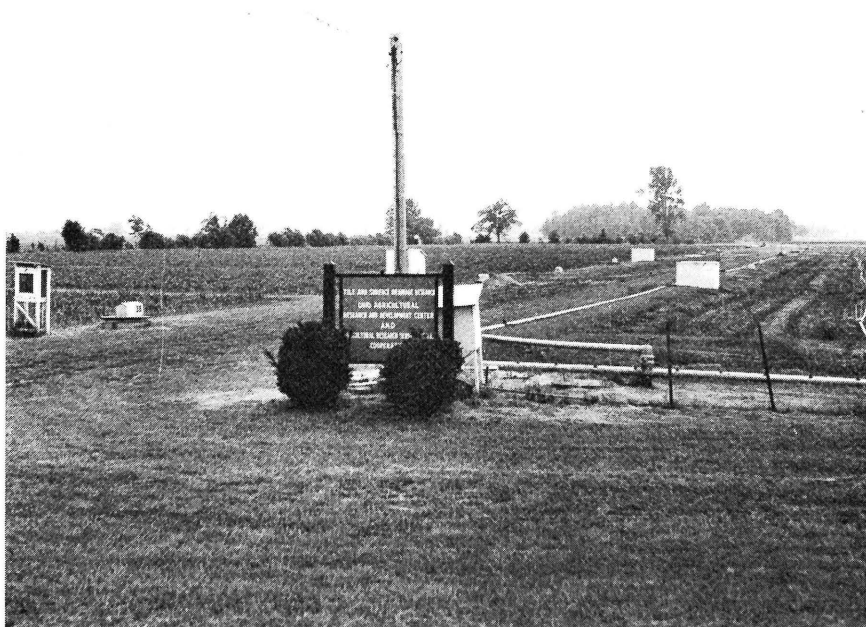


Tile and Surface Drainage of Clay Soils

II. Hydrologic Performance with Field Crops (1962-72)

III. Corn, Oats, and Soybean Yields (1962-72)

G. O. SCHWAB, N. R. FAUSEY and C. R. WEAVER



**OHIO AGRICULTURAL RESEARCH
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ON THE COVER: General view of experimental area.

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INTRODUCTION

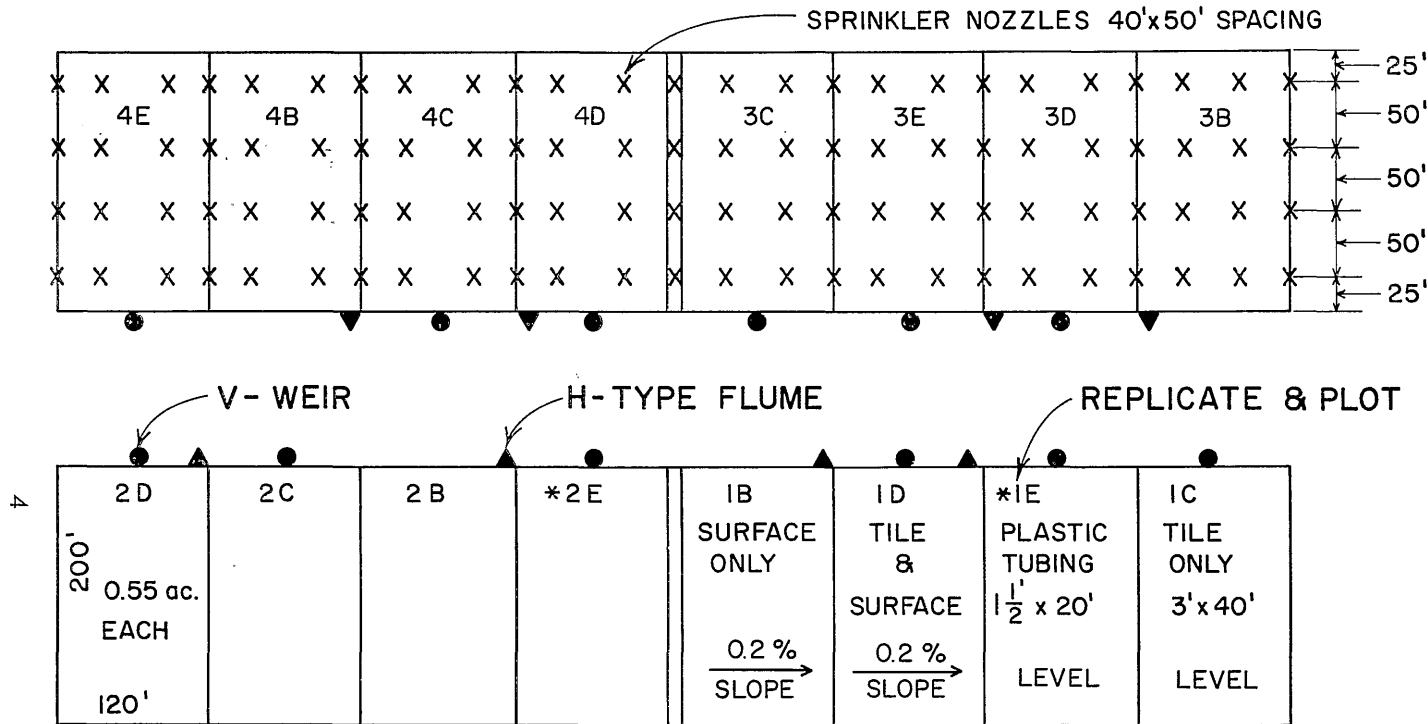
This report summarizes the data collected for the 11-year period, 1962-72, from a long-term field experiment at the North Central Branch, Ohio Agricultural Research and Development Center, near Sandusky. The predominant soil type is Toledo silty clay, typical of the soils in the lake region of the North Central United States. In Part I of this bulletin, Schwab *et al.* (12) reported hydrologic data for the first 3 years, 1959-1961, with the crop tall fescue. In this report as well as in Schwab and Thiel (11), the drainage and irrigation systems, the soils, and the measuring equipment were also described. They found the highest flow came from the combination tile and surface drained plots, followed by surface drainage only and then tile drainage only.

Hoffman and Schwab (3) studied the relationship between tile flow and water table drawdown rates after irrigation. They developed a procedure for estimating tile spacing based on drain flows and water table heights. They predicted that with good surface drainage, tile spacing can be increased about 50% as compared with plots with no surface drainage. Taylor *et al.* (13) measured hydraulic conductivity and other soil properties in a nearby field.

For the years 1962-64, an economic evaluation of the drainage systems by Schwab *et al.* (9) for corn (100 lb./acre of nitrogen) showed that the benefit/cost ratio was highest for surface drainage only (10:1), followed by tile drainage only (6:1), and then by the combination tile-surface drainage system (4:1). These ratios based on undrained plot yields are applicable for high moisture levels artificially produced annually by two 3.0-inch irrigations.

Yields were significantly higher on all three drainage treatments than on the undrained plots, and N increased corn yields significantly at all drainage levels. Comparison of tile flow and surface runoff by Schwab and Fouss (5) showed tile flow from corn (1962-64) was slightly greater than from tall fescue (1960-61), but surface runoff was considerably higher from fescue than from corn. Fausey and Schwab (1)

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* NO DRAINAGE A PLOTS, 1958 -70

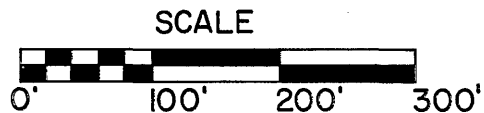
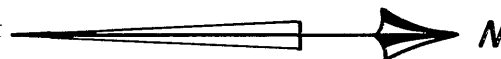


FIG. 1.—Field plot layout (1970 and later) and sprinkler system (1964 and later).

found that 1965 soybean yields decreased in the following order: combination tile and surface, tile only, surface only, and no drainage. Soil moisture content to a 1-foot depth in April and May and soil crust formation, however, increased in about the same order as above.

Water quality studies were started in 1967. Sediment, plant nutrient, and pesticide losses for 1967-69 were reported by Schwab *et al.* (10). A more comprehensive study for 1969-72 was prepared by Schwab *et al.* (8) and Schwab and McLean (6, 7). Water quality results are not included in this report.

FIELD LAYOUT AND PROCEDURES

Cropping and Tillage Practices

Soil and crop management practices for 1958-72 are summarized in Table 1. Plot symbols and descriptions are shown in Figure 1. The

TABLE 1.—Soil and Crop Management Practices, 1958-72.

Year	Crop	Total Irrigation Water in Inches	Fertilizers Applied in Lb./Acre			Remarks
			N	P	K	
1958	Alfalfa	0	—	—	—	Land grading completed, autumn seeding, poor stand
1959	Alfalfa	0	38	23	44	Reseeded to alfalfa, poor stand, autumn fescue seeding
1960	Ky. 31 fescue	6.7	100	0	0	
1961	Ky. 31 fescue	7.8	85	0	0	
1962	Corn, CT*	6.0	0-200	32	30	0, 100, and 200 lb. N per acre, split plot
1963	Corn, CT	6.0	0-200	32	30	0, 100, and 200 lb. N per acre, split plot
1964	Corn, CT	6.9	0-200	32	30	0, 100, and 200 lb. N per acre, split plot
Sprinkler spacing changed from 40x40 to 40x50 ft. in 1964						
1965	Soybeans	9.0	0	32	30	
1966	Oats	6.2	13	28	52	A plots not planted
1967	Corn, CT	6.0	98	22	42	
1968	Corn, CT	6.0	336	25	47	Replicates 1, 2
	Corn, NT†	6.0	336	25	47	Replicates 3, 4
1969	Corn, CT	3.0	207	30	56	Replicates 1, 2
	Corn, NT	3.0	207	30	56	Replicates 3, 4 (crop failure)
1970	Corn, CT	6.0	151	44	28	Replicates 1, 2 (A plots replaced)
	Corn, NT	6.0	166	44	28	Replicates 3, 4 by E plots)
1971	Corn, CT	6.0	115	30	56	Replicates 1, 2
	Corn, NT	6.0	100	30	56	Replicates 3, 4
1972	Oats	3.0	7	6	11	B plots not planted
	Alfalfa, fall seeding		0	150	282	

*CT=Conventional tillage.

†NT=No tillage.

no drainage system during the 11-year period was changed after the 1969 crop year by installing 2-inch diameter (18 inches depth) corrugated plastic tubing 20 feet apart (see E plots in Figure 1). To provide the same area as the 40-foot tile, flow was measured from the two center drains. From 1965-69, the drainage on the undrained (A) plots was improved by removing the small surface dikes along the short sides of the plots to allow cross-row drainage. In 1970, the dikes were replaced in all plots after the plastic tubing was installed. All 16 plots were regraded and smoothed in 1966 and in 1972.

From 1968-71, half of the plots (replicates 1 and 2) were farmed by conventional tillage (fall plow, disking, and planting) and the other half (replicates 3 and 4) were planted with no tillage. Figure 2 shows the soil surface in these plots in June 1971. To evaluate the tillage variable, rates of planting, sprinkler application of water, fertilization, etc. were the same on all plots. Plots were tilled and planted as soon as drainage would permit (occasionally labor and equipment caused short delays).

In 1966, oats were planted 2 weeks later on the surface-drained treatment than on the other drained plots, and the undrained (A) plots were not planted at all. In 1964, corn planting was delayed 8 days on the surface-drained (B) plots and 10 days on the undrained (A) plots. In 1972, oats were not planted on the surface-drained (B) plots. At all other times, all plots were planted at about the same time. In 1970 and 1971, the crop residue was burned prior to planting the no tillage plots to destroy weed seed (primarily fall panicum), which accounted for the small amount of crop residue (Fig. 2B).

Atrazine was applied annually for weed control. Several other pesticides were applied for water quality effects rather than for weed or insect control from 1967-71 (6). Atrazine was so effective on conventional tillage corn that cultivation for weed control was seldom required. However, in 1965 atrazine residual caused slight damage to the soybeans.

Irrigation Scheduling

For the 1964 growing season and thereafter, the sprinkler irrigation system was enlarged to cover two replications at one setting with a 40 by 50-foot spacing (Fig. 1). Although the number of sprinklers was increased from 78 to 100, the same application rate was maintained at 0.23 iph for 13 hours for a 3.0-inch application. Irrigation scheduling, soil temperature, and antecedent soil moisture prior to irrigation are given in Table A1. Precipitation and amounts of irrigation are shown in Table A2.

