Saved/ac (5)	$ Organic Matter Saved/ac (6)	Time Saved per ac (7)
None	200-95-170	28% & Urea	167 bu.	3 Ton	70 Ton	+$88.71	$35.00	$35.00	25 min.
None	200-95-170	28% & Urea	140 bu.	10 Ton					
None	0-0-120		24 bu.	6 Ton	100 Ton	+$0.62	$85.00	$85.00	26 min.
None	0-0-120		26 bu.	23 Ton					
None	Applied/w previous crop year		34 bu.	3 Ton (9)	56 Ton	-$71.72	$40.00	$40.00	45 min.
None	Applied/w previous crop year		45 bu.	10 Ton					

1985 Otter Creek Demonstration Project.....

	Cooperator; Plot Size; Crop	Planting; Date; Variety	Seed Drop --- Stand	Row Width and Planter	Tillage Equipment	Residue or Cover	Soil Type (1)	Drainage Class (2)	Herbicides (rate/ac)
No-Till	Lynn Albring 10.0 ac. Soybeans	5-7-85 Rupp 2460	80 pounds --- 188,500	7 in. Intern'tl 5100	None	Rye (8)	Selfridge ls Pewamo cl Oakville fs	S.W. Poor Poor Mod. Well	Paraquat 2 pt. (8) Activator 90 Surfactant Dual 2 pt.
Compari-son	3.0 ac.	5-7-85 Rupp 2460	80 pounds --- 193,000	7 in. Intern'tl 5100	Moldboard Plow, Disk Field Cultivator	Rye	Selfridge ls Pewamo cl	S.W. Poor Poor	Dual 2 pt.
No-Till	Diesing Brothers 10.0 ac. Soybeans	5-22-85 Agri Pro 200	130,000 --- 116,000	30 in. Intern'tl 400	None	Corn	Corunna sl	Poorly	Paraquat 1 qt. Dual 1-1/2 pt. Lorox 1-1/2 pt.
Compari-son	10.0 ac.	5-22-85 Agri Pro 200	130,000 --- 104,000	30 in. Intern'tl 400	Moldboard Plow	Corn	Corunna sl	Poorly	Dual 1-1/2 pt. Lorox 1-1/2 pt.
No-Till	Donald Newell 9 ac. Corn	5-3-85 Pioneer 3744	25,500 --- 25,100	30 in. Allis Chalmers 333	None	Corn	Belleville ls Granby lfs Thetford ls	Poorly Poorly S.W. Poor	Pre-emerge: Dual 8E 1 qt. Paraquat 1-1/2 pt. Atrazine 4L 2 qt. Post: Crop Oil 1.1 qt. Atrazine 4L 2 qt.
Compari-son	5 ac.	5-3-85 Pioneer 3744	25,500 --- 25,100	30 in. Allis Chalmers 333	Disk (3)	Corn	Belleville ls Thetford ls Randolph cl	Poorly S.W. Poor S.W. Poor	Pre-emerge: Dual 8E 1 qt. Atrazine 4L 2 qt. Post: Atrazie 4L 2 qt. Crop Oil 1.1 qt.
No-Till	Daniel Secord 5 ac. Corn	5-2-85 Pioneer 3747	26,700 --- 26,000	30 in. J. Deere 7000	None	Corn	Selfridge ls Pewamo cl	S.W. Poor Poorly	Lasso- Atrazine 3 qt.
Compari-son	5 ac.	5-2-85 Pioneer 3747	26,700 --- 26,000	30 in. J. Deere 7000	Chisel Field Cultivator	Corn	Selfridge ls Pewamo cl	S.W. Poor Poorly	Lasso- Atrazine 3 qt.

Plot Data and Results.....

