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Runoff and Erosion Investigations

on Plastic Till Soil of Northeastern Illinois

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CONTENTS

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RUNOFF AND EROSION INVESTIGATIONS ON PLASTIC TILL SOIL OF NORTHEASTERN ILLINOIS[1]

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This report sets forth the results of runoff and erosion investigations to determine the effects of cropping systems, row direction, and nitrogen fertility level on soil and water losses and crop yields from a plastic till soil of northeastern Illinois. The data were classified and analyzed in a manner that would make the results of value in development of the universal erosion equation reported by Wischmeier (4).[3]

The poorly drained plastic till soils that occur extensively in northeastern Illinois, parts of Indiana, and Wisconsin were considered to be sufficiently different from the well drained soils of that area to require special study (Figure 1). Internal drainage of the plastic till subsoil is limited. This frequently results in excessive erosion on moderately steep slopes.

Intensive cropping systems and farming practices similar to those used on the more permeable and more productive soils of the Corn Belt are frequently used on the plastic till soils. Consequently, in many cases runoff is high and erosion is a serious problem.

Kidder and Lytle (1) found that field permeability rates for Elliott silt loam were 0.34" per hour for the A_1 horizon, 3.57" per hour for the A_3 horizon, 3.60" per hour for the B horizon, and 0.49" per hour for the C horizon. Van Doren and Klingebiel (3) found that on plots farmed in good rotation the permeability was greater for the surface and subsurface soil on Elliott silt loam when full applications of limestone, rock phosphate, and potash were applied and residues returned than when no treatment was used. Elliott silt loam has been known to drain adequately when it is properly tiled and a good rotation including grasses and legumes is followed.

EXPERIMENTAL DESIGN

In 1950 thirteen runoff plots 13.3 feet wide and 100 feet long were established on a 4-percent slope. To lessen border effects, strips two corn rows in width were farmed adjacent to the runoff plots. Standard measuring equipment was installed at the lower end of each plot to sample runoff and soil loss. The measuring equipment consisted of a collection trough, a silt settling box, a nine-slot divisor unit, and a round catchment tank for each plot. Corrugated metal dividers 9 inches wide were driven into the soil to a depth of 5 inches around the measured plot area.

The soil studied was Symerton silt loam which was developed from silty clay loam glacial till with 24 to 40 inches of medium-textured outwash under prairie vegetation. Symerton silt loam differs from Elliott silt loam in that the Symerton soil has more than 24 inches of loess or medium-textured outwash over till and has better internal drainage.

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[1]Joint contribution of the Soil and Water Conservation Research Division, Agricultural Research Service, USDA, and the Illinois Agricultural Experiment Station.

[2]Soil Scientists, Soil and Water Conservation Research Division, Agricultural Research Service, USDA, headquartered at Joliet, Ill. 1955-59 and at Morris, Minn., after 1959.

The author gratefully acknowledges the assistance of C. A. Van Doren and A. A. Klingebiel, former Project Supervisors; H. B. Atkinson, former Project Leader, SWCRD; A. L. Lang, L. T. Kurtz, Agronomy Department, Illinois Agr. Exp. Sta.; M. Silliman, Jr., Area Conservationist, SCS; and others with the Illinois Agricultural Experiment Station and the Soil Conservation Service who assisted with the study.

[3]Figures in parentheses refer to Literature Cited at end of this publication.

FIGURE 1.--Plastic till soil area of northeastern Illinois.

During 1951-53, cropping systems and row direction were as follows:

Plots 1, 2, and 3; corn, corn, oats (clover, green manure)--Contoured.

Plots 4, 5, and 6; corn, corn, oats (clover, green manure)--tillage in the up-down slope direction.

Plots 7, 8, and 9; corn, oats, hay--tillage in the up-down slope direction.

Plots 10, 11, 12, and 13; corn, oats, hay, hay--tillage in the up-down slope direction.

Initial soil treatments, based on soil tests, included 4 tons of limestone per acre and 1,500 pounds of rock phosphate per acre. The fertility program from 1951 through 1953 provided for two-thirds maintenance of phosphorus and potash and full maintenance of nitrogen at a production level of 80 bushels of corn per acre. All crop residues were returned to the plots except the first and second cutting of first-year hay and the first cutting of second-year hay.

During the second period, 1954-58, cropping systems and row direction were as follows:

Plots 1 and 2; continuous corn--contoured.

Plots 3, 4, and 5; corn, corn, oats (clover, green manure) tillage in the up-down slope direction.

Plots 6 and 12;[4] continuous corn--tillage in the up-down slope direction.

Plots 7 and 13;[5] continuous corn--tillage in the up-down slope direction.

Plots 8, 9, 10, and 11; corn, corn, corn, oats, hay--tillage in the up-down slope direction.

Fertilizer applications during the second period were based on two-thirds of full maintenance requirements for phosphorus and potash and full maintenance of nitrogen for the rotations. These fertilizer rates were considered adequate for optimum yields. Soil fertility tests made in 1956 indicated adequate supplies of available phosphorus and potassium. Limestone was applied at the rate of 3 tons per acre after plowing in 1958 to correct for acidity.

Field operations were performed as conventionally as the experiment permitted. Disk-hillers were used when cultivating corn to ridge soil into the corn row for weed control. Many farmers in the area follow this practice.

As reported by Wischmeier (4), a universal soil loss equation is being developed, which will be applicable where the erosion problem is caused by rainfall and where local base values have been determined. Rainfall, runoff, and erosion data reported herein were classified and computed for various stages of crop development. These major crop-stage periods are defined as follows:

Corn:

1. Seedbed period--planting date to 1 month thereafter.
2. Establishment period--1 month after planting date to 2 months after planting date.
3. Reproduction and maturity period--2 months after planting date to harvest date.

[4] Low nitrogen.
[5] High nitrogen.

4. Residue period--

   a. First year corn--harvest date to turn-plow date.

   b. Second year corn--harvest date to oats seeding date.

5. Rough plow period--turn plow date to planting date.

6. Losses resulting from thaw and/or snow-ice melt.

Oats:

1. Seedbed period--seeding date to 1 month thereafter.

2. Establishment period--1 month after seeding date to 2 months after seeding date.

3. Reproduction and maturity period--2 months after seeding date to grain harvest date.

4. Residue period--

   a. Stand-over legumes--grain harvest date to corn harvest date.

   b. Catch crop legumes--grain harvest date to turn-plow date.

5. Rough-plow period--

   a. Stand-over legumes--this period not represented.

   b. Catch-crop legumes--turn-plow date to planting date.

6. Losses resulting from thaw and/or snow-ice melt.

Hay:

Periods 1, 2, and 3 included for oat crop. Period 4 subdivided as follows:

4A. First dormant period--corn harvest date to April 1.

4B. Spring, early-summer growing period--April 1 to first hay harvest.

4C. Late summer-fall growing period--first hay harvest date to corn harvest date.

4D. Second dormant period--corn harvest date to turn-plow date.

5. Rough-plow period--turn-plow date to planting date.

6. Losses resulting from thaw and/or snow-ice melt.

EXPERIMENTAL RESULTS

Rain-gage records began in 1950 and crop yield, runoff, and soil loss measurements in 1951. The experiment was terminated in June 1959.

Rainfall

Average annual rainfall for the 8-year period 1951-58 was 30.72 inches compared with the 40-year average of 31.50 inches from the U.S. Weather Bureau Station at

Morris, Ill. which is 16.5 miles from the erosion plot site. Rainfall during the 1950-53 period was above normal (33.42 inches) and during the 1954-58 period was slightly below normal (29.62 inches). Extremes in annual precipitation were 20.06 inches in 1956 and 39.19 inches in 1957.

The 5-year average total precipitation and average precipitation contributing to runoff for the 1954-58 period are reported in Table 1.