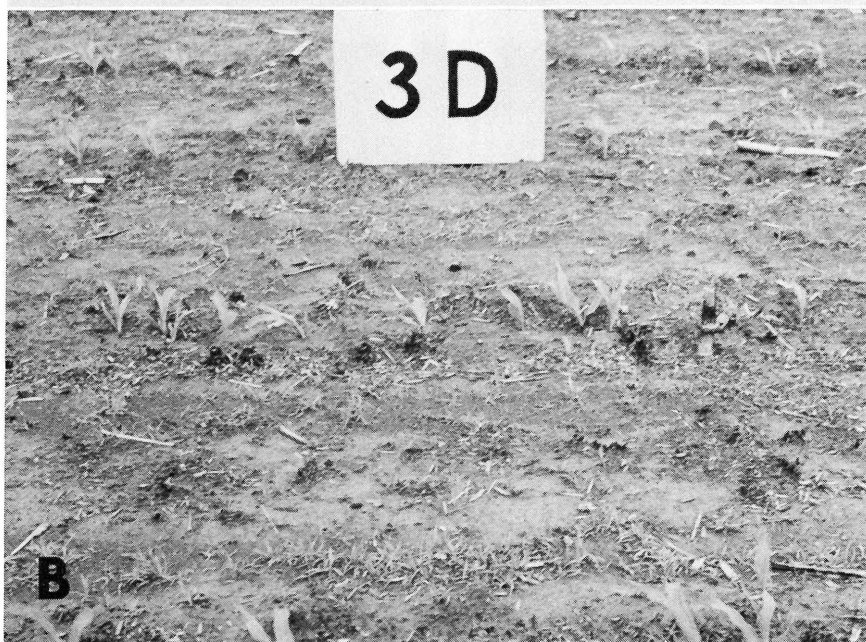


FIG. 2.—Soil surface of conventional tillage (A) and no tillage (B) surface-drained plots, June 3, 1971.

Usually two 3-inch sprinkler applications were planned annually for row crops. Corn was first watered when plants were about 6 inches high and the second time when about 24 inches high. In 1969, the second irrigation was cancelled because of a large storm. In 1965, soybeans were sprinkled with a third application later in the season.

Two major storms occurred during the 11-year period, 7.4 inches in July 1966 and 11.65 inches in July 1969. Maximum water level for the 1969 storm is shown in Figure 3. Both storms far exceeded the 100-year return period rainfall. These were unusual events and flow records were lost. However, flow estimates for these storms were assigned the same values for all four replicates of drainage treatments B, C, and D.



FIG. 3.—About 12 hours after the 11.65-inch storm of July 5, 1969.

II. HYDROLOGIC PERFORMANCE WITH FIELD CROPS²

For 1962-72, flows by drainage treatments are given in detail in Appendix B. Except for 1968-71 (tillage variable), the flows were obtained from four replications of each tillage treatment. For 1968-71, each tillage treatment contained two replications.

Table B7 has detailed flow data by months for each tillage and drainage treatment for the years 1962-72. These data were subjected to a least squares analysis of variance (2) to obtain unbiased estimates of the effects of years, drainage, and tillage.

Mean flows for the tillage and drainage systems for the years 1962-72 are given in Table 2. The values are least squares means, *i.e.*, adjusted for bias due to years and unequal numbers of replications in the different systems. The least squares analysis of variance also provided an F test for evaluating differences between the various means.

²For: I. Hydrologic Performance with Grass Cover, see Schwab *et al.* (12).

TABLE 2.—Monthly and Seasonal Flows for Tillage and Drainage Systems from Rainfall (Least squares means for years 1962-72).

Tillage	Drainage	Flow Depth in Inches							Seasonal Total from Rainfall
		March	April	May	June	July	Aug.	Sept.	
No	Surface	0.58	0.73	0.84	0.30	2.12	0.14	0.33	5.01
	Tile	0.90	0.98	1.08	0.71	1.28	0.19	0.37	5.53
	Tile plus Surface	0.83	1.17	1.16	0.53	2.18	0.16	0.32	6.34
Conven- tional	Surface	0.36	0.52	0.77	0.74	1.55	0.19	0.35	4.49
	Tile	1.03	0.96	1.14	1.03	1.48	0.13	0.30	6.06
	Tile plus Surface	0.87	0.95	1.11	1.08	1.86	0.14	0.31	6.32
Tillage-Drainage Interaction		NS	NS	NS	NS	NS	NS	NS	NS
No	All	0.77	0.96	1.03	0.51	1.86	0.16	0.34	5.65
Conven- tional	All	0.75	0.81	1.01	0.95	1.63	0.15	0.32	5.60
Tillage Means		NS	NS	NS	**	NS	NS	NS	NS
All	Surface	0.47	0.63	0.81	0.52	1.84	0.16	0.34	4.80
	Tile	0.96	0.97	1.11	0.87	1.38	0.16	0.34	5.76
	Tile plus Surface	0.85	1.06	1.13	0.80	2.02	0.15	0.32	6.31
Drainage Means†		**	**	**	**	**	NS	NS	**

†Symbols for significance: **=significant at 99 %, NS=not significant.

For both tillage systems, the seasonal surface flow shown in Table 2 was less and the combination tile and surface flow was more than tile alone. The tillage means were significantly different only in June. The drainage means were significantly different for the seasonal total and for all months except the low flow months of August and September. The tillage-drainage interaction (Table 2, flow from rainfall only) was not significant for any month. However, if the flows from irrigation were included, the interaction was significant for June, July, and the seasonal total (90% level or greater).

To further pursue the tillage-drainage interaction, the data from the combination surface and tile plots were separated into surface runoff and tile flow (Table 3). An analysis of variance, removing annual and block variability, revealed a significant interaction (99% level) between the tillage treatment and surface and tile flow in June, July, and the seasonal total. The least squares means of flow in June and July are largely from irrigation or floods in 1966 and 1969. During June and July, surface runoff shown in Table 3 (rainfall plus irrigation) was greater in the no-tilled plots and the tile flow was greater in the conventionally tilled plots. The same phenomenon was true in the plots with surface and tile alone. These data for rainfall plus irrigation are not shown (Table 2 shows rainfall data only). This observation on flat land with a heavy soil should be of interest to those studying the comparison of tillage systems. For the combination tile and surface-drained plots, seasonal tile flow was greater than the surface runoff.

The distribution of flow from rainfall by months (Fig. 4) shows flow was highest in May and lowest in August for all drainage systems. The flows in Fig. 4 are lower than those in Table 2 (mostly July) be-

TABLE 3.—Flow* from Combination Tile and Surface Drainage System.

Tillage	Type of Flow	Flow Depth in Inches							Seasonal Total
		March	April	May	June	July	Aug.	Sept.	
No	Surface	0.30	0.33	0.70	2.38	1.41	0.06	0.16	5.34
	Tile	0.54	0.95	1.11	1.74	1.08	0.08	0.16	5.65
Conventional	Surface	0.16	0.08	0.39	1.16	1.01	0.04	0.15	2.99
	Tile	0.71	0.84	1.06	2.39	1.38	0.10	0.16	6.65
Tillage-Drainage Interaction†		NS	NS	NS	**	**	NS	NS	**

*Flow from rainfall and irrigation (1962-72), including flood flows in July 1966 and July 1969.

†NS=no significant, **=significant at 99% level.

cause the July 1966 and July 1969 floods were not included in Fig. 4. As compared to data reported by Hoover and Schwab (4) for Tiffin, Ohio (1951-66), tile flows were 500 to 900% greater than Tiffin values for May, June, and July, but only 25% higher for March and April.

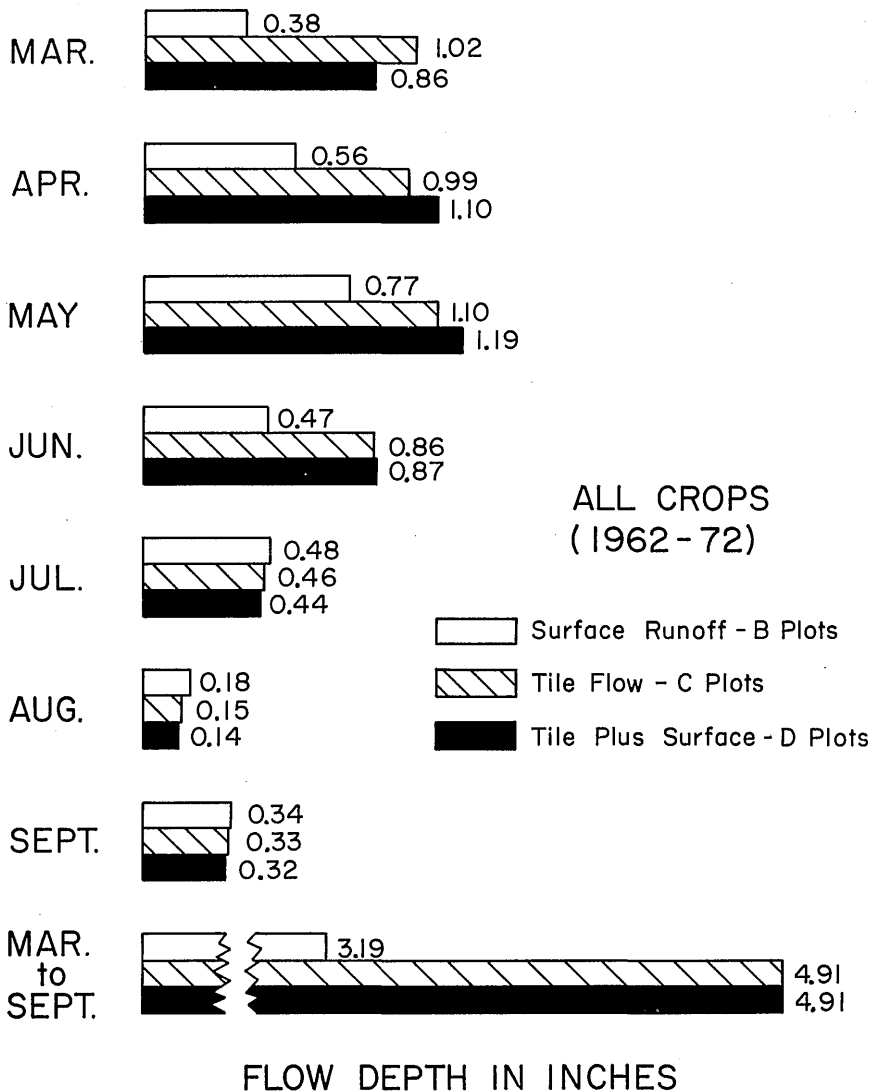


FIG. 4.—Least squares monthly flows from rainfall for all crops and both tillage systems. (Flood flows in July 1966 and July 1969 are not included.)



FIG. 5—Undrained (A) and surface drainage (B) 2 hours after 3.0-inch irrigation, June 12, 1962.



FIG. 5 (continued).—Tile drainage (C) and combination tile plus surface drainage (D) 2 hours after 3.0-inch irrigation, June 12, 1962.

TABLE 4.—Seasonal and Annual Tile Flow and Surface Runoff, 1969-72.

Drainage System	Flow in Inches*		
	March-September	October-February	Annual
B Surface only	5.38 (73 %)	1.95 (27 %)	7.33 (100 %)
C Tile only	6.45 (82 %)	1.41 (18 %)	7.86 (100 %)

*Flood flows of July 1969 are not included. Each value is the average of two replications 1 and 3 for 3 years of conventional and no tillage corn and 1 year in oats. Winter flows in other years were not taken.

For example, in May the flow at Tiffin was about 0.2 inch as compared with 1.1 inches for tile (Fig. 4). Unlike Tiffin, May was the peak flow month in this study rather than March or April. Total tile flows for the growing season were about 250% of those at Tiffin.

Seasonal runoff from the surface-drained (B) plots (Fig. 4) was 35% lower than the total seasonal flow from either the tile-drained or the combination tile and surface-drained plots. These two tile-drained plots had the same total flow for the March-Sept. growing season.

As shown in Tables B1 thru B7, seasonal flow varied considerably from year to year. The highest flows were in 1969, although the rainfall was slightly greater in 1972. These data include the July 1966 and the July 1969 floods. Because the high water level covered all plots (Fig. 3), the estimated flows were considered to have little differential effect on the crop. As shown in Figure 5, water from irrigation and normal rains were contained within the surface dikes of the four drainage treatments following irrigation.