Insecticides (rate/ac)	Fertilizer N-P-K (lbs/ac)	Nitrogen Source/s	Yield Dry Bushels (3)	Soil Loss Avg/ac/yr (Wind + Water)	Tot.Soil Saved on Plot	Change in Net Profit per/ac (4)	$ Nutrients (N-P-K) Saved/ac (5)	$ Organic Matter Saved/ac (6)	Time Saved per ac (7)
None	None, applied in spring 1984 for 2 yrs.	None	52 bu.	2 Ton	160 Ton	+$18.92	$63.22	$63.22	35 min.
None	None, applied in spring 1984 for 2 yrs.	None	51 bu.	18 Ton					
None	9-22-22	None	49 bu.	1 Ton	40 Ton	-$26.99	$15.90	$15.90	27 min.
None	9-22-22	None	56 bu.	5 Ton					
Dyfonate 5.5 lbs.	236-63-134 (9)	Urea Anhydrous and Starter	124 bu. (9)	4 Ton	63 Ton	-$5.21	$27.66	$27.66	45 min.
Dyfonate 5.5 lbs.	190-63-134 (9)	Anhydrous and Starter	127 bu. (9)	11 Ton					
Agorox Seed Treatment	204-96-168	Anhydrous and Starter	No (10) Harvest Check	2 Ton	10	NA	$7.90	$7.90	23 min.
Agorox Seed Treatment	204-96-168	Anhydrous and Starter	No (10) Harvest Check	4 Ton					

	Cooperator; Plot Size; Crop	Planting; Date; Variety	Seed Drop ------ Stand	Row Width and Planter	Tillage Equipment	Residue or Cover	Soil Type (1)	Drainage Class (2)	Herbicides (rate/ac)
No-Till	Edward Ruehs 5 ac. Corn	5-7-85 Pioneer 3744	26,000 ------ 24,000 (11)	30 in. J. Deere 7000	None	Soy-beans (12	Ottokee fs Granby lfs	Mod. Well Poorly	Bladex 1 pt. Atrazine 1 lb. Dual 1 pt.
Compari-son	5 ac.	5-7-85 Pioneer 3744	26,000 ------ 20,000 (11)	30 in. J. Deere 7000	Disk Pack	Soy-beans (12	Ottokee fs Granby lfs	Mod. Well Poorly	Bladex 1 pt. Atrazine 1 lb. Dual 1 pt.
No-Till	Herbert Smith 15 ac. Corn	5-2-85 Bo-Jax 432	25,000 ------ 24,750	30 in. White 5100	None	Soy-beans	Selfridge ls-Pewamo cl Pewamo cl	S.W. Poor/ Poor Poorly	Pre-emerge: Lasso 2 qt. Bladex 2-1/2 qt. Post: Banvel 1/2 pt. Atrazine 1 -1/2 qt.
Compari-son	4 ac.	5-2-85 Bo-Jax 432	25,000 ------ 24,900	30 in. White 5100	Moldboard Plow Field Cultivator	Soy-beans	Selfridge ls-Pewamo cl Pewamo cl	S.W. Poor/ Poor Poorly	Pre-emerge: Lasso 2 qt. Bladex 2-1/2 qt. Post: Banvel 1/2 pt. Atrazine 1-1/2 qt.

(4) "Change in net profit" for the no-till plot vs. the comparison plot is the difference in their gross profit minus the difference in their production costs. Gross profit was calculated by using their yield difference in bushel, times the price per bushel. Prices per bushel were assumed as follows: $2.55/bu. for corn; $5.02/bu. for soybeans. Production costs included the cost of all field operations, fertilizers, herbicides, and insecticides. Costs of field operations were based upon costs published in Custom Work Rates in Michigan, Bulletin E-458 by the MSU Cooperative Extension Service, August 1983. The custom rate for using a spring tooth drag was estimated by Paul Marks, Agricultural Extension Agent, Monroe. Costs used for other items were as reported by each farmer.

(8) Paraquat sprayed early and rye grew back to compete with soybeans initially.

(9) Since different rates and forms of nitrogen were used on the plots yield comparisons are compl
See 'Nitrogen Source' column.

Plot Data and Results.....

