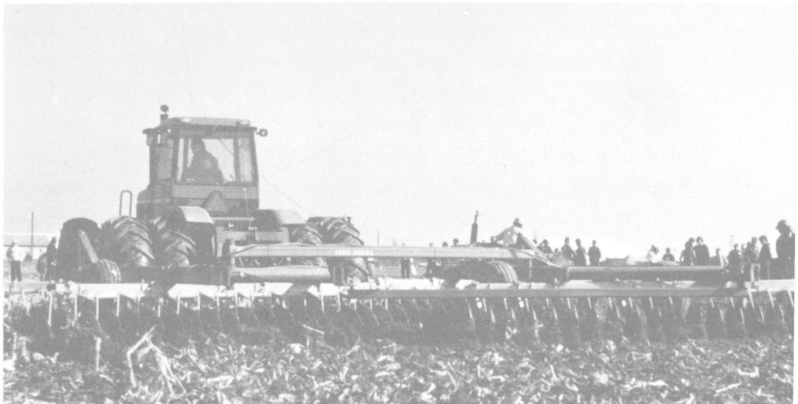
Bulletin 620

TILLAGE RESEARCH in Ohio

A Guide to the Selection of Profitable Tillage Systems



COOPERATIVE EXTENSION SERVICE
THE OHIO STATE UNIVERSITY

TILLAGE RESEARCH in Ohio

by

SAMUEL W. BONE, *Extension Agronomist*, The Ohio State University, and D. M. VAN DOREN, JR. and G. B. TRIPLETT, JR., *Professors*, Ohio Agricultural Research and Development Center.

1/77—10M

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Roy M. Kottman, Director of The Cooperative Extension Service, The Ohio State University.

TILLAGE RESEARCH in Ohio

New tillage systems are challenging the traditional moldboard plow as the most useful tool in preparing Ohio soils for crop production. Today, new know-how, equipment and herbicides can make decreased tillage systems more attractive in both dollar and soil saving on many Ohio soils.

Until recently, the moldboard plow, invented nearly 200 years ago, was considered the most effective single tool used as the first step in soil preparation for planting crops. It kills or severely weakens existing vegetation, loosens the soil and buries crop residues. Subsequent shallow tillage smooths the soil surface, recompacts the soil and kills weed seedlings.

During the past 40 years, traditional tillage methods have been undergoing ever-more-careful review. Farmers and scientists have asked, "Is all that work necessary?" Each year tillage for seedbed preparation moves enough soil to build a superhighway from New York to California. Another question has been, "How can we reduce soil erosion and still grow predominantly cash grain crops?"

Within the last 15 years, two major technological advances have greatly increased the possible successful alternatives to plow-based tillage systems. One is the development of both selective and non-selective herbicides that can control unwanted vegetation without tillage. The other is the development of planting equipment that can properly place seeds in a wide range of tilled and non-tilled soils, regardless of soil roughness or residue cover.

This same period of time has seen dramatic changes in agriculture. Farming units have become larger, and crop rotations have given way to repeating the same crop such as continuous corn. Because of less available farm labor, more land is being tilled by fewer farmers in a manner that encourages or accelerates soil erosion. Researchers have been searching for tillage practices that both reduce soil erosion and require fewer man hours per acre. To be adopted by farmers, however, any new systems must be successful, reliable and less costly than the conventional plow-based practices.

Since 1960, tillage research in Ohio has concentrated on comparing yield-producing potentials of several alternatives to plow-based tillage. These tests have assumed that satisfactory weed control and planting techniques could be developed for any new system. Consequently, all yield data in this bulletin are for trials in which weed control and equal plant populations were achieved, with or without tillage, for all treatments.

Results indicate that no one tillage system produces the greatest corn or soybean yields for all combinations of soil types, rainfall patterns and crop rotations. Researchers have obviously not studied all possible combinations of crop rotations and rainfall patterns on the nearly 400 different soil types in Ohio. Data shown are for specific combinations of soil properties, rainfall and crop rotations at the Ohio Agricultural Research and Development Center at Wooster and five of the outlying branches. Soils at these locations represent important soils in Ohio. The following tillage systems were used in the evaluation:

Tillage Systems

Conventional Tillage (CT): Moldboard plow 6 to 10 inches deep (in spring for sloping medium-textured soils; in fall or winter for level, fine-textured soils) followed by a shallow leveling operation — disc, harrow, field cultivator — shortly before planting. Planting is in a soil surface that is generally bare. This CT is the standard against which all other systems are compared. Additional treatments included 1) no post-emergence sweep cultivations or equivalent and 2) at least two post-emergence sweep cultivators or equivalent.