Variability of rainfall characteristics and numerous combinations of these characteristics are of such magnitude that single characteristics, such as total amount of

TABLE 1.--Five-year average total precipitation and average precipitation contributing to runoff by crop-stage periods, 1954-58

Crop-stage period[1]	Continuous corn			Rotation C-C-O(c)			Rotation C_1-C_2-O-H			
	Contour HF[2]	Up-down								
		HF[2]	LF[3]	C_1	C_2	O	C_1	C_2	O	H
	In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
				Average Total Precipitation						
1	5.10	5.10	5.10	5.01	4.73	3.44	4.73	5.01	3.44	
2	4.35	4.35	4.35	4.04	4.63	3.33	4.63	4.35	3.33	
3	7.68	7.68	7.68	7.98	7.08	6.86	7.68	7.68	6.86	
4	8.05	8.05	8.05	7.98	6.11	14.63	8.11	6.11	8.17	
4A										5.72
4B										9.82
4C										12.30
4D										7.98
5	3.62	3.62	3.62	2.91	--	3.00	2.91	--	--	2.91
6	2.69	2.69	2.69	2.69	2.69	2.69	2.69	2.69	--	3.95
Total	31.49	31.49	31.49	30.61	25.24	33.95	30.75	25.84	21.80	42.68
				Average Precipitation Contributing to Runoff						
1	3.09	3.09	3.05	3.05	3.14	1.66	3.05	2.60	1.86	
2	3.34	3.23	3.23	3.03	3.03	1.38	2.80	3.14	1.69	
3	3.75	3.59	3.96	3.46	3.98	5.42	4.02	3.80	4.36	
4	3.92	4.08	4.10	3.56	3.53	7.06	4.23	4.15	3.60	
4A										1.52
4B										5.66
4C										6.70
4D										3.71
5	2.65	2.65	2.65	1.99	--	1.99	1.99	--	--	1.99
6	2.11	2.11	2.11	1.99	2.11	1.61	2.11	2.11	--	3.11
Total	18.68	18.75	19.10	17.08	15.79	19.12	18.20	15.80	11.51	22.69
Pct. of Annual	59.9	59.5	60.6	55.8	62.6	56.3	59.2	61.1	52.8	53.2

[1] Crop-stage periods: 1--Seedbed, 2--establishment, 3--reproduction and maturity, 4--residue, 5--rough-plow, and 6--snow-ice melt.
[2] HF = high fertility.
[3] LF = low fertility.

precipitation for a given storm, provide insufficient information for predicting soil loss recurrence probabilities. Wischmeier and Smith (5) reported that the best variable found for prediction of soil loss from cultivated fallow plots is the product of energy of a storm and its maximum 30-minute intensity.

The major rainstorms for the 1951-58 period are presented in table 2, together with the 5-, 15-, and 30-minute intensities and the return period in years for each storm.

TABLE 2.--Total amount, maximum intensities and return period for major rainstorms, 1951-1958

Date	Total amount	Crop-stage period for corn	Maximum intensity and return period					
			5-min. intensity	Return period[1]	15-min. intensity	Return period[1]	30-min. intensity	Return period[1]
1951	*In.*		*In/hr.*		*In./hr.*		*In./hr.*	
9/21 & 22	2.96	3	3.36	--	3.28	5	2.66	5
1952								
6/12	1.49	1	2.16	--	1.48	--	0.86	--
6/13 & 14	1.89	1	5.52	5	3.68	4	2.16	2
6/14	1.25	1	2.64	--	2.00	--	1.18	--
1953								
7/5	2.64	2	3.84	--	2.24	--	2.08	2
1954								
7/6 & 7	4.16	2	5.28	4	3.02	--	2.04	2
1955								
8/29	2.37	3	3.24	--	1.88	--	1.14	--
1956								
7/16	1.57	2	4.44	2	2.84	--	2.72	5
1957								
6/12 & 13	1.76	1	2.16	--	1.36	--	0.70	--
6/17 & 18	1.55	1	2.64	--	1.16	--	0.84	--
6/27 & 28	2.25	1	1.56	--	0.96	--	0.68	--
7/12 & 13	5.75	2	6.60	20	[2] 4.08	5-10	[2] 3.48	20
1958								
6/8 & 9	1.91	1	3.48	--	2.24	--	1.52	--
6/9 & 10	1.29	1	3.36	--	2.84	--	1.70	--
6/12 & 13	1.89	2	1.92	--	0.96	--	0.80	--
7/2	1.54	2	2.64	--	1.52	--	1.26	--

[1] Chicago, Ill.,--Blank space indicates return period less than 2 years.
[2] From Lockport, Ill., gage. Mechanical failure gave only partial data at Station.

Rainfall intensities reported herein were compared with the Rainfall Intensity-Duration-Frequency Curves for Chicago, Ill. (2). This data tends to indicate near normal rainfall characteristics for the period sampled. Six storms during the sample period had 30-minute intensities equal to or in excess of the 2-year return period. Two storms had 30-minute intensities equal to the 5-year return period and one storm had a 30-minute intensity equal to the 20-year return period.

The product of the total energy and maximum 30-minute intensity measures the interaction effect of the two rainfall characteristics on soil loss as reported by Wischmeier and Smith (5). They designated the term as the E X I variable. The E X I value explained from 72 to 97 percent of the variation in individual storm erosion from tilled continuous fallow plots on six different soils. Similar seasonal E X I values computed by adding the E X I values for the storms greater than 0.50 inch explained 94 percent of the yearly deviation in the total soil loss. The summed E X I values also explained 72 to 85 percent of the yearly variation in soil loss within corresponding cover periods. According to Wischmeier (4), the erosion potential can be readily computed from local rainfall records from which all intensities of each storm can be determined.

In this study, E X I values were greater during the months of June and July than during the remaining months of the year (Table 3). Greater E X I values were obtained for the third crop-stage period, July 15 to October 14, than for other crop-stage periods (Table 4). However, when the time factors for the various periods are considered, the greatest daily erosion potential due to rainfall occurs during the second crop-stage period, June 15 through July 14. This is the period in which the surface of row cropped land is exposed to the greatest energy force of falling raindrops. Figure 2 shows the

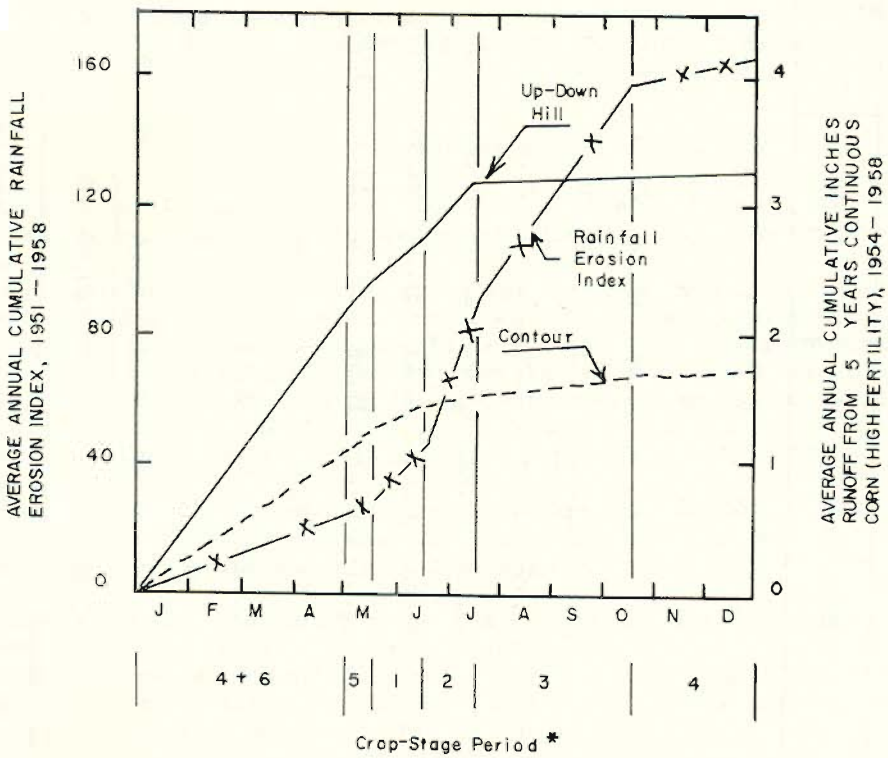

FIGURE 2.--Effect of contouring on average annual cumulative inches runoff from 5 years continuous corn and average annual cumulative rainfall erosion index by crop-stage periods. (*Crop-stage periods: 1, Seedbed; 2, establishment and growing; 3, reproduction and maturity; 4, residue; 5, rough plow; 6, losses from thaw and/or snow-ice melt.)