Seasonal and annual flows (1969-72) from surface and tile drainage are shown in Table 4. Tile flow for the 7-month growing season (March-Sept.) accounted for 82% of the annual flow, and surface runoff accounted for 73% of the annual runoff. The winter flows were taken primarily for water quality studies and probably have little effect on crop production.

III. CORN, OATS, AND SOYBEAN YIELDS

Crop yields are given by years and plots in Table C1. Corn stands by drainage treatment and years are shown in Table C2. All yields have been corrected to a uniform moisture content and harvesting losses are included. Yields were determined by harvesting the entire plot after all rows were trimmed to a uniform length and border rows were removed.

Corn yields and stand were subjected to a least squares analysis of variance to obtain unbiased estimates of the tillage and drainage effects (Table 5). The contrast between undrained and drained plots is shown in Figure 6. The interaction between tillage and drainage was not significant for either yield or stand, which indicates the drainage systems had a similar effect for both the conventional and the no tillage treatments. For all drainage systems, the stands and yields were significantly higher in the conventional than in the no tillage. For both tillage

TABLE 5.—Corn Yield and Stand for Tillage and Drainage Systems (Least squares means for years 1962-64, 1967-71).

Tillage	Drainage	Yield in Bu./A.		Stand in 1,000 Plants/A.
		Unadjusted	Adjusted for Stand	
No	A No	34.6	68.9	7.38
	B Surface	49.9	63.1	13.61
	C Tile	62.7	72.1	14.72
	D Surface plus tile	81.6	88.7	15.40
Conventional	A No	50.4	60.1	14.64
	B Surface	78.5	72.6	19.26
	C Tile	100.1	89.8	20.54
	D Surface plus tile	105.9	94.5	20.85
Significance of interaction between tillage and drainage†		N.S.	N.S.	N.S.
ALL DRAINAGE				
Tillage	No	57.2	73.2	12.27
	Conventional	83.7	79.2	18.82
Significance of tillage means†		**	N.S.	**
ALL TILLAGE				
Drainage	A No	42.5a‡	64.5a‡	11.01a‡
	B Surface	64.2b	67.8ab	16.44b
	C Tile	81.4c	80.9bc	17.63b
	D Surface plus tile	93.7c	91.6c	18.13b
Significance of drainage means†		**	**	**

†N.S.—not significant, **—significant at 99% level.

‡Means followed by the same letter are not different.

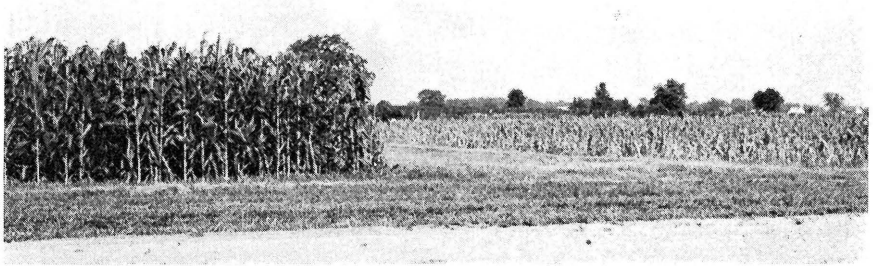


FIG. 6—Surface-drained (left) and undrained (right) plots in July 1962.

treatments, the stands and yields were significantly different for the drainage means. Stands and yields increased in order—no drainage, surface, tile, and combination tile and surface.

The unadjusted yields are of more practical interest than those adjusted for stand because a higher stand is an inherent benefit of drainage. At the 99% level of significance, corn yields from no drainage treatment were lower than any of the other three drainage systems. Surface drainage yields were lower than either the tile-drained or combination-drained, but the differences between the tile and combination-drained plots were not significant.

Since a correlation coefficient of 0.59 existed between yield and stand measures, stand was inserted as a covariant in the analysis to see if yield differences due to tillage and drainage were caused by stand differences. The yields adjusted for stand are also given in Table 5. For all drainage systems, the significance between the no tillage and conventional tillage yields disappeared when adjusted for stand. Thus, the yield difference due to tillage is brought about by the difference in stand. For both tillage treatments, the significance between the drainage system means remained at the same level of significance. These data demonstrate that drainage treatment differences in yield were not caused primarily by their effect on stand.

Data for the three drainage treatments were analyzed to relate corn yield and stand to flow. As a covariant, flow was significantly related to yield at the 90% level and nonsignificant with regard to stand. Tillage and drainage means of yield and stand adjusted to flow showed little difference in pattern from the unadjusted means. If the adjustment for flow had altered the pattern of treatment effects, then the treatment effects could be due to the mechanism of altering the flow. However, these data did not exhibit that phenomenon.

TABLE 6.—Standard Deviation and Coefficient of Variation of Corn Yields and Stands Due to Yearly Effects (Conventional tillage treatment for 1962-64, 1967-71).

Drainage Treatment	Yield		Stand	
	Standard Deviation* in Bu./A.	Coefficient of Variation (Percent)	Standard Deviation* in 1000 Plants/A.	Coefficient of Variation (Percent)
A None	26.0	47.8	6.8	49.2
B Surface	37.5	50.1	5.4	27.9
C Tile	20.4	20.7	4.7	23.4
D Tile and Surface	23.3	21.3	5.5	26.0

*All comparisons using one-tailed F test were nonsignificant.

The effect of the drainage treatments on the annual variability of yield and stand was evaluated (Table 6). Probably a good drainage system would reduce the annual variation. This conjecture was investigated by extracting the variances of corn yield and stand due to years. The standard deviations and the coefficients of variation due to years are given in Table 6.

Each variance, within yield or stand, was compared with all others in paired combinations by the use of an F test. In no case were any of the variances significantly different. Thus, from these data it could not be concluded that the drainage system produced any systematic reduction in the annual variation.

The yields for soybeans and oats are given in Table 7. Compared to corn, these showed a similar pattern of response to the drainage treatments. Oat yields from surface drainage were considerably lower than the tile or tile and surface combination. Because of wet field conditions and a change in the experimental design, some plot data are missing.

TABLE 7.—Average Oat and Soybean Yields by Drainage Treatments and Years.*

Year	Crop	Yield in Bu./A.			
		Surface Drainage	Tile Drainage	Tile and Surface Drainage	No Drainage
1965	Soybeans	43.3	49.8	49.7	3.8
1966	Oats	48.0	71.0	79.5	0‡
1972	Oats	0‡	35.6	44.6	†
	Oats, Av.	24.0	53.3	62.1	

*Averages are for four replicates.

†Treatment changed to plastic tube drainage in 1970.

‡Crop was not planted due to poor drainage.

SUMMARY

Corn, soybean, and oat yields, plant populations, and drainage flows were measured on 0.5-acre plots on Toledo silty clay soil near Sandusky, Ohio, during 1962-72. Corn with conventional tillage and with no tillage was compared for the period 1968-71. Drainage treatments were no drainage, surface drainage, tile drainage, and a combination of tile and surface drainage. Irrigation water was applied yearly (two 3-inch applications) to simulate heavy rainfall. Rainfall plus irrigation amounts for the growing season were greater than the 60-year average rainfall in all years except 1963.

Tile and surface flows were measured for all years from all plots during the growing season (March-Sept.) and winter flows were measured from four plots for 4 years. Least squares means flow for the growing season from rainfall (not including flow from irrigation) increased in the order of surface, tile, and combination tile and surface. For all drainage systems, the flow was nearly the same for conventional and no tillage. For the combination tile and surface drainage system, seasonal tile flow was more than double the surface runoff for conventional tillage, but nearly the same for no tillage. The highest flow from rainfall normally occurred in the month of May (ignoring the July 1966 and July 1969 floods); if the floods were included, the highest mean flow would have been in July. The lowest flow occurred in August. Average tile flow for the 7-month growing season accounted for 82% of the annual flow, and surface runoff was 73% of the annual runoff.

For all drainage systems, the stands and yields were significantly higher in the conventional than in the no tillage system. The stands and yields increased in the order of no drainage, surface, tile, and the combination tile and surface. The conventional and no tillage management treatments showed similar patterns of yield and stand for the four drainage treatments. The adjusted corn yields for conventional tillage were 50.4, 78.5, 100.1, and 105.9 bu./acre, respectively, for the four systems. The average oat yields for 1966 and 1972 were 0, 24.0, 53.3, and 62.1 bu./acre, respectively, for the four systems.

The annual coefficients of variation of corn yields were 47.8% for no drainage, 50.1% for surface, 20.7% for tile, and 21.3% for the combination tile and surface drainage system. By pairing treatments, the variances of any two systems were not significantly different for either yield or stand.

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APPENDIX A

PRECIPITATION, IRRIGATION, AND SOIL PROPERTIES

TABLE A1. IRRIGATION SCHEDULING, SOIL TEMPERATURE, AND ANTECEDENT MOISTURE BY DRAINAGE TREATMENT

Test No.	Year	Date Irrigation Start-End	Soil Temperature 8' Depth Min.-Max.	Avg. Irrigation in Inches	Avg. Antecedent Moisture Content at 6' depth in % by weight				
					Drainage Plots				
					A	B	C	D	E
(One replicate per setting, 40 x 40-foot spacing)									
5	1962	6/11-6/15	*69-85	3.0	35.7	35.7	34.6	35.2	
6	1962	6/27-7/6	*66-80	3.0	33.8	30.6	28.0	28.2	
7	1963	6/5-6/12	*66-73	3.0	32.2	33.6	32.2	32.6	
8	1963	6/19-6/26	*66-71	3.0	29.8	29.4	26.5	27.3	
(Two replicates per setting 40 x 50-foot spacing)									
9	1964	6/23-6/26	66-72	3.9	31.8	33.6	30.1	30.3	
10	1964	7/1-7/3	71-73	3.0	35.3	33.7	30.3	30.3	
11	1965	6/13-6/25	54-68	3.0	28.7	30.2	29.1	30.5	
12	1965	6/30-7/3	64-70	3.0	33.0	29.4	27.6	28.3	
13	1965	7/19-7/21	67-70	3.0	33.7	26.6	24.1	25.1	
14	1966	5/25-5/27	57-61	3.1	35.1	34.2	30.4	31.2	
15	1966	6/6-6/8	61-64	3.1	31.3	27.4	24.7	24.6	
16	1967	5/31-6/2	52-54	3.0	27.8	28.4	26.8	28.2	
17	1967	6/19-6/21	63-66	3.0	31.6	30.7	29.0	29.9	
18	1968	5/15-5/21	52-57	3.1	27.8	29.3	28.8	30.3	
19	1968	6/18-6/21	61-64	3.0	26.5	26.2	23.8	25.8	
20	1969	6/18-6/20	61-63	3.0	34.5	33.2	31.4	31.6	
21	1970	6/3-6/5	59-64	3.0		32.7	31.8	32.8	34.2
22	1970	6/17-6/19	68-70	3.0		41.3	35.4	32.8	36.2
23	1971	6/7-6/11	60-66	3.0		29.1	29.1	28.3	30.3
24	1971	6/28-6/30	70-75	3.0		24.7	23.7	23.6	24.0
25	1972	6/8-6/13	60-66	3.0		33.4	25.5	25.3	25.0

* From Weather Bureau Climatological Data for Wooster, Ohio.

