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THE ENERGY BUDGET AT THE EARTH'S SURFACE

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Soil Moisture Analyses, Ellis Hollow,
(Ithaca, N. Y.) 1960 and 1961

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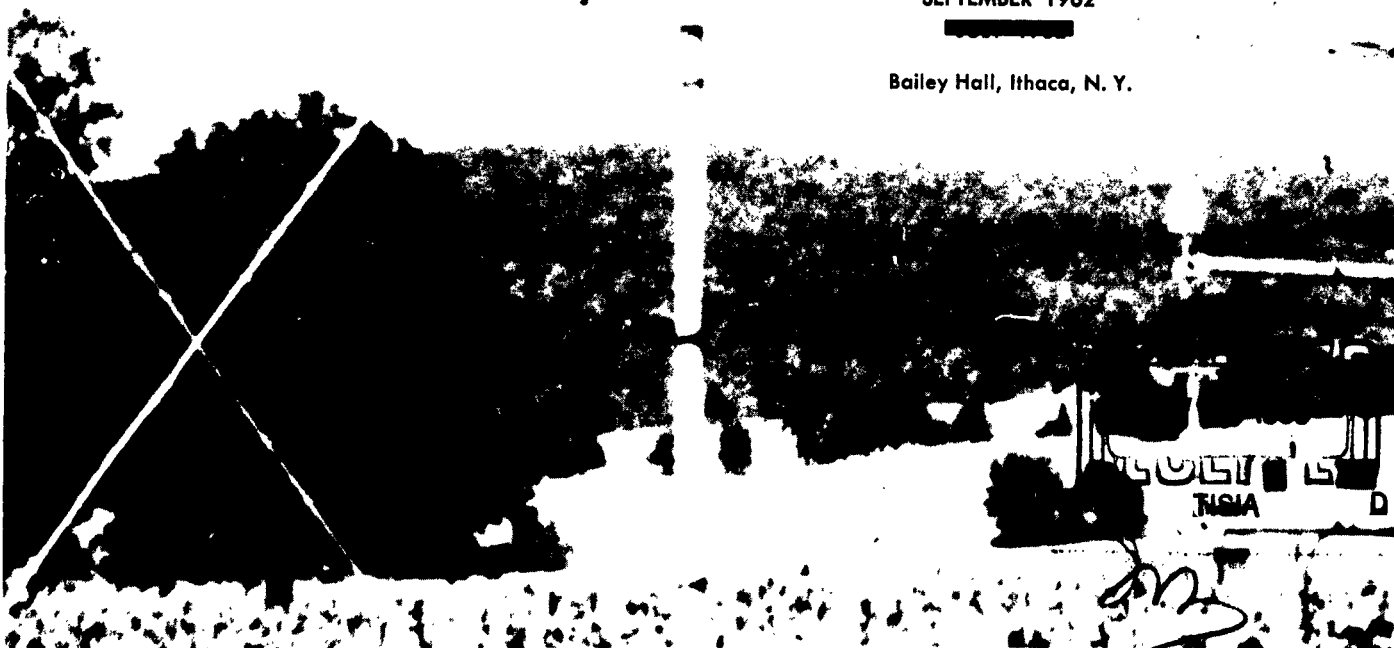
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SOIL MOISTURE ANALYSES, ELLIS HOLLOW, ITHACA, N. Y.
1960 and 1961^{1/}

by

J.H. Shinn, K.W. Brown, and R.F. West^{2/}

Northeast Branch
Soil and Water Conservation Research Division
Agricultural Research Service
U. S. Department of Agriculture
Ithaca New York

The following is a summarization of soil moisture data taken for an energy balance study during the 1960 and 1961 growing seasons in Ellis Hollow at Ithaca, New York.

The soil is Chenango channery silt loam, fan phase. This is a moderately well-drained soil, and has a layer of glacially deposited stones at a depth of two feet. Little soil development is present below two feet, but some root penetration does occur. Eighty-five percent (by weight) of the roots of mature corn are distributed in the first 18 inches.

The Desorption Characteristic

The desorption curve was determined on a pressure membrane and a pressure plate apparatus.

For the pressure membrane, samples were taken at 6 - 12", 12", 18", and 24" with an auger. The samples were the 2 mm. fraction, and were handled in the standard manner.

^{1/} Contribution from the Northeast Branch, Soil and Water Conservation Research Division, Agricultural Research Service, U.S. Dept. of Agriculture, in cooperation with the Dept. of Agronomy at Cornell University. The work was supported in part by the Meteorology Dept., U.S. Army Electronic Proving Ground, Fort Huachuca, Arizona. Dept. of Agronomy Series Paper No. 587.

^{2/} Soil Scientist, USDA; Graduate Student, Dept. of Agronomy, Cornell University; and Research Helper, USDA; Ithaca, N.Y., respectively.

Equilibration pressures were 2, 5, and 15 atm. The conversion of weight fractions to volume fractions was made by bulk density determination.

Bulk densities were measured from 0 to 6; 6 to 12; and 12 to 18 inches. A water column and balloon were used to measure the displaced volume. Because of the high stone content, a total volume greater than 1500 cm.³ was sampled to minimize errors. The samples were oven dried.

A correction for the stones present was necessary also on the sieved samples. The fraction of 2 mm. soil to total solids was determined.

The percent moisture by volume, PV, is then given by:

$$PV = dk(PW)$$

where:

d = bulk density or mass of solids per unit volume;

k = fraction of soil 2 mm. per total mass of solids, and,

PW = percent moisture by weight.

The pressure plate samples were eight undisturbed core samples from the 6 to 12-inch depth. The equilibrium pressures were 0.01, 0.30, and 0.30 atm.

The desorption characteristic was supplemented by the field measurements using the neutron probe and tensiometer^{3/} measurements at 12 inches. In addition, the field capacity probe data therefore provided field capacity water content as a function of depth (figure 1.)

The desorption data are presented in tabular form and plotted (figure 2.) Where the data are used to supplement the soil moisture measurements, the 6 to 12-inch curve is used, in deference to the lack of supporting data on the lower depth curves.

^{3/} Model "R" Irrrometer, Irrrometer Company, Riverside, California.

Table 1. Summary - desorption data, Ellis Hollow
Chenango channery silt loam (fan phase)

Depth <u>Inches</u>	Soil + stones	Volume	Bulk density ^{1/}	Soil + stones	Soil ^{2/}	Soil fraction
0 - 6	2198	1598	1.375	5732	2766	0.483
6 - 12	2470	1765	1.399	3843	1407	.366
12 - 18	1083	753	1.438	1066	340	.319
	<u>ψ atm.^{3/}</u>	<u>P_w^{4/}</u>	<u>P_v^{5/}</u>			
6 - 12	0.10	38.3	25.3			
	.30	36.4	24.0			
	.33	35.6	23.5			
	2.0	19.5	12.9			
	5.0	15.5	10.2			
	15.0	11.3	7.5			
12	2.0	18.1	9.2			
	5.0	13.8	7.0			
	15.0	9.9	5.0			
18	2.0	14.8	6.8			
	5.0	11.0	5.1			
	15.0	8.1	3.7			
24	2.0	12.5	5.6			
	5.0	9.6	4.4			
	15.0	7.2	3.3			

^{1/} Bulk densities in gm/cm³. Average of eight undisturbed cores; others are average of four samples, or two samples (18" and 24".)

^{2/} Soil dry sieved through 2 mm.

^{3/} ψ = applied differential pressure

^{4/} P_w = percent moisture by weight

^{5/} P_v = percent moisture by volume.

Figure 1. Field capacity (0.10 atm.) as a function of depth.

Figure 2. The desorption characteristic of Chenango channery silt loam,
fan phase, for various depths.

FIELD CAPACITY (0.10 ATM.)
AS A FUNCTION OF DEPTH

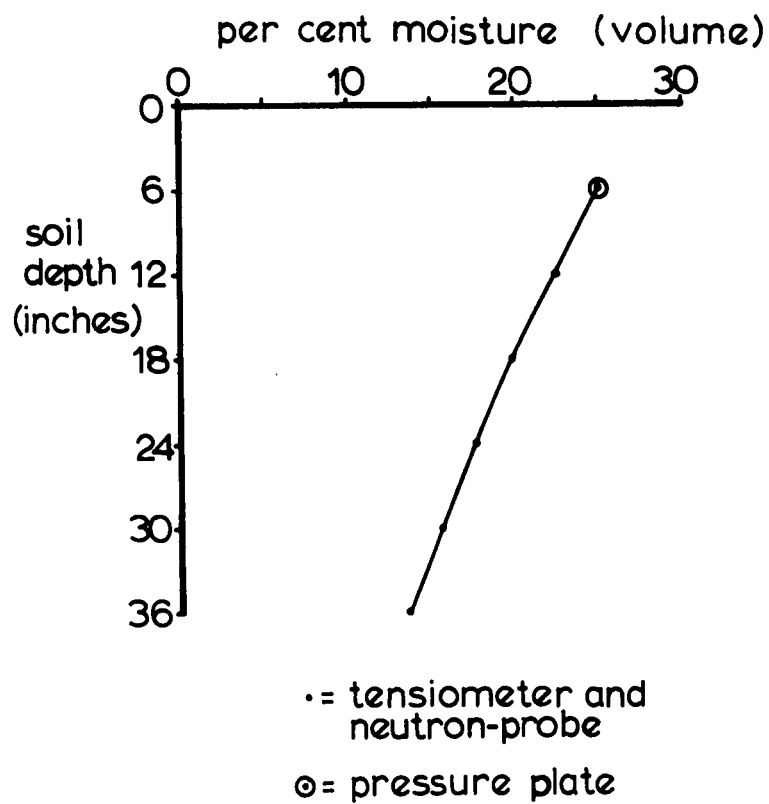
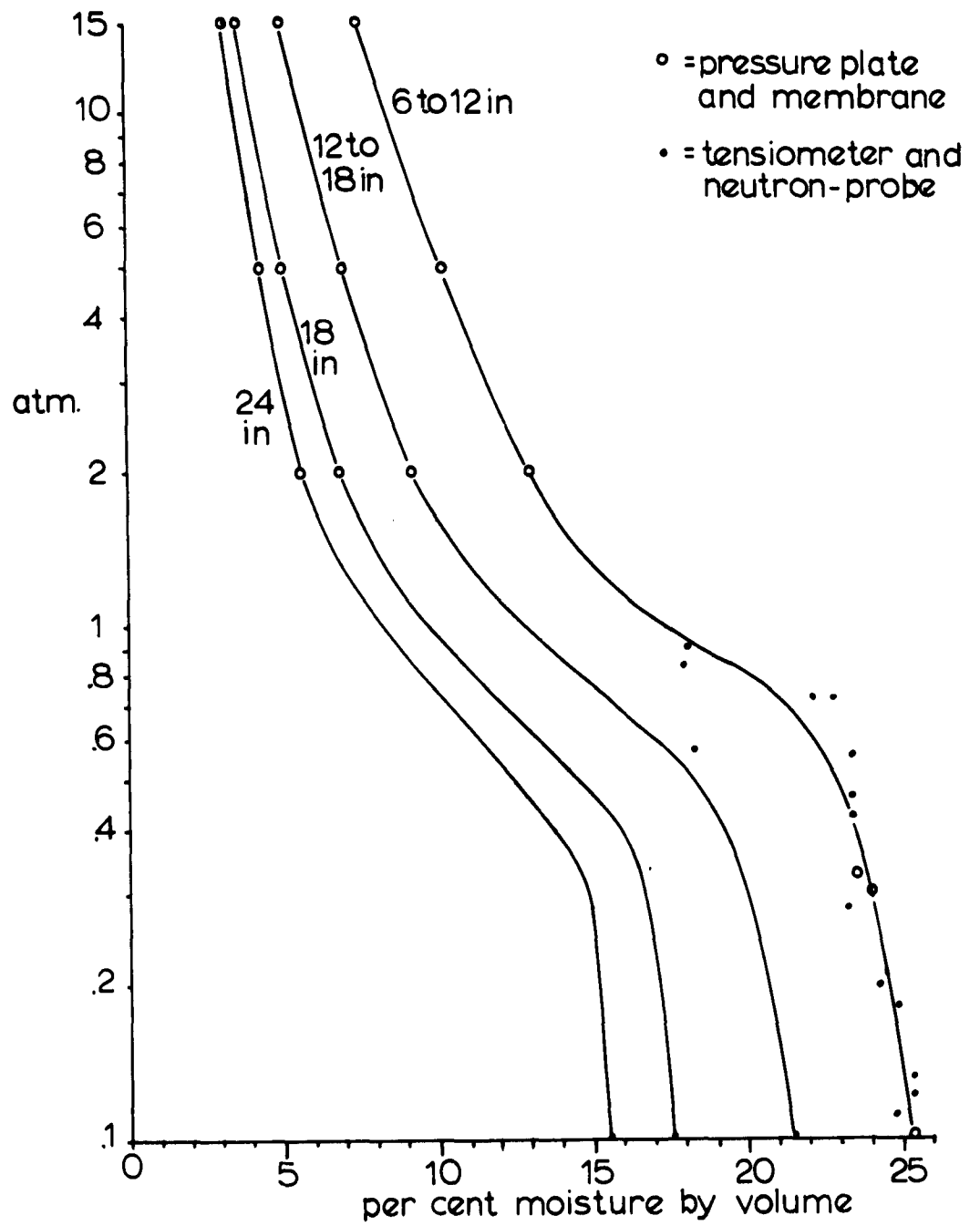


FIG. 1

differential
pressure



Soil Moisture Measurements, Ellis Hollow, 1961

Soil moisture measurements for 1960 were begun on July 5, 1960. Tensiometers were placed at three depths (12, 24, and 36 inches) as follows:

Irrigated corn, sampling plot	- 3 sites (in the row)
Unirrigated corn, sampling plot	- 2 sites (in the row)
Irrigated alfalfa	- 2 sites (in the row),
Irrigated alfalfa	- 2 sites, and,
Unirrigated alfalfa	- 1 site.

The soil moisture tension was considered to have gone out of tensiometer range when the tensiometers read in excess of 0.80 atm. The data were supplemented with neutron-probe and desorption curve data at these points when possible. This is a valid approximation within the range ± 0.1 atm., when the soil is drying. The desorption curve used was determined in the lower range of tensions for the 6 to 12-inch soil depth. It was used to estimate tension in the 24-inch depth also; thus, the estimates are probably higher than true tension at that depth.

The soil moisture neutron probe was used to measure the percent moisture by volume of the soil. Access pipes were placed at three sites in each of the treatments less than 3 feet from the tensiometers (in the row, in the case of corn.) The factory calibration curve was used with no independent checks. The standard count ratio was determined before and after each day's run. Measurements were made at 12, 24, and 30 inches. Counts were taken over 10,000 so that a 90% confidence allows less than 1.7% error from the "true" count.

In order to calculate water use, the percent moisture as a function of depth was plotted and integrated graphically, assigning the water content at zero inches the same value as determined at 12 inches. The variation between sites was less than 10% for absolute water content, and less than 2% for changes in water content (after equilibrium.) The changes in water content in a five-day period may be less than 5%, however. Therefore, the water use data is inaccurate. Only an accumulative water content makes any sense, and this tends to mask the changes.

Rainfall was measured by a standard rain gauge; irrigation by the time interval. The rate of application of irrigation was previously determined at constant pressure, by a systematic placing of No. 10 cans around a sprinkler.