Minimum Tillage (MT): Moldboard plow 6 to 10 inches deep (in spring for sloping medium-textured soil; in fall or winter for level, fine-textured soils). Planting was in strips prepared by rotary hoes and wheel tracks. The soil surface is generally bare. MT requires less labor and total time than CT and is more effective for erosion control. Subsequent cultivation is more difficult for MT then for CT, best stands are achieved if planting is done shortly after plowing, which may increase labor requirements during the desirable planting period. Additional treatments included 1) no post-emergence sweep cultivation or equivalent.

Conservation Tillage (Cons. T): Non-moldboard plow initial tillage, using chisel plow, disc and field cultivator from 4 to 16 inches deep followed by one or, at most, two shallow leveling operations and planting. Generally, about half the previous crop residues remain on the soil surface. Cons. T. is potentially more effective for erosion control than CT or MT and often requires less labor and time than CT. Weed control and stand establishment can be greater problems than for CT. Herbicides are needed for satisfactory weed control in Cons. T. systems. Additional treatments included 1) no post-emergence sweep cultivations or equivalent and 2) at least two post-emergence sweep cultivations or equivalent.

No-Tillage (NT): Weed control was accomplished entirely with herbicides. Planting was done with specially equipped planters. Most of the previous crop residues remained on the soil surface. There was no post-emergence cultivation. NT was the most effective erosion-control practice if there was crop residue cover (65% cover or more). NT requires up to 75 percent less time to establish the crop than CT. NT requires greater managerial skill and tolerates fewer mistakes than CT, and stand establishment may be more difficult than for CT.

Soils and Soil Properties

Soils on which tillage evaluations have been made are grouped into three broad classes based on soil properties and crop response to tillage. These include:

Well and Moderately Well-Drained Soils: With medium surface texture (loam, silt loam) on slopes from 2 to 6 percent. The data would appear to apply to slopes up to 18 percent. Row crop production usually is not practical on slopes greater than about 18 percent. A dominant problem for corn and soybean production on these soils is maintaining adequate water infiltration throughout the growing season to prevent a shortage of water for crop growth. Another potentially serious problem is soil erosion and sediment loss from tilled land on slopes greater than 2 percent.

Somewhat Poorly Drained Soils: With medium surface texture on nearly level topography (slopes less than 3 percent). These soils often have problems with excess water (poor drainage) in the early part of the growing season, followed by the need to maintain adequate water infiltration rate to prevent shortage of water for crop growth during the growing season. Soil erosion may be a localized problem for slopes of 1 to 3 percent.

Very Poorly Drained Soils: Dark-colored soils with fine texture (silty clay loam to clay) on nearly level topography. A dominant problem for crop production on these soils is removal of excess water. Surface and subsurface drainage systems are usually required. Soil erosion does not appear to be a serious problem on these soils.

Selection of tillage practices can reduce erosion.

Tillage Evaluation and Crop Yields

Well Drained Soils. WOOSTER silt loam at the main campus of OARDC in Wayne County is a well-drained medium-texture soil. The following data were obtained on sites having slopes from 3 to 6 percent. Yield data are listed in Table I and II.

Mulch cover prior to tillage was about 10 percent after corn harvested for silage, 60 to 70 percent after corn harvested for grain and 90 to 100 percent after grass meadow. Cons. T consisted of only 2 to 3 passes with a 16-inch disc before planting. All fields were plowed the year prior to the experiments (7 years of data for corn; 4 years data for soybeans).

Table I. Average Corn and Soybean Yields for Tillage Systems and Previous Crop
Wooster Silt Loam—OARDC, Wooster, Ohio

	Corn Yields Bu/A			Soybean Yields Bu/A		
	After Corn Harvested for		After Grass	After Corn Harvested for		After Grass
Tillage	Silage	Grain	Meadow	Silage	Grain	Meadow
CT + cultivation	101	102	106	44	44	47
CT, no cultivation	93	91	96	42	42	46
MT + cultivation	99	98	107	43	44	46
MT, no cultivation	91	88	98	40	40	42
Cons. T + cult.	103	105	118	44	44	44
Cons. T, no cult.	85	93	106	36	41	44
NT	75	105	122	36	41	44
LSD_{05}		9.0			3.8	

Table II. Average Corn and and Soybean Yields for Tillage Systems and Crop Sequence
Wooster Silt Loam—OARDC, Wooster, Ohio

Tillage	Corn Yields Bu/A			Soybean Yields Bu/A
	Continuous Corn	Corn-Soybean Rotation	Corn-Oats-Hay Rotation	Corn-Soybean Rotation
CT + Cultivation	111	112	124	26
MT + Cultivation	114	115	125	25
NT	130	129	131	28
LSD_{05}		7.0		2.9

Corn yield differences between treatments have been increasing since the first few years of the experiment. Soybean yield differences among treatments have been about the same for most years. To obtain equal corn stands among tillage treatments required overplanting NT in the corn-oats-hay rotation and continuous corn an average of 10 percent. All plots have been maintained continuously by the prescribed tillage treatment for 13 years.