TABLE A2. PRECIPITATION AND IRRIGATION RECORD

Month	Precipitation or Irrigation () in Inches												60-Yr. Avg.***
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972		
Jan.	2.61	1.31	*0.53	*2.64	0.50	1.35	*3.10	*2.58	0.75	0.82	*1.04	2.39	
Feb.	1.52	*0.94	*0.40	*2.35	1.41	1.25	*0.40	*0.24	1.25	1.88	*0.71	1.88	
Mar.	1.48	1.97	5.14	1.18	1.61	2.38	1.85	*1.29	2.45	0.89	2.77	2.91	
April	1.53	1.93	5.18	2.26	3.81	2.75	1.62	5.24	3.43	0.91	4.45	2.85	
May	2.35	1.90	1.08	4.52	2.69	4.83	4.57	5.00	1.70	3.80	4.35	3.14	
				***(3.1)			(3.1)						
June	1.98	1.32	1.30	2.78	5.97	2.12	1.70	3.91	6.18	2.82	3.21	3.65	
	(6.0)	(6.0)	(3.9)	(3.5)	(3.1)	(6.0)	(3.0)	(3.0)	(6.0)	(6.0)	(3.0)		
July	4.43	2.76	1.06	2.84	10.82	2.97	2.71	13.72	5.30	2.67	4.25	3.50	
			(3.0)	(5.5)									
Aug.	1.49	1.39	3.87	3.43	2.54	3.61	3.76	0.46	0.79	3.81	6.45	3.13	
Sept.	4.75	0.59	*1.51	*2.66	1.66	2.63	1.96	3.62	3.41	2.87	8.19	2.89	
Oct.	2.61	*0.12	*0.97	*4.20	1.18	3.31	0.94	1.49	*2.69	*1.82	*1.73	2.32	
Nov.	2.42	*1.57	*0.84	*1.91	5.54	2.93	*4.10	3.10	*2.10	*1.33	*4.92	2.26	
Dec.	2.05	*0.30	*2.08	*1.75	3.22	2.61	*3.20	1.15	*2.17	*3.52	*3.29	2.14	
Total Rainfall (March-Sept.)	18.01	11.86	19.14	19.67	29.10	21.29	18.17	33.24	23.26	17.77	33.67	22.07	
Total Precipitation (Jan.-Dec.)	29.22	16.10	23.96	32.52	40.95	32.74	29.91	41.80	32.22	27.14	45.36	33.06	
Total Irrigation	6.0	6.0	6.9	9.0	6.2	6.0	6.1	3.0	6.0	6.0	3.0		
Total Precipitation and Irrigation	35.22	22.05	30.86	41.52	47.15	38.74	36.01	44.80	38.22	33.14	48.36	33.06	

* Records from monthly reports, North Central Branch, OARDC.

** Irrigation amounts shown in parentheses.

*** 60-yr avg. at Sandusky, Ohio, 1896-1955.

APPENDIX B TILE AND SURFACE FLOW

TABLE B1.

MONTHLY AND SEASONAL SURFACE RUNOFF BY YEARS - B PLOTS
(Least squares means adjusted for replication and tillage)*

Month	Flow Depth in Inches by Years											Avg.
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	
Mar.	0.01	0.03	0.10	0.01	0.08	0.89	1.69	0.16	0.54	0	0.71	0.38
Apr.	0.01	0.01	0.61	0.01	0.70	0.02	0.22	2.42	0.99	0	1.22	0.56
May	0	0	0	0.15	0.41	2.22	1.64	2.73	0	0.85	0.51	0.77
					(1.70)			(2.52)				(0.38)
June	0	0	0	0	3.51	0	0.30	0.42	1.83	0.70	0	0.47
	(2.11)	(2.78)	(2.07)	(2.20)	(1.33)	(4.28)	(1.57)	(2.81)	(6.21)	(3.18)	(1.92)	(2.77)
July	1.02	0.17	0.20	0.58	4.45	0.29	0	10.0	1.50	0	1.37	1.78
	(0.38)		(2.01)	(1.23)								(0.33)
Aug.	0	0	0	0	0.01	0.05	0	0	0	0	1.92	0.18
Sept.	0	0	0	0	0	0	0	0	0.04	0.02	3.73	0.34
Total	0.73	0.01	0.58	0.46	9.15	3.23	3.85	15.72	4.91	1.56	9.18	4.49
Total for Irrigation	(2.47)	(2.77)	(4.06)	(3.42)	(3.02)	(4.27)	(4.09)	(2.81)	(6.21)	(3.18)	(1.91)	(3.47)

* Values without brackets are flows from rainfall.
Values with brackets are flows from irrigation.

TABLE B2.

MONTHLY AND SEASONAL TILE FLOWS BY YEARS - C PLOTS
 (Least squares means adjusted for replication and tillage)*

Month	Flow Depth in Inches by Years											
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	Avg.
Mar.	1.88	1.86	0.13	0.03	0.63	1.23	1.56	0.34	1.38	0.28	1.94	1.02
Apr.	0.28	0.43	2.73	0.35	0.81	0.33	0.46	2.82	1.08	0.14	1.47	0.99
May	0	0	1.08	1.13	0.64 (1.48)	2.16	1.81 (1.86)	3.36	0.09	1.04	0.79	1.10 (0.37)
June	0.28 (2.60)	0.42 (3.42)	0 (2.06)	0.26 (1.67)	3.77 (0.67)	0.36 (2.44)	0.60 (1.30)	1.15 (2.15)	1.87 (4.01)	0.71 (2.94)	0.09 (1.10)	0.86 (2.21)
July	0.62 (0.67)	0.14 (0.01)	0.50 (1.74)	0.80 (3.36)	5.06 (0.01)	0.28 (0.01)	0.03	7.01	1.24	0.01 (0.02)	1.12 (0.01)	1.53 (0.53)
Aug.	0.02	0.02	0.02	0.02	0.02	0.04	0.07	0	0	0.06	1.40	0.15
Sept.	0.03	0.03	0.03	0.03	0.03	0.03	0	0	0.11	0.01	3.36	0.33
Total	3.08	2.86	4.43	2.62	10.95	4.42	4.52	14.66	5.76	2.24	10.17	5.98
Total for Irrigation	(3.26)	(3.42)	(3.79)	(5.03)	(2.15)	(2.44)	(3.16)	(2.15)	(4.01)	(2.96)	(1.09)	(3.04)

* Values without brackets are flows from rainfall.
 Values with brackets are flows from irrigation.

TABLE B3. AVERAGE TILE FLOW DURING WINTER MONTHS
(C Plots, with no surface drainage)

*Tile Flow in Inches					
Month	1969	1970	1971	1972	Avg.
Jan.	0	0	0.04	0	0.01
Feb.	0.23	0.34	0.13	0	0.18
Oct.	0	0.32	0	0.06	0.10
Nov.	0.04	0	0	2.38	0.60
Dec.	0.04	0.64	0.48	0.92	0.52
Total Winter Months--	0.31	1.30	0.65	3.36	1.41
Total Mar.-Sept. Growing Season--	13.90	5.42	2.49	9.57	7.84
Total Calendar Year--	14.21	6.72	3.14	12.93	9.25

*Each value is the average of two replications, 1 and 3.

TABLE B4.

MONTHLY AND SEASONAL SURFACE RUNOFF PLUS TILE FLOW BY YEARS - D. PLOTS
(Least squares means adjusted for replication and tillage)*

Month	Flow Depth in Inches by Years											Avg.
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	
Mar.	0.60	1.24	0.09	0	0.49	1.62	2.18	0.21	0.77	0.32	1.91	0.86
Apr.	0.55	0.75	2.55	0.29	1.17	0.63	0.55	2.51	1.61	0.01	1.50	1.10
May	0.13 (0.07)	0.19 (0.07)	1.33 (0.07)	1.64 (0.07)	0.75 (1.77)	2.30 (0.07)	1.55 (2.70)	3.0	0.18	1.19	0.85 (0.07)	1.19 (0.44)
June	0.11 (3.36)	0.66 (4.40)	0 (2.81)	0.30 (2.56)	4.72 (1.21)	0.18 (3.91)	0.53 (1.57)	0.70 (2.74)	1.79 (5.65)	0.59 (2.75)	0 (1.63)	0.87 (2.96)
July	0.57 (0.51)	0.07	0.53 (2.18)	0.85 (2.65)	5.90	0.22	0.03	10.99	1.13	0.01	1.18	1.95 (0.48)
Aug.	0	0	0	0	0	0	0.04	0	0.03	0.01	1.49	0.14
Sept.	0	0	0	0	0	0	0	0	0.01	0	3.45	0.32
Total	1.96	2.92	4.50	3.06	13.02	4.96	4.88	17.41	5.51	2.13	10.31	6.42
Total for Irrigation	(3.93)	(4.46)	(5.05)	(5.28)	(2.99)	(3.98)	(4.26)	(2.74)	(5.65)	(2.75)	(1.70)	(3.89)

* Values without brackets are flows from rainfall.
Values with brackets are flows from irrigation.

TABLE B5. AVERAGE MONTHLY PLASTIC DRAIN FLOW BY YEARS
(E Plots, with no surface drainage)

*Drain Flow in Inches				
Month	1970	1971	1972	Avg.
Mar.	0	0.22	1.39	0.54
Apr.	0.13	0.06	2.32	0.84
May	0.06	1.78	1.45	1.10
June	1.22 **(3.42)	0.92 (2.71)	0.29 (1.49)	0.81
July	1.15	0.01	1.19	0.78
Aug.	0	0.13	1.15	0.43
Sept.	0.23	0.10	2.19	0.84
Total from Rainfall--	2.78	3.22	9.98	5.33
Total from Irrigation--	3.42	2.71	1.49	2.54
Total--	6.20	5.93	11.47	7.87

* Each value is the average of four replications.
** Flow from irrigation shown in parentheses.

TABLE B6. AVERAGE SURFACE RUNOFF DURING WINTER MONTHS
(B Plots, with no tile drainage)

*Surface Runoff in Inches					
Month	1969	1970	1971	1972	Avg.
Jan.	0	0.01	0.03	0	0.01
Feb.	0.21	2.17	0.11	0	0.62
Oct.	0	0	0	0	0
Nov.	0.08	0	0	3.08	0.79
Dec.	0	0.34	0.18	1.60	0.53
Total Winter Months--	0.29	2.52	0.32	4.68	1.95
Total Mar.-Sept. Growing Season--	15.05	4.22	1.36	8.54	7.29
Total Calendar Year--	15.34	6.74	1.68	13.22	9.24

* Each value is the average of two replications, 1 and 3.

TABLE B7.—Monthly Tile Flow and/or Surface Runoff by Plots and Years (Rainfall and Irrigation).

1	2	3	4	5	6	7	8	9	10	11	12	13
62	1	1	1	0	0.000	0.000	0.000	0.200	0.630	0.000	0.000	0.830
62	1	1	1	1	0.000	0.000	0.000	1.820	0.000	0.000	0.000	1.820
62	1	2	1	0	0.000	0.000	0.000	0.000	1.440	0.000	0.000	1.440
62	1	2	1	1	0.000	0.000	0.000	1.820	0.620	0.000	0.000	2.440
62	1	3	1	0	0.000	0.000	0.000	0.000	0.160	0.000	0.000	0.160
62	1	3	1	1	0.000	0.000	0.000	1.710	0.000	0.000	0.000	1.710
62	1	4	1	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
62	1	4	1	1	0.000	0.000	0.000	1.720	0.880	0.000	0.000	2.600
62	2	1	1	0	0.000	0.000	0.000	0.000	0.090	0.000	0.000	0.090
62	2	1	1	1	0.000	0.000	0.000	0.380	0.000	0.000	0.000	0.380
62	2	2	1	0	0.000	0.000	0.000	0.000	0.190	0.000	0.000	0.190
62	2	2	1	1	0.000	0.000	0.000	0.870	0.320	0.000	0.000	1.190
62	2	3	1	0	0.000	0.000	0.000	0.000	0.080	0.000	0.000	0.080
62	2	3	1	1	0.000	0.000	0.000	0.790	0.000	0.000	0.000	0.790
62	2	4	1	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
62	2	4	1	1	0.000	0.000	0.000	1.370	0.310	0.000	0.000	1.680
62	3	1	1	0	1.899	0.158	0.086	0.383	0.310	0.000	0.000	2.836
62	3	1	1	1	0.000	0.000	0.000	2.912	0.023	0.000	0.000	2.935
62	3	2	1	0	2.020	0.400	0.049	0.119	1.109	0.000	0.000	3.697
62	3	2	1	1	0.000	0.000	0.000	2.647	0.796	0.000	0.000	3.443
62	3	3	1	0	0.070	0.097	0.000	1.102	0.387	0.000	0.000	1.656
62	3	3	1	1	0.000	0.000	0.000	2.356	0.011	0.000	0.000	2.367
62	3	4	1	0	3.379	0.302	0.000	0.194	0.170	0.000	0.000	4.045
62	3	4	1	1	0.000	0.000	0.000	2.720	1.843	0.000	0.000	4.563
62	4	1	1	0	0.388	0.238	0.000	0.458	0.482	0.000	0.000	1.566
62	4	1	1	1	0.000	0.000	0.000	2.349	0.053	0.000	0.000	2.402
62	4	2	1	0	0.219	0.307	0.030	0.105	0.412	0.000	0.000	1.073
62	4	2	1	1	0.000	0.000	0.000	1.489	0.243	0.000	0.000	1.732
62	4	3	1	0	1.680	0.773	0.054	0.403	0.547	0.000	0.000	3.457
62	4	3	1	1	0.000	0.000	0.000	2.943	0.000	0.000	0.000	2.943
62	4	4	1	0	0.169	0.172	0.000	0.182	0.256	0.000	0.000	0.779
62	4	4	1	1	0.000	0.000	0.000	1.414	1.101	0.000	0.000	2.515
63	1	1	1	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63	1	1	1	1	0.000	0.000	0.000	2.450	0.000	0.000	0.000	2.450
63	1	2	1	0	0.070	0.000	0.000	0.000	0.000	0.000	0.000	0.070
63	1	2	1	1	0.000	0.000	0.000	2.100	0.000	0.000	0.000	2.100
63	1	3	1	0	0.000	0.000	0.000	0.270	0.000	0.000	0.000	0.270
63	1	3	1	1	0.000	0.000	0.000	1.980	0.000	0.000	0.000	1.980
63	1	4	1	0	0.100	0.000	0.000	0.040	0.000	0.000	0.000	0.140
63	1	4	1	1	0.000	0.000	0.000	3.240	0.000	0.000	0.000	3.240

Column	Code
1	Year, last two digits
2	Drainage source 1 surface flow, only (B) 2 surface flow, combination system (D) 3 tile flow, only (C) 4 tile flow, combination system (D) 5 plastic tubing, only (E)
3	Replication number
4	Tillage 0 no tillage 1 conventional, fall plowing, spring disking and planting
5	Water source 1 irrigation, sprinkling 0 rainfall
6-12	Flow depth in inches by months (Mar. thru Sept.)
13	Flow depth in inches, Mar. to Sept. total

TABLE B7 (continued).—Monthly Tile Flow and/or Surface Runoff by Plots and Years (Rainfall and Irrigation).