Insecticides (rate/ac)	Fertilizer N-P-K (lbs/ac)	Nitrogen Source/s	Yield Dry Bushels (3)	Soil Loss Avg/ac/yr (Wind + Water)	Tot.Soil Saved on Plot	Change in Net Profit per/ac (4)	$ Nutrients (N-P-K) Saved/ac (5)	$ Organic Matter Saved/ac (6)	Time Saved per ac (7)
Counter 10 lbs.	168-49-120	Anhydrous	Harvested for Silage (13)	3 Ton	90 Ton	NA	$71.12	$71.12	15 min.
Counter 10 lbs.	168-49-120	Anhydrous	Harvested for Silage (13)	21 Ton					
None	195-70-210	28% Weed and Feed	155 bu.	4 ton	120 Ton	-$7.30	$31.62	$31.62	29 min.
None	195-70-210	28% Weed and Feed	165 bu.	12 Ton					

(10) Extremely wet harvest conditions, farmer decided not to take time to do check.

(11) Cutworm damage on both plots, and wind erosion damage on comparison plot.

(12) Very little residue present since 1984 was a light stand of soybeans on very sandy soil which underwent wind erosion in 1984.

(13) Used for silage because of severe crop damage from hail and wind erosion.

1986 Otter Creek Demonstration Project.....

	Cooperator; Plot Size; Crop	Planting; Date; Variety	Seed Drop --- Stand	Row Width and Planter	Tillage Equipment	Residue or Cover	Soil Type (1)	Drainage Class (2)	Herbicides (rate/ac)
No-Till	Michael Bilan 28 ac. Corn	5-3-86 (8) Garno S-10	26,500 --- 25,250	30 in. Intern'tl 800	None	Soy-beans	Corunna sl	Poorly	Bladex 4L 3/4 qt. Lasso 2 qt. Atrazine 4L 1/2 qt. 2,4-D l.v. ester 1 pt. X-77 1 qt. Crop Oil 1 qt.
Compari-son	24 ac.	5-3-86 Garno S-10	24,500 --- 24,000	30 in. Intern'tl 800	Chisel Disk Field Cultivator	Corn	Corunna sl	Poorly	Bladex 4L 3/4 qt. Lasso 2 qt. Atrazine 4L 1/2 qt.
No-Till	Diesing Brothers 10 ac. Corn	5-10-86 Pioneer 3737	21,900 --- 20,000	30 in. Intern'tl 400	None	Corn	Corunna sl	Poorly	Paraquat 8 ozs. Atrazine 4L 1 qt.
Compari-son	10 ac.	5-10-86 Pioneer 3737	21,900 --- 21,000	30 in. Intern'tl 400	Disk Plow	Corn	Corunna sl	Poorly	Atrazine 4L 1 qt.
No-Till	Drodt Farms 15 ac. Corn	5-3-86 DeKalb 55A	26,000 (10) --- 19,700	30 in. J. Deere 7000	None	Soy-beans	Selfridge ls Pewamo cl	S.W. Poor Poor	Lasso 2 qt. Bladex 2 lbs. 2,4-D 40, 1 pt.
Compari-son	15 ac.	5-3-86 DeKalb 55A	26,000 --- 21,300	30 in. J. Deere 7000	Field Cultivator	Soy-beans	Selfridge ls Pewamo cl	S.W. Poor/ Poor	Sutazine 3-1/2 qt. Atrazine 4 lbs. Crop Oil 1 pt.
No-Till	Glenn Hoppert 5 ac. Corn	5-16-86 Jacques 151	22,000 --- 20,000	30 in. Allis Chalmers 333	None	Rye	Selfridge ls Belleville ls	S.W. Poor Poorly	Roundup 1 qt. 2,4-D 40, 1 pt. Atrazine 1 qt. Crop Oil 1 pt.
Compari-son	5 ac.	5-16-86 Jacques 151	18,000 (11) --- 16,000	30 in. Allis Chalmers 333	Plow Disk Field Cultivator Cultivate	Rye	Metea s Selfridge ls Belleville ls	Well S.W. Poor Poorly	2,4-D 40, 1 pt. Atrazine 1 qt. Crop Oil 1 pt.

Plot Data and Results.....