Moderately Well-Drained Soils

CANFIELD silt loam at the main campus at OARDC in Wayne County is a moderately well-drained soil. A fragipan at 20- to 24-inch depth limits root growth, often resulting in droughty conditions and below-average crop yields. Data in Table III were obtained from sites having slopes from 1 to 4 percent.

Table III. Average Corn Yields for Tillage Treatments for Continuous Corn
Canfield Silt Loam—OARDC, Wooster, Ohio

Tillage	Corn Yield Bu/A
CT + Cultivation	79
CT, no cultivation	68
NT, after corn harvested for silage	68
NT, after corn harvested for grain	90
LSD_{05}	10

Mulch cover after planting NT plots was about 20 percent after corn harvested for silage and 70 percent after corn harvested for grain. Average of one 6-year and two 3-year studies.

ROSSMOYNE silt loam at the Southern Branch, OARDC in Brown County is a moderately well-drained soil. A fragipan at 20- to 24-inch depth also limits root growth. This location in Southwestern Ohio has one of the most favorable rainfall distributions throughout the growing season of any region in the state. Drought conditions did not develop as frequently as for Canfield soil. Data in Table IV were obtained on sites having slopes of 2 to 4 percent.

Table IV. Average Corn Yields for Tillage Treatments for Continuous Corn
Rossmoyne Silt Loam—OARDC, Southern Branch

Tillage	With one Cultivation	Without Cultivation
	-------------Bu/A-------------	
CT	142	143
Cons. T (Rototil 6 inches deep one time)	143	137
Cons. T (Disc 4 inches deep 1 to 2 times)	136	136
Cons. T (Chisel plow 8 inches deep one time)	138	142
NT after harvesting corn for silage		142
NT after harvesting corn for grain		144
LSD_{05}	10	

Mulch cover after planting was about 20 percent for roto-tilled and NT after corn silage, 30 percent for the disced and the chisel plowed treatments, and 70 percent for NT after corn grain. Yields are averages of one 7-year and one 2-year study.

Results of Tillage Evaluation

Corn yields and, to a lesser extent, soybean yields on the well-to-moderately-well-drained soils respond favorably to decreased tillage and mulch cover provided by the previous crop. If the land is bare (e.g.

previous crop of corn harvested for silage) it must be tilled to produce highest yields. Once the land is tilled, cultivation may be needed to break soil crusts formed by rainfall. With a 70-percent or greater mulch surface cover, tillage is not needed. Tillage may reduce yields if the land has close to 100 percent mulch cover, (e.g. after meadow) or had developed improved soil physical and chemical regime with continued use of no-tillage (e.g. Table II). Use of a chisel plow, disc, sweep cultivator or similar tool reduces mulch to about half of that present prior to tillage. Moldboard plowing generally removes all mulch.

Both tillage and mulch cover tend to increase water infiltration and otherwise conserve water for use by the crop and help to reduce soil erosion. Tillage practices tend to remove mulch from the soil surface, and the effectiveness of tillage in conserving water may be partly or completely offset by removal of mulch.

Yield differences caused by tillage or mulch cover often are reduced or eliminated in growing seasons with excellent rainfall. (e.g. Table IV). With adequate, well distributed rainfall (even if some run-off or other water loss occurs) there may be sufficient water to satisfy the needs of the crop, and yields will be nearly equal for all treatments. Mulch and/or tillage on crusted soil, however, is needed for erosion control.

Location of Well and Moderately Well Drained Soils in Ohio

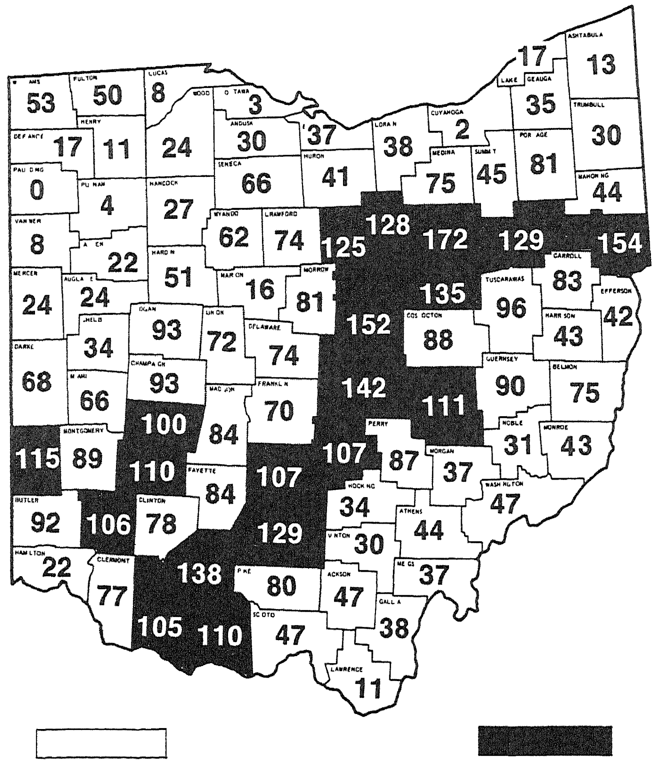
Data from the Ohio Soil and Water Conservation Needs Inventory show there are 5,714,000 acres of soils with these characteristics on Ohio farms. The soils are on slopes of up to 18 percent. Excluded are soils in woodland.