1	2	3	4	5	6	7	8	9	10	11	12	13
63	2	1	1	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63	2	1	1	1	0.000	0.000	0.000	0.260	0.000	0.000	0.000	0.260
63	2	2	1	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63	2	2	1	1	0.000	0.000	0.000	0.780	0.000	0.000	0.000	0.780
63	2	3	1	0	0.000	0.000	0.000	0.040	0.000	0.000	0.000	0.040
63	2	3	1	1	0.000	0.000	0.000	0.720	0.000	0.000	0.000	0.720
63	2	4	1	0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
63	2	4	1	1	0.000	0.000	0.000	0.640	0.000	0.000	0.000	0.640
63	3	1	1	0	2.000	0.314	0.016	0.497	0.020	0.000	0.000	2.847
63	3	1	1	1	0.000	0.000	0.000	3.057	0.000	0.000	0.000	3.057
63	3	2	1	0	1.372	0.400	0.000	0.662	0.026	0.000	0.000	2.460
63	3	2	1	1	0.000	0.000	0.000	3.658	0.000	0.000	0.000	3.658
63	3	3	1	0	1.939	0.250	0.000	0.573	0.000	0.000	0.000	2.762
63	3	3	1	1	0.000	0.000	0.000	2.733	0.000	0.000	0.000	2.733
63	3	4	1	0	2.000	0.597	0.084	0.616	0.000	0.000	0.000	3.287
63	3	4	1	1	0.000	0.000	0.000	4.478	0.000	0.000	0.000	4.478
63	4	1	1	0	1.487	0.579	0.027	0.904	0.032	0.000	0.000	3.029
63	4	1	1	1	0.000	0.000	0.000	3.610	0.000	0.000	0.000	3.610
63	4	2	1	0	0.406	0.211	0.000	0.366	0.000	0.000	0.000	0.983
63	4	2	1	1	0.000	0.000	0.000	2.761	0.000	0.000	0.000	2.761
63	4	3	1	0	1.652	0.654	0.153	1.003	0.000	0.000	0.000	3.462
63	4	3	1	1	0.000	0.000	0.000	2.963	0.000	0.000	0.000	2.963
63	4	4	1	0	1.488	0.842	0.131	1.040	0.058	0.000	0.000	3.559
63	4	4	1	1	0.000	0.000	0.000	4.017	0.000	0.000	0.000	4.017
64	1	1	1	0	0.130	0.440	0.040	0.000	0.030	0.000	0.000	0.640
64	1	1	1	1	0.000	0.000	0.000	1.620	2.010	0.000	0.000	3.630
64	1	2	1	0	0.070	0.500	0.000	0.000	0.080	0.000	0.000	0.650
64	1	2	1	1	0.000	0.000	0.000	1.120	2.110	0.000	0.000	3.230
64	1	3	1	0	0.030	0.260	0.000	0.000	0.000	0.000	0.000	0.290
64	1	3	1	1	0.000	0.000	0.000	2.090	1.990	0.000	0.000	4.080
64	1	4	1	0	0.160	1.220	0.000	0.000	0.000	0.000	0.000	1.380
64	1	4	1	1	0.000	0.000	0.000	2.090	1.920	0.000	0.000	4.010
64	2	1	1	0	0.040	0.160	0.000	0.000	0.000	0.000	0.000	0.200
64	2	1	1	1	0.000	0.000	0.000	0.430	0.900	0.000	0.000	1.330
64	2	2	1	0	0.340	0.190	0.000	0.000	0.000	0.000	0.000	0.530
64	2	2	1	1	0.000	0.000	0.000	0.470	0.890	0.000	0.000	1.360
64	2	3	1	0	0.030	0.050	0.000	0.000	0.000	0.000	0.000	0.080
64	2	3	1	1	0.000	0.000	0.000	0.330	0.680	0.000	0.000	1.010
64	2	4	1	0	0.600	0.010	0.000	0.000	0.000	0.000	0.000	0.610
64	2	4	1	1	0.000	0.000	0.000	0.430	0.600	0.000	0.000	1.030
64	3	1	1	0	0.245	2.535	0.914	0.000	0.433	0.000	0.000	4.127
64	3	1	1	1	0.000	0.000	0.000	2.144	1.715	0.000	0.000	3.859
64	3	2	1	0	0.086	3.254	1.346	0.040	0.572	0.000	0.000	5.300
64	3	2	1	1	0.000	0.000	0.000	2.229	1.877	0.000	0.000	4.106
64	3	3	1	0	0.022	2.393	1.426	0.371	0.215	0.000	0.000	4.427
64	3	3	1	1	0.000	0.000	0.000	1.900	1.487	0.000	0.000	3.387
64	3	4	1	0	0.049	2.565	0.851	0.035	0.251	0.000	0.000	3.751
64	3	4	1	1	0.000	0.000	0.000	2.240	1.846	0.000	0.000	4.086
64	4	1	1	0	0.000	2.275	1.550	0.066	0.210	0.000	0.000	4.100
64	4	1	1	1	0.000	0.000	0.000	1.767	1.393	0.000	0.000	3.160
64	4	2	1	0	0.000	1.766	0.880	0.000	0.367	0.000	0.000	3.010
64	4	2	1	1	0.000	0.000	0.000	1.401	1.198	0.000	0.000	2.599
64	4	3	1	0	0.000	2.057	0.930	0.013	0.674	0.011	0.000	3.690
64	4	3	1	1	0.000	0.000	0.000	2.204	1.468	0.000	0.000	3.672
64	4	4	1	0	0.026	2.981	1.510	0.615	0.650	0.000	0.000	5.780
64	4	4	1	1	0.000	0.000	0.000	2.356	1.580	0.000	0.000	3.936
65	1	1	1	0	0.000	0.000	0.140	0.040	0.530	0.000	0.000	0.710
65	1	1	1	1	0.000	0.000	0.000	2.510	1.060	0.000	0.000	3.570
65	1	2	1	0	0.000	0.010	0.270	0.040	0.490	0.000	0.000	0.810
65	1	2	1	1	0.000	0.000	0.000	2.310	0.950	0.000	0.000	3.260
65	1	3	1	0	0.000	0.000	0.120	0.000	0.580	0.000	0.000	0.700
65	1	3	1	1	0.000	0.000	0.000	1.440	2.500	0.000	0.000	3.940
65	1	4	1	0	0.000	0.000	0.190	0.000	0.050	0.000	0.000	0.240
65	1	4	1	1	0.000	0.000	0.000	1.190	0.420	0.000	0.000	1.610
65	2	1	1	0	0.000	0.000	0.010	0.010	0.120	0.000	0.000	0.140

TABLE B7 (continued).—Monthly Tile Flow and/or Surface Runoff by Plots and Years (Rainfall and Irrigation).

	1	2	3	4	5	6	7	8	9	10	11	12	13
65	2	1	1	1	0.000	0.000	0.000	0.610	0.180	0.000	0.000	0.790	
65	2	2	1	0	0.000	0.000	0.170	0.060	0.420	0.000	0.000	0.650	
65	2	2	1	0	0.000	0.000	0.000	0.890	0.450	0.000	0.000	1.340	
65	2	3	1	0	0.000	0.000	0.000	0.000	0.090	0.000	0.000	0.090	
65	2	3	1	1	0.000	0.000	0.000	0.440	0.100	0.000	0.000	0.540	
65	2	4	1	0	0.000	0.000	0.130	0.000	0.180	0.000	0.000	0.310	
65	2	4	1	1	0.000	0.000	0.000	0.650	1.040	0.000	0.000	1.690	
65	3	1	1	0	0.000	0.212	0.903	0.465	0.560	0.000	0.000	2.140	
65	3	1	1	1	0.000	0.000	0.000	1.972	3.287	0.000	0.000	5.259	
65	3	2	1	0	0.000	0.244	1.723	0.565	0.686	0.000	0.000	3.240	
65	3	2	1	1	0.000	0.000	0.000	1.281	3.366	0.000	0.000	4.647	
65	3	3	1	0	0.000	0.690	1.016	0.206	0.719	0.000	0.000	2.631	
65	3	3	1	1	0.000	0.000	0.000	1.641	3.085	0.000	0.000	4.726	
65	3	4	1	0	0.000	0.089	1.090	0.479	0.727	0.000	0.000	2.385	
65	3	4	1	1	0.000	0.000	0.000	2.041	3.694	0.000	0.000	5.735	
65	4	1	1	0	0.000	0.000	0.493	0.037	0.092	0.000	0.000	0.622	
65	4	1	1	1	0.000	0.000	0.000	0.750	1.820	0.000	0.000	2.570	
65	4	2	1	0	0.000	0.000	1.337	0.782	0.683	0.000	0.000	2.802	
65	4	2	1	1	0.000	0.000	0.000	1.755	2.487	0.000	0.000	4.242	
65	4	3	1	0	0.000	0.200	2.000	0.761	1.086	0.000	0.000	4.045	
65	4	3	1	1	0.000	0.000	0.000	1.818	2.421	0.000	0.000	4.239	
65	4	4	1	0	0.000	0.223	1.963	0.254	0.508	0.000	0.000	2.968	
65	4	4	1	1	0.000	0.000	0.000	1.502	2.100	0.000	0.000	3.602	
66	1	1	1	0	0.140	0.660	0.490	3.990	5.030	0.000	0.000	10.310	
66	1	1	1	1	0.000	0.000	1.790	0.830	0.000	0.000	0.000	2.620	
66	1	2	1	0	0.140	0.610	0.540	4.070	4.090	0.000	0.000	9.450	
66	1	2	1	1	0.000	0.000	1.890	0.790	0.000	0.000	0.000	2.680	
66	1	3	1	0	0.000	0.390	0.350	3.720	3.870	0.020	0.000	8.350	
66	1	3	1	1	0.000	0.000	1.480	1.120	0.000	0.000	0.000	2.600	
66	1	4	1	0	0.000	1.110	0.360	3.490	4.150	0.000	0.000	9.110	
66	1	4	1	1	0.000	0.000	1.680	1.210	0.000	0.000	0.000	2.890	
66	2	1	1	0	0.430	0.010	0.040	2.000	3.030	0.000	0.000	5.510	
66	2	1	1	1	0.000	0.000	0.520	0.150	0.000	0.000	0.000	0.670	
66	2	2	1	0	0.140	0.370	0.040	2.600	3.070	0.000	0.000	6.220	
66	2	2	1	1	0.000	0.000	0.750	0.290	0.000	0.000	0.000	1.040	
66	2	3	1	0	0.000	0.290	0.170	1.780	3.010	0.000	0.000	5.250	
66	2	3	1	1	0.000	0.000	0.830	0.470	0.000	0.000	0.000	1.300	
66	2	4	1	0	0.000	0.010	0.020	2.060	3.260	0.000	0.000	5.350	
66	2	4	1	1	0.000	0.000	0.670	0.390	0.000	0.000	0.000	1.060	
66	3	1	1	0	0.793	1.021	1.000	4.151	4.371	0.000	0.000	11.336	
66	3	1	1	1	0.000	0.000	1.643	0.432	0.000	0.000	0.000	2.075	
66	3	2	1	0	0.762	0.938	0.807	3.873	4.616	0.000	0.000	10.996	
66	3	2	1	1	0.000	0.000	1.776	0.577	0.000	0.000	0.000	2.353	
66	3	3	1	0	0.450	0.608	0.553	3.750	5.625	0.000	0.000	10.986	
66	3	3	1	1	0.000	0.000	1.292	0.795	0.000	0.000	0.000	2.087	
66	3	4	1	0	0.383	0.489	0.419	4.000	5.110	0.000	0.000	10.398	
66	3	4	1	1	0.000	0.000	1.239	1.123	0.000	0.000	0.000	2.362	
66	4	1	1	0	0.855	1.061	0.308	3.128	2.611	0.000	0.000	7.193	
66	4	1	1	1	0.000	0.000	1.183	0.290	0.000	0.000	0.000	1.473	
66	4	2	1	0	0.546	0.827	0.653	2.481	2.861	0.006	0.000	7.374	
66	4	2	1	1	0.000	0.000	0.923	0.353	0.000	0.000	0.000	1.276	
66	4	3	1	0	0.470	0.938	1.016	3.362	2.610	0.011	0.000	8.415	
66	4	3	1	1	0.000	0.000	1.141	0.557	0.000	0.000	0.000	1.698	
66	4	4	1	0	0.342	0.429	0.291	2.164	2.940	0.000	0.000	6.166	
66	4	4	1	1	0.000	0.000	0.816	0.510	0.000	0.000	0.000	1.326	
67	1	1	1	0	0.600	0.020	2.310	0.000	0.070	0.020	0.000	3.020	
67	1	1	1	1	0.000	0.000	0.000	3.460	0.000	0.000	0.000	3.460	
67	1	2	1	0	0.810	0.000	2.070	0.000	0.060	0.080	0.000	3.020	
67	1	2	1	1	0.000	0.000	0.000	4.120	0.000	0.000	0.000	4.120	
67	1	3	1	0	1.180	0.030	2.270	0.110	0.060	0.040	0.000	3.690	
67	1	3	1	1	0.000	0.000	0.000	3.860	0.000	0.000	0.000	3.860	
67	1	4	1	0	0.960	0.010	2.350	0.150	0.280	0.050	0.000	3.800	
67	1	4	1	1	0.000	0.000	0.000	4.330	0.000	0.000	0.000	4.330	
67	2	1	1	0	0.050	0.000	0.340	0.000	0.000	0.000	0.000	0.390	
67	2	1	1	1	0.000	0.000	0.000	1.760	0.000	0.000	0.000	1.760	