The water use over a period of time will then be the rainfall (or irrigation), minus the change in soil moisture content. This contains runoff and percolation dispersal of water as well.

The data are presented in tabular form. Their use in studying certain periods of moisture stress is best noted in the changes of the depth profile over the period in question.

Table 2. Soil moisture tension and applied water (rain + irrig.)^{1/}
Ellis Hollow - 1960.

Date	Rain in.	Irrig. in.	Irrigated corn									Unirrigated corn					
			Site 1			Site 2			Site 3			Site 1			Site 2		
			Depth - inches														
			12	24	36	12	24	36	12	24	36	12	24	36	12	24	36
7/5	-		39	16	-	60	12	11	-	-	-	-	-	-	-	-	
7/6	-		47	18	18	66	12	11	60	18	17	55	43	56	41	30	21
7/7	-		62	18	14	79	13	11	59	17	16	55	17	14	57	15	15
7/8	-		77	19	14	83	14	11	63	17	16	62	16	13	62	15	16
7/11	-		85	22	14	-	14	12	75	19	18	76	17	11	82	16	16
7/13	0.43		(120)	25	15	-	14	12	83	20	20	84	18	13	76	16	16
7/14	.20		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/15	-		62	27	15	65	15	12	88	19	23	85	18	14	71	20	16
7/17	.07		-	30	16	63	17	14	86	23	26	86	23	14	85	25	17
7/18	.04		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/19	.14		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/20	-		-	38	14	-	16	14	83	27	37	-	-	-	-	-	-
7/21	-	3.6	-	5	14	0	9	13	2	4	20	-	46	18	-	74	19
7/22	.06		5	8	10	6	6	10	6	6	10	-	45	17	-	68	22
7/23	.09		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/25	-		17	10	11	19	8	10	21	8	11	-	69	20	-	61	23
7/26	-		19	10	11	24	8	10	26	8	11	-	74	21	-	83	24
7/27	.02		-	-	-	-	-	-	-	-	-	(190)	(92)	-	(140)	(120)	-
7/28	-		50	10	12	67	8	11	75	14	12	-	-	23	-	-	28
7/30	.38		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

^{1/} Soil moisture tension (atm x 10⁻²) measured by tensiometers. Those values in () beyond the range of tensiometer were determined by neutron probe measurements and desorption curve for the soil.

Dates listed are dates when rainfall occurred or measurements were made.

(cont.)

Table 2, cont.

Date	Rain in.	Irrig. in.	Irrigated corn									Unirrigated corn								
			Site 1			Site 2			Site 3			Site 1			Site 2					
			Depth - inches																	
			12	24	36	12	24	36	12	24	36	12	24	36	12	24	36			
8/1	-	3.0	72	20	11	80	13	11	88	22	16	(150)	(110)	24	(170)	(160)	52			
/2) 3)	0.88		4	8	9	4	6	10	4	8	10	-	-	-	-	-	-			
8/4	-		8	9	10	8	6	10	6	8	10	53	67	25	70	76	60			
/6	-		13	10	10	12	9	10	10	10	10	82	67	25	69	-	70			
/9	-		36	12	11	34	11	11	29	13	10	84	-	29	83	82	85			
/10	-		-	-	-	-	-	-	-	-	-	(140)	(130)	-	(160)	(170)	-			
/15	-		31	17	13	34	13	12	36	16	12	-	70	30	-	-	-			
/17	-		64	21	13	56	14	12	63	19	12	65	-	30	69	80	82			
8/18 2/-			73	21	13	74	15	12	79	18	12	-	65	35	-	82	84			
			76	22	13	77	15	12	80	19	12	-	-	-	-	-	-			
			80	24	13	78	15	12	80	22	16	-	66	36	-	82	86			
			84	24	13	79	16	12	82	22	17	-	68	40	-	82	86			
			85	24	14	83	16	12	83	22	17	(130)	(170)	-	(170)	(200)	-			
8/19) 20)	.75		84	24	13	85	16	12	86	24	18	88	70	40	82	82	88			
8/22	.19		31	22	14	17	10	12	-	10	20	29	-	42	81	9	85			
/24	-		29	21	15	21	16	13	-	19	19	-	-	45	-	-	-			
/25	-		34	23	14	27	16	14	-	20	20	-	84	37	-	72	78			
/26	-		-	-	-	-	-	-	-	-	-	(140)	(130)	-	(150)	(200)	-			
/29	.87		79	35	15	75	24	14	-	30	25	78	-	43	72	-	-			
/30	-		11	26	14	11	14	14	-	14	26	62	64	41	67	71	-			
/31	-		22	25	14	14	15	14	32	17	24	70	66	42	71	75	56			

2/ Data taken for 8/18 at 08:30, 10:30, 13:00, 15:15, and 17:15, respectively

(cont.)

Table 2, cont.

Date	Rain in.	Irrig. in.	Irrigated corn									Unirrigated corn					
			Site 1			Site 2			Site 3			Site 1			Site 2		
			Depth - inches														
			12	24	36	12	24	36	12	24	36	12	24	36	12	24	36
9/1	0.13		-	-	-	-	-	-	-	-	-	-	-	-	-	-	
/2	-		33	26	14	24	18	14	23	45	24	-	70	48	82	80	71
/3	-		-	-	-	-	-	-	-	-	-	(105)	(270)	-	(135)	(210)	-
/4	.68		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
/5	-		12	18	14	10	10	14	14	13	21	30	70	-	3	-	47
/6	-		18	18	12	11	14	12	19	15	18	3	51	46	57	51	-
/8	-		35	22	14	22	14	14	34	20	19	-	71	49	68	71	-
/9	.51		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
/11	1.05		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
/12	.47		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
/13	.15		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
/15	-		8	10	10	7	7	10	9	8	11	13	52	47	10	46	-
/16	.10		9	10	10	9	8	11	10	9	12	13	27	43	9	15	44
/19	.03		9	10	10	10	8	11	11	10	12	15	23	35	12	16	35
/20	.22		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
/23	-		10	11	11	11	9	12	12	11	13	16	23	30	13	18	32
/29	.10		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
/30	.22		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10/3	-		13	14	12	15	12	13	18	13	13	23	27	26	29	24	32
/10	-		15	15	13	18	13	15	20	14	15	27	25	25	29	29	33
/11	-		15	15	12	18	13	14	20	15	15	28	25	25	28	28	32

Table 3a. Percent moisture (volume fraction)^{1/}
Ellis Hollow, 1960.

I r r i g a t e d c o r n

Date	Site 1			Site 2			Site 3		
				Depth - inches					
	12	24	30	12	24	30	12	24	30
<u>July</u>									
7-8	17.6	14.2	13.9	19.6	14.5	14.8	20.2	16.7	16.8
13	15.6	14.2	2/						
26	20.0	15.2	14.7	21.4	14.5	15.4	22.0	18.0	18.1
<u>August</u>									
2	22.5	17.2	16.5	23.7	16.2	15.6	24.5	19.7	19.8
9	18.6	15.1	14.6	20.7	14.5	14.8	21.3	17.4	17.3
18	18.4	14.3	14.3	19.8	14.2	15.0	20.1	16.5	17.1
25	17.5	14.5	14.0	20.6	14.0	14.5	22.6	17.3	16.4
<u>Sept.</u>									
2	18.8	13.9	13.5	21.6	13.9	14.2	20.9	15.7	16.1
9	18.1	14.0	13.6	21.4	14.5	14.5	20.6	16.1	16.1
16	21.2	16.4	15.2	24.1	15.3	15.2	23.5	16.4	17.4
23	20.7	15.4	14.6	22.7	14.9	15.3	22.3	17.7	18.0
<u>October</u>									
3	20.0	14.8	14.3	22.0	14.4	15.0	21.8	17.5	17.3
10	19.8	14.7	14.4	21.2	14.5	14.7	21.8	17.3	17.6

^{1/} By neutron-scatter probe from calibration curve supplied with instrument.

^{2/} Instrument breakdown

Table 3b. Percent moisture (volume fraction)^{1/}
Ellis Hollow, 1960.

Unirrigated corn									
Date	Site 1			Site 2			Site 3		
	12	24	30	Depth - inches 12	24	30	12	24	30
<u>July</u>									
26	14.6	17.6	19.8	14.7	15.4	17.5	13.3	12.2	13.5
<u>August</u>									
2	14.2	16.2	20.5	13.6	13.8	16.5	13.0	11.7	12.7
9	14.7	15.1	19.8	14.0	13.5	14.7	14.2	11.8	11.8
18	15.0	13.5	19.0	13.6	13.0	13.5	13.4	11.6	11.4
25	14.7	15.1	17.7	14.2	13.0	13.5	15.1	11.7	11.4
<u>Sept.</u>									
2	16.5	11.7	11.2	14.8	12.8	13.3	16.4	15.0	14.0
9	17.5	15.0	17.5	16.1	13.0	13.1	16.4	12.2	11.3
16	18.7	17.5	17.2	21.6	17.4	17.6	21.1	15.6	14.5
23	19.8	18.1	19.6	20.8	16.9	17.1	20.9	15.0	13.8
<u>October</u>									
3	18.4	18.0	19.6	20.4	16.5	16.8			
10	19.0	17.3	20.4	20.3	16.2	16.8			

^{1/} By neutron-scatter probe from calibration curve supplied with instrument.

Errata Sheet

Table 4. Profile water status and water use - 1960.

Date	<u>Inches water in 30-inch profile^{1/}</u>			Average profile water	Irrigation + rainfall	Accumulated water use
	Site 1	Site 2	Site 3			
<u>I r r i g a t e d c o r n</u>						
7/8	5.70	6.18	6.73	6.2	0	-
/13	5.30	2/	-	3/ 5.8	0	0.4
/26	6.36	6.59	7.23	6.7	4.6	4.1
8/2	7.13	8.00	8.00	7.7	4.3	7.4
/9	6.09	6.36	6.93	6.5	0	8.6
/18	5.89	6.19	6.63	6.2	0	8.9
/25	5.76	6.26	6.97	6.3	1.0	9.8
9/2	5.92	6.43	6.61	6.3	1.0	10.8
/9	5.89	6.39	6.65	6.3	1.2	12.0
/16	6.66	7.09	7.36	7.0	1.7	13.0
/23	6.53	6.83	7.26	6.9	.3	13.4
10/3	6.19	6.56	7.03	6.6	.4	14.1
/10	6.23	6.39	7.00	6.5	0	14.2
<u>U n i r r i g a t e d c o r n</u>						
7/13	-	-	-	2/ 5.8	0	.4
/26	5.97	5.60	4.77	5.4	1.0	1.8
8/2	5.98	4.90	4.50	5.1	1.3	3.4
/9	5.84	5.08	4.66	5.2	0	3.4
/18	5.60	4.78	4.50	5.0	0	3.6
/25	5.68	4.14	4.72	4.8	1.0	4.8
9/2	5.09	5.03	5.50	5.2	1.0	5.4
/9	6.20	5.40	5.05	5.6	1.2	6.2
/16	6.40	7.10	6.56	6.7	1.7	6.8
/23	7.20	6.95	6.35	6.8	.3	7.0
10/3	6.60	6.63	-	6.6	.4	7.6
/10	6.75	6.80	-	6.8	0	7.6

^{1/} Determined from 0-30-inch profile graphical integrations^{2/} Instrument breakdown^{3/} Adjusted mean

Table 4. Profile water status and water use - 1960.

Date	<u>Inches water in 30-inch profile^{1/}</u>			Average profile water	Irrigation + rainfall	Accumulated water use
	Site 1	Site 2	Site 3			
<u>I r r i g a t e d c o r n</u>						
7/8	5.70	6.18	6.73	6.2	0	-
/13	5.30	2/	-	5.83/	0	0.4
/26	6.36	6.59	7.23	6.7	4.6	3.9
8/2	7.13	8.00	8.00	7.7	4.3	7.2
/9	6.09	6.36	6.93	6.5	0	8.4
/18	5.89	6.19	6.63	6.2	0	8.7
/25	5.76	6.26	6.97	6.3	1.0	9.7
9/2	5.92	6.43	6.61	6.3	1.0	10.7
/9	5.89	6.39	6.65	6.3	1.2	11.9
/16	6.66	7.09	7.36	7.0	1.7	13.2
/23	6.53	6.83	7.26	6.9	.3	13.6
10/3	6.19	6.56	7.03	6.6	.4	14.3
/10	6.23	6.39	7.00	6.5	0	14.4
<u>U n i r r i g a t e d c o r n</u>						
7/13	-	-	-	5.83/	0	.4
/26	5.97	5.60	4.77	5.4	1.0	1.8
8/2	5.98	4.90	4.50	5.1	1.3	3.4
/9	5.84	5.08	4.66	5.2	0	3.4
/18	5.60	4.78	4.50	5.0	0	3.6
/25	5.68	4.14	4.72	4.8	1.0	4.8
9/2	5.09	5.03	5.50	5.2	1.0	5.4
/9	6.20	5.40	5.05	5.6	1.2	6.2
/16	6.40	7.10	6.56	6.7	1.7	6.8
/23	7.20	6.95	6.35	6.8	.3	7.0
10/3	6.60	6.63	-	6.6	.4	7.6
/10	6.75	6.80	-	6.8	0	7.6

^{1/} Determined from 0 - 30-inch profile graphical integrations^{2/} Instrument breakdown^{3/} Adjusted mean

Table 5. Soil moisture tension and applied water (rain + irrig.)^{1/}
Ellis Hollow - 1960.

Date	Rain inches	Irrig. inches	Irrigated alfalfa			Unirrigated alfalfa					
			Site 1			Site 2			Site 1		
			D e p t h - i n c h e s								
			12	24	36	12	24	36	12	24	36
7/5			44	-	-	-	-	-	-	-	-
7/6			52	15	40	59	58	21	39	28	45
7/7			57	23	28	60	22	15	23	15	15
7/8			64	26	21	64	21	15	23	16	15
7/11			85	32	21	75	22	16	30	18	18
7/13	0.43		89	39	21	82	25	17	35	19	20
7/14	.20	0.75	-	-	-	-	-	-	-	-	-
7/15	-		44	44	26	29	27	19	35	22	22
7/16	-	3.25	-	-	-	-	-	-	-	-	-
7/17	.07		12	52	28	9	21	20	40	25	25
7/18	.04		-	-	-	-	-	-	-	-	-
7/19	.14		-	-	-	-	-	-	-	-	-
7/20	-		25	57	32	15	16	18	-	-	-
7/21	-		32	55	35	17	17	19	56	30	32
7/22	.06		37	55	36	20	17	20	60	31	34
7/23	.09		-	-	-	-	-	-	-	-	-
7/25	-		65	60	45	43	25	21	75	40	45
7/26	-		77	64	47	53	26	21	75	48	50
7/27	.02		87	67	55	66	40	23	80	59	60
7/30	.38		-	-	-	-	-	-	-	-	-
7/31			C r o p h a r v e s t e d								

^{1/}

Soil moisture tension (atm x 10⁻²) measured by tensiometers.

Dates listed are those when rainfall occurred, or irrigation or measurements were made.

(cont.)

Table 5, cont.