The acreage in each county is shown in Figure 1 as thousands of acres.

Somewhat Poorly Drained Soils

CROSBY silt loam, a somewhat poorly drained soil, at the Western Branch of OARDC in Clark County has

Figure 1. Acres of Well and Moderately Well Drained Soils on Ohio Farms (thousands of acres).



slopes of 0 to 2 percent on the experimental sites; tile spaced at 60-foot intervals helped alleviate drainage problems on this soil. Date are listed in Table V and VI.

In order to maintain equal stands among tillage treatments over-planting of 20 percent was required on NT in the corn-oats-hay rotation and continuous corn. Do not compare yields of the last 4 years of continuous corn with the first 9 years of any rotation because weather and agronomic inputs were not comparable. These data include 9 years of one experiment and 13 years for another.

Table V. Average Corn Yields for Tillage Treatments and Crop Sequence
Crosby Silt Loam—OARDC, Western Branch

Tillage	Continuous Corn First 9 Years	Continuous Corn Next 4 Years	Corn-Soybeans Rotation (9 yrs.)	Corn-Oats-Hay Rotation (9 yrs.)
	Bu/A			
CT + Cultivation	114	144	121	125
MT + Cultivation	118	145	122	130
NT	114	135	113	133
LSD_{05}	11.0			

Table VI. Average Corn Yields for Tillage Treatments for 4 Years
Crosby Silt Loam—OARDC, Western Branch

Initial Tillage	Corn Yields: No Additional Tillage	Corn Yields: + Spring Field Cultivate (4 In.)
	Bu/A	
CT (Spring plow)	—	140
CT (Fall plow)	—	138
Cons. T (Fall chisel plow to 16 inches)	148	146
Cons. T (Fall chisel plow to 8 inches)	145	142
Cons. T (Fall field cultivate to 4 inches)	143	146
Cons. T (Spring field cultivate to 4 inches)	141	—
NT	143	—
LSD_{05}	7 Bu/A	

These treatments received no post-emergence cultivation. Weeds were adequately controlled with herbicides.

RAVENNA silt loam is a somewhat poorly drained soil at the Mahoning County Farm on slopes of 1 to 3 percent on the experimental site. No tile was used on this somewhat poorly drained soil. Data are listed in Table VII.

Table VII. Average Corn Yields for Tillage Treatments
Ravenna Silt Loam—OARDC, Mahoning Branch

Tillage	Corn Yields: Continuous Corn	Corn Yields: Corn-Oats-Hay Rotation
CT + Cultivation	97	107
MT + Cultivation	97	111
NT	95	106
LSD_{05}	8 Bu/A	

In order to maintain equal stands among tillage treatments required an average overplanting of 10 percent on NT treatment. Average yields have been about the same for the entire time of the experiment. Difference between rotations has increased steadily with time. The yield data is for crop sequence of 13 years.