TABLE B7 (continued).—Monthly Tile Flow and/or Surface Runoff by Plots and Years (Rainfall and Irrigation).

1	2	3	4	5	6	7	8	9	10	11	12	13
67	2	2	1	0	0.000	0.000	0.010	0.000	0.030	0.000	0.000	0.040
67	2	2	1	1	0.000	0.000	0.000	2.050	0.000	0.000	0.000	2.050
67	2	3	1	0	0.100	0.000	1.100	0.050	0.110	0.020	0.000	1.380
67	2	3	1	1	0.000	0.000	0.000	2.550	0.000	0.000	0.000	2.550
67	2	4	1	0	0.090	0.000	1.010	0.000	0.090	0.000	0.000	1.190
67	2	4	1	1	0.000	0.000	0.000	2.050	0.000	0.000	0.000	2.050
67	3	1	1	0	1.042	0.186	1.475	0.209	0.037	0.000	0.000	2.949
67	3	1	1	1	0.000	0.000	0.000	1.996	0.000	0.000	0.000	1.996
67	3	2	1	0	1.348	0.425	2.368	0.607	0.113	0.070	0.000	4.931
67	3	2	1	1	0.000	0.000	0.005	2.295	0.000	0.000	0.000	2.300
67	3	3	1	0	1.123	0.464	2.524	0.768	0.384	0.000	0.000	5.259
67	3	3	1	1	0.000	0.000	0.000	2.378	0.000	0.000	0.000	2.378
67	3	4	1	0	1.255	0.093	2.487	0.552	0.048	0.000	0.000	4.435
67	3	4	1	1	0.000	0.000	0.000	3.331	0.000	0.000	0.000	3.331
67	4	1	1	0	1.728	0.656	1.971	0.376	0.086	0.000	0.000	4.817
67	4	1	1	1	0.000	0.000	0.000	1.412	0.000	0.000	0.000	1.412
67	4	2	1	0	1.425	0.587	1.900	0.350	0.081	0.000	0.000	4.343
67	4	2	1	1	0.000	0.000	0.000	1.187	0.000	0.000	0.000	1.187
67	4	3	1	0	1.817	0.323	1.288	0.465	0.242	0.000	0.000	4.135
67	4	3	1	1	0.000	0.000	0.000	1.505	0.000	0.000	0.000	1.505
67	4	4	1	0	1.336	0.219	1.146	0.185	0.050	0.000	0.000	2.936
67	4	4	1	1	0.000	0.000	0.000	1.288	0.000	0.000	0.000	1.288
68	1	1	1	0	1.650	0.370	1.900	0.490	0.000	0.000	0.000	4.410
68	1	1	1	1	0.000	0.000	2.430	1.600	0.000	0.000	0.000	4.030
68	1	2	1	0	1.780	0.270	1.630	0.150	0.000	0.000	0.000	3.830
68	1	2	1	1	0.000	0.000	2.730	1.660	0.000	0.000	0.000	4.390
68	1	3	0	0	1.540	0.150	1.880	0.090	0.000	0.000	0.000	3.660
68	1	3	0	1	0.000	0.000	2.160	1.470	0.000	0.000	0.000	3.630
68	1	4	0	0	1.800	0.070	1.160	0.460	0.000	0.000	0.000	3.490
68	1	4	0	1	0.000	0.000	2.770	1.540	0.000	0.000	0.000	4.310
68	2	1	1	0	0.650	0.030	0.290	0.110	0.030	0.000	0.000	1.110
68	2	1	1	1	0.000	0.000	1.950	0.560	0.000	0.000	0.000	2.510
68	2	2	1	0	1.010	0.000	0.550	0.000	0.000	0.000	0.000	1.560
68	2	2	1	1	0.000	0.000	1.440	0.470	0.000	0.000	0.000	1.910
68	2	3	0	0	1.370	0.020	0.470	0.010	0.000	0.000	0.000	1.870
68	2	3	0	1	0.000	0.000	1.740	0.990	0.000	0.000	0.000	2.730
68	2	4	0	0	0.470	0.090	0.500	0.210	0.000	0.000	0.000	1.270
68	2	4	0	1	0.000	0.000	2.060	0.950	0.000	0.000	0.000	3.010
68	3	1	1	0	1.163	0.248	2.122	0.890	0.042	0.069	0.000	4.534
68	3	1	1	1	0.000	0.000	2.287	1.361	0.000	0.000	0.000	3.648
68	3	2	1	0	1.366	0.348	1.745	0.649	0.051	0.051	0.000	4.210
68	3	2	1	1	0.000	0.000	1.498	1.513	0.000	0.000	0.000	3.011
68	3	3	0	0	1.327	0.328	1.731	0.343	0.011	0.118	0.000	3.858
68	3	3	0	1	0.000	0.000	1.667	1.213	0.000	0.000	0.000	2.880
68	3	4	0	0	2.370	0.930	1.621	0.524	0.000	0.042	0.000	5.487
68	3	4	0	1	0.000	0.000	1.994	1.122	0.000	0.000	0.000	3.116
68	4	1	1	0	1.216	0.712	0.908	0.405	0.000	0.034	0.000	3.275
68	4	1	1	1	0.000	0.000	0.680	0.738	0.000	0.000	0.000	1.418
68	4	2	1	0	0.924	0.387	1.128	0.371	0.019	0.016	0.000	2.845
68	4	2	1	1	0.000	0.000	0.794	0.916	0.000	0.000	0.000	1.710
68	4	3	0	0	1.399	0.409	1.167	0.434	0.018	0.064	0.000	3.491
68	4	3	0	1	0.000	0.000	0.929	0.863	0.000	0.000	0.000	1.792
68	4	4	0	0	1.685	0.534	1.186	0.581	0.065	0.044	0.000	4.095
68	4	4	0	1	0.000	0.000	1.178	0.798	0.000	0.000	0.000	1.976
69	1	1	1	0	0.110	2.340	2.670	0.800	9.990	0.000	0.000	15.910
69	1	1	1	1	0.000	0.000	0.000	2.230	0.000	0.000	0.000	2.230
69	1	2	1	0	0.030	2.420	2.710	0.730	10.000	0.000	0.000	15.890
69	1	2	1	1	0.000	0.000	0.000	2.540	0.000	0.000	0.000	2.540
69	1	3	0	0	0.090	2.130	1.980	0.000	9.990	0.000	0.000	14.190
69	1	3	0	1	0.000	0.000	0.000	2.730	0.000	0.000	0.000	2.730
69	1	4	0	0	0.420	2.800	3.550	0.130	10.000	0.000	0.000	16.900
69	1	4	0	1	0.000	0.000	0.000	3.740	0.000	0.000	0.000	3.740
69	2	1	1	0	0.000	0.110	0.270	0.060	5.990	0.000	0.000	6.430
69	2	1	1	1	0.000	0.000	0.000	0.500	0.000	0.000	0.000	0.500
69	2	2	1	0	0.010	0.160	0.360	0.080	6.010	0.000	0.000	6.620

TABLE B7 (continued).—Monthly Tile Flow and/or Surface Runoff by Plots and Years (Rainfall and Irrigation).