TABLE 3.--Rainfall erosion index[1] values by months, 1950-1958, Elwood, Ill., SWC b10-3 Illinois 7

EROSION INDEX VALUES BY YEARS

Month	1950	1951	1952	1953	1954	1955	1956	1957	1958	Total	Average	Cumu-lative
January	4.30	2.40	1.25	0	0.69	0.94	0	0	0	99.58	1.06	--
February	0	1.43	0	0	41.83	0	1.95	.40	0	45.61	5.07	6.13
March	0	0	1.09	11.52	29.41	0	5.30	2.63	0	49.95	5.55	11.68
April	23.0	11.65	3.73	1.95	10.92	2.02	56.94	6.93	1.67	118.81	13.20	24.88
May	2.95	12.33	3.20	6.91	25.07	4.32	9.04	6.79	6.90	77.51	8.61	33.49
June	45.58	13.82	67.27	40.50	15.45	2.67	7.59	21.43	43.04	257.35	28.59	62.08
July	53.22	26.63	20.43	81.23	91.84	9.28	48.26	111.14	63.04	505.07	56.12	118.20
August	12.41	38.61	15.98	39.70	19.52	31.45	0	2.85	19.16	179.68	19.96	138.16
September	26.52	86.53	24.91	1.24	0	1.25	0	2.63	1.71	144.79	16.09	154.25
October	2.12	.95	1.13	3.65	50.94	18.07	0	4.39	1.99	82.34	9.15	163.40
November	.79	12.09	2.74	.61	0	6.08	0	.94	.55	23.08	2.64	166.04
December	0	1.29	1.21	2.64	.76	0	0	2.36	.15	8.41	.94	166.98
Total	170.89	207.73	142.90	189.90	286.40	76.08	129.10	162.49	137.21	1,502.18		

[1] Rainfall Erosion Index Value = $\frac{\text{Total E X I values per storm per month}}{100}$

E X I value per storm = Accumulated rainfall energy (in foot-tons per acre) per storm x max. 30-min. intensity (in inches per hour) per storm.

TABLE 4.--Rainfall erosion index[1] by crop-stage periods and relative daily erosion potential

Crop-stage period No.	Dates covered	No. days	Erosion index	Average daily erosion index	Relative daily erosion potential[2]
1	May 15 through June 14	31	18.60	0.60	1.30
2	June 15 through July 14	30	42.36	1.41	3.07
3	July 15 through Oct. 14	92	68.69	.75	1.63
4	Oct. 15 through Apr. 30	198	33.04	.17	.37
	(Oct. 15 through Dec. 31)	(78)	(8.16)	(.10)	(.22)
	(Jan. 1 through Apr. 30)	(120)	(24.86)	(.21)	(.46)
5	May 1 through May 14	14	4.30	.31	.67
		365	166.99	.46	1.00

[1] Erosion Index = EI ÷ 100.
[2] Relative daily erosion potential is a ratio of the average daily EI during a crop-stage period divided by the average yearly daily EI value expressed as 100.

effect of contouring on average annual cumulative inches of runoff from 5 years of continuous corn and average annual cumulative rainfall erosion index by crop-stage periods. Figure 3 shows the effect of contouring on average annual cumulative tons of soil loss from 5 years of continuous corn and average annual cumulative rainfall erosion index by crop-stage periods.

Runoff

Soil and water losses have been variable for this study. In some cases this variability would not appear to be entirely due to treatment differences included in the study.

Runoff is reported by years and crop-stage periods for the various treatments for the 1951-53 period (Appendix Table A). Runoff was low for all treatments during the first 3 years of the 1954-58 period (Appendix Table B) with the greater amounts occurring in 1957 and 1958. Most of the runoff occurred from ice and snow melt. The greatest average annual water losses occurring during the growing season were obtained for crop-stage period No. 2. The storms of July 6 and 7, 1954, and July 12 and 13, 1957, caused the greatest amount of runoff for the 1951-58 period (Appendix Table C).

The average annual runoff from 5 years of continuous corn at a high level of nitrogen fertility and farmed on the contour was 1.61 inches as compared with 3.25 inches for the same treatment farmed up and down the slope (Figure 4).

Runoff was less on contoured plots than on those farmed up and down the slope. Nitrogen fertility level had little, if any, effect on runoff in this study. Continuous corn plots had slightly greater runoff than corn plots in the 3- and 4-year rotations, which included legumes. The rotation including stand-over legume showed no advantage in reducing runoff as compared with the rotation with a legume catch crop.

Soil Losses

Soil losses from corn plots farmed up and down the slope were greater than from plots farmed on the contour. Soil losses were low except for a very few individual storms

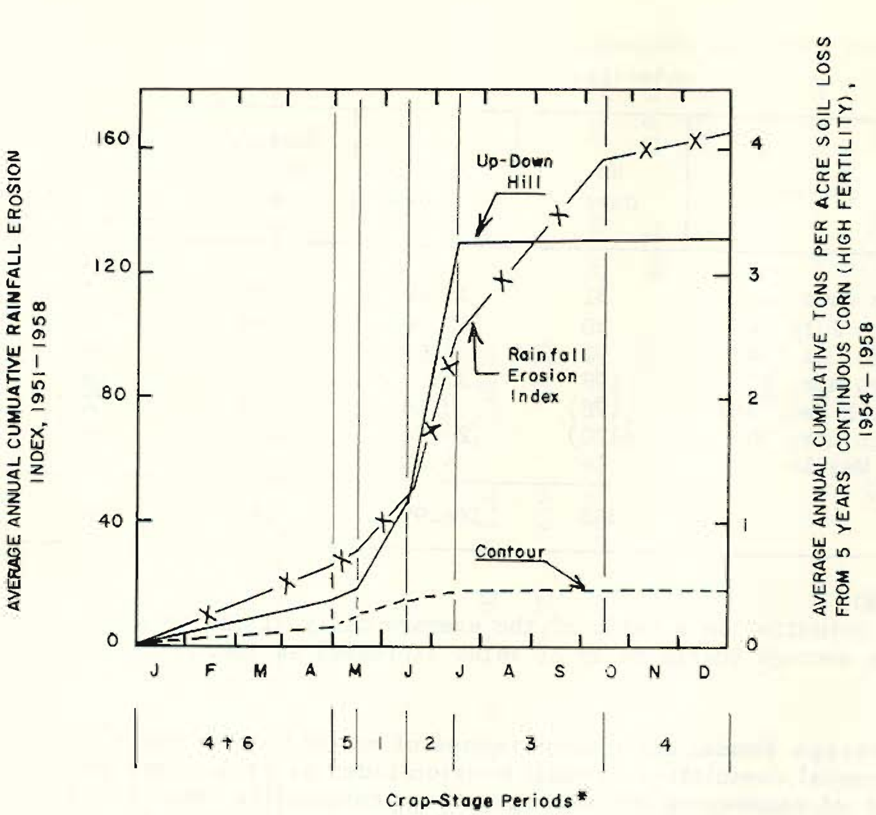

FIGURE 3.--Effect of contouring on average annual cumulative soil loss from 5 years of continuous corn and average annual rainfall erosion index by crop-stage periods. (*Crop-stage periods: 1, Seedbed; 2, establishment and growing; 3, reproduction and maturity; 4, residue; 5, rough plow; 6, losses from thaw and/or snow-ice melt.)

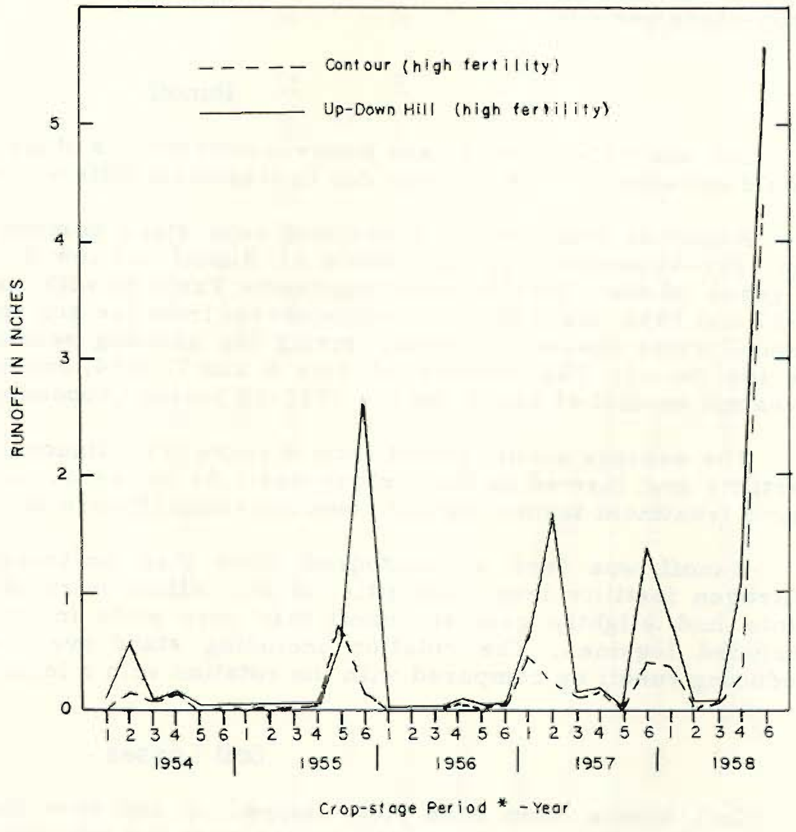

FIGURE 4.--Effect of row direction on runoff from 5 years of continuous corn, 1954 through 1958. (*Crop-stage periods: 1, seedbed; 2, establishment; 3, reproduction and maturity; 4, residue; 5, rough-plow; 6, losses from thaw and/or snow-ice melt.

during this study. Prior to the initiation of the erosion study, the plot area had been in meadow for a number of years, which probably resulted in low soil and water losses from all plots. Generally, the greatest soil losses occurred during crop-stage period No. 2 (1 month to 2 months after planting date).