Results of Tillage Evaluation

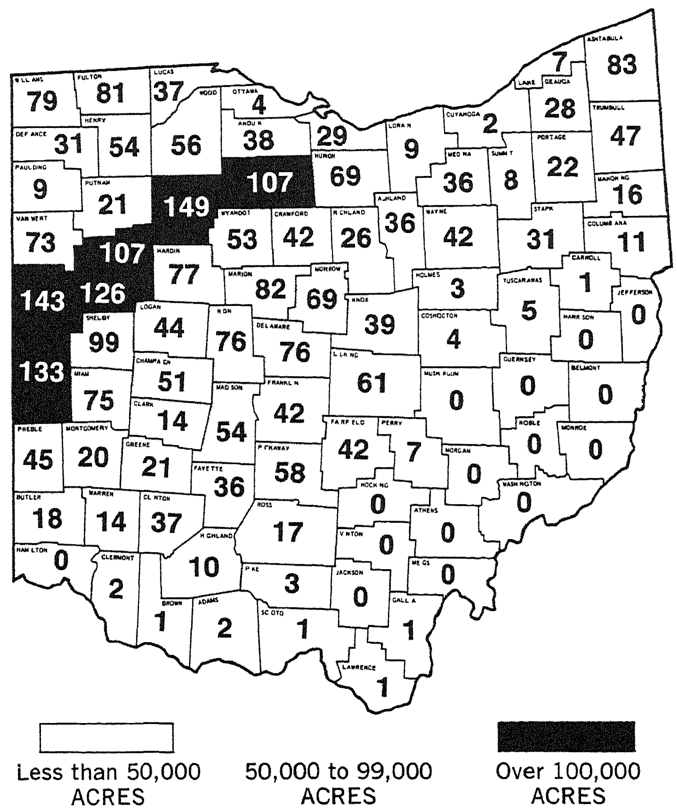
The yield data show that tillage had little influence on corn and soybean yields on medium texture somewhat poorly drained soils, regardless of depth, timing or of crop rotation Results from adjoining states have indicated reduced yield with some conservation tillage techniques and especially with no-tillage on similar soils This reduced yields appears to be associated with poor stands and weed control. These problems could have occurred in the Ohio trials if overplanting had not been done on some treatments and if weeds had not been controlled with herbicides. The potential exists for satisfactory crop production on these somewhat poorly drained soils with conservation tillage and even no-tillage, with the addition of drainage improvements.

Location of Somewhat Poorly Drained Soils in Ohio

Data from the Ohio Soil and Water Conservation Needs Inventory show 3,054,000 acres of these soils on Ohio farms. This figure excludes acres in woodland.

The acreage in each county is shown in Figure 2 as thousands of acres.

Figure 2. Acres by County of Somewhat Poorly Drained Medium Textured Soils on Ohio Farms (thousands of acres).



Very Poorly Drained Soils

BROOKSTON silty clay loam at the Western Branch at OARDC in Clark County is one of the more productive soils in Ohio when provided with adequate drainage, using tile and surface drainage systems. Table VIII and IX list yield data for tillage evaluations on Brookston. The experimental sites had tile spaced at 60-foot intervals.

Table VIII. Average Corn Yields for Tillage Treatments and Continuous Corn
Brookston Silty Clay Loam—OARDC, Western Branch

Initial Tillage	Corn Yields: No Additional Tillage	Corn Yields: + Spring Field Cultivate (4 in.)
	---Bu/A---	
CT (Spring plow)	—	166
CT (Fall plow)	—	159
Cons. T (Fall chisel to 16 inches)	150	150
Cons. T (Fall chisel to 8 inches)	151	151
Cons. T (Fall field cultivate to 4 inches)	154	151
Cons. T (Spring field cultivate to 4 inches)	158	—
NT	146	—
LSD05	7.3 Bu/A	

No treatment received post-emergence cultivation. Weeds were completely controlled with herbicides. Data are for 4 years, 1971-1974.

Table IX. Average Corn and Soybean Yields for Tillage Treatments and Continuous Cropping of Corn and Soybeans
Brookston Silty Clay Loam—OARDC, Western Branch

Tillage	Corn Yield	Soybean Yield
	---Bu/A---	
CT (Spring plow)	137	52
CT (Fall plow)	138	52
MT (Rototil in fall)	127	51
Cons. T (Field cultivate to 4 inches)	124	51
Cons. T (Spring disc 2 times to 4 inches)	123	52
NT	118	48
LSD05	7.2	2.5

Field cultivation for corn was done in the spring and for soybeans in the fall. No treatment received post-emergence cultivation. Data were for 4 years for each crop, from 1967 to 1974.

HOYTVILLE silty clay loam to clay at the Northwestern Branch at OARDC in Wood County is a moderately productive soil when provided with surface and subsurface drainage. All of the experimental sites on Hoytville have surface drainage. For the sites having tile, the spacing was 50 feet between laterals. Yield data are listed in Tables X, XI, XII and XIII.

Table X. Average Corn and Soybean Yields for Tillage Treatments and Crop Sequence
Hoytville Clay—OARDC, Northwestern Branch

Time Period	Tillage	Corn Yields: Continuous Corn	Corn Yields: Corn-Soybeans Rotation	Corn Yields: Corn-Oats-Hay Rotation	Soybean Yields: Corn-Soybeans Rotation
		---Bu/A---			
First 8 years	CT	106	112	110	38
	MT	107	112	110	37
	NT	90	108	109	37
LSD05			6.1		5.0
Next 5 years	CT	135	136	143	39
	MT	134	139	141	41
	NT	114	131	137	34
LSD05			9.4		3.5

No treatment received post-emergence cultivation. All treatments have tile drainage.