Date	Rain inches	Irrig. inches	Irrigated alfalfa						Unirrigated alfalfa				
			Site 1			Site 2			Site 1				
			D e p t h - i n c h e s										
			12	24	36	12	24	36	12	24	36		
8/1	-		-	-	-	-	-	-	-	76	77		
8/2) /3)	0.88		-	-	-	-	-	-	-	-	-		
8/4	-		-	-	-	-	-	-	60	83	87		
8/6	-		44	55	76	22	50	30	70	83	87		
8/7	-								harvested				
8/9	-		63	64	79	46	51	31	-	-	-		
8/15	-		64	69	80	63	48	36	-	-	-		
8/17	-		77	69	80	74	48	40	84	68	75		
8/18 ^{2/}	-		81	68	79	78	50	38	87	72	77		
									85	72	77		
			U n d e r i r r i g a t i o n									72	77
			81	69	79	39	50	41		72	77		
			81	69	79	5	50	40					
8/19) 8/20)	.75	3.6	81	78	79	25	7	10	90	76	78		
8/22	.19		10	10	72	10	10	10	90	79	80		
8/24	-		10	9	14	11	10	12	89	38	80		
8/25	-		13	10	14	12	10	12	80	75	79		
8/29	.87		32	16	17	24	13	12	88	80	85		
8/30	-		7	13	16	6	10	12	89	80	85		
8/31	-		12	11	16	7	10	12	86	80	85		

^{2/} Data for 8/18 taken at 08:30, 10:30, 13:00, 15:15, and 17:15, respectively

(cont.)

Table 5, cont.

Date	Rain inches	Irrig. inches	Irrigated alfalfa			Unirrigated alfalfa		
			Site 1			Site 2		
			D e p t h - i n c h e s			Site 1		
			12	24	36	12	24	36
9/1	0.13		-	-	-	-	-	-
9/2	-		16	12	16	14	11	12
9/4	.68		-	-	-	-	-	-
9/5	-		4	11	18	9	10	11
9/6	-		12	10	18	9	8	11
9/8	-		20	13	19	15	10	12
9/9	.51		-	-	-	-	-	-
9/11	1.05		-	-	-	-	-	-
9/12	.47		-	-	-	-	-	-
9/13	.15		-	-	-	-	-	-
9/15	-		9	8	12	9	10	11
9/16	.10		10	10	12	12	10	11
9/19	.03		10	10	11	12	10	12
9/20	.22		-	-	-	-	-	-
9/23	-		13	11	13	15	12	13
9/29	.10		-	-	-	-	-	-
9/30	.22		-	-	-	-	-	-
10/3	-		22	15	14	21	17	14
10/10	-		-	-	-	-	-	-
10/11	-		37	20	15	30	19	16

Table 6. Percent moisture (volume fraction),
Ellis Hollow, 1960^{1/}

Date	Site 1			Site 2			Site 3		
	Depth - inches								
	12	24	30	12	24	30	12	24	30
<u>I r r i g a t e d a l f a l f a</u>									
7/8	14.5	13.8	13.5	21.5	15.0	14.7	20.7	13.1	13.2
/13	13.2	13.5	13.1	18.5	15.4	14.1	18.6	12.8	13.0
8/6	15.6	12.3	12.0	20.6	14.0	13.9	-	-	-
/9	14.2	12.3	11.7	20.4	13.7	13.5	21.8	13.0	13.6
/18	13.4	12.1	11.6	19.5	13.5	13.3	21.0	13.0	13.3
/25	16.9	13.6	12.0	24.7	15.5	14.7	24.6	14.1	14.2
9/2	16.0	13.2	12.2	24.5	15.5	14.9	24.4	14.4	14.8
/9	16.2	13.6	12.2	24.5	15.6	15.0	24.2	14.3	14.8
/16	15.8	15.4	14.4	25.6	16.8	15.2	24.6	14.2	15.2
/23	17.5	15.0	14.1	25.0	15.6	15.1	23.9	14.2	14.5
10/3	16.8	14.2	13.9	24.2	15.3	14.6	-	-	-
/10	15.8	14.0	13.2	23.8	15.2	14.6	-	-	-
<u>U n i r r i g a t e d a l f a l f a</u>									
8/2	14.6	14.0	12.8	15.5	13.3	12.8	17.6	13.5	14.2
/9	14.6	13.0	-	19.8	13.2	-	-	-	-
/18	14.6	12.6	12.8	15.2	13.9	13.6	17.5	12.7	13.5
/25	13.5	12.5	12.6	15.1	14.0	13.5	19.0	12.9	13.4
9/2	16.5	12.4	12.6	17.5	14.5	13.7	18.8	12.4	13.5
/9	16.4	12.5	12.6	16.1	14.6	13.4	18.9	12.6	13.3
/16	19.6	16.5	16.8	19.8	17.3	16.7	22.5	14.6	15.5
/23	18.3	14.9	16.0	17.4	16.5	15.4	21.5	14.1	14.9
10/3	16.7	14.6	15.2	-	-	-	-	-	-
/10	16.0	14.1	14.5	16.1	15.6	14.5	-	-	-

^{1/} By neutron-scatter probe from calibration curve supplied with instrument.

Figure 3. Seasonal 12-inch soil moisture tension - 1960.

Figure 4. Seasonal 24 and 36-inch soil moisture tension - 1960.

Figure 5. Seasonal water use and water use as a function of dry
weight per plant - 1960.

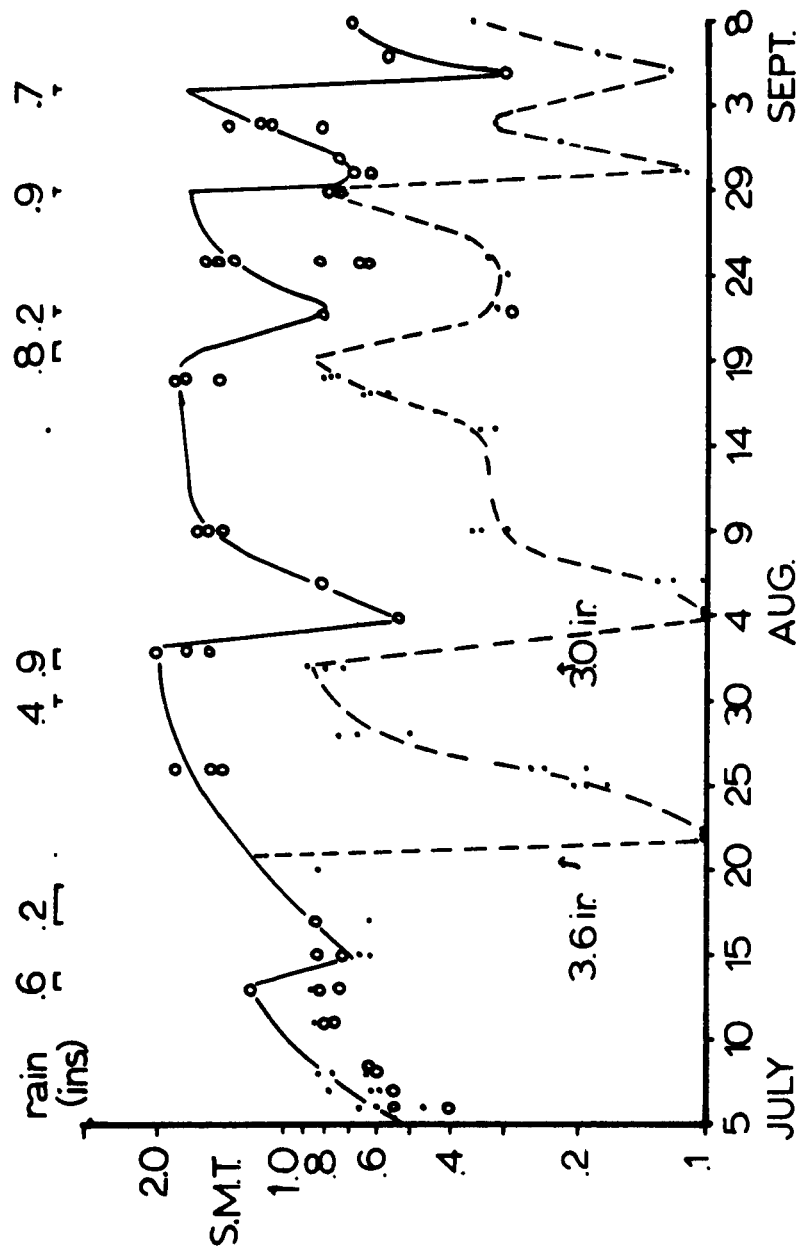


FIG. 3

SEASONAL 12inch SOIL MOISTURE TENSION

1960

--- = irrigated
 —○— = unirrigated

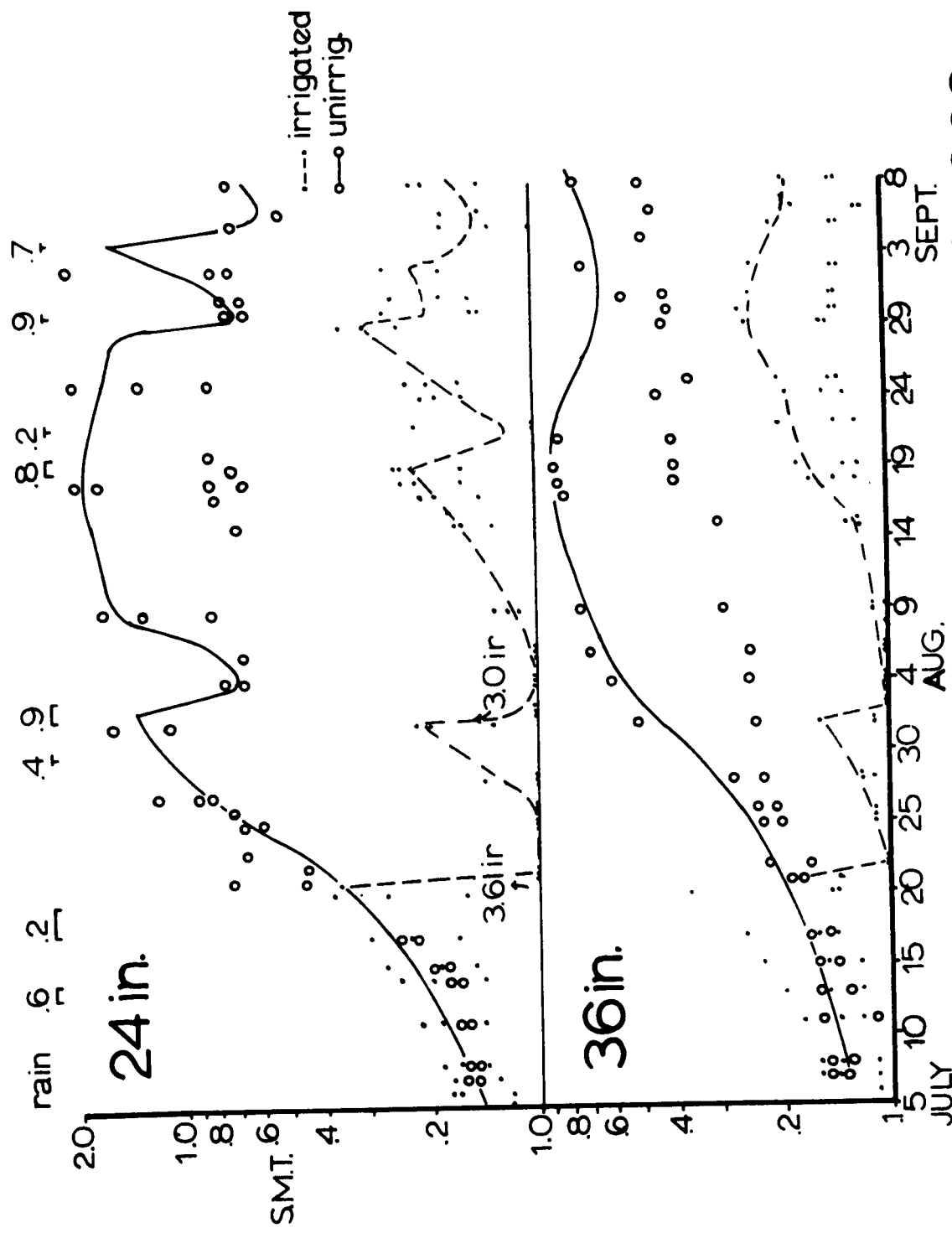


FIG. 4

SEASONAL SOIL MOISTURE TENSION -1960

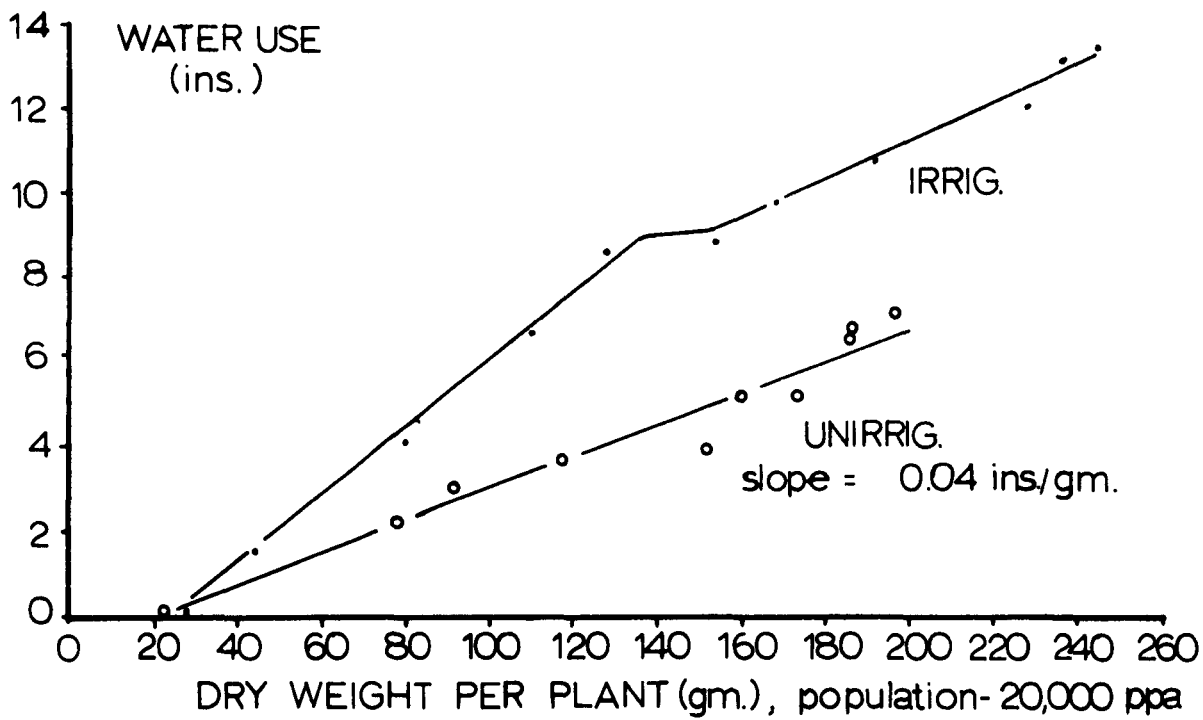
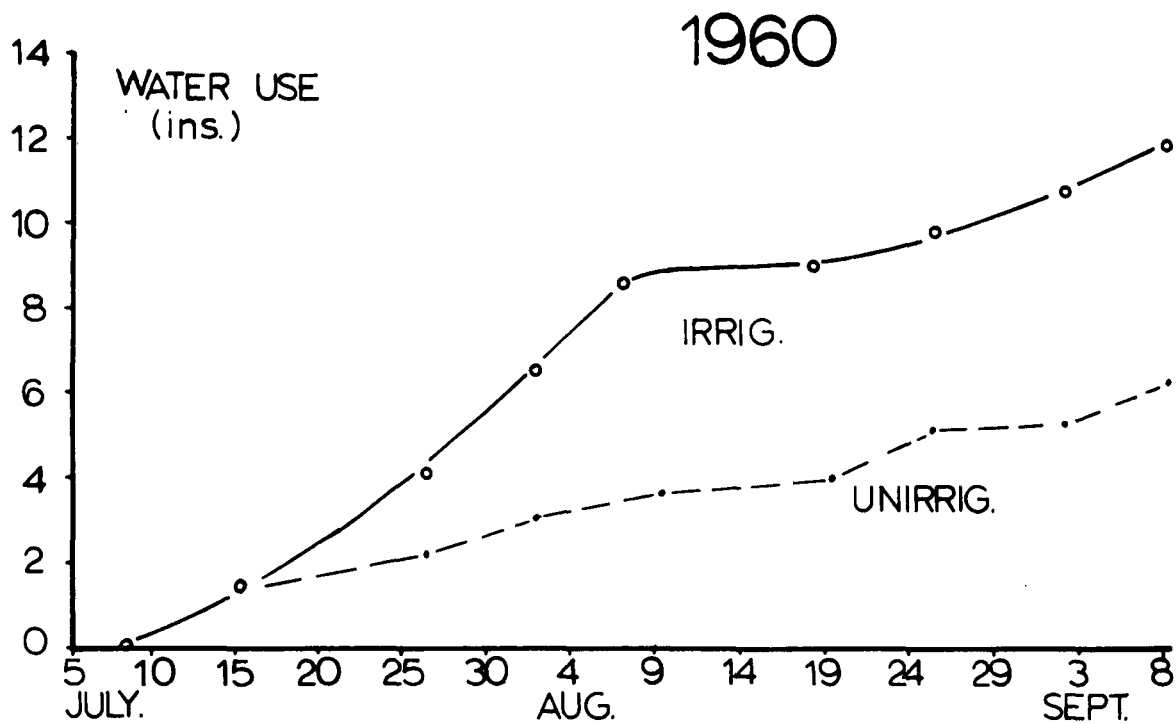