Soil losses for the first portion of the study (1951-53) were very low for all treatments (Appendix Table D). The greatest soil loss for this period occurred during a rainstorm of 3.14 inches on June 13 and 14, 1952 (Appendix Table E).

Soil losses for the 1954-58 sampling period was greatest during the 1957 and 1958 seasons (Appendix Table F). The practice of contour tillage resulted in the greatest reduction in soil loss for this study (Table 5). Average annual soil loss for 5 years of continuous corn at the high nitrogen fertility level farmed on the contour was 0.46 tons per acre as compared to 3.29 tons per acre for plots similarly treated but tilled up and down the slope. Effect of row direction on soil loss by crop-stage periods from 5 years of continuous corn is shown in Figures 5 and 6. The level of fertility did not show any appreciable effect on soil loss. The low level fertility plots averaged nearly 90 bushels of corn per acre; consequently, large quantities of residues were incorporated on all plots.

TABLE 5.--Effect of rotation, row direction and nitrogen level on average annual soil loss by crop-stage periods, 1954-1958

Rotation row direction nitrogen[1]	Crop	Crop-stage periods[2]						Annual total
		1	2	3	4	5	6	
		Tons/a.	*Tons/a.*	*Tons/a.*	*Tons/a.*	*Tons/a.*	*Tons/a.*	*Tons/a.*
Continuous corn contour, H. N.	C	0.14	0.05	0.02	0.10	0.11	0.04	0.46
Continuous corn up-down slope, H. N.	C	0.68	2.12	0.02	0.32	0.10	0.05	3.29
Continuous corn up-down slope, L. N.	C	0.70	1.66	0.03	0.25	0.14	0.05	2.80
C-C-O(cl)	C_1	0.56	1.53	0.08	0.17	0.17	0.03	2.50
Up-down slope	C_2	0.51	1.05	0.03	0.17	--	0.05	1.80
	O	0.06	T[3]	0.02	T	0.08	T	0.15
Rotation Average		0.38	0.86	0.04	0.11	0.08	0.03	1.48
C-C-O-H	C_1	0.32	2.08	T	0.27	0.11	0.03	2.79
up-down slope	C_2	0.56	1.97	0.03	0.23	--	0.08	2.87
	O	0.03	T	0.01	0	--	--	0.04
		4A	4B	4C	4D			
	H	T	0.02	T	0.02	0.02	0.01	0.07
Rotation Average								1.44

[1] H.N.--100 lb. N_2/A; L.N. 8 lb. N_2/A.
[2] Crop stage periods: 1, Seedbed; 2, establishment; 3, reproduction and maturity; 4, residue; 5, rough-plow; and 6, snow-ice melt.
[3] T = trace.

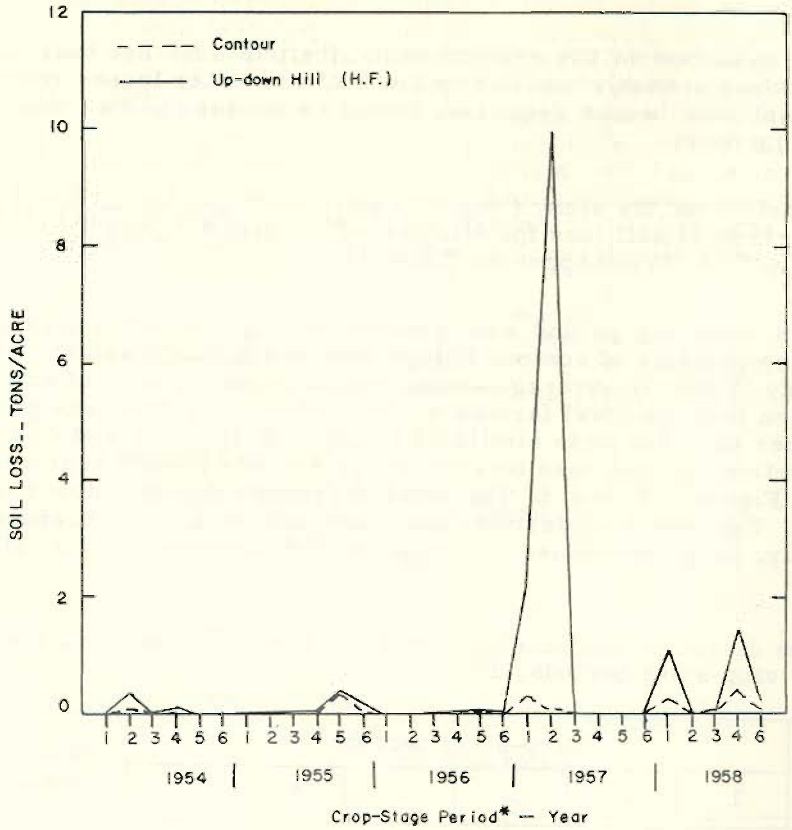

FIGURE 5.--Effect of row direction on soil loss from 5 years continuous corn. (*Crop-stage periods: 1, Seedbed; 2, establishment; 3, reproduction and maturity; 4, residue; 5, rough-plow; 6, losses from thaw and/or snow-ice melt.)

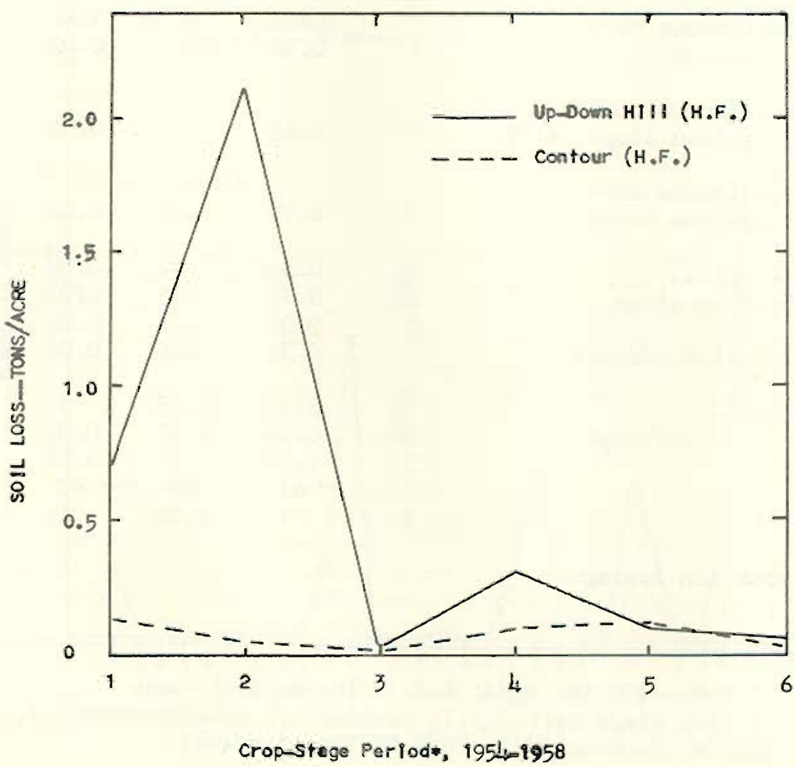

FIGURE 6.--Effect of row direction on average annual soil loss from 5 years of continuous corn by crop-stage periods. (*Crop-stage periods: 1, Seedbed; 2, establishment; 3, reproduction and maturity; 4, residue; 5, rough-plow; 6, losses from thaw and/or snow-ice melt.