Table XI. Average Corn and Soybean Yields for Tillage Treatments and Crop Sequence
Hoytville Clay—OARDC, Northwestern Branch

Drainage		Tillage	Corn Yields: Continuous Corn	Corn Yields: Corn-Oats Rotation	Corn Yields: Corn-Soys-Sugar-beets Rotation	Soybean Yields: Corn-Soys-Beets Rotation
			Bu/A			
With Tile		CT	121	126	123	39
		NT	110	112	118	37
	LSD_{05}			10.4		7.7
No Tile		CT	115	114	117	37
		NT	96	100	105	29
	LSD_{05}			13.1		6.7

CT occassionally received post-emergence cultivation to aid in weed control. Corn yield differences among treatments have been increasing since the first few years of the experiment. Data are for 8 years.

Weeds were controlled with herbicides in all treatments, regardless of cultivation. All plots were fall plowed and field cultivated in the spring. Data are for two-years.

Table XII. Corn Yield as Affected by Post-Emergence Cultivation
Hoytville Clay—OARDC, Northwestern Branch

Number of Cultivations	Yield
	- Bu/A -
0	111
1	110
2	102
4	104

Plots in Table XIII were planted as soon as soil-water content permitted the required spring tillage and planting operations. No treatment received post-emergence cultivation. All treatments averaged about the same planting date *except* CT and MT treatment plowed in the spring, which averaged 3 weeks later planting. CT, spring plowed, required 15 percent overplanting and MT, spring plowed, required 30 percent overplanting to establish equal stands with the other treatments. Mulch cover prior to spring tillage averaged 10 percent after corn harvested for silage and 60 to 70 percent after corn harvested for grain.

Table XIII. Corn Yields on Land Plowed Every Other Year
Hoytville Clay—OARDC, Northwestern Branch

Tillage	After Grass Meadow	After Corn Harvested for Grain	After Corn Harvested for Silage
	Bu/A		
CT (Fall plowed)	142	133	—
CT (Spring plowed)	135	115	—
MT (Fall plowed)	141	129	—
MT (Spring plowed)	139	107	—
Cons. T	131	122	124
NT	137	124	128
LSD_{05}		7.6	

TOLEDO CLAY at the Northcentral Branch of OARDC in Erie County had tile at 40-foot spacing. Surface drainage was inadequate; water ponding in the dead furrows tended to flood the entire area. Yield data are listed in Table XIV.

Table XIV. Average Corn Yields for Tillage Treatments and Crop Sequence
Toledo Clay—OARDC, Northcentral Branch

Tillage	Corn Yields		
	Continuous Corn	Corn-Soybeans Rotation	Corn-Oats-Hay Rotation
	---------------------Bu/A	---------------------	
CT	94	102	104
MT	95	98	97
NT	90	96	96
LSD_{05}		9	

CT and MT occasionally received post-emergence cultivation to aid in weed control. Research is over a 10-year period.

Results of Tillage Evaluation

Corn and soybeans responded differently to tillage on these very poorly drained, fine textured soils than on other soils discussed. Using the same tillage system year after year on land in monoculture for corn caused significantly lower yields for NT compared with CT or MT. The yield differences generally become larger with time. Cons. T treatments generally produced yields somewhere between plow and NT treatments. Corn yield reduction associated with NT were partly or completely eliminated by plowing alternate years (Table XIII) or rotating corn with soybeans or meadow (Tables X and XI). Yield reduction for NT was somehow associated with soil drainage; yield losses with NT occurred earlier for crop rotations without drainage than for the tile-drained areas.

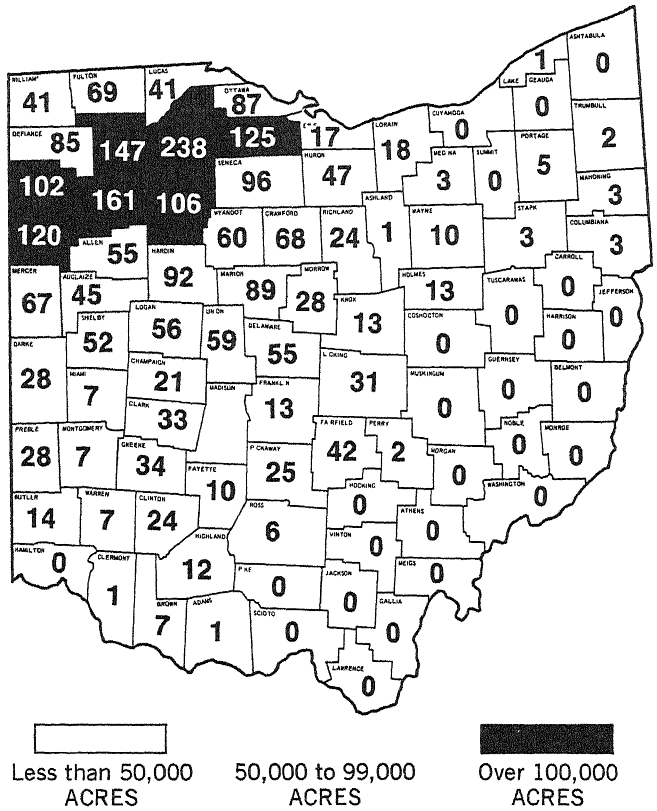
Other differences between corn response to tillage on these soils and the well-drained soils were the effects of mulch cover and post-emergence cultivation. On the very poorly drained, fine textured soils, mulch cover had little effect on yield for Cons. T and NT (compare Table XIII and Tables I and III). Also, if post-emergence cultivation was not necessary for weed control, cultivation did not increase yields on these soils. Yields were decreased by cultivation, depending on the number of cultivations (Table XII).