FIG. 5

Soil Moisture Measurements, Ellis Hollow, 1961

Soil moisture measurements for 1961 were begun on June 27. In order to better characterize the soil moisture profiles with depth, tensiometers were placed at six depths (6, 12, 18, 24, and 36 inches.) This was a sacrifice of replicated measurements in the same treatment, because only one site was sampled.

Neutron access pipes were placed at three locations within the treatment, and site 1 was not more than 5 feet from the tensiometers in the row. These measurements were made also at 6, 12, 18, 24, and 36 inches, although the 6-inch depth may have had some neutron escape to the atmosphere. The factory calibration was used as previously, with the standard count ratio before and after each run. Counts were taken over 17,000 so that a 90% confidence allows less than 1.3% error from the "true" count.

The tensiometer and neutron-probe data were plotted and integrated graphically for the zones 0 to 12 inches, and 0 to 36 inches, assigning the value at zero inches the same as determined at 6 inches. This was an effort to incorporate the contributions of all depths to the total tension.

Water use calculations were made utilizing rainfall and irrigation measurements. The calculations are subject to large errors, and thus are sensible only in the accumulative evaluation. A 2% variation in time changes may be expected due to the sites, while only a 5% change may occur in water content over a few days.

The data are presented in tabular form. Their use in studying any period of moisture stress is best noted in the changes of the depth profiles over the period in question. The soil moisture profiles of volume water content (PV) and the soil moisture tension (SMT) are plotted for the course of the 1961 season in figs. 9 - 25.

The seasonal soil moisture tension at 12 inches, and the integrated data for the 0 to 12-inch zone, and the 0 to 36-inch zone, are plotted for the irrigated and unirrigated treatments in figures 6 and 7 for reference purposes. Water use for the unirrigated treatment as a function of time and dry weight per plant is shown also in figure 8.

Table 7. Soil moisture tension, Ellis Hollow, 1961^{1/}

Date	Site	Depth - inches					
		6	12	18	24	30	36
6/27	I - C ^{2/}	15	9	10	11	11	11
	U - C	16	12	13	10	13	11
/30	I - C	32	17	11	10	12	12
	U - C	39	13	12	11	14	11
7/6	I - C	29	16	10	11	11	12
	U - C	44	18	12	9	13	11
/11	I - C	32	24	11	10	10	10
	U - C	45	20	14	10	12	11
/18	I - A	-	13	-	10	-	12
	I - C	48	66	21	16	12	12
	U - C	76	72	20	14	15	14
/19	I - C	70	75	22	16	13	12
/20	I - C	79	81	26	19	13	13
	U - C	83	76	25	16	17	15
	I - A	-	8	-	10	-	12
	U - A	-	-	-	10	-	8
/21	I - C	81	83	28	21	14	14
	U - C	90	-	27	17	17	15
	I - A	-	10	-	12	-	12
	U - A	-	13	-	11	-	10
/24	I - C	83	-	40	30	15	15
	U - C	-	-	35	21	19	15
	I - A	-	14	-	11	-	13
	U - A	-	22	-	11	-	8
/26	I - C	6	4	8	10	10	10
	U - C	4	-	20	15	16	15
	I - A	-	6	-	8	-	10
	U - A	-	6	-	7	-	6
/28	U - C	20	15	35	23	19	16

^{1/}

Soil moisture tension (atm. x 10) by tensiometers

^{2/}

I = irrigated; U = unirrigated; C = corn; A = alfalfa.

(cont.)

Table 7, cont.

Date	Site	Depth - inches					
		6	12	18	24	30	36
8/1	I - C	8	6	8	9	9	10
	U - C	8	28	22	18	16	15
/4	I - C	7	4	6	7	9	9
	U - C	6	11	11	10	12	10
	U - A	-	8	-	8	-	6
/5	I - A	-	10	-	9	-	11
/7	U - A	-	17	-	10	-	8
/8	I - A	-	14	-	10	-	13
/9	I - C	45	18	19	16	10	12
	U - C	82	57	23	16	15	13
/14	U - C	75	82	42	27	19	16
/15	I - C	82	88	35	30	16	17
/18	U - C	92	84	71	76	30	18
/25	U - C	86	82	76	80	36	22
/30	I - C	2	0	10	10	12	10
	U - C	9	3	9	9	10	11
9/6	I - C	68	65	22	20	16	16
	U - C	59	42	30	27	21	16
/13	I - C	72	72	32	31	22	21
	U - C	80	72	70	81	53	26
/25	I - C	68	51	20	21	18	17
	U - C	65	46	35	42	45	24
/29	I - C	87	70	27	26	20	19
	U - C	88	72	52	54	51	32

Table 8. Percent moisture by volume, Ellis Hollow 1961^{1/}

Date	Site ^{2/}	Depth - inches					
		9	12	18	24	30	36
6/27	I - C - 1	19.55	23.05	19.35	15.48	16.67	17.21
	U - C - 1	21.83	25.22	21.34	16.71	19.52	13.75
/30	I - C - 1	17.79	21.83	18.92	15.02	16.23	17.02
	U - C - 1	20.47	25.04	20.70	16.79	18.10	13.40
7/6	I - C - 1	16.52	21.24	18.86	15.17	16.19	16.73
	I - C - 2	17.90	19.88	18.24	18.39	17.32	14.39
	U - C - 1	19.93	24.86	21.08	16.59	18.79	13.19
	U - C - 2	16.55	23.37	23.53	22.55	18.19	14.91
/11	I - C - 1	16.46	20.71	19.00	15.12	16.19	17.10
	I - C - 2	15.37	20.47	18.89	-	-	-
	U - C - 1	19.18	24.44	20.82	16.49	18.68	13.34
	U - C - 2	16.47	23.77	23.10	22.66	18.47	20.68
	U - C - 3	17.47	20.70	18.72	15.84	14.47	13.62
/18	I - A - 1	23.6	21.9	18.5	17.5	17.1	14.9
	I - A - 2	27.8	23.7	21.8	23.7	23.4	26.5
	I - A - 3	20.3	20.7	19.4	17.5	13.8	14.6
	I - C - 1	17.06	19.17	17.10	14.55	15.72	16.62
	U - C - 1	18.09	22.16	19.29	15.93	18.55	12.76
	U - C - 2	16.64	22.74	22.16	21.87	17.91	14.57
	U - C - 3	17.42	19.33	17.45	15.95	13.95	13.54
/19	U - A - 1	21.8	20.6	18.9	15.5	13.9	13.4
	U - A - 2	30.5	30.3	24.1	17.0	17.3	20.8
/21	I - C - 1	20.68	17.63	17.79	15.06	15.63	18.01
	U - C - 1	18.13	-	-	-	-	-
/28	U - C - 1	19.00	21.25	17.79	16.13	18.02	12.34
8/1	I - C - 1	21.28	22.22	21.35	16.89	17.24	16.80
	I - C - 2	21.39	20.61	18.89	18.73	18.02	14.87
	I - C - 3	21.60	24.22	15.45	14.57	15.51	12.90
	U - C - 1	19.44	23.16	20.38	16.24	18.84	13.17
	U - C - 2	14.00	21.53	21.99	23.32	19.74	15.58
	U - C - 3	16.46	18.98	17.53	15.40	16.41	13.47
/4	I - C - 1	16.73	22.33	21.30	16.00	15.42	16.59
	I - C - 2	20.36	19.75	19.03	19.05	17.97	14.92
	I - C - 3	19.88	25.02	16.06	14.64	16.02	13.10
	U - C - 1	22.22	24.84	19.37	16.91	17.97	13.70
	U - C - 2	17.35	23.32	23.25	23.23	19.42	15.26
	U - C - 3	18.25	20.80	19.05	15.50	14.55	14.27

^{1/} Soil moisture content by neutron probe^{2/} I = irrigated; U = unirrigated; C = corn; A = alfalfa; 1 = site 1; 2 = site 2;
3 = site 3. (cont.)

Table 8, cont.

Date	Site ^{2/}	Depth - inches					
		9	12	18	24	30	36
8/4 cont.	U - A - 1	22.86	21.07	16.75	15.65	14.60	12.87
	U - A - 2	23.92	21.53	17.42	13.33	15.17	14.18
	U - A - 3	23.87	26.79	18.43	12.85	13.79	14.39
	U - A - 4	25.20	26.86	21.00	17.53	14.21	14.30
8/5	I - A - 1	24.51	22.49	16.18	14.46	12.74	13.15
	I - A - 2	25.75	22.84	20.11	18.15	13.98	14.96
	I - A - 3	21.30	22.33	21.16	19.44	15.12	15.70
	I - A - 4	24.56	21.87	18.48	19.76	16.71	14.80
/7	U - A - 1	21.21	18.98	15.97	14.53	13.61	12.23
	U - A - 2	21.81	21.53	17.14	13.03	14.62	13.55
	U - A - 3	13.54	25.57	18.13	12.00	13.24	13.52
	U - A - 4	21.74	25.92	20.75	17.51	14.07	13.91
/8	I - A - 1	19.03	23.92	16.34	14.48	12.60	12.12
	I - A - 2	24.10	21.58	19.60	17.10	13.77	14.96
	I - A - 3	19.53	21.67	20.93	19.78	14.71	15.33
	I - A - 4	22.77	20.75	17.63	19.10	15.72	13.95
/9	I - C - 1	17.1	20.1	18.2	14.6	15.6	16.8
	I - C - 2	15.77	18.26	17.64	17.38	17.43	14.36
	I - C - 3	19.50	22.59	14.33	14.41	14.92	12.55
	U - C - 1	19.7	23.2	18.3	16.4	17.4	12.7
	U - C - 2	16.1	20.9	22.0	22.1	18.3	14.6
	U - C - 3	16.9	19.0	17.3	15.7	14.2	13.5
/14	U - C - 1	17.43	21.19	17.77	15.43	18.29	12.55
	U - C - 2	14.19	20.37	19.90	20.79	17.71	14.77
	U - C - 3	15.92	17.48	15.92	14.28	13.71	13.02
/15	I - C - 1	16.08	18.52	17.11	13.71	15.13	16.23
	I - C - 2	16.30	17.38	15.70	15.52	16.00	13.71
	I - C - 3	20.26	20.58	13.86	13.69	14.05	12.18
/18	U - C - 1	17.66	19.30	15.79	14.99	16.43	11.91
	U - C - 2	11.89	18.80	17.21	17.67	15.38	14.32
	U - C - 3	14.32	15.88	14.46	13.22	12.94	12.78
/25	U - C - 1	18.75	19.76	14.73	13.68	14.46	11.22
	I - C - 1	22.79	-	-	-	-	-
/30	U - C - 1	22.08	23.92	18.41	17.70	17.60	17.33
	U - C - 2	11.89	17.35	15.97	16.96	15.24	13.49
	U - C - 3	19.56	19.41	17.24	16.46	17.35	17.08
	I - C - 1	19.74	22.59	20.34	15.19	16.46	15.86

^{2/}

I = irrigated; U = unirrigated; C = corn; A = alfalfa.

1 = site 1; 2 = site 2; 3 = site 3.

(cont.)

Table 8, cont.

Date	Site ^{2/}	D e p t h - i n c h e s					
		9	12	18	24	30	36
9/6	I - C - 1	20.27	21.20	18.81	15.24	16.57	17.21
	I - C - 2	20.10	19.32	18.06	17.70	15.83	14.69
	I - C - 3	24.22	22.59	14.84	14.99	15.37	13.28
	U - C - 1	-	23.44	19.41	16.62	18.88	13.69
	U - C - 2	20.57	22.36	21.32	21.44	18.30	15.19
	U - C - 3	19.58	19.11	16.80	15.19	14.16	13.99
/13	I - C - 1	19.96	20.70	18.26	15.10	15.91	16.58
	U - C - 1	-	22.77	18.76	15.31	18.50	13.48
/25	I - C - 1	20.00	21.11	19.09	15.17	15.91	16.58
	U - C - 1	-	23.49	19.11	16.12	18.46	13.27

^{2/} I = irrigated; U = unirrigated; C = corn; A = alfalfa;

1 = site 1; 2 = site 2; 3 = site 3.

Table 9. Profile water status 1961 - irrigated corn.

Date	Site	Volume water in profile ^{1/}			Soil moisture tension ^{1/}		
		0 - 36 inches	0 - 12 inches	Ratio	0 - 36 inches	0 - 12 inches	Ratio
6/27	1	6.76	2.52	0.373	0.113	0.122	0.926
/30	1	6.31	2.18	.346	.174	.294	.592
7/6	1	6.17	2.06	.335	.157	.246	.638
	2	6.54	2.30	.352	-	-	-
/11	1	6.22	1.98	.319	.183	.316	.579
/18	1	6.10	2.16	.354	.323	.530	.609
/19	1	-	-	-	.388	.700	.554
/20	1	-	-	-	.452	.808	.559
/21	1	6.29	2.45	.389	.484	.824	.587
/24	1	-	- -	-	.511	.854	.598
/26	1	-	-	-	.080	.052	1.538
8/1	1	7.03	2.52	.358	.085	.078	1.190
	2	7.04	2.62	.372	-	-	-
	3	6.43	2.64	.410	-	-	-
/4	1	6.55	2.21	.337	.071	.060	1.183
	2	6.88	2.48	.361	-	-	-
	3	6.61	2.76	.417	-	-	-
/9	1	6.07	2.16	.356	.218	.366	.596
	2	6.07	2.03	.334	-	-	-
	3	6.16	2.18	.355	-	-	-
/15	1	5.68	2.04	.359	.505	.836	.604
	2	5.78	2.02	.349	-	-	-
	3	6.02	2.54	.422	-	-	-
/30	1	6.60	2.45	.371	.069	.01	6.900
9/6	1	6.52	2.38	.365	.384	.656	.585
	2	6.61	2.47	.374	-	-	-
	3	6.66	3.00	.450	-	-	-
/13	1	6.57	2.45	.378	.456	.720	.633
/25	1	6.48	2.47	.381	.364	.638	.571
/29	1	-	-	-	.466	.830	.561

^{1/} Integrated graphically.