1	2	3	4	5	6	7	8	9	10	11	12	13
69	2	2	1	1	0.000	0.000	0.000	0.630	0.000	0.000	0.000	0.630
69	2	3	0	0	0.000	0.230	0.670	0.000	5.990	0.000	0.000	6.890
69	2	3	0	1	0.000	0.000	0.000	1.750	0.000	0.000	0.000	1.750
69	2	4	0	0	0.000	0.550	1.030	0.000	5.990	0.000	0.000	7.570
69	2	4	0	1	0.000	0.000	0.000	2.430	0.000	0.000	0.000	2.430
69	3	1	1	0	0.270	2.615	3.268	1.624	6.991	0.000	0.000	14.768
69	3	1	1	1	0.000	0.000	0.000	2.722	0.000	0.000	0.000	2.722
69	3	2	1	0	0.376	3.292	3.804	1.278	6.996	0.000	0.000	15.747
69	3	2	1	1	0.000	0.000	0.000	2.212	0.000	0.000	0.000	2.212
69	3	3	0	0	0.278	2.079	3.186	0.488	6.998	0.000	0.000	13.029
69	3	3	0	1	0.000	0.000	0.000	2.068	0.000	0.000	0.000	2.068
69	3	4	0	0	0.449	3.273	3.169	1.188	7.035	0.000	0.000	15.114
69	3	4	0	1	0.000	0.000	0.000	1.604	0.000	0.000	0.000	1.604
69	4	1	1	0	0.147	2.270	2.680	1.133	4.990	0.000	0.000	11.217
69	4	1	1	1	0.000	0.000	0.000	2.030	0.000	0.000	0.000	2.030
69	4	2	1	0	0.161	1.928	2.311	0.777	4.995	0.000	0.000	10.172
69	4	2	1	1	0.000	0.000	0.000	1.568	0.000	0.000	0.000	1.568
69	4	3	0	0	0.090	1.888	2.047	0.263	4.990	0.000	0.000	9.278
69	4	3	0	1	0.000	0.000	0.000	1.020	0.000	0.000	0.000	1.020
69	4	4	0	0	0.444	2.885	2.632	0.483	5.002	0.000	0.000	11.446
69	4	4	0	1	0.000	0.000	0.000	1.025	0.000	0.000	0.000	1.025
70	1	1	1	0	0.510	0.830	0.000	1.920	0.630	0.000	0.000	3.890
70	1	1	1	1	0.000	0.000	0.000	5.610	0.000	0.000	0.000	5.610
70	1	2	1	0	0.660	0.970	0.000	2.120	1.030	0.000	0.100	4.879
70	1	2	1	1	0.000	0.000	0.000	6.340	0.000	0.000	0.000	6.340
70	1	3	0	0	0.300	0.910	0.000	1.600	1.720	0.000	0.030	4.560
70	1	3	0	1	0.000	0.000	0.000	5.560	0.000	0.000	0.000	5.560
70	1	4	0	0	0.680	1.250	0.010	1.690	2.620	0.000	0.040	6.290
70	1	4	0	1	0.000	0.000	0.000	7.340	0.000	0.000	0.000	7.340
70	2	1	1	0	0.000	0.060	0.000	0.660	0.340	0.000	0.000	1.060
70	2	1	1	1	0.000	0.000	0.000	2.820	0.000	0.000	0.000	2.820
70	2	2	1	0	0.210	0.230	0.000	1.040	0.360	0.000	0.000	1.840
70	2	2	1	1	0.000	0.000	0.000	2.470	0.000	0.000	0.000	2.470
70	2	3	0	0	0.090	0.870	0.000	0.930	0.570	0.000	0.000	2.460
70	2	3	0	1	0.000	0.000	0.000	3.380	0.000	0.000	0.000	3.380
70	2	4	0	0	0.280	1.180	0.060	1.290	1.120	0.000	0.000	3.930
70	2	4	0	1	0.000	0.000	0.000	3.820	0.000	0.000	0.000	3.820
70	3	1	1	0	1.432	0.814	0.000	1.648	0.781	0.000	0.000	4.681
70	3	1	1	1	0.000	0.000	0.000	3.740	0.000	0.000	0.000	3.740
70	3	2	1	0	1.580	1.158	0.000	2.027	0.656	0.000	0.000	5.421
70	3	2	1	1	0.000	0.000	0.000	4.019	0.000	0.000	0.000	4.019
70	3	3	0	0	1.532	1.162	0.128	1.932	1.264	0.000	0.133	6.151
70	3	3	0	1	0.000	0.000	0.000	4.691	0.000	0.000	0.000	4.691
70	3	4	0	0	0.990	1.179	0.208	1.854	2.247	0.006	0.303	6.787
70	3	4	0	1	0.000	0.000	0.000	3.597	0.000	0.000	0.000	3.597
70	4	1	1	0	0.898	1.122	0.000	1.030	0.762	0.095	0.000	3.907
70	4	1	1	1	0.000	0.000	0.000	2.915	0.000	0.000	0.000	2.915
70	4	2	1	0	0.849	0.896	0.000	0.688	0.424	0.007	0.000	2.864
70	4	2	1	1	0.000	0.000	0.000	2.118	0.000	0.000	0.000	2.118
70	4	3	0	0	0.253	1.000	0.184	0.965	0.578	0.000	0.006	2.983
70	4	3	0	1	0.000	0.000	0.000	2.790	0.000	0.000	0.000	2.790
70	4	4	0	0	0.482	1.094	0.471	0.540	0.371	0.000	0.027	2.985
70	4	4	0	1	0.000	0.000	0.000	2.277	0.000	0.000	0.000	2.277
70	5	1	1	0	0.000	0.000	0.000	1.962	1.604	0.000	0.000	3.566
70	5	1	1	1	0.000	0.000	0.000	3.182	0.000	0.000	0.000	3.182
70	5	2	1	0	0.000	0.054	0.000	0.898	0.949	0.000	0.000	1.901
70	5	2	1	1	0.000	0.000	0.000	2.868	0.000	0.000	0.000	2.868
70	5	3	0	0	0.000	0.229	0.109	0.849	0.926	0.000	0.338	2.451
70	5	3	0	1	0.000	0.000	0.000	3.674	0.000	0.000	0.000	3.674
70	5	4	0	0	0.000	0.232	0.126	1.167	1.115	0.007	0.562	3.209
70	5	4	0	1	0.000	0.000	0.000	3.938	0.000	0.000	0.000	3.938
71	1	1	1	0	0.000	0.000	0.710	1.310	0.000	0.000	0.000	2.020
71	1	1	1	1	0.000	0.000	0.000	2.150	0.000	0.000	0.000	2.150
71	1	2	1	0	0.000	0.000	1.040	1.450	0.000	0.000	0.010	2.500
71	1	2	1	1	0.000	0.000	0.000	2.690	0.000	0.000	0.000	2.690

TABLE B7 (continued).—Monthly Tile Flow and/or Surface Runoff by Plots and Years (Rainfall and Irrigation).

1	2	3	4	5	6	7	8	9	10	11	12	13
71	1	3	0	0	0.000	0.000	0.700	0.000	0.000	0.000	0.000	0.700
71	1	3	0	1	0.000	0.000	0.000	3.420	0.000	0.000	0.000	3.420
71	1	4	0	0	0.000	0.000	0.950	0.030	0.000	0.000	0.050	1.020
71	1	4	0	1	0.000	0.000	0.000	4.470	0.000	0.000	0.000	4.470
71	2	1	1	0	0.110	0.000	0.220	0.510	0.000	0.020	0.000	0.860
71	2	1	1	1	0.000	0.000	0.000	0.530	0.000	0.000	0.000	0.530
71	2	2	1	0	0.000	0.000	0.750	0.400	0.000	0.000	0.000	1.150
71	2	2	1	1	0.000	0.000	0.000	0.400	0.000	0.000	0.000	0.400
71	2	3	0	0	0.030	0.000	0.580	0.000	0.000	0.000	0.000	0.610
71	2	3	0	1	0.000	0.000	0.000	2.020	0.000	0.000	0.000	2.020
71	2	4	0	0	0.220	0.000	0.580	0.000	0.000	0.000	0.000	0.800
71	2	4	0	1	0.000	0.000	0.000	2.260	0.000	0.000	0.000	2.260
71	3	1	1	0	0.662	0.194	0.949	1.029	0.000	0.000	0.000	2.831
71	3	1	1	1	0.000	0.000	0.000	2.800	0.000	0.000	0.000	2.800
71	3	2	1	0	0.015	0.000	1.108	0.867	0.000	0.010	0.000	1.989
71	3	2	1	1	0.000	0.000	0.000	2.950	0.000	0.000	0.000	2.950
71	3	3	0	0	0.300	0.355	1.108	0.247	0.034	0.099	0.000	2.143
71	3	3	0	1	0.000	0.000	0.000	3.662	0.000	0.000	0.000	3.662
71	3	4	0	0	0.145	0.011	1.001	0.689	0.000	0.141	0.011	1.998
71	3	4	0	1	0.000	0.000	0.000	2.334	0.091	0.000	0.000	2.425
71	4	1	1	0	0.463	0.000	0.892	0.657	0.000	0.000	0.000	2.012
71	4	1	1	1	0.000	0.000	0.000	1.684	0.000	0.000	0.000	1.684
71	4	2	1	0	0.430	0.000	0.575	0.687	0.000	0.007	0.000	1.699
71	4	2	1	1	0.000	0.000	0.000	1.383	0.000	0.000	0.000	1.383
71	4	3	0	0	0.000	0.035	0.723	0.086	0.025	0.000	0.000	0.869
71	4	3	0	1	0.000	0.000	0.000	1.400	0.000	0.000	0.000	1.400
71	4	4	0	0	0.010	0.013	0.431	0.032	0.008	0.024	0.000	0.518
71	4	4	0	1	0.000	0.000	0.000	1.327	0.000	0.000	0.000	1.327
71	5	1	1	0	0.352	0.000	1.784	1.724	0.000	0.092	0.121	4.072
71	5	1	1	1	0.000	0.000	0.000	3.601	0.000	0.000	0.000	3.601
71	5	2	1	0	0.514	0.000	1.294	1.431	0.000	0.134	0.165	3.538
71	5	2	1	1	0.000	0.000	0.000	1.750	0.000	0.000	0.000	1.750
71	5	3	0	0	0.000	0.000	2.215	0.209	0.000	0.056	0.039	2.519
71	5	3	0	1	0.000	0.000	0.000	3.648	0.000	0.000	0.000	3.648
71	5	4	0	0	0.000	0.231	1.840	0.323	0.050	0.229	0.086	2.759
71	5	4	0	1	0.000	0.000	0.000	1.825	0.000	0.000	0.000	1.825
72	1	1	1	0	0.320	1.150	0.610	0.000	1.180	2.030	3.970	9.260
72	1	1	1	1	0.000	0.000	0.000	1.470	0.000	0.000	0.000	1.470
72	1	2	1	0	1.310	1.340	0.660	0.040	1.240	1.690	3.610	9.890
72	1	2	1	1	0.000	0.000	0.000	1.640	0.000	0.000	0.000	1.640
72	1	3	1	0	0.400	1.190	0.220	0.000	1.130	1.720	3.170	7.830
72	1	3	1	1	0.000	0.000	0.000	1.350	0.000	0.000	0.000	1.350
72	1	4	1	0	0.800	1.190	0.660	0.070	1.240	2.250	4.150	10.360
72	1	4	1	1	0.000	0.000	0.000	1.860	0.000	0.000	0.000	1.860
72	2	1	1	0	0.450	0.250	0.170	0.000	0.520	0.590	1.710	3.690
72	2	1	1	1	0.000	0.000	0.000	0.150	0.000	0.000	0.000	0.150
72	2	2	1	0	0.420	0.400	0.160	0.040	0.570	0.420	1.560	3.570
72	2	2	1	1	0.000	0.000	0.000	0.520	0.000	0.000	0.000	0.520
72	2	3	1	0	1.110	0.080	0.010	0.000	0.340	0.660	1.310	3.510
72	2	3	1	1	0.000	0.000	0.000	0.030	0.000	0.000	0.000	0.030
72	2	4	1	0	0.390	0.310	0.060	0.000	0.360	0.360	2.220	3.700
72	2	4	1	1	0.000	0.000	0.000	0.230	0.000	0.000	0.000	0.230
72	3	1	1	0	1.553	1.224	0.669	0.075	0.864	1.471	3.885	9.740
72	3	1	1	1	0.000	0.000	0.000	1.116	0.000	0.000	0.000	1.116
72	3	2	1	0	2.422	1.566	0.933	0.093	1.004	1.338	3.257	10.613
72	3	2	1	1	0.000	0.000	0.000	1.387	0.000	0.000	0.000	1.387
72	3	3	1	0	1.641	1.326	0.761	0.221	1.004	0.963	3.486	9.402
72	3	3	1	1	0.000	0.000	0.000	0.974	0.000	0.000	0.000	0.974
72	3	4	1	0	2.025	1.607	1.013	0.650	1.080	1.748	2.709	10.832
72	3	4	1	1	0.000	0.000	0.000	1.161	0.000	0.000	0.000	1.161
72	4	1	1	0	1.451	1.242	0.866	0.015	0.729	1.029	2.425	7.757

TABLE B7 (continued).—Monthly Tile Flow and/or Surface Runoff by Plots and Years (Rainfall and Irrigation).

1	2	3	4	5	6	7	8	9	10	11	12	13
72	4	1	1	1	0.000	0.000	0.000	1.150	0.000	0.000	0.000	1.150
72	4	2	1	0	1.139	0.889	0.478	0.030	0.332	0.963	1.501	5.332
72	4	2	1	1	0.000	0.000	0.000	0.805	0.000	0.000	0.000	0.805
72	4	3	1	0	1.262	1.161	0.672	0.184	0.793	0.968	1.617	6.657
72	4	3	1	1	0.000	0.000	0.000	0.957	0.000	0.000	0.000	0.957
72	4	4	1	0	1.460	0.961	0.541	0.153	0.892	0.969	1.448	6.424
72	4	4	1	1	0.000	0.000	0.000	0.835	0.000	0.000	0.000	0.835
72	5	1	1	0	1.480	2.370	2.098	0.204	1.187	1.265	2.080	10.684
72	5	1	1	1	0.000	0.000	0.000	1.261	0.000	0.000	0.000	1.261
72	5	2	1	0	1.466	2.117	1.345	0.130	1.050	0.959	2.602	9.669
72	5	2	1	1	0.000	0.000	0.000	1.615	0.000	0.000	0.000	1.615
72	5	3	0	0	1.583	1.606	1.093	0.324	1.349	1.212	2.034	9.201
72	5	3	0	1	0.000	0.000	0.000	1.482	0.000	0.000	0.000	1.482
72	5	4	0	0	1.046	3.174	1.248	0.505	1.181	1.174	2.040	10.368
72	5	4	0	1	0.000	0.000	0.000	1.607	0.000	0.000	0.000	1.607

APPENDIX C—CROP YIELDS

TABLE C1.—Crop Yields and Plant Populations by Plots and Years.