Another aspect of tillage is in relationship to crop yield as influenced by date of planting. Where drainage is inadequate, the soil may be too wet to plow in the fall or early spring. If plowing is delayed past the optimum planting date for corn, shallow Cons. T or NT could be substituted for plow-based tillage. By waiting for the soil to dry sufficiently for spring plow in areas planted to continuous corn, planting was delayed an average 4 weeks in 3 of 4 years. This delay and poor seedbed preparation associated with spring plowing caused a significant loss of stand and yield potential compared with discing or NT. Use of these reduced tillage techniques may be desirable in "emergency" situations. Taking advantage of this flexibility requires planting equipment that can operate satisfactorily in rough soil and with crop residues on the soil surface.

Location of Very Poorly Drained Soils in Ohio

Figure 3 lists the acreages in thousands of acres per county of poorly drained, fine textured soils on farms. This excludes the area in woodland. The Ohio Soil and Water Conservation Needs Inventory shows a total of 2,663,000 acres.

Figure 3. Acres by County of Fine Texture Very Poorly Drained Soil in Ohio (thousands of acres).



Identification of Soil Drainage

The Ohio Cooperative Soil Survey program is proceeding as rapidly as possible to compile the identification of soils and soil properties on all land areas in the state. To date, 63 counties have been involved in this program.

The identification of soil texture and soil drainage can be made through the use of county soil survey reports. This information is available through county Extension and Soil and Water Conservation District offices where the Soil Survey has been completed.

Tillage Options—Seed Placement—Weed Control

Data on yield response to tillage in Ohio indicate a wide range of options of tillage system selections for both corn and soybean production. As tillage is decreased, more attention must be directed toward using equipment to provide for effective seed placement at uniform depth. With decreased tillage, herbicide selection and use become very important in obtaining desirable weed control.

Tillage and Soil Erosion

The ability to control soil erosion on sloping topography can be important in selecting a tillage system. Intensity of rainfall, inherent soil erodability, slope steepness and slope length are factors that cannot easily be altered. Crop sequence, tillage and conservation practices can be altered to minimize erosion hazards.

Tillage practices selected for crop production can have a dramatic effect on potential soil loss from erosion. Decreasing tillage intensity and adopting systems that leave the soil surface covered with mulch reduce the erosion potential. Mulch cover protects soil surfaces from raindrop impact, helps increase rainfall infiltration and slows the rate of run-off. Changing from moldboard plowing to chisel plowing, field cultivation, discing or no-tillage can decrease the amount of erosion by a factor of several fold. Data from the University of Illinois listed in Table XV illustrate the influence of tillage on erosion on a soil with a 5 percent slope under 10 inches of simulated rainfall applied at 2.5 inches per hour.

Table XV. Tillage and Soil Loss on 5% Slope with 10 Inches of Simulated Rainfall, University of Illinois

Tillage System	Soil Loss T/A
CT (Fall Plow-Spring Disc-Plant)	8.3
Cons. T (Fall Chisel-Spring Disc-Plant)	3.2
Cons. T (Spring Disc-Plant)	1.7
NT (No-Tillage)	1.1

In Ohio, even more dramatic reductions in erosion have been observed. No-tillage corn was planted in killed sod on a 21-percent slope at the North Appalachian Watershed, Coshocton, Ohio. A 5-inch rain eroded less than 100 pounds of soil per acre from this field while adjacent fields on slopes of less than 10 percent but plowed, lost as much as 20 tons of soil per acre.

Probable losses of soil by water erosion on sloping topography can be calculated, using the universal soil loss equation as adapted in Ohio in Agronomy Publication 594, "Ohio Erosion Control and Sediment Pollution Abatement Guide."