Table 10. Profile water status 1961 - unirrigated corn.

Date	Site	Volume water in profile ^{1/}			Integrated soil moisture tension ^{2/}		
		0 - 36 inches	0 - 12 inches	Ratio	0 - 36 inches	0 - 12 inches	Ratio
6/27	1	7.32	2.72	0.372	0.071	0.142	0.500
/30	1	7.15	2.64	.369	.191	.328	.582
7/6	1	7.00	2.59	.370	.197	.364	.541
	2	7.28	2.21	.303	-	-	-
/11	1	6.89	2.50	.362	.213	.394	.540
	2	7.40	2.28	.308	-	-	-
	3	6.23	2.26	.362	-	-	-
/18	1	6.49	2.28	.351	.391	.730	.536
	2	7.01	2.21	.315	-	-	-
	3	6.00	2.22	.370	-	-	-
/20	1	-	-	-	.447	.816	.547
/21	1	-	-	-	.467	-	-
/24	1	-	-	-	.517	-	-
/26	1	-	-	-	.137	.080	1.713
/28	1	6.52	2.44	.374	.245	.212	1.156
8/1	1	6.78	2.38	.350	.169	.130	1.300
	2	7.03	1.97	.280	-	-	-
	3	5.93	2.10	.354	-	-	-
/4	1	7.19	2.82	.392	.099	.078	1.269
	2	7.44	2.35	.316	-	-	-
	3	6.34	2.28	.360	-	-	-
/9	1	6.54	2.64	.404	.393	.764	.514
	2	6.92	2.16	.312	-	-	-
	3	5.94	2.18	.368	-	-	-
/14	1	6.30	2.26	.358	.497	.764	.627
	2	6.53	1.97	.301	-	-	-
	3	5.59	2.02	.361	-	-	-
/18	1	5.88	2.24	.382	.679	.918	.740
	2	5.40	1.78	.329	-	-	-
	3	5.14	1.79	.389	-	-	-
/25	1	5.68	2.39	.421	.699	.874	.800

^{1/}, ^{2/} Integrated graphically.

(cont.)

Table 10, cont.

Date	Site	Volume water in profile ^{1/}			Integrated soil moisture tension ^{2/}		
		0 - 36 inches	0 - 12 inches	Ratio	0 - 36 inches	0 - 12 inches	Ratio
8/30	1	7.09	2.76	0.389	0.088	0.07	1.257
	2	5.32	1.86	.350	-	-	-
	3	6.56	2.38	.362	-	-	-
9/6	1	7.14	2.82	.395	.353	.548	.644
	2	7.36	2.56	.347	-	-	-
	3	6.19	2.47	.399	-	-	-
/13	1	6.96	2.72	.391	.680	.774	.879
/25	1	7.02	2.83	.403	.456	.600	.760
/29	1	-	-	-	.625	.838	.745

^{1/}, ^{2/} Integrated graphically

Table 11. Rainfall, irrigation, and water use in corn, 1961.

Date	Rainfall inches	Corn irrigation	Period	Accumulative water use	
				irrigated	unirrigated
			6/30	-	-
7/3	0.7	-			
/8	.6	-	7/6	0.21	0.22
/16	.2	-	/11	.76	.40
/20	.1	-	/18	1.08	.76
/23	.2	-	/21	1.37	-
/24	1.0	1.0			
/26	.2	-			
/27	-	.7			
/30	.8	-	7/28	-	1.23
/31	.1	-			
8/3	1.8	-	8/1	6.10	1.87
			/4	8.04	3.26
			/9	8.62	3.78
8/11	.2	-	/14	-	4.31
/15	.1	-	/15	9.19	-
/18	-	2.0	/18	-	5.08
/20	.2	-			
/21	.6	-			
/26	1.5	-	/25	-	6.08
/27	.1	-			
9/3	.1	-	8/30	13.28	6.97
/7	.4	-	9/6	13.46	7.28
/19	1.4	-	/13	13.91	7.86
			/25	15.30	9.20

Table 12. Profile water status - 1961, alfalfa

Date	Site	Volume water in profile ^{1/}		
		0 - 36 inches	0 - 12 inches	Ratio
<u>I r r i g a t e d</u>				
7/18	1	6.96	2.81	0.403
	2	8.70	3.28	.377
	3	6.58	2.57	.391
8/5	1	6.58	3.00	.456
	2	7.43	3.16	.425
	3	7.39	2.80	.378
	4	7.48	2.94	.393
8/8	1	6.12	2.48	.405
	2	6.97	2.89	.415
	3	7.15	2.60	.364
	4	7.08	2.76	.390
<u>U n i r r i g a t e d</u>				
7/19	1	6.47	2.75	.425
	2	8.76	3.73	.426
8/4	1	6.55	2.72	.416
	2	6.77	2.78	.411
	3	7.22	3.10	.429
	4	7.82	3.11	.397
8/7	1	6.00	2.58	.430
	2	6.42	2.74	.426
	3	5.99	2.16	.361
	4	7.12	2.76	.388

^{1/} Integrated graphically

Figure 6. Seasonal 12-inch soil moisture tension and integrated profile tension - unirrigated plot - 1961.

Figure 7. Seasonal 12-inch soil moisture tension and integrated profile tension - irrigated plot - 1961.

Figure 8. Seasonal water use and water use as a function of dry weight per plant - 1961.

Figures 9 - 24, inclusive. Soil moisture tension (SMT) and soil water content (PV) as a function of depth, on progressive days through the 1961 season.