Unexpected variation in erosion during the 1954-58 period occurred during the 5.75 inch rainstorm of July 12 and 13, 1957 (Appendix Table G). Soil physical measurements were made on samples collected from the plots in April 1958 in an attempt to find reasons for the variability in soil losses caused by this storm (Appendix Table H). Only aggregate stability appeared to have any relationship to the soil loss variation between plots treated alike (Plots 7 and 13 vs. 6 and 12) (Table 6). In any pair of replicated plots, that plot having the greatest soil loss also had the highest percent of stable aggregates. It is reasoned that the high rain intensity and resulting runoff rate produced high overland flow depths and velocities required to transport large soil particles. This unexpected variation points up the need for research in the various phases of mechanics of erosion.

TABLE 6.--Soil losses for 5.75" storm (July 12 and 13, 1957) and percent water stable aggregates from 5 years of continuous corn plots

Plot No.	Row direction	Nitrogen level	Soil loss	Stable aggregates after sieving	
				5 min.	10 min.
			Tons/a.	*Pct. by wt.*	*Pct. by wt.*
1	Contour	High	0.10	41.0	30.7
2	do.	do.	.09	47.1	29.4
7	Up-down	do.	14.08	50.1	40.2
13	do.	do.	5.97	39.6	31.2
6	do.	Low	8.33	44.6	37.6
12	do.	do.	6.20	39.6	32.8

Crop Yields

Data on crop yields indicated a favorable response from contouring and nitrogen (Table 7 and Appendix Table I). For the 1954-58 period an average yield of 97.2 bushels per acre was produced on plots planted to continuous corn with a high level of nitrogen fertility and farmed on the contour. Plots similarly treated but farmed up and down the slope had an average yield of 93.4 bushels per acre. Five years of continuous corn with a low level of nitrogen fertility and farmed up and down the slop gave an average yield of 89.3 bushels per acre.

The 4-year rotation with stand-over legume produced higher average annual corn and oat yields than the 3-year rotation with a legume catch-crop. The average annual corn yield for the corn-corn-oats-hay rotation was 100.2 and 95.3 bushels per acre for the first and second year corn, respectively, while the average annual corn yield for corn-corn-oats (clover) was 88.4 and 85.2 bushels per acre for first and second year corn, respectively.

Average annual oat yield was 89.9 bushels per acre for the corn-corn-oats-hay rotation compared with an average annual oat yield of 86.9 bushels per acre for the corn-corn-oats (clover) rotation.

TABLE 7.--Effect of row direction, cropping system, fertility level on crop yields, 1954-1958

Rotation row direction fertility[1]	Crop	Yield		
		Corn	Oats	Hay
		Bu./a.	*Bu./a.*	*Tons/a.*
Continuous corn contour H. N. (av. 2 plots)	C	97.2	--	--
Continuous corn Up-down slope H. N. (av. 2 plots)	C	93.4	--	--
Continuous corn Up-down slope L. N. (av. 2 plots)	C	89.3	--	--
C-C-O(cl) Up-down slope	C_1	88.4	--	--
	C_2	85.2	--	--
	O		86.9	--
C-C-O-H Up-down slope	C_1	100.2	--	--
	C_2	95.3	--	--
	O	--	89.5	--
	H	--	--	3.51

[1] H. N. = High nitrogen level
L. N. = Low nitrogen level

SUMMARY

Data are presented for 8 years showing the effects of row direction, nitrogen fertility level, and cropping system on runoff and soil and water losses and crop yield from a plastic till soil in northeastern Illinois.

The erosion potential for this study, computed as the product of rainfall energy and maximum 30-minute intensity of the storm, shows that the greatest amount of erosion can be expected to occur in June and July. The greatest daily erosion potential occurs in the crop-stage period of from 1 to 2 months after planting (usually June 15 through July 14).

Runoff and soil losses were generally lower than would be expected in the area. It should be recognized that the plots were only 100 feet in length and that the soil condition sampled was undoubtedly less conducive to runoff and erosion than similar slopes in the area that had a more intensive cropping history.

The greatest water losses occurred in 1957 and 1958. Most of the runoff during the winter period was caused by melting snow and ice. The greatest average annual water losses during corn production occurred from 1 to 2 months after corn planting. Water losses were two times greater from corn farmed up and down the slope than from corn farmed on the contour.

On plots farmed to continuous corn for 5 years with a high nitrogen fertility level, the average annual soil loss was seven times greater from those plots farmed up and down the slope than from those farmed on the contour. Nitrogen fertility level did not affect soil losses. High productivity of both the high and low nitrogen fertility level plots resulted in the incorporation of large quantities of residues for the two treatments. Average annual soil losses from corn in the 3- and 4-year rotations were only slightly less than the soil losses from 5 years of continuous corn. Soil loss was greater from corn at the stage of crop growth from 1 to 2 months after planting than from other growth periods.

Highest yields were obtained from contour plots, high nitrogen level applications, and rotations that included legumes.

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APPENDIX TABLE A.--Effect of rotation and row direction on runoff, 1951-1953

Rotation and row direction	Crop	Plot No.	Year	Runoff: Crop-stage periods[1] [2] 1	2	3	4	6	Annual total
				In.	*In.*	*In.*	*In.*	*In.*	*In.*
C-C-O(cl) Contour	C_1	3	1951	0.02	0.01	0.01	0.01	0	0.05
		2	1952	1.04	0	0	0	0	1.04
		1	1953	.01	0	.02	.04	0	.07
Average				.36	T[3]	.01	T	0	.39
	C_2	1	1951	T	.01	.01	.01	0	.03
		3	1952	1.44	0	0	0	0	1.44
		2	1953	0	0	.01	.06	0	.07
Average				.48	T	.01	.02	0	.51
	O	2	1951	.02	.01	T	.01	0	.04
		1	1952	0	.01	0	0	0	.01
		3	1953	0	T	0	.05	0	.05
Average				.01	.01	T	.02	0	.03
C-C-O(cl) Up-down slope	C_1	6	1951	.03	.01	.04	.01	0	.09
		5	1952	.97	0	0	0	0	.97
		4	1953	.02	0	.33	.06	0	.41
Average				.32	T	.12	.02	0	.49
	C_2	4	1951	.02	.01	.02	.01	0	.06
		6	1952	1.10	0	0	0	0	1.10
		5	1953	.10	0	.38	.06	0	.54
Average				.41	T	.13	.02	0	.57
	O	5	1951	.02	.01	.01	T	0	.04
		4	1952	0	.04	0	0	0	.04
		6	1953	0	T	0	0	0	T
Average				.01	.02	T	T	0	.03
C-O-H Up-down slope	C	9	1951	.01	.01	.01	T	0	.03
		8	1952	.76	0	0	0	0	.76
		7	1953	T	T	.18	.30	0	.48
Average				.26	T	.06	.10	0	.42
	O	7	1951	.10	.02	T	T	0	.12
		9	1952	0	.02	0	0	0	.02
		8	1953	0	T	0	0	0	T
Average				.03	.01	T	T	0	.05
	H	8	1951	1.92	.08	T	T	.19	2.19
		7	1952	0	.02	0	0	0	.02
		9	1953	0	T	0	.50	0	.50
Average				.64	.03	T	.17	.06	.90
C-O-H-H Up-down slope	C	13	1951	.02	T	.01	.04	0	.07
		12	1952	.63	0	0	0	0	.63
		11	1953	.01	0	.16	.06	0	.23
Average				.22	T	.06	.03	0	.31
	O	10	1951	.50	.01	T	T	0	.51
		13	1952	0	.12	0	0	0	.12
		12	1953	0	T	0	0	0	T
Average				.17	.04	T	T	0	.21
	H	11	1951	[4] 1.95	.03	T	--	.19	2.17
		10	1952	0	0	T	--	0	T
		13	1953	0	T	0	--	0	T
Average				.65	.01	T	--	.06	.72
	H	12	1951	[4] 1.64	.03	T	0	.19	1.86
		11	1952	0	T	0	0	0	T
		10	1953	0	T	0	1.04	0	1.04
Average				.55	.01	T	.35	.06	.97

[1] Crop-stage periods: 1--seedbed, 2--establishment, 3--reproduction and maturity, 4--residue, 5--rough-plow, and 6--snow-ice melt.
[2] Period 5 not included in measurement from 1951-1953 as plots were planted immediately after plowing.
[3] T = Trace.
[4] January 1 to April 1, 1951.