Timely Planting

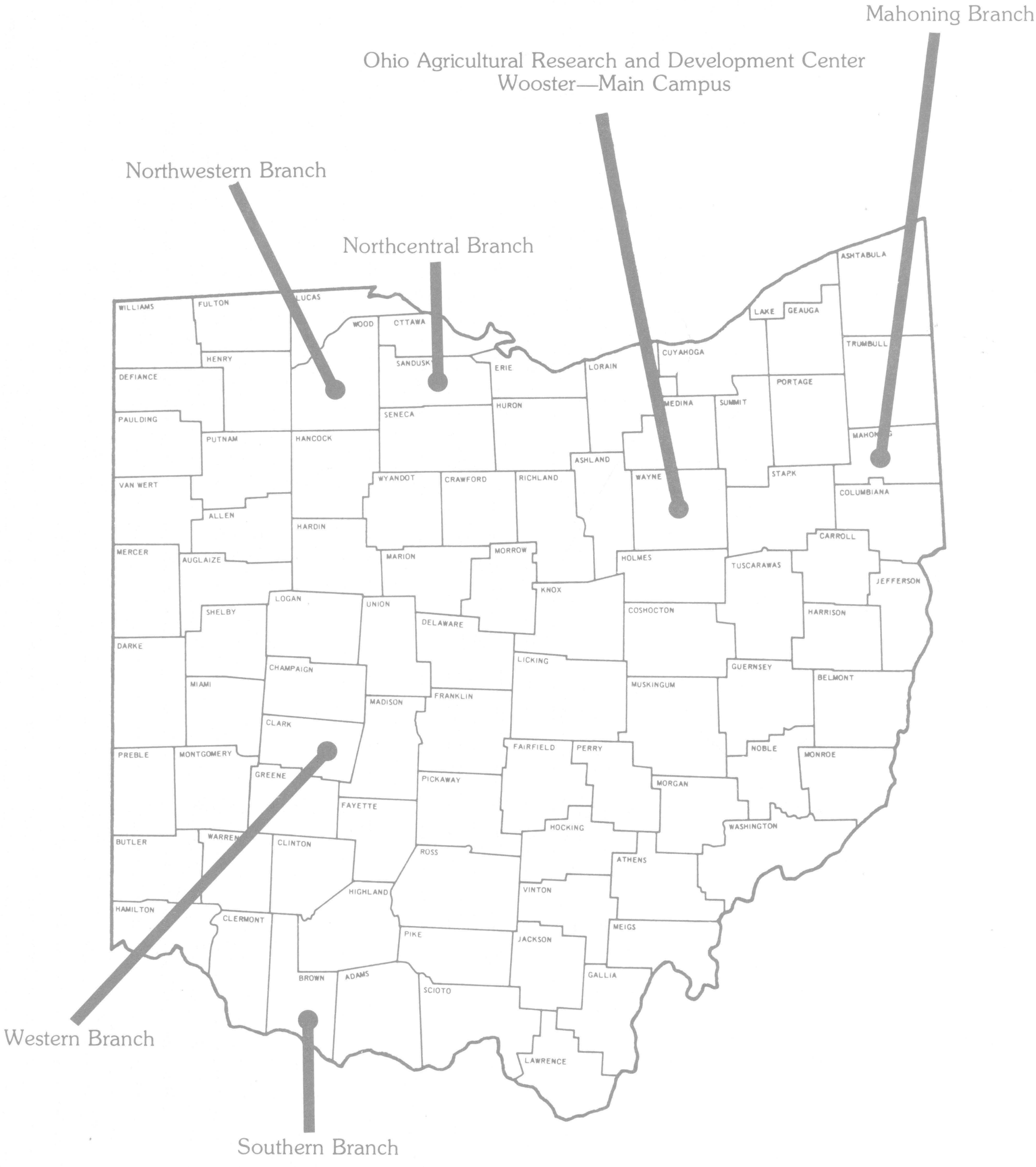
Timely planting of both corn and soybeans is needed for optimum yields of these crops. Corn planting should be completed by the first week of May and soybeans by May 20 in most of Ohio. Later planting can decrease corn yields by 1 to 2 bushels and soybean yields by as much as ½ to 1 bushel for each day of delay. The Statistical Reporting Service analysis of planting dates for the period 1971 through 1974 indicates that 40 percent of the corn and 75 percent of the soybeans were planted after the optimum dates (Tables XVI and XVII). Shifting to tillage systems that minimize spring tillage operations could facilitate more timely planting, resulting in higher yields and more profit to Ohio farmers.

Table XVI. Percent of Corn Planted in Ohio, April and May 1971-1974 (Ohio Crop Reporting Service).

	Year				
Date	1971	1972	1973	1974	Ave.
April 30	40	5	2	21	17
May 10	65	25	13	51	39
20	85	40	38	75	60

Table XVII. Percent of Soybeans Planted in Ohio, May 1971-1974. (Ohio Crop Reporting Service).

	Year				
Date	1971	1972	1973	1974	Ave.
May 10	10	5	3	14	8
20	40	10	15	33	25
30	70	45	26	60	51



Research was conducted at the Ohio Agricultural Research and Development Center and the branches shown.