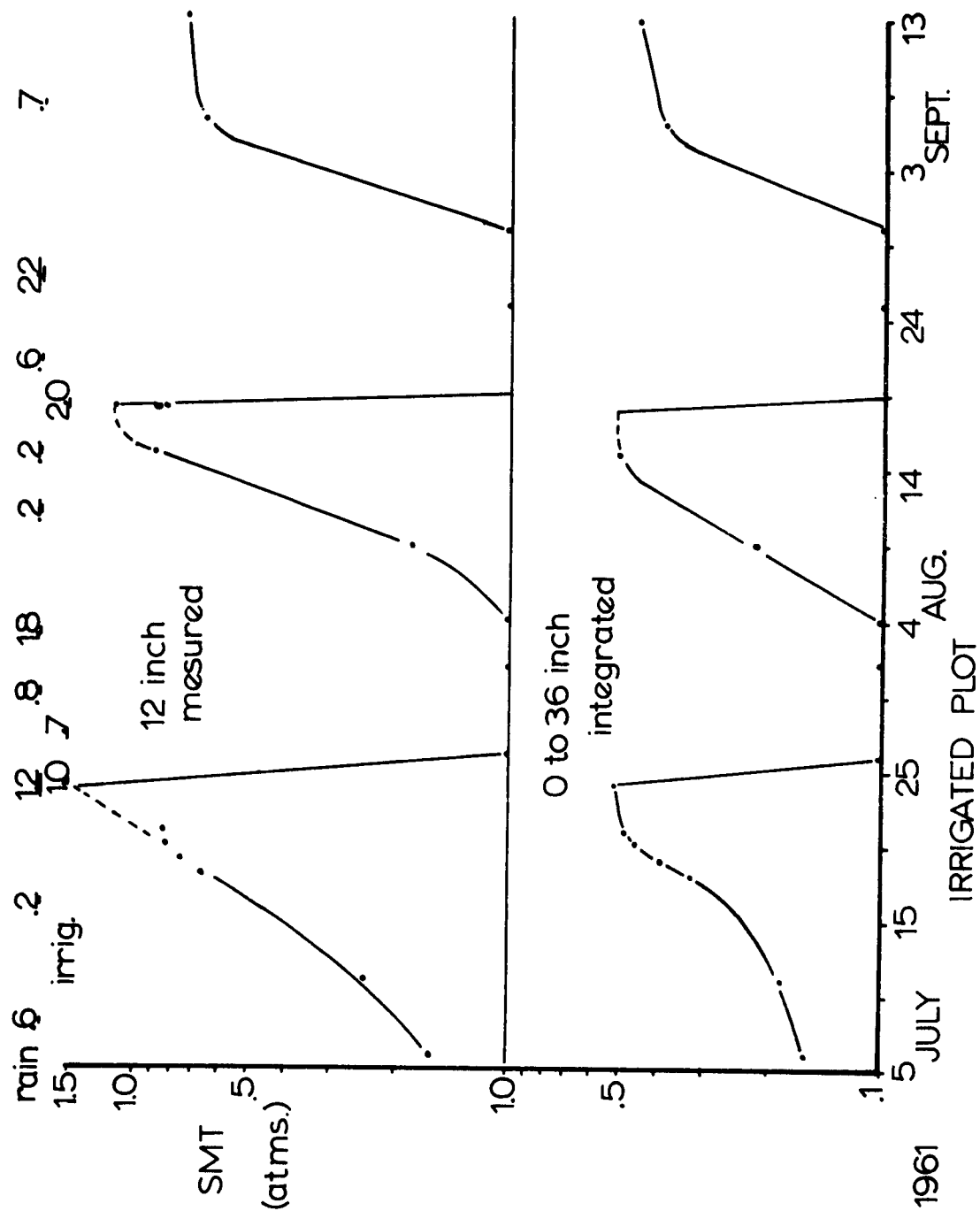


FIG. 6

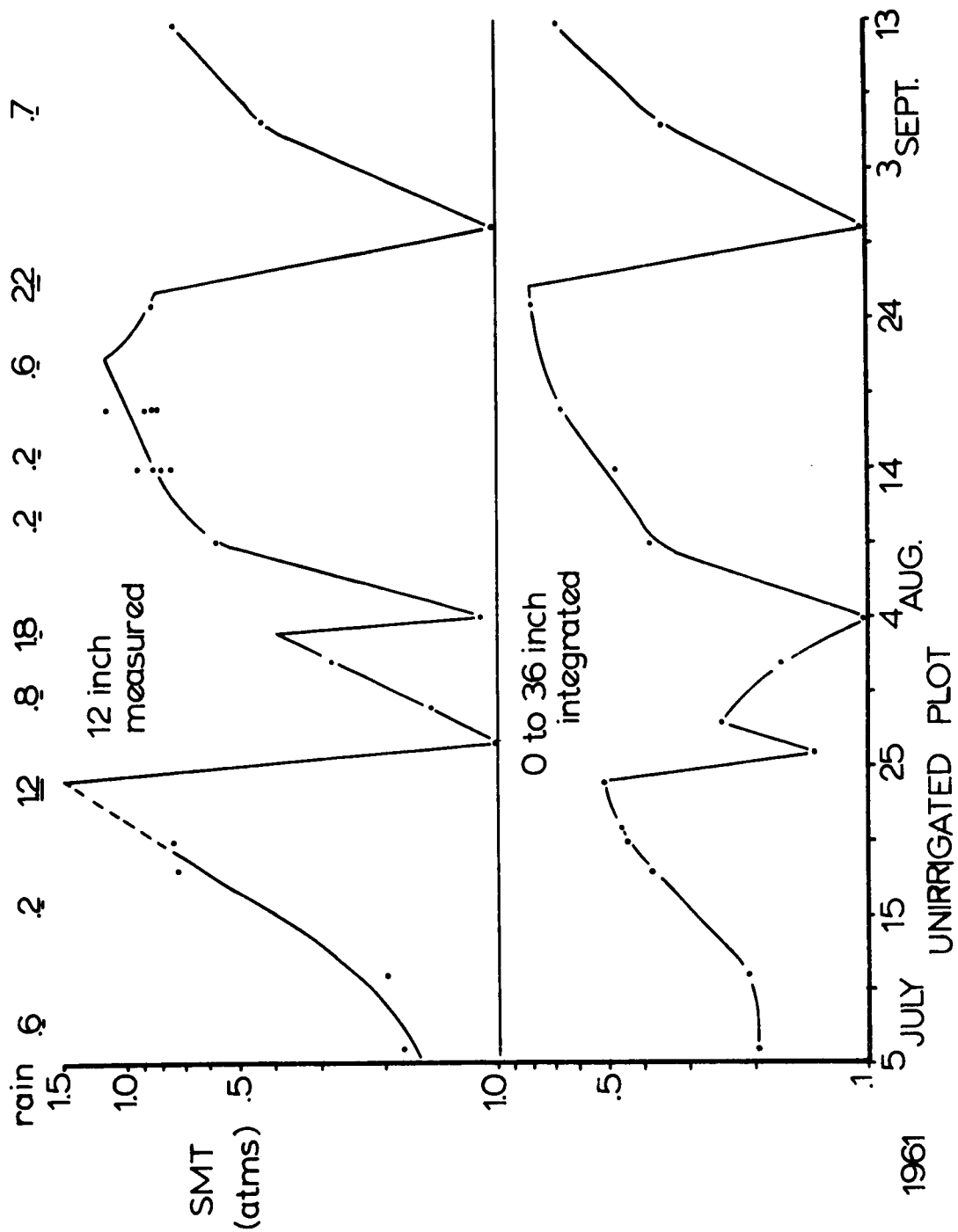


FIG. 7

WATER USE, UNIRRIGATED CORN, 1961

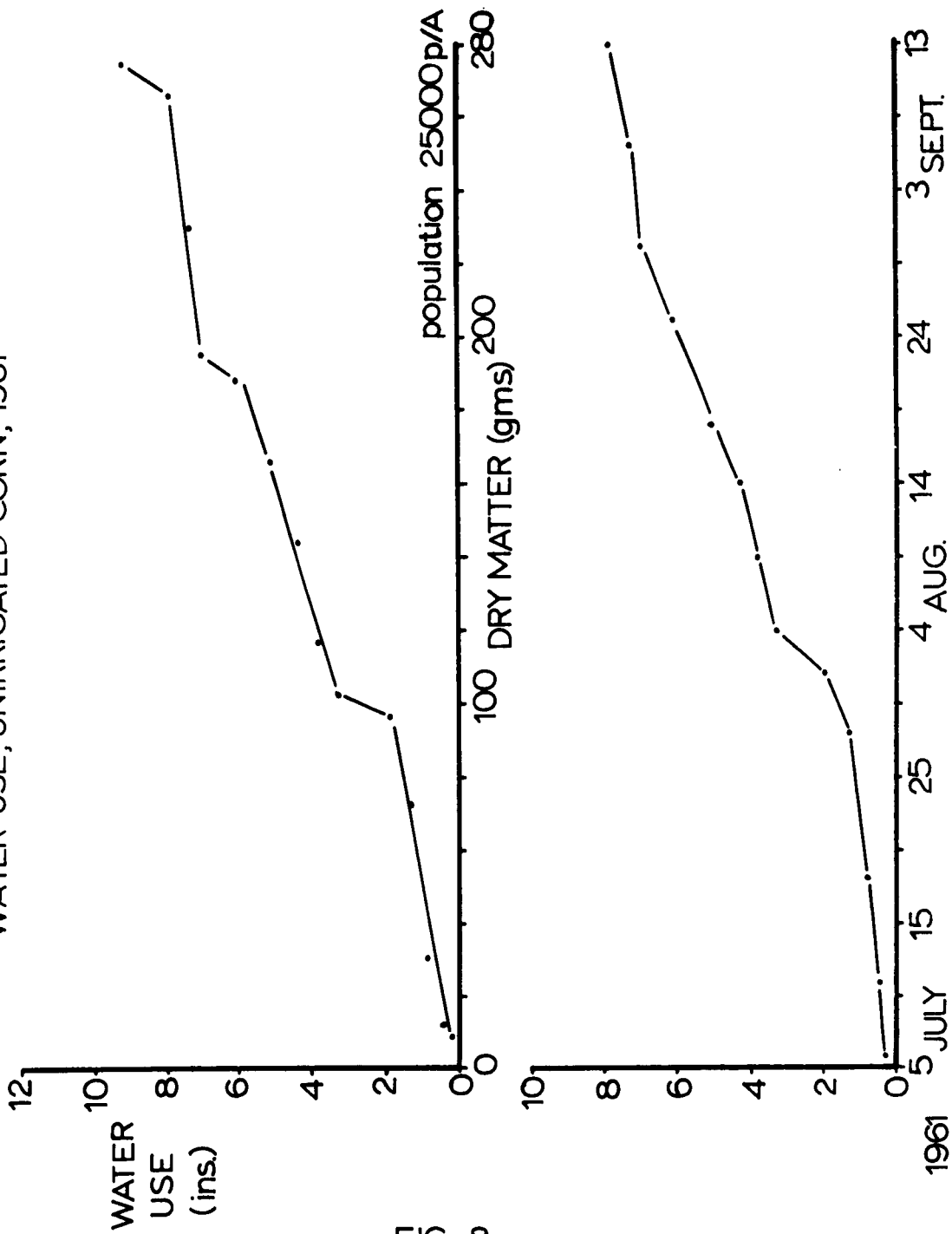
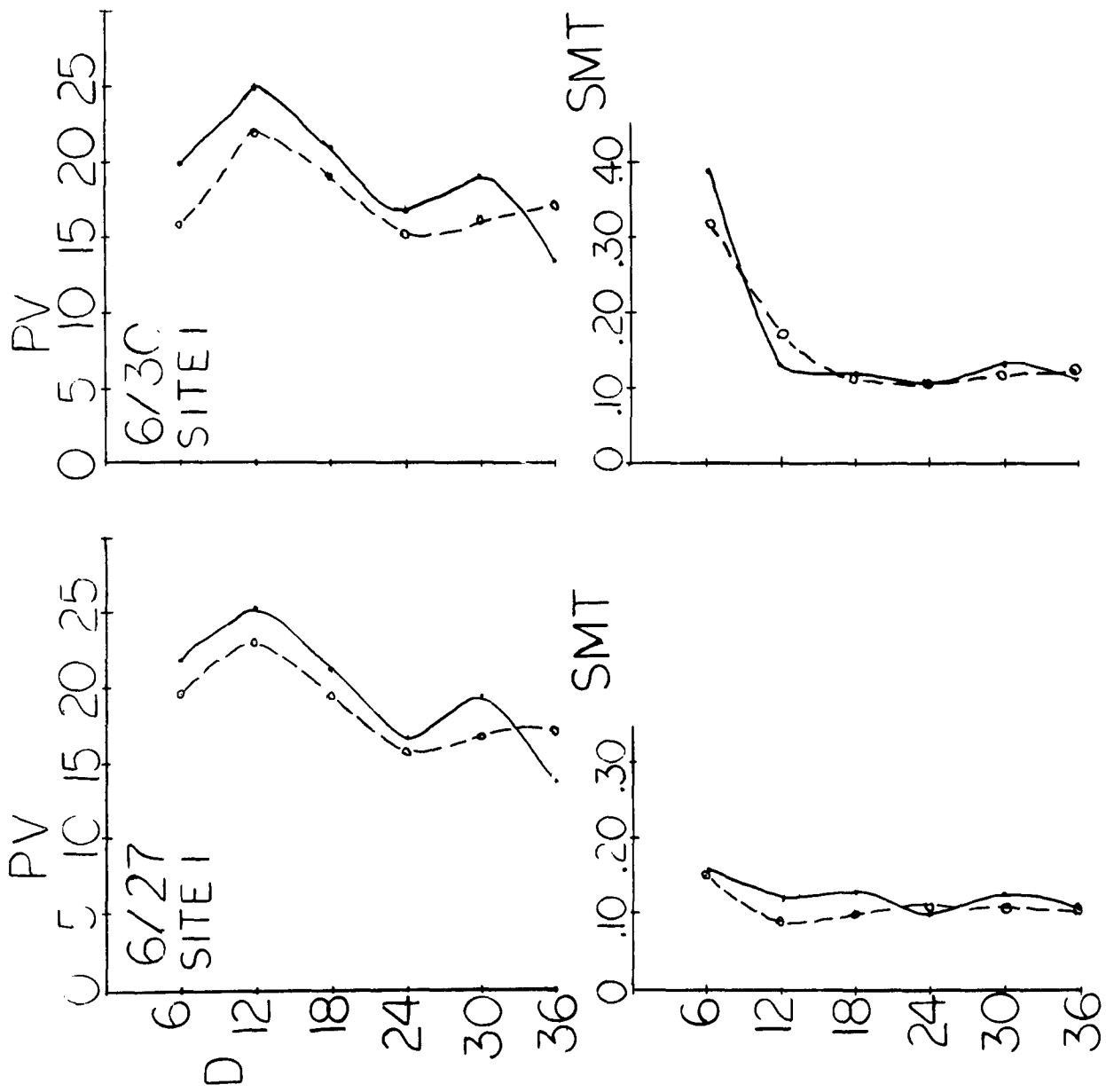


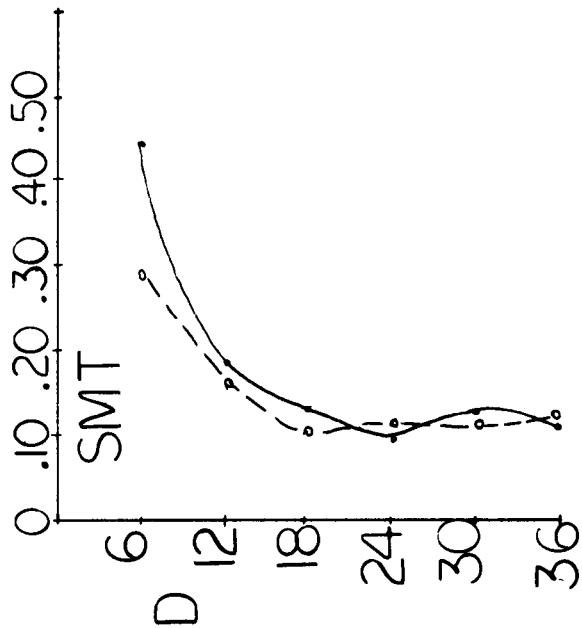
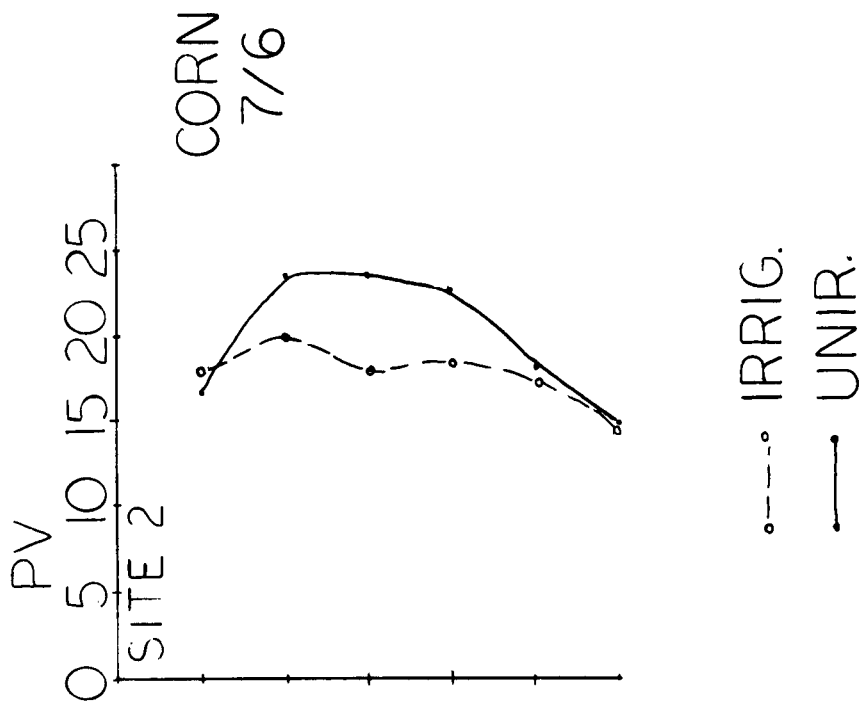
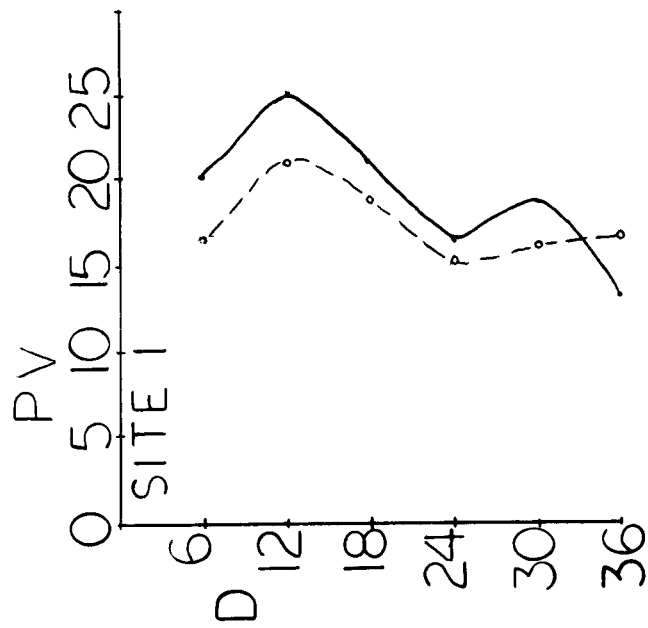
FIG. 8

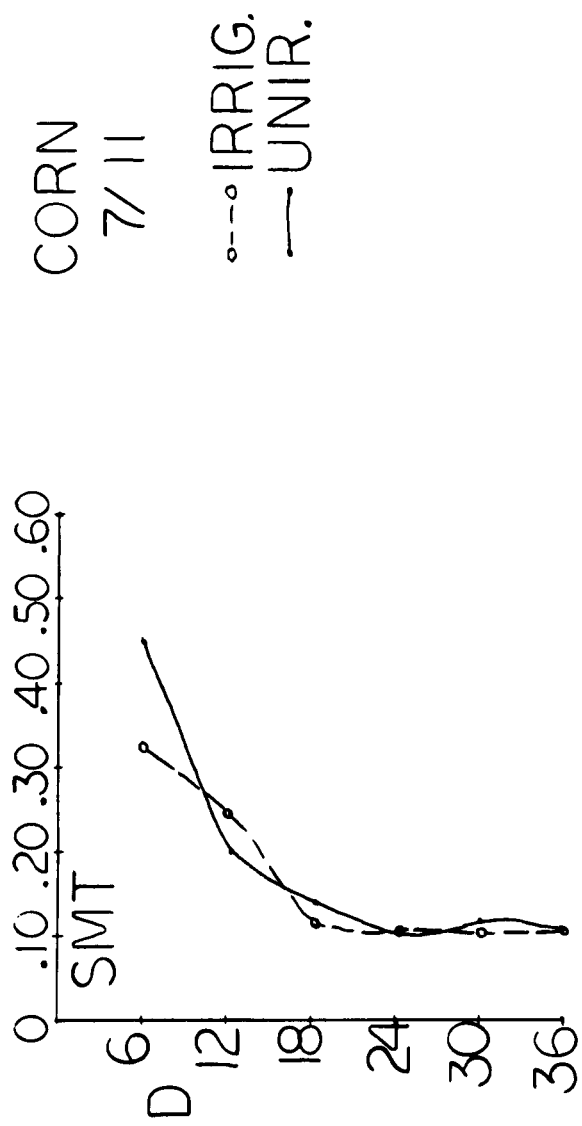
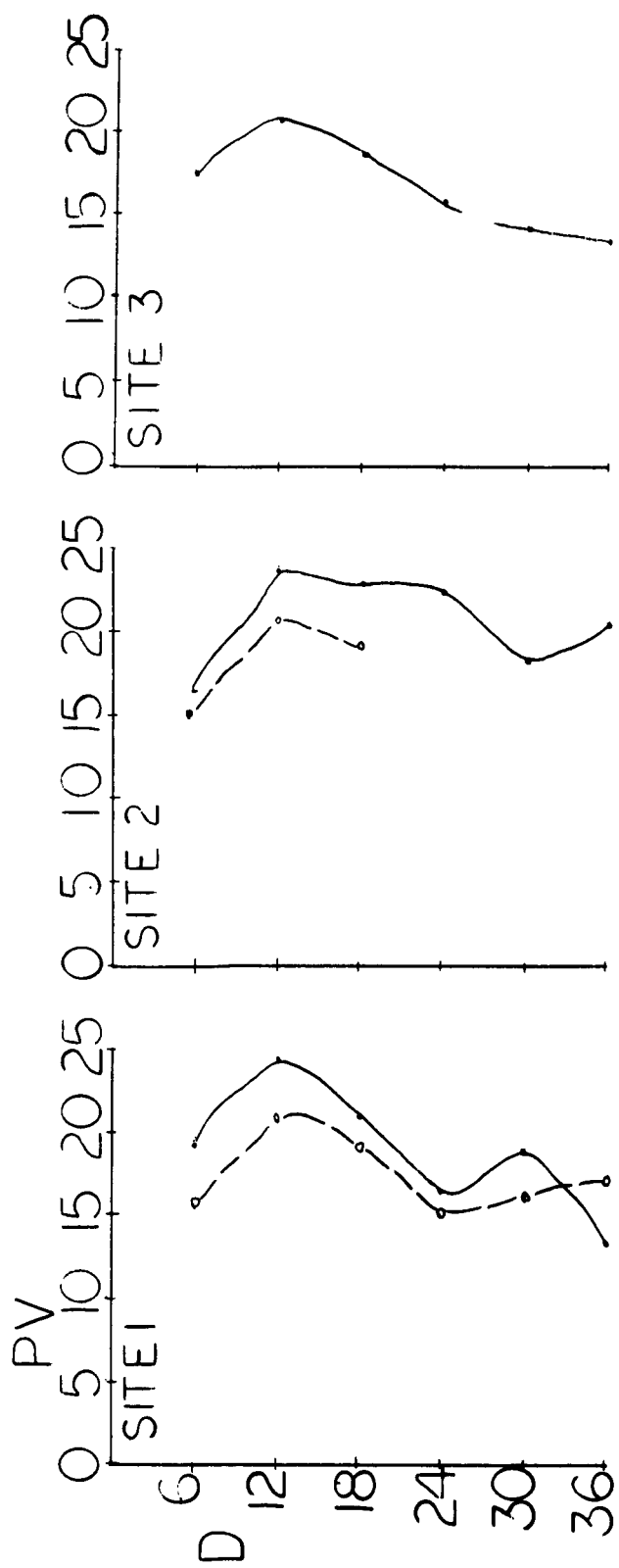
CORN 1961