Insecticides (rate/ac)	Fertilizer N-P-K (lbs/ac)	Nitrogen Source/s	Yield Dry Bushels (3)	Soil Loss Avg/ac/yr (Wind + Water)	Tot.Soil Saved on Plot	Change in Net Profit per/ac (4)	$ Nutrients (N-P-K) Saved/ac (5)	$ Organic Matter Saved/ac (6)	Time Saved per ac (7)
Agorox Seed Treatment	160-0-210	Urea	115 bu. (8,9)	2 Ton	84 Ton	+$13.56	$10.74	$10.74	38 min.
Agorox Seed Treatment	160-0-210	Urea and Anhydrous (9)	130 bu. (8,9)	5 Ton					
Dyfonate 5-1/2 lbs.	170-119-455	Anhydrous	134 bu.	2 Ton	20 Ton	-$9.24	$7.15	$7.15	27 min.
Dyfonate 5-1/2 lbs.	170-119-455	Anhydrous	148 bu.	4 Ton					
None	157-29-149	Anhydrous and Starter	141 bu. (10)	5 Ton	105 Ton	-$1.87	$25.06	$25.06	8 min.
None	157-29-149	Anhydrous and Starter	146 bu. (10)	12 Ton					
Dyfonate 4 lbs.	212-48-228	Anhydrous and Starter	86 bu.	1 Ton	65 Ton	+$26.36	$44.75	$44.75	46 min.
Dyfonate 4 lbs.	212-48-228	Anhydrous and Starter	70 bu. (11)	14 Ton					

1986 Otter Creek Demonstration Project.....

	Cooperator; Plot Size; Crop	Planting; Date; Variety	Seed Drop ------ Stand	Row Width and Planter	Tillage Equipment	Residue or Cover	Soil Type (1)	Drainage Class (2)	Herbicides (rate/ac)
No-Till	Donald Newell 9.5 ac. Corn	5-2-86 Pioneer 3737	25,800 ------ 25,000	30 in. Allis Chalmers 333	None	Corn	Belleville ls Thetford ls Tedrow ls	Poorly S.W. Poor S.W. Poor	Pre-emerge: 2,4-D 1 pt. Post: (2) Basagran 3/4 qt. Crop Oil 3/4 qt.
Compari-son	9.5 ac.	5-2-86 Pioneer 3737	25,800 ------ 25,250	30 in. Allis Chalmers 333	Chisel Drag	Corn	Belleville ls Thetford ls Granby fs	Poorly S.W. Poor Poorly	(2) Basagran 3/4 qt. Crop Oil 3/4 qt.
No-Till	Herbert Smith 30 ac. Corn	5-3-86 Funks 4312	25,000 ------ 22,500	30 in. White 5100	None	Soy-beans	Selfridge ls-Pewamo cl	S.W. Poor/ Poor	Lasso 2 qt. Bladex 2-1/2 qt. Banvel (in 28%) 1/2 pt.
Compari-son	35 ac.	5-3-86 Funks 4312	25,000 ------ 23,000	30 in. White 5100	Modified Field Cultivator	Soy-beans	Selfridge ls-Pewamo cl Blount l Millsdale cl Pewamo cl	S.W. Poor/ Poor S.W. Poor Poorly Poorly	Lasso 2 qt. Bladex 2-1/2 qt. Banvel (in 28%) 1/2 pt.

(1) Selfridge-Pewamo hyphenated indicates the Selfridge-Pewamo soil complex. These soils are so intricately mixed that it was not practical for soil scientists to map them separately.

(2) "S.W. Poor" is an abbreviation for somewhat poorly drained.

(3) Corn yields adjusted to 15.5% moisture. Soybean yields adjusted to 13.0%.

(4) "Change in net profit" for the no-till plot vs. the comparison plot is the difference in their gross profit minus the difference in their production costs. Gross profit was calculated by using their yield difference in bushel, times the price per bushel. Price per bushel was assumed as follows: $1.50/bu. for corn. Production costs included the cost of all field operations, fertilizers, herbicides, and insecticides. Costs of field operations were based upon costs published in Custom Work Rates in Michigan, Bulletin E-458 by the MSU Cooperative Extension Service, August 1983. The custom rate for using a spring tooth drag was estimated by Paul Marks, Agricultural Extension Agent, Monroe. Costs used for other items were as reported by each farmer.