1	2	3	4	5	5	7	8	9	10	11	12	13	14
1	65	0	1	1	1.8	0.	2	67	0	3	1	90.4	179.
1	65	0	2	1	2.4	0.	2	67	0	4	1	86.7	75.
1	65	0	3	1	10.2	0.	2	67	1	1	1	86.2	189.
1	65	0	4	1	3.2	0.	2	67	1	2	1	90.0	221.
1	65	1	1	1	49.9	0.	2	67	1	3	1	111.7	206.
1	65	1	2	1	45.8	0.	2	67	1	4	1	107.6	209.
1	65	1	3	1	42.3	0.	2	67	2	1	1	117.7	195.
1	65	1	4	1	39.9	0.	2	67	2	2	1	113.9	190.
1	65	2	1	1	52.7	0.	2	67	2	3	1	124.3	230.
1	65	2	2	1	50.3	0.	2	67	2	4	1	119.2	226.
1	65	2	3	1	50.9	0.	2	67	3	1	1	114.9	189.
1	65	2	4	1	48.8	0.	2	67	3	2	1	108.8	188.
1	65	3	1	1	54.6	0.	2	67	3	3	1	115.1	198.
1	65	3	2	1	49.6	0.	2	67	3	4	1	110.7	206.
1	65	3	3	1	49.1	0.	3	63	0	1	1	78.0	161.
1	65	3	4	1	46.3	0.	3	63	0	2	1	36.9	148.
2	62	0	1	1	47.5	116.	3	63	0	3	1	89.8	157.
2	62	0	2	1	13.7	119.	3	63	0	4	1	31.4	110.
2	62	0	3	1	44.7	131.	3	63	1	1	1	82.5	159.
2	62	0	4	1	1.6	121.	3	63	1	2	1	83.8	151.
2	62	1	1	1	101.8	154.	3	63	1	3	1	94.3	160.
2	62	1	2	1	90.3	163.	3	63	1	4	1	71.6	150.
2	62	1	3	1	92.2	142.	3	63	2	1	1	104.4	161.
2	62	1	4	1	90.8	149.	3	63	2	2	1	88.9	160.
2	62	2	1	1	99.3	192.	3	63	2	3	1	107.5	160.
2	62	2	2	1	88.8	136.	3	63	2	4	1	102.5	161.
2	62	2	3	1	106.1	216.	3	63	3	1	1	109.1	174.
2	62	2	4	1	107.1	181.	3	63	3	2	1	96.9	156.
2	62	3	1	1	108.8	174.	3	63	3	3	1	87.9	150.
2	62	3	2	1	102.1	168.	3	63	3	4	1	91.5	167.
2	62	3	3	1	98.9	148.	3	64	0	1	1	61.3	127.
2	62	3	4	1	97.5	165.	3	64	0	2	1	31.7	75.
2	67	0	1	1	0.0	20.	3	64	0	3	1	72.3	122.
2	67	0	2	1	62.6	141.	3	64	0	4	1	55.4	136.

Columns	Code
1 and 8	Crop 1 soybeans 2 corn, 1st year 3 corn, 2nd year or more 4 oats
2 and 9	Year, last two digits
3 and 10	Drainage 0 no drainage 1 surface only 2 combination tile plus surface 3 tile only 4 plastic tubing
4 and 11	Replication number
5 and 12	Tillage 0 no tillage 1 conventional, fall plowing, spring disking, and planting
6 and 13	Yield in bu./acre
7 and 14	Plant population in 100's/acre

TABLE C1 (continued).—Crop Yields and Plant Populations by Plots and Years.

1	2	3	4	5	5	7	8	9	10	11	12	13	14
3	64	1	1	1	103.6	151.	3	70	3	3	0	47.9	154.
3	64	1	2	1	68.6	165.	3	70	3	4	0	23.2	153.
3	64	1	3	1	67.5	113.	3	70	5	1	1	48.9	198.
3	64	1	4	1	77.1	194.	3	70	5	2	1	52.1	191.
3	64	2	1	1	106.1	183.	3	70	5	3	0	41.6	116.
3	64	2	2	1	96.9	183.	3	70	5	4	0	38.2	154.
3	64	2	3	1	95.4	185.	3	71	1	1	1	62.5	240.
3	64	2	4	1	90.2	192.	3	71	1	2	1	62.3	231.
3	64	3	1	1	114.4	264.	3	71	1	3	0	69.8	240.
3	64	3	2	1	92.8	179.	3	71	1	4	0	79.5	253.
3	64	3	3	1	86.5	191.	3	71	2	1	1	123.7	252.
3	64	3	4	1	86.9	149.	3	71	2	2	1	140.6	250.
3	68	0	1	1	26.1	64.	3	71	2	3	0	124.1	253.
3	68	0	2	1	77.5	147.	3	71	2	4	0	133.2	256.
3	68	0	3	0	44.0	58.	3	71	3	1	1	117.1	243.
3	68	0	4	0	65.1	100.	3	71	3	2	1	111.1	266.
3	68	1	1	1	102.8	224.	3	71	3	3	0	129.2	268.
3	68	1	2	1	104.5	233.	3	71	3	4	0	98.1	250.
3	68	1	3	0	90.8	180.	3	71	5	1	1	82.3	255.
3	68	1	4	0	97.1	172.	3	71	5	2	1	72.7	254.
3	68	2	1	1	119.8	246.	3	71	5	3	0	96.2	256.
3	68	2	2	1	125.2	256.	3	71	5	4	0	91.6	254.
3	68	2	3	0	122.4	252.	4	66	0	1	1	0.0	0.
3	68	2	4	0	104.8	222.	4	66	0	2	1	0.0	0.
3	68	3	1	1	114.4	245.	4	66	0	3	1	0.0	0.
3	68	3	2	1	117.4	249.	4	66	0	4	1	0.0	0.
3	68	3	3	0	95.3	183.	4	66	1	1	1	49.7	0.
3	68	3	4	0	70.2	172.	4	66	1	2	1	51.2	0.
3	69	0	1	1	50.0	221.	4	66	1	3	1	42.4	0.
3	69	0	2	1	60.8	218.	4	66	1	4	1	47.8	0.
3	69	0	3	0	0.0	100.	4	66	2	1	1	82.9	0.
3	69	0	4	0	0.0	100.	4	66	2	2	1	82.7	0.
3	69	1	1	1	40.4	216.	4	66	2	3	1	75.9	0.
3	69	1	2	1	30.4	219.	4	66	2	4	1	78.2	0.
3	69	1	3	0	0.0	100.	4	66	3	1	1	60.9	0.
3	69	1	4	0	0.0	100.	4	66	3	2	1	75.1	0.
3	69	2	1	1	88.5	221.	4	66	3	3	1	72.7	0.
3	69	2	2	1	88.5	218.	4	66	3	4	1	65.4	0.
3	69	2	3	0	0.0	100.	4	72	1	1	1	0.0	0.
3	69	2	4	0	0.0	100.	4	72	1	2	1	0.0	0.
3	69	3	1	1	85.0	222.	4	72	1	3	0	0.0	0.
3	69	3	2	1	71.5	221.	4	72	1	4	0	0.0	0.
3	69	3	3	0	10.9	100.	4	72	2	1	1	35.8	0.
3	69	3	4	0	0.0	100.	4	72	2	2	1	32.7	0.
3	70	1	1	1	41.2	194.	4	72	2	3	0	57.4	0.
3	70	1	2	1	40.3	187.	4	72	2	4	0	52.6	0.
3	70	1	3	0	21.6	105.	4	72	3	1	1	26.2	0.
3	70	1	4	0	20.9	141.	4	72	3	2	1	32.7	0.
3	70	2	1	1	94.9	206.	4	72	3	3	0	48.1	0.
3	70	2	2	1	109.9	203.	4	72	3	4	0	35.3	0.
3	70	2	3	0	74.4	111.	4	72	5	1	1	16.7	0.
3	70	2	4	0	65.2	140.	4	72	5	2	1	16.9	0.
3	70	3	1	1	69.9	202.	4	72	5	3	0	63.0	0.
3	70	3	2	1	92.2	213.	4	72	5	4	0	27.9	0.

TABLE C2.

AVERAGE CORN PLANT POPULATION BY DRAINAGE TREATMENT AND YEARS*

Year	Tillage	Seeding Rate per Ac.	Population in Plants per Ac.			
			Surface Drainage	Tile Drainage	Tile & Surface Drainage	No Drainage
1962	Conv.	20,000	15,200	15,375	18,125	12,175
1963	Conv.	22,000	15,500	16,175	16,025	14,400
1964	Conv.	22,000	15,575	19,575	18,575	11,500
1967	Conv.	28,000	20,625	19,525	21,025	10,375
1968	Conv.	26,000	22,850	24,700	25,100	10,550
	No till.	26,000	17,600	17,750	23,700	7,900
1969	Conv.	26,000	21,750	22,150	21,950	21,950
	No till.	26,000	Not taken in 1969 - zero yield			
1970	Conv.	26,000	19,050	20,750	20,450	**
	No till.	26,000	12,300	15,350	12,550	**
1971	Conv.	26,000	23,550	25,450	25,100	**
	No till.	26,000	24,650	25,900	25,450	**

* Averages are for 4 replicates in 1962, 63, 64, and 67; and for 2 replicates in 1968, 69, 70, and 71.

** Treatment changed to plastic tube drainage in 1970.

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BETTER LIVING IS THE PRODUCT

of research at the Ohio Agricultural Research and Development Center. All Ohioans benefit from this product.

Ohio's farm families benefit from the results of agricultural research translated into increased earnings and improved living conditions. So do the families of the thousands of workers employed in the firms making up the state's agribusiness complex.

But the greatest benefits of agricultural research flow to the millions of Ohio consumers. They enjoy the end products of agricultural science—the world's most wholesome and nutritious food, attractive lawns, beautiful ornamental plants, and hundreds of consumer products containing ingredients originating on the farm, in the greenhouse and nursery, or in the forest.

The Ohio Agricultural Experiment Station, as the Center was called for 83 years, was established at The Ohio State University, Columbus, in 1882. Ten years later, the Station was moved to its present location in Wayne County. In 1965, the Ohio General Assembly passed legislation changing the name to Ohio Agricultural Research and Development Center—a name which more accurately reflects the nature and scope of the Center's research program today.

Research at OARDC deals with the improvement of all agricultural production and marketing practices. It is concerned with the development of an agricultural product from germination of a seed or development of an embryo through to the consumer's dinner table. It is directed at improved human nutrition, family and child development, home management, and all other aspects of family life. It is geared to enhancing and preserving the quality of our environment.

Individuals and groups are welcome to visit the OARDC, to enjoy the attractive buildings, grounds, and arboretum, and to observe first hand research aimed at the goal of Better Living for All Ohioans!

The State Is the Campus for Agricultural Research and Development



Ohio's major soil types and climatic conditions are represented at the Research Center's 13 locations.

Research is conducted by 15 departments on nearly 7,400 acres at Center headquarters in Wooster, eight branches, Green Springs Crops Research Unit, Pomerene Forest Laboratory, North Appalachian Experimental Watershed, and The Ohio State University.

- Center Headquarters, Wooster, Wayne County: 1953 acres
- Eastern Ohio Resource Development Center, Caldwell, Noble County: 2053 acres
- Green Springs Crops Research Unit, Green Springs, Sandusky County: 26 acres
- Jackson Branch, Jackson, Jackson County: 502 acres

- Mahoning County Farm, Canfield: 275 acres
- Muck Crops Branch, Willard, Huron County: 15 acres
- North Appalachian Experimental Watershed, Coshocton, Coshocton County: 1047 acres (Cooperative with Agricultural Research Service, U. S. Dept. of Agriculture)
- North Central Branch, Vickery, Erie County: 335 acres
- Northwestern Branch, Hoytville, Wood County: 247 acres
- Pomerene Forest Laboratory, Coshocton County: 227 acres
- Southern Branch, Ripley, Brown County: 275 acres
- Western Branch, South Charleston, Clark County: 428 acres