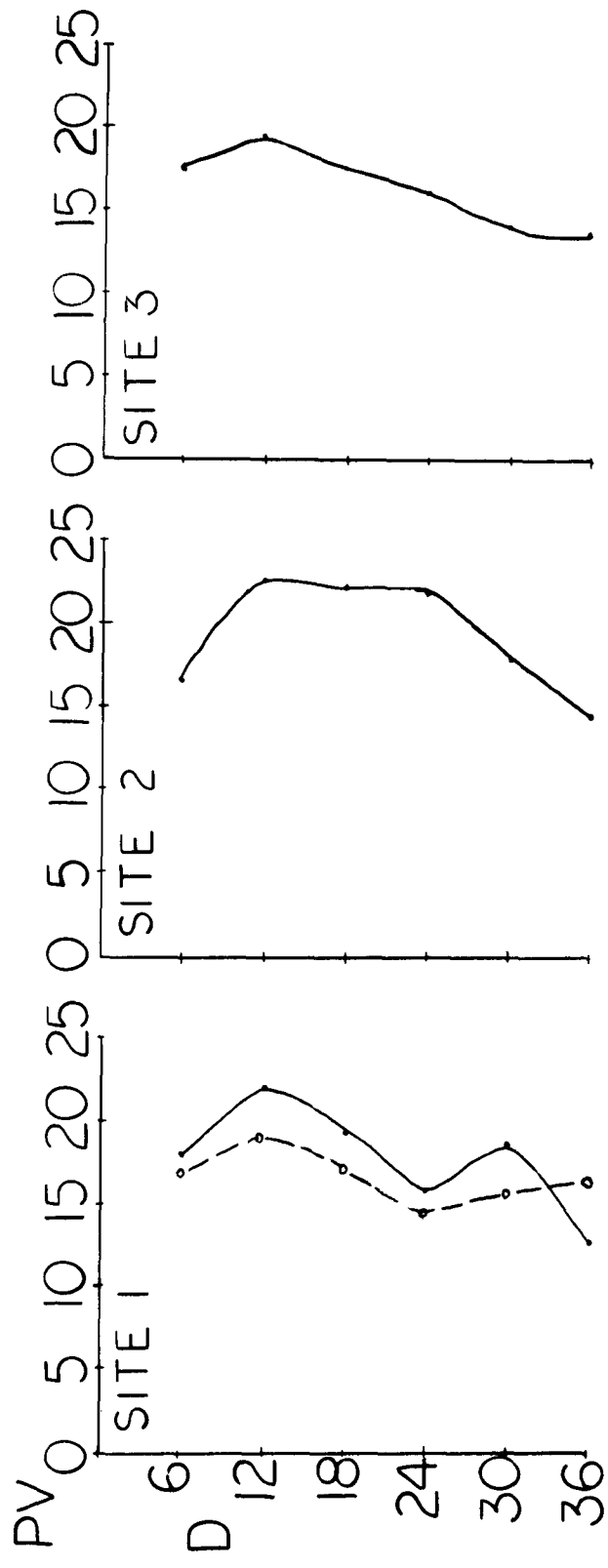
KEY
 -o- IRRIGATED
 - UNIRRIG.

PV = PER CENT
 MOISTURE,
 SMT = SOIL
 MOISTURE
 TENSION (ATM),
 D = DEPTH
 (INS.)

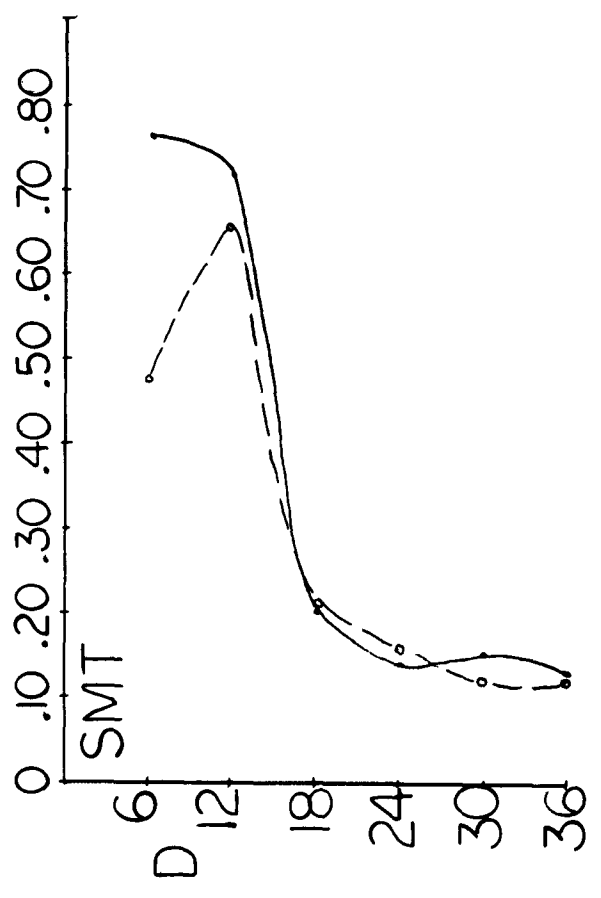




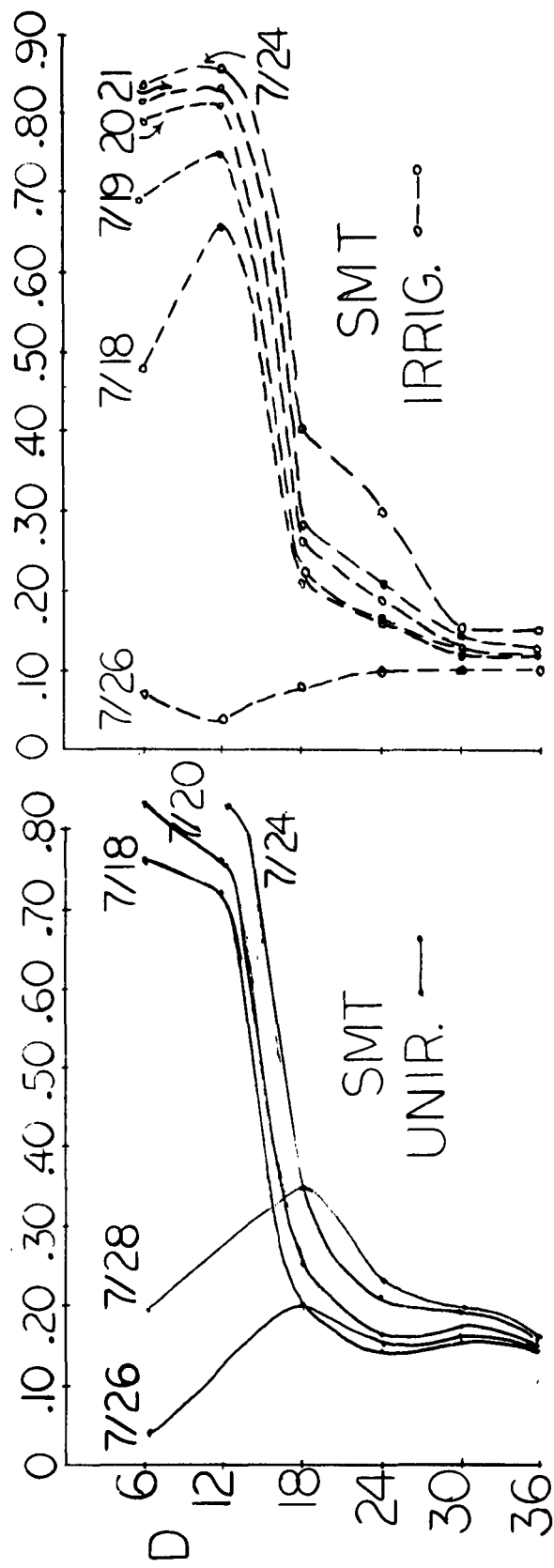
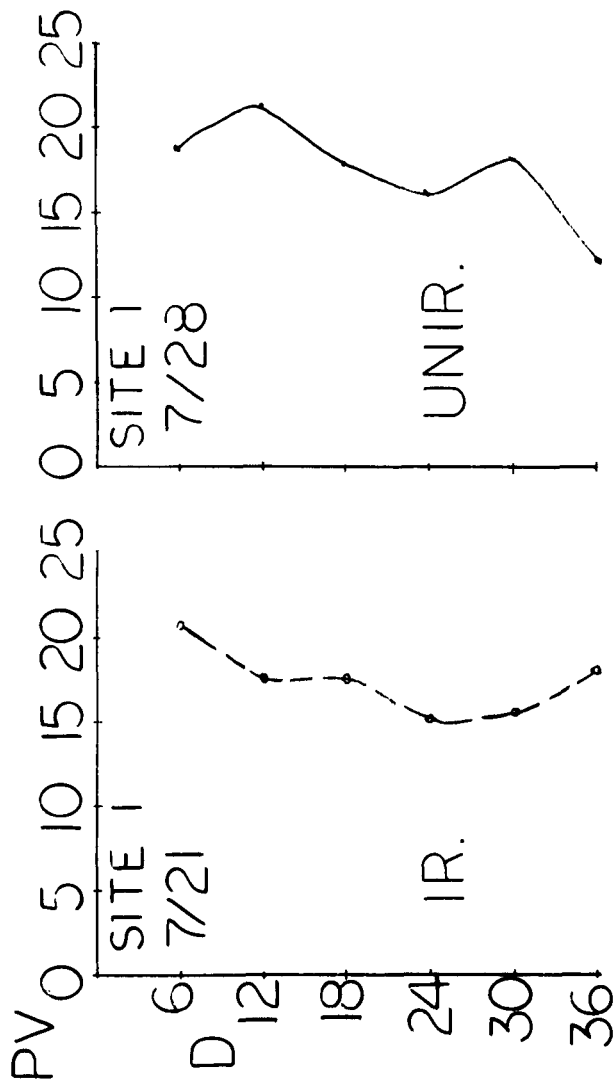


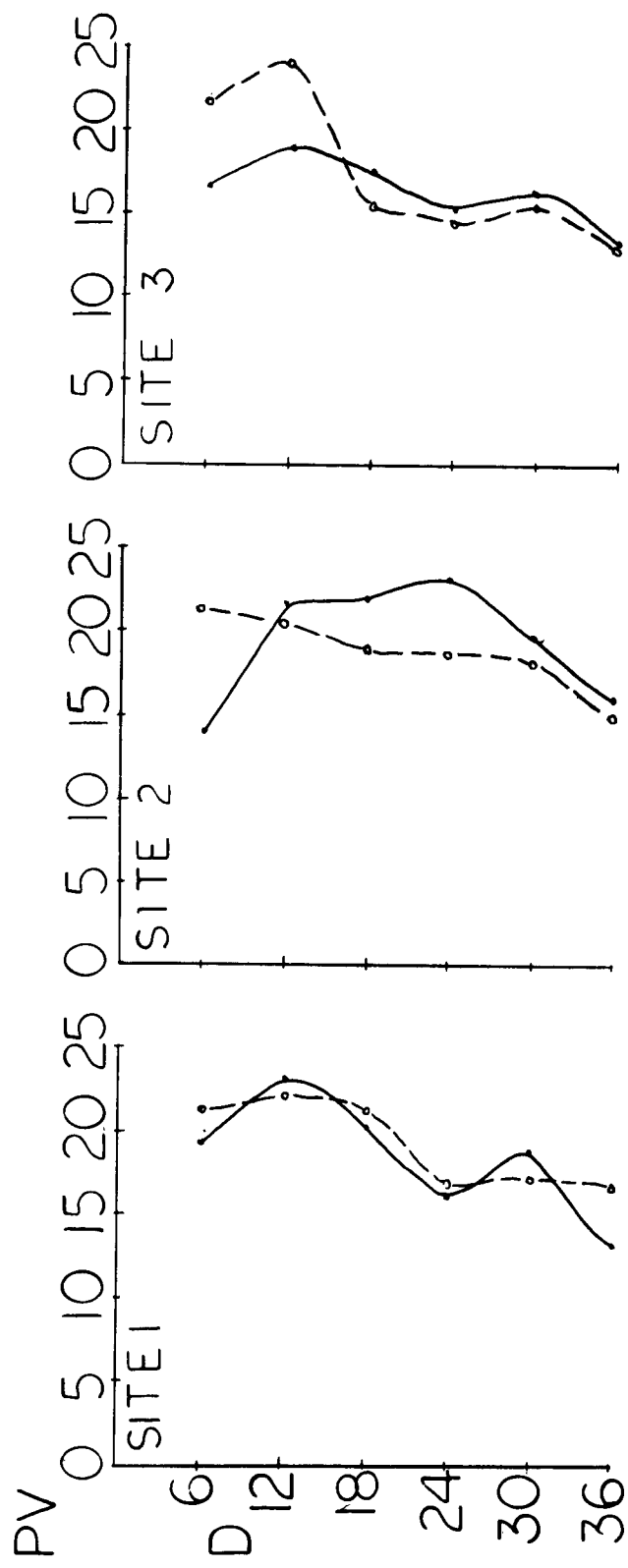


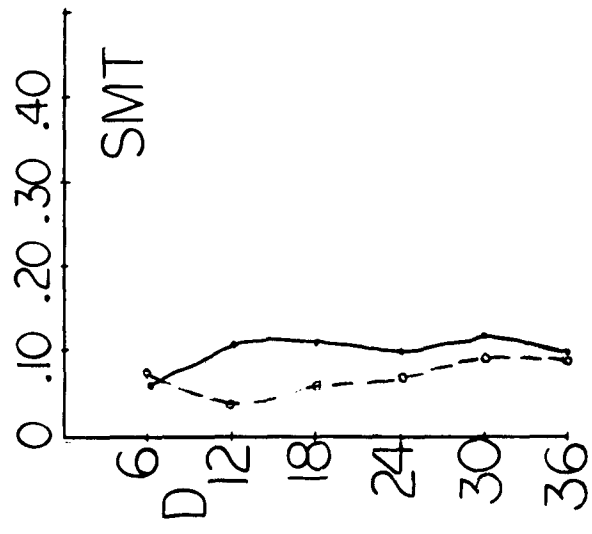
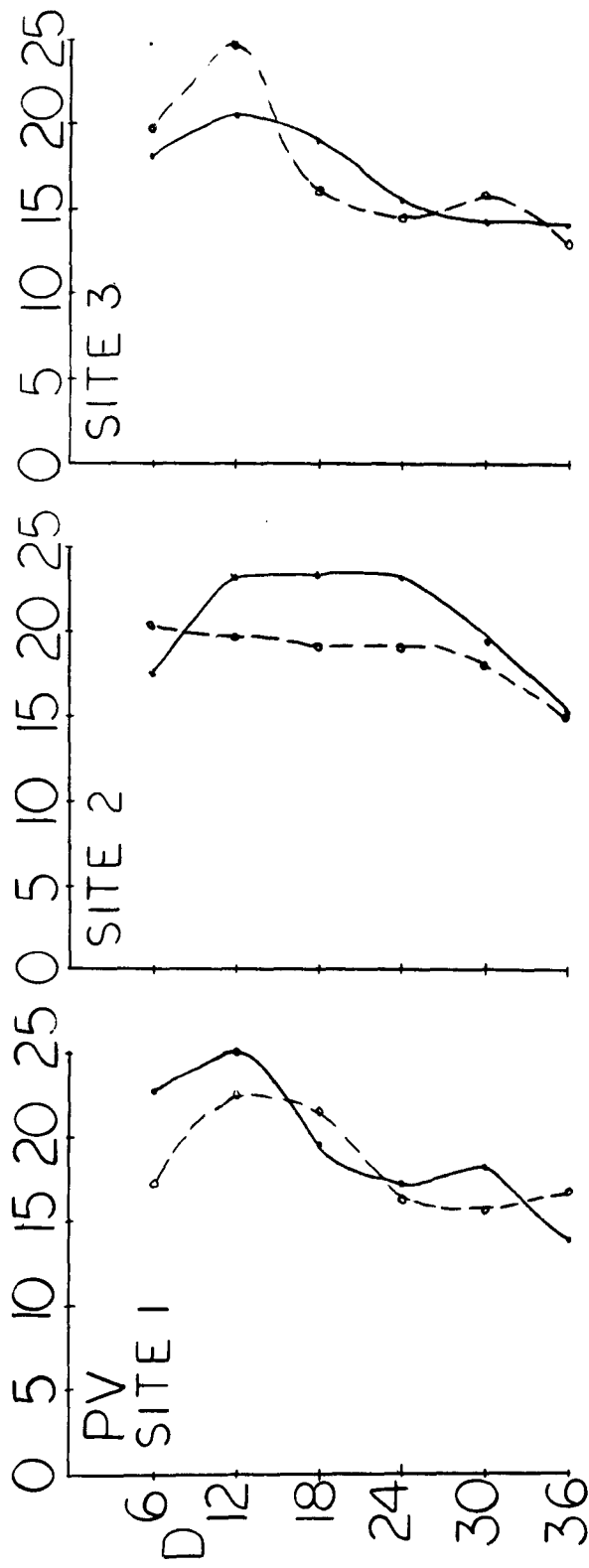
CORN 7/18



---○ IRRIG.
—● UNIR.