(5) The value of nutrients saved is based upon calculations that 2 lbs of Nitrogen (N), 3 lbs. of Phosphate, P(2)O(5), and 3 lbs. of Potash, K(2)0 are lost with each ton of soil lost to erosion.
Source- Beasley, Erosion and Sediment Control, p. 15.

(6) The value of organic matter saved is based upon estimates that, when soil erosion occurs, an equal value of organic matter is lost for each dollar of nutrients lost. Source- Dr. Lynn Robertson, Soil Physicist, formerly with Michigan State University.

Plot Data and Results.....

Insecticides (rate/ac)	Fertilizer N-P-K (lbs/ac)	Nitrogen Source/s	Yield Dry Bushels (3)	Soil Loss Avg/ac/yr (Wind + Water)	Tot.Soil Saved on Plot	Change in Net Profit per/ac (4)	$ Nutrients (N-P-K) Saved/ac (5)	$ Organic Matter Saved/ac (6)	Time Saved per ac (7)
None	230-63-134	Urea Anhydrous and Starter	130 bu.	4 Ton	70 Ton	+$10.73	$26.49	$26.49	21 min.
None	230-63-134	Urea Anhydrous and Starter	128 bu.	11 Ton					
None	180-120-145	28%	130 bu.	3 Ton	210 Ton	+$10.80	$25.06	$25.06	10 min.
None	180-120-145	28%	128 bu.	10 Ton					

(7) Time savings are based upon data published in the 1983 Conservation Tillage Results; Allen County, Ohio, p. 8.

(8) Problems with planter; no-till was replanted.

(9) Cooperator applied additional nitrogen to the comparison plot which invalidates their comparison.

(10) Extremely heavy rains after planting caused drowning out of some areas; more in no-till.

(11) Used new planter, problems with adjustment. Started on comparison plot.

Soil Texture Symbols (1)

fs----fine sand
s----sand
ls----loamy sand
sl----sandy loam
lfs----loamy fine sand
l----loam
sil----silty loam
cl----clay loam
sicl----silty clay loam

A P P E N D I X B

CONSERVATION TILLAGE TECHNICIAN CONTRACT

MONROE COUNTY SOIL AND WATER CONSERVATION DISTRICT

Monroe County Soil and Water Conservation District
15621 SOUTH TELEGRAPH RD. PHONE 241-7755
MONROE, MICHIGAN 48161

CONTRACT FOR CONSERVATION TILLAGE TECHNICIAN SERVICES

This agreement is made this 14 day of Feb., 1984 by and between the Monroe County Soil and Water Conservation District (hereinafter called the District) and William E. Anson, 4490 Newburg Road, Carleton, Michigan (hereinafter called the Contractor).

The District agrees to contract for and the Contractor agrees to provide technical assistance for the Otter Creek Conservation Tillage Project as described herein and requested by the District.

The area within which the duties are to be performed shall be the delineated boundaries of the Otter Creek Watershed with the District retaining the right to assign duties outside of the designated Otter Creek Watershed demonstration plots.

Payment for duties performed on the Otter Creek Watershed demonstration plots shall be as follows:

a) $150 at the end of one week of training as approved by the District.

b) $500 when one-half of the planting is completed as approved by the District.

c) $500 when the planting is totally completed as approved by the District.

d) $150 after the completion of field review in June as approved by the District.

e) $150 after the completion of field review in July as approved by the District.

f) $500 when harvest is one-half completed as approved by the District.

g) $500 when harvest is totally completed as approved by the District.

h) $500 when one-half of evaluation of project is completed as approved by the District.

i) $570 when evaluation of project is completed and is approved by the District.

j) Total contract $3,520.

Payment for duties performed outside of the designated Otter Creek Watershed demonstration plots shall be $5 per acre planted. Payment will be remitted to the contractor when a voucher is submitted documenting acres planted and approved by the District.

Performance under this contract shall be in accordance with the following conditions:

Specific Duties and Performance Requirements

1. Keep all District equipment in condition for field operation. This includes providing service, maintenance, and repair on equipment as often as needed. A regular service and maintenance program should be in effect at all times (grease, oil, etc.).