APPENDIX TABLE 8.--Effect of row direction, cropping system and fertility level on runoff, 1954-1958

Rotation, row direction, fertility[1]	Crop	Year	Runoff						
			Crop-stage periods[2]						Annual total
			1	2	3	4	5	6	
			In.	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
Continuous Corn-- Contour H. F. (Av. of 2 plots)		1954	0.01	0.17	0.08	0.14	(3)	0.0	0.40
		1955	0	0	.02	.01	.73	.15	.91
		1956	.02	.02	0	.06	.01	.02	.13
		1957	.44	.22	.10	.16	0	.41	1.33
		1958	.38	.03	.07	.29	(3)	4.31	4.55
Average			.17	.09	.05	.13	.19	.98	1.61
Continuous Corn-- Up-down slope H. F. (Av. of 2 plots)		1954	.05	.59	.08	.11	(3)	0	.83
		1955	0	0	T[4]	T	.68	2.62	3.30
		1956	.03	.02	0	.10	.02	.03	.20
		1957	.62	1.70	.13	.20	0	1.38	4.03
		1958	.75	.04	.07	1.18	(3)	5.66	8.06
Average			.29	.47	.06	.32	.18	1.94	3.25
Continuous Corn-- Up-down slope H. F. (Av. of 2 plots)		1954	.01	.96	.11	.30	(3)	0	1.45
		1955	0	0	T	T	.88	1.61	2.49
		1956	.03	.03	0	.12	.06	.04	.86
		1957	.86	1.80	.23	.21	0	.84	3.94
		1958	1.00	.06	.13	1.11	(3)	4.89	7.19
Average			.38	.57	.09	.35	.24	1.48	3.11
C-C-O(cl)	C_1	1954	T	.63	.12	.14	(3)	0	.89
		1955	0	0	0	T	.90	.67	1.57
		1956	.03	.03	0	.09	.07	.04	.26
		1957	.94	1.12	.24	.17	0	.72	3.19
		1958	.50	.02	.05	1.00	(3)	4.23	5.80
Average			.29	.36	.08	.28	.32	1.13	2.46
C-C-O(cl)	C_2	1954	.18	1.11	.10	.11	--	0	1.50
		1955	0	0	0	T	--	1.22	1.22
		1956	.01	.02	0	0	--	.02	.05
		1957	.88	1.71	.20	.19	--	.32	3.30
		1958	.94	.06	.18	.93	--	4.64	6.75
Average			.40	.58	.10	.24	--	1.24	2.56
C-C-O(cl)	O	1954	0	T	.01	.18	0	0	.19
		1955	0	0	0	T	.66	.85	1.51
		1956	.57	.05	.04	.04	.03	.02	.75
		1957	.06	.05	1.85	.20	0	.55	2.71
		1958	.06	0	.31	1.01	(3)	3.31	4.69
Average			.14	.02	.44	.29	.17	.95	2.01
Rotation Average			.28	.32	.23	.27	.16	1.11	2.34
C-C-O-H	C_1	1954	T	.50	.02	.09	0	0	.61
		1955	0	0	0	T	.79	2.29	3.08
		1956	.03	.03	0	.07	.05	.01	.19
		1957	.87	2.02	.21	.21	0	1.16	4.47
		1958	.66	.06	.17	2.03	(3)	6.22	9.14
Average			.31	.52	.08	.48	.21	1.94	3.54
C-C-O-H	C_2	1954	T	.27	.01	.09	--	0	.37
		1955	0	0	0	T	--	1.86	1.86
		1956	.03	.03	0	0	--	.05	.11
		1957	.81	2.12	.17	.12	--	.83	4.05
		1958	.96	.06	.09	2.25	--	7.14	10.50
Average			.36	.50	.05	.49	--	1.98	3.38
C-C-O-H	O	1954	T	T	.01	.01	--	0	.02
		1955	0	0	0	0	--	0	0
		1956	.35	.07	.06	0	--	0	.48
		1957	.14	.12	3.69	.17	--	0	4.12
		1958	.03	0	.32	.03	--	5.40	5.78
Average			.10	.04	.82	.04	--	1.08	2.08
			4A	4B	4C	4D			
C-C-O-H	H	1954	.39	.05	.05	0	0	0	.49
		1955	.16	0	0	T	.26	.55	.97
		1956	T	.17	.02	.06	.03	2.55	2.83
		1957	.01	.37	2.94	.21	0	1.39	4.92
		1958	.13	.52	.10	1.86	(3)	9.04	11.65
Average			.14	.22	.60	.43	.07	2.71	4.17
Rotation Average									3.29

[1] H. F. = High fertility, L. F. = low fertility.
[2] Crop-stage periods: 1--Seedbed, 2--establishment, 3--reproduction and maturity, 4--residue, 5--rough-plow, and 6--snow-ice melt.
[3] Period No. 5 not represented as plots were planted immediately after plowing.
[4] T = Trace.

APPENDIX TABLE C.--Effect of major rainstorms on runoff from corn, 1951-1958

Date	Total rain-fall	Crop-stage period[1]	Runoff										
			Continuous corn			C_1-C_2-O(cl)		C_1-C_2-O-H		C-O-H	C-O-H-H	C_1-C_2-O(cl)	
			Contour HF[2]	Up-down HF[2]	Up-down LF[2]	Up-down		Up-down		Up-down	Up-down	Contour	
						C_1	C_2	C_1	C_2	C	C	C_1	C_2
	In.		*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*	*In.*
1951													
9/21 & 22	2.96	3	--	--	--	0.04	0.02	--	--	0.01	0.01	0.01	0.01
1952													
6/12	1.49	1	--	--	--	T	T	--	--	T	T	T	T
6/13 & 14	3.14	1	--	--	--	.97	1.10	--	--	.76	.63	.52	.72
1953													
7/5 & 6	3.07	2	--	--	--	0	.02	--	--	T	0	0	0
1954													
7/6 & 7	4.16	2	.18	.58	.95	.63	1.11	.51	.27	--	--	--	--
1955													
8/29	2.37	3	0	0	0	0	0	0	0	--	--	--	--
1956													
7/16	1.57	2	.02	.02	.03	.03	.02	.03	.03	--	--	--	--
1957													
6/12 & 13	1.76	1	.12	.26	.34	.35	.37	.25	.42	--	--	--	--
6/17 & 18	1.55	1	.26	.30	.40	.50	.38	.42	.37	--	--	--	--
6/27 & 28	2.25	1	.03	.11	.10	.08	.11	.19	0	--	--	--	--
7/12 & 13	5.75	2	.21	1.64	1.64	1.12	1.62	1.89	1.96	--	--	--	--
1958													
6/8 & 9	1.91	1	.10	.19	.26	.14	.22	.08	.24	--	--	--	--
6/9 & 10	1.29	1	.14	.23	.33	.17	.25	.12	.29	--	--	--	--
6/12 & 13	1.89	2	.12	.30	.35	.17	.41	.40	.39	--	--	--	--
7/2	1.54	2	.02	.02	.03	.01	.03	.03	.03	--	--	--	--
Totals for Major Storms													
1951-53	--	--	--	--	--	1.01	1.14	--	--	0.77	0.64	0.53	0.73
1954-58	--	--	1.20	3.65	5.33	3.20	4.52	3.92	4.00	--	--	--	--
Totals for All Storms													
1951-53	--	--	--	--	--	1.47	1.70	--	--	1.27	.93	1.16	1.54
1954-58	--	--	7.32	16.42	15.93	11.71	12.82	17.49	16.89	--	--	--	--
Percentage of Major Storms to All Storms													
1951-53	--	--	--	--	--	69	67	--	--	61	69	46	47
1954-58	--	--	16	22	33	27	29	22	24	--	--	--	--

[1] Crop-stage periods: 1--Seedbed, 2--establishment, 3--reproduction and maturity, 4--residue, 5--rough-plow, and 6--snow-ice melt.
[2] HF = High fertility, LF = low fertility.