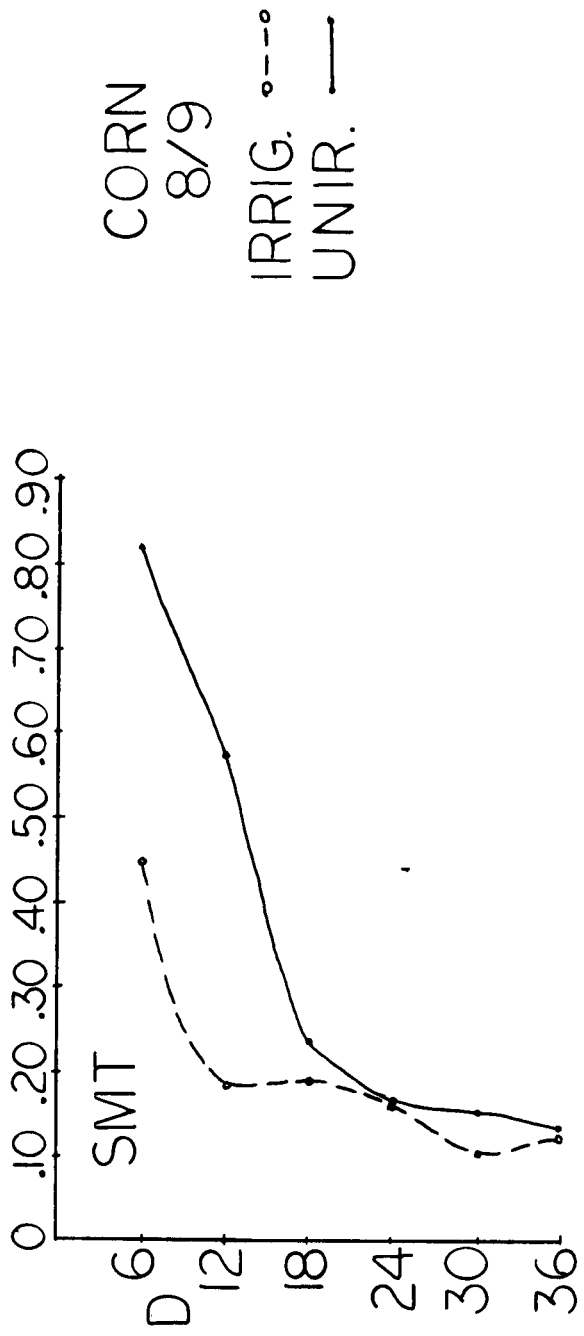
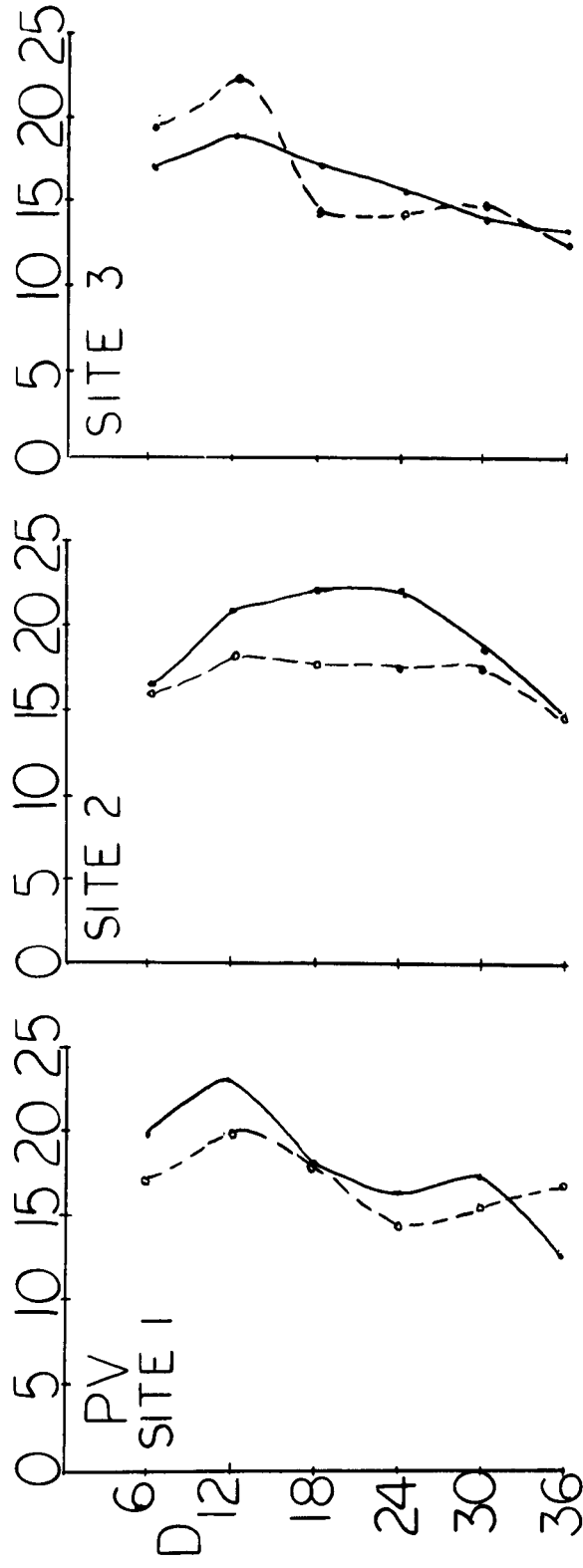




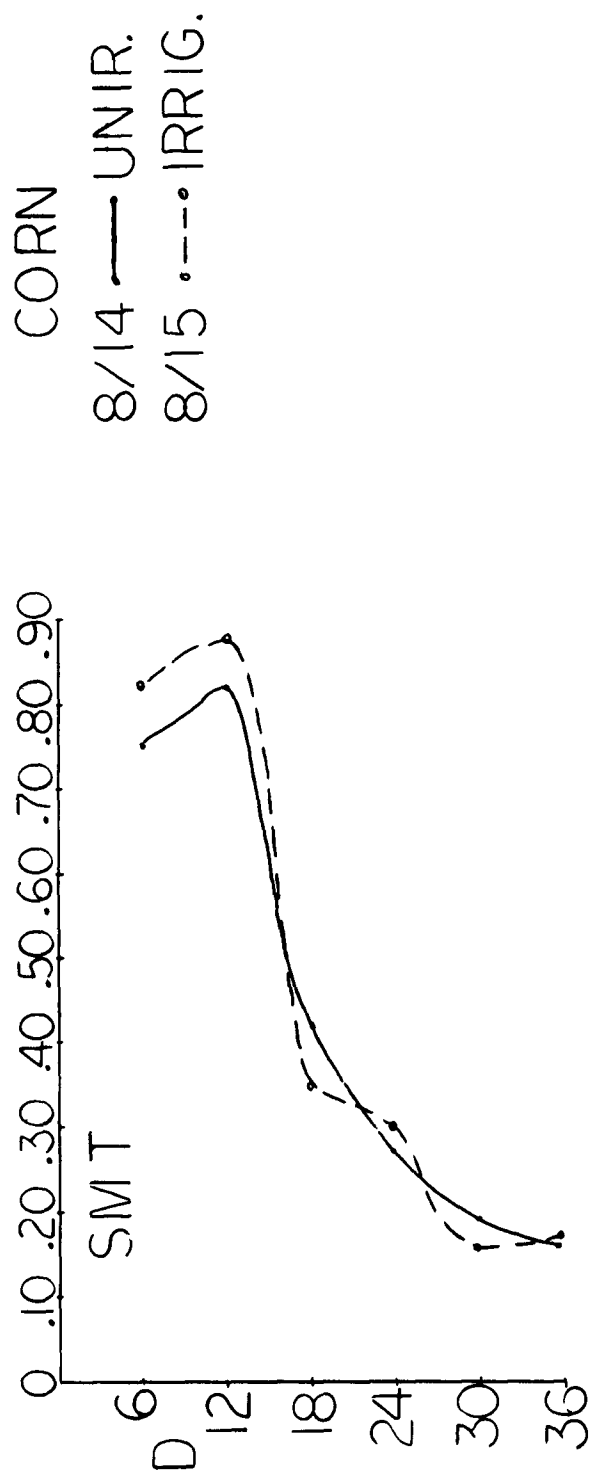
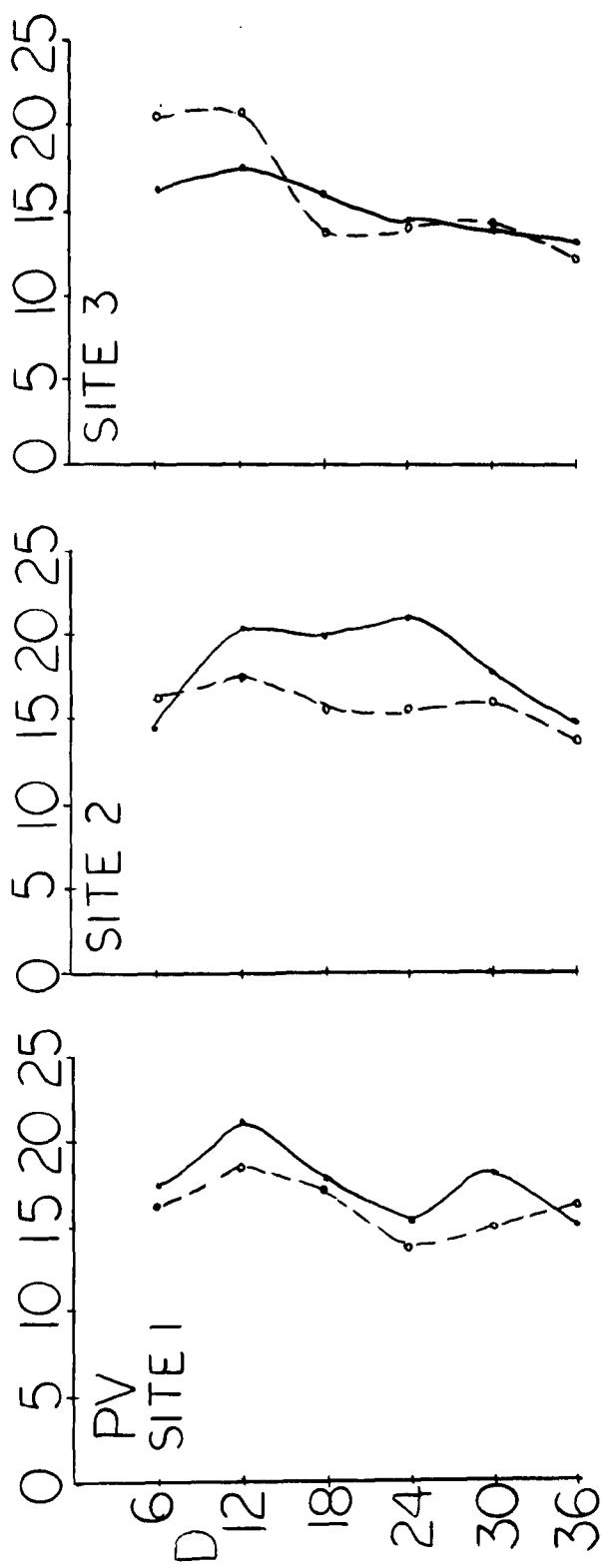


CORN
8/4

IRRIG.
UNIR.

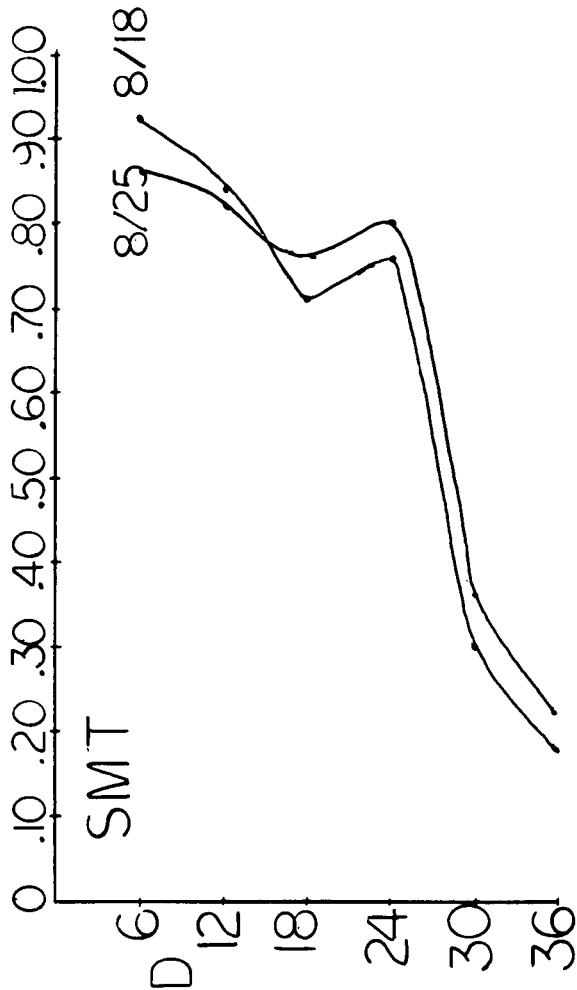