2. Assure that the equipment is safely and adequately stored when not in use.

3. Keep all tillage equipment, storage buildings, and desk in clean and neat condition.

4. In coordination with the district coordinator and under supervision of the district conservationist take soil tests as required.

5. In cooperation with the district coordinator, and under the supervision of the district conservationist, receive and respond to requests by local farmers for use of equipment. Coordination with the district coordinator and consultation with the district conservationist will be essential to assure that the request is of priority and to assure that the equipment is available.

6. Upon approval by the district conservationist, make delivery of the requested equipment to the farmer.

7. Review the use and operation of the equipment with the farmer. Be knowledgeable about the proper setting, depth, spacing and other variables on which the farmer will want information. Be able to make equipment adjustments.

8. Provide farmer with a general understanding about the objective of the District's program and our desire to record and learn as much as possible about his demonstration plot.

9. Be knowledgeable and equip yourself with enough information about various conservation tillage systems so that you can answer at least the farmer's general questions about fertility, pest management, and equipment operation.

10. Provide district coordinator with current, accurate neatly written records relative to equipment used for her use in charging rental fees.

11. Assist the district conservationist and SCS field staff in collecting tillage data which must be recorded on prescribed forms. This includes collection of yield data in the fall. (The weigh wagon and moisture tester provided by the project will be used to collect samples on all priority plots.)

12. A progress report approved by the board is required before advance payment is made.

13. The contract can be terminated by the board of directors if performance of duties is not satisfactory at time of submitting report for advance payment.

Supervision

As the contractor in this position, you are directly responsible to the Monroe County Soil and Water Conservation District board of directors. However, your daily activities will be under the supervision of the district conservationist, SCS. The Chairman of the Board will serve as their representative for the overall daily management of the district. You, the district conservationist and district coordinator are responsible to the Chairman of the Board. Any difficulties that arise with your tillage duties that cannot be resolved by the district conservationist will be brought to the Chairman of the Board.

Any disciplinary or other problems that arise and cannot be resolved will be taken to the Board.

Work Hours

Office work hours are from 8:00 a.m. until 4:30 p.m. (with one-half hour off for lunch), Monday through Friday except during planting and harvest season. If additional time is needed for lunch, the starting or ending time can be adjusted accordingly.

There are times of the year when tillage and harvest operations require extra hours and you will be asked to extend your hours accordingly.

The contractor shall perform the services requested of him by the district with dispatch, in an efficient manner, and with a reasonable expenditure of time in relation to the total values involved.

No services or assistance shall be performed by the contractor under this agreement on any lands owned by him or in which he has an interest, or for any services for which he is retained or reimbursed by a landowner.

The District shall not be liable for any damages claimed to have resulted from services rendered to any person under this agreement, and the Contractor hereby accepts full responsibility for all actions consequent to technical determinations rendered by him under the provisions of this agreement. The Contractor will endemnify and hold harmless the District.

This contract shall be effective immediately and shall expire in the fall of 1984 after harvest and evaluation is completed and approved by the District, unless extended by agreement between the Contractor and the District, and

may be terminated at an earlier date by either party upon written notice to the other.

Richard Schmitt
Monroe County Soil & Water Conservation District

William E Anson
Contractor

2-14-84
(Date)

2/14/84
(Date)

☆ U.S. Government Printing Office : 1991 - 281-724/43565

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7. AUTHOR(S) Marion Smith Kathy F. Pielsticker		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Monroe County Soil and Water Conservation District 1523 North Telegraph Road Monroe, Michigan 48161		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO. S005721-01
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15. SUPPLEMENTARY NOTES Ralph G. Christensen, Project Officer John C. Lowrey, Technical Assistant		

16. ABSTRACT
The demonstration project was to evaluate the effectiveness of conservation tillage for controlling soil erosion and thus preventing the runoff of soil and nutrients into Lake Erie. It was designed to demonstrate to farmers the successful application of conservation tillage by other farmers in their community. The Soil and Water Conservation District and Soil Conservation Service provided the technical assistance to demonstrate the tillage practice.

17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Soil Erosion Conservation Tillage No-Till Runoff Fertilizer Pesticide Phosphorus Nonpoint Source Sediment Water Quality		
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