APPENDIX TABLE D.--Effect of rotation and row direction on crop yields and soil losses by crop-stage periods, average 1951-1953

Rotation and row direction	Crop	Plot Nos.	Crop yield	Average soil loss						Annual total
				Crop-stage periods[1]						
				1	2	3	4	5	6	
			Bu./a. or Ton/a.	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*
C-C-O(cl) Contour	C_1	3,2,1	85.5	0.161	0.005	0.006	0.015	--	0	0.187
	C_2	1,3,2	78.7	.195	.001	.006	.027	--	0	.229
	O	2,1,3	59.5	.015	.043	.003	.001	--	0	.062
Average				.124	.016	.005	.014	--		.159
C-C-O(cl) Up-down slope	C_1	6,5,4	85.0	.268	.002	.058	.026	--	0	.354
	C_2	4,6,5	89.2	.380	.002	.052	.029	--	0	.463
	O	5,4,6	62.2	.003	.003	.005	.002	--	0	.016
Average				.217	.002	.038	.019	--		.278
C-O-H Up-down slope	C	9,8,7	84.2	.183	.002	.028	.050	--	0	.263
	O	7,9,8	67.0	.022	.005	.001	.001	--	0	.029
	H	8,7,9	2.78	.016	.027	.001	.004	--	.003	.050
Average				.074	.011	.010	.018	--	.001	.114
C-O-H-H Up-down slope	C	13,12,11	93.4	.194	.001	.022	.016	--	0	.233
	O	10,13,12	[2] 55.3	.033	.008	.001	0	--	0	.042
	H_1	11,10,13	2.39	.014	.041	.003	0	--	.001	.059
	H_2	12,11,10	3.34	.034	.036	0	.008	T[3]	.004	.083
Average				.069	.021	.006	.002	--	.001	.104

[1] Crop-stage periods: 1--Seedbed, 2--establishment, 3--reproduction and maturity, 4--residue, 5--rough-plow and 6--snow-ice melt. No rough plow period for corn during 1951-53 as plots were planted immediately after plowing.
[2] Average of 1951 and 1952. No record for 1953.
[3] T = trace.

APPENDIX TABLE E.--Effect of major rainstorms on soil loss from corn, 1951-1958

Date	Total rain-fall	Crop-stage period[1]	Soil loss: Continuous corn, Contour HF[2]	Continuous corn, Up-down HF[2]	Continuous corn, Up-down LF[2]	C-C-O(cl), Up-down, C1	C-C-O(cl), Up-down, C2	C-C-O-H, Up-down, C1	C-C-O-H, Up-down, C2	C-O-H, Up-down, C	C-O-H-H, Up-down, C	C-C-O(cl), Contour, C1	C-C-O(cl), Contour, C2
	In.		*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*
1951													
9/21 & 22	2.96	3	--	--	--	0.01	0.01	--	--	T[2]	T	0.01	T[3]
1952													
6/12	1.49	1	--	--	--	T	.01	--	--	T	T	T	T
6/13 & 14	3.14	1	--	--	--	.76	1.10	--	--	.51	.53	.22	.28
1953													
7/5 & 6	3.07	2	--	--	--	0	.02	--	--	T	.01	0	0
1954													
7/6 & 7	4.16	2	.12	.51	.79	.59	.83	.21	.23	--	--	--	--
1955													
8/29	2.37	3	0	0	0	0	0	0	0	--	--	--	--
1956													
7/16	1.57	2	T	T	T	T	T	T	T	--	--	--	--
1957													
6/12 & 13	1.76	1	.12	.96	1.00	.93	.83	.46	.73	--	--	--	--
6/17 & 18	1.55	1	.22	1.20	1.16	1.45	.79	.75	.98	--	--	--	--
6/27 & 28	2.25	1	.02	.06	.07	.05	.05	.04	0	--	--	--	--
7/12 & 13	5.75	2	.09	10.02	7.26	7.03	3.74	9.98	9.30	--	--	--	--
1958													
6/8 & 9	1.91	1	0.09	0.34	0.43	0.14	0.32	0.04	0.38	--	--	--	--
6/9 & 10	1.29	1	.13	.37	.46	.13	.40	.06	.39	--	--	--	--
6/12 & 13	1.89	2	.08	.40	.34	.07	.56	.22	.30	--	--	--	--
7/2	1.54	2	.01	.01	.01	0	.02	T	.02	--	--	--	--
Totals for Major Storms													
1951-53	--	--	--	--	--	0.77	1.14	--	--	0.51	0.54	0.23	0.28
1954-58	--	--	.88	13.87	11.52	10.39	7.54	11.86	12.33	--	--	--	--
Totals of All Storms													
1951-53	--	--	--	--	--	1.06	1.39	--	--	.79	.70	.56	.69
1954-58	--	--	2.17	16.46	14.01	12.50	9.02	13.95	14.33	--	--	--	--
Percentage of Major Storms to All Storms													
1951-53	--	--	--	--	--	73	82	--	--	65	77	41	41
1954-58	--	--	41	84	82	83	84	85	86	--	--	--	--

[1] Crop-stage periods: 1--Seedbed, 2--establishment, 3--reproduction and maturity, 4-- residue, 5--rough-plow, and 6--snow-ice melt.
[2] HF = High fertility, LF = low fertility.
[3] T = trace.

APPENDIX TABLE F.--Effect of rotation, row direction, and nitrogen level on soil loss, 1954-1958

Rotation, row direction, and nitrogen[1]	Crop	Year	Soil Loss: Crop-stage periods[2] 1	2	3	4	5	6	Annual Total
			Ton/a.	Ton/a.	Ton/a.	Ton/a.	Ton/a.	Ton/a.	Ton/a.
Continuous corn, contour, H. N.	C	1954	0.01	0.13	0.03	0.07	(3)	0	0.24
		1955	0	0	T[4]	.01	.40	.06	.47
		1956	T	T	0	.01	.03	.02	.06
		1957	.36	.10	.01	T	0	.04	.51
		1958	.32	.01	.04	.42	(3)	.10	.89
Average			.14	.05	.02	.10	.11	.04	.46
Continuous corn, Up-down slope, H. N.	C	1954	.03	.51	.02	.07	(3)	0	.63
		1955	0	0	T	T	.39	.16	.55
		1956	T	T	0	.01	.02	T	.03
		1957	2.24	10.08	.07	.02	0	.09	12.50
		1958	1.14	.01	.01	1.50	(3)	.09	2.75
Average			.68	2.12	.02	.32	.10	.05	3.29
Continuous corn, Up-down slope, L. N.	C	1954	0	.79	.02	.10	(3)	0	.91
		1955	0	0	0	T	.55	.14	.69
		1956	T	T	0	.01	.02	T	.03
		1957	2.24	7.49	.14	.02	0	.07	9.96
		1958	1.25	.01	.01	1.12	(3)	.03	2.42
Average			.70	1.66	.03	.25	.14	.05	2.80
C-C-O(cl) Up-down slope	C_1	1954	0	.60	.02	0	0	.03	.65
		1955	0	0	0	T	.68	.09	.77
		1956	.01	T	0	.01	T	T	.02
		1957	2.44	7.03	.35	.02	0	.02	9.86
		1958	.36	T	.01	.81	(3)	.02	1.20
Average			.56	1.53	.08	.17	.17	.03	2.50
C-C-O(cl) Up-down slope	C_2	1954	.12	.84	.02	T	--	0	.98
		1955	0	0	0	T	--	.15	.15
		1956	.01	T	0	0	--	T	.01
		1957	1.69	3.81	.11	T	--	.03	5.64
		1958	.73	.58	.01	.83	--	.08	2.24
Average			.51	1.05	.03	.17	--	.05	1.80
C-C-O(cl) Up-down slope	O	1954	0	0	0	0	0	0	0
		1955	0	0	0	0	.32	.01	.33
		1956	.28	T	T	0	.02	T	.30
		1957	.01	T	.06	0	0	T	.07
		1958	.01	0	.02	.02	--	T	.05
Average			.06	T	.02	T	.08	T	.15
Rotation Average			.38	.86	.04	.11	.08	.03	1.48
C-C-O-H Up-down slope	C_1	1954	0	.21	0	.10	0	0	.31
		1955	0	0	0	T	.41	.10	.51
		1956	T	T	0	.01	.02	0	.03
		1957	1.26	10.18	.01	.01	0	.04	11.50
		1958	.35	T	T	1.23	--	.02	1.60
Average			.32	2.08	T	.27	.11	.03	2.79
C-C-O-H Up-down slope	C_2	1954	0	.23	0	.06	--	0	.29
		1955	0	0	0	T	--	.13	.13
		1956	.01	T	0	0	--	T	.01
		1957	1.72	9.58	.14	T	--	.23	11.67
		1958	1.07	.02	.02	1.09	--	.03	2.23
Average			.56	1.97	.03	.23	--	.08	2.87
C-C-O-H Up-down slope	O	1954	0	0	0	0	--	--	0
		1955	0	0	0	0	--	--	0
		1956	.14	T	T	0	--	--	.14
		1957	.01	T	.05	0	--	--	.06
		1958	.01	0	.02	0	--	--	.03
Average			.03	T	.01	0	--	--	.04
			4A	4B	4C	4D			
C-C-O-H Up-down slope	H	1954	.01	0	0	0	0	0	.01
		1955	T	0	0	0	.04	T	.04
		1956	T	.01	T	T	.02	.02	.05
		1957	0	T	.03	0	0	.01	.04
		1958	0	.10	0	.07	--	.02	.19
Average			T	.02	T	.02	.02	.01	.07
Rotation Average									1.44

[1] H. N. = 100 lb. N_2/A, L. N. = 8 lb. N_2/A.
[2] Crop-stage periods: 1--Seedbed, 2--establishment, 3--reproduction and maturity, 4--residue, 5--rough-plow, and 6--snow-ice melt.
[3] Period 5 not represented as plots were planted same day of plowing.
[4] T = trace.

APPENDIX TABLE G.--Soil and water losses for rainstorm of July 12 and 13, 1957 (5.75")

Plot No.	Row direction	Cropping and nitrogen level	1957 crop	Soil loss	Water loss
				Ton/a.	*In.*
1	Contour	Continuous Corn, HN	Corn	0.10	0.21
2	do.	do.	do.	.09	.21
7	Up-down slope	Continuous Corn, HN	Corn	14.08	1.23
13	do.	do.	do.	5.97	2.04
6	Up-down slope	Continuous Corn, LN	Corn	8.33	1.79
12	do.	do.	do.	6.20	1.49
3	Up-down slope	C-C-O(cl)	C_1	7.03	1.12
4	do.	do.	C_2	3.74	1.62
5	do.	do.	O	.06	1.81
8	Up-down slope	C-C-O-H	O	.04	3.56
9	do.	do.	H	.03	2.73
10	do.	do.	C_1	9.98	1.89
11	do.	do.	C_2	9.30	1.96

APPENDIX TABLE H. .--Soil physical data from erosion plots, April 1958

Plot No.	Mechanical composition: Wt. percentage of Sand	Silt	Clay	Bulk Density	Moisture retention (0-6" depth): 1/3 Atm.	15 Atm.	Sample	Saturated hydraulic conductivity: Initial	Ave.	After 1 Hr.	Ave.	Stable aggregates (percent by Wt.): After 5-min. sieving	After 10-min. sieving
				gm./cc.	Pct.	Pct.		In./hr.	In./hr.	In./hr.	In./hr.		
1	32	51	17	1.10	30.7	13.8	a	10.7	--	10.1	--	41.0	30.7
							b	8.7	9.7	8.6	9.4	--	--
2	30	52	18	1.14	31.3	13.8	a	24.9	--	2.9	--	47.1	29.4
							b	6.1	--	5.7	4.3		
3	28	51	21	1.25	29.1	12.9	a	1.1	--	1.0	--	61.2	40.2
							b	4.0	2.5	3.6	2.3	--	--
4	30	54	16	1.26	31.4	13.2	a	4.6	--	3.2	--	49.5	27.3
							b	.1	--	.04	--	--	--
5	33	51	16	1.14	32.9	13.4	a	13.5	--	10.6	--	44.6	32.2
							b	15.3	14.4	11.2	10.9		
6	32	51	19	1.14	33.5	12.9	a	8.6	--	44.4	--	44.6	37.6
							b	10.6	9.6	8.9	--	--	--
7	30	48	22	1.21	32.8	13.0	a	3.8	--	2.1	--	50.1	40.2
							b	6.8	5.3	5.2	3.7	--	--
8	29	51	20	1.17	33.0	12.8	a	11.7	--	7.3	--	50.6	40.1
							b	6.7	9.2	3.3	5.3	--	--
9	32	53	15	1.04	32.5	14.5	a	22.7	--	15.4	--	61.4	46.8
							b	40.4	31.6	19.5	17.5	--	--
10	34	51	15	1.14	32.3	15.2	a	27.9	--	21.3	--	48.6	36.2
							b	5.9	--	1.9	--	--	--
11	34	50	16	1.18	31.4	14.8	a	.6	--	.1	--	45.8	33.7
							b	.6	0.6	.5	--	--	--
12	35	49	16	1.15	29.2	14.8	a	9.9	--	7.2	--	39.6	32.8
							b	10.0	9.9	5.4	6.3	--	--
13	36	49	15	1.12	28.9	14.2	a	11.5	--	20.0	--	39.6	31.8
							b	7.0	9.2	8.5	--	--	--

Procedural Notes: Mechanical composition determined by hydrometer method; single determination.
Bulk-density determined with core samples used in conductivity measurements.
Moisture retention at 1/3 atmosphere tension determined with porous plate apparatus; 15 atmosphere with pressure membrane apparatus.
Aggregate stability determined on aggregates which passed a 4.699 mm. sieve but were retained on a 2.00 mm. sieve.

APPENDIX TABLE I.--Effect of row direction, cropping system, and fertility level on crop yields, 1951-1958

Crop	Year	Continuous corn[1]			C-C-O(cl)		C-C-O-H	C-O-H	C-O-H-H
		Contour HF	Up-down HF	Up-down LF	Contour	Up-down	Up-down	Up-down	Up-down
		Bu./a.	*Bu./a.*	*Bu./a.*	*Bu./a.*	*Bu./a.*	*Bu./a.*	*Bu./a.*	*Bu./a.*
Corn[2]	1951	--	--	--	77.6	89.1	--	84.3	91.6
	1952	--	--	--	84.4	76.3	--	82.4	93.8
	1953	--	--	--	95.4	89.7	--	85.2	94.8
	1954	105.1	106.0	107.7	--	94.9	[3] 110.8	--	--
	1955	44.9	37.5	44.8	--	47.5	44.9	--	--
	1956	95.3	85.0	89.0	--	70.1	99.0	--	--
	1957	120.1	118.5	100.7	--	113.1	117.5	--	--
	1958	120.4	120.0	104.3	--	116.6	128.7	--	--
	Av. 1951-53	--	--	--	85.8	85.0	--	84.2	93.4
	Av. 1954-58	97.2	93.4	89.3	--	88.4	100.2	--	--
Corn[4]	1951	--	--	--	67.6	99.4	99.4	--	--
	1952	--	--	--	76.8	82.2	--	--	--
	1953	--	--	--	91.7	85.8	--	--	--
	1954	--	--	--	--	96.0	([3])	--	--
	1955	--	--	--	--	34.8	52.2	--	--
	1956	--	--	--	--	83.0	88.6	--	--
	1957	--	--	--	--	103.1	121.5	--	--
	1958	--	--	--	--	109.1	118.8	--	--
	Av. 1951-53	--	--	--	78.7	89.1	--	--	--
	Av. 1954-58	--	--	--	--	85.2	95.3	--	--
Oats	1951	--	--	--	68.6	59.7	--	58.4	48.6
	1952	--	--	--	84.4	65.3	--	81.7	62.0
	1953	--	--	--	44.9	61.7	--	60.8	No record
	1954	--	--	--	--	60.4	58.6	--	--
	1955	--	--	--	--	109.2	131.1	--	--
	1956	--	--	--	--	84.4	73.1	--	--
	1957	--	--	--	--	76.7	76.0	--	--
	1958	--	--	--	--	103.6	110.5	--	--
	Av. 1951-53	--	--	--	66.0	62.2	--	67.0	55.3
	Av. 1954-58	--	--	--	--	86.9	89.9	--	--
		Ton/a.	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*	*Ton/a.*
Hay[1]	1951	--	--	--	--	--	--	2.76	2.27
	1952	--	--	--	--	--	--	2.90	2.90
	1953	--	--	--	--	--	--	2.69	2.00
	1954	--	--	--	--	--	3.27	--	--
	1955	--	--	--	--	--	2.63	--	--
	1956	--	--	--	--	--	2.97	--	--
	1957	--	--	--	--	--	3.93	--	--
	1958	--	--	--	--	--	4.75	--	--
	Av. 1951-53	--	--	--	--	--	--	2.78	2.39
	Av. 1954-58	--	--	--	--	--	3.51	--	--
Hay[4]	1951	--	--	--	--	--	--	--	3.15
	1952	--	--	--	--	--	--	--	4.20
	1953	--	--	--	--	--	--	--	2.67
	Av. 1951-53	--	--	--	--	--	--	--	3.34

[1] H. F. = High fertility, L. F. = low fertility.
[2] First year crop.
[3] Two plots in first year corn, second year corn not presented.
[4] Second year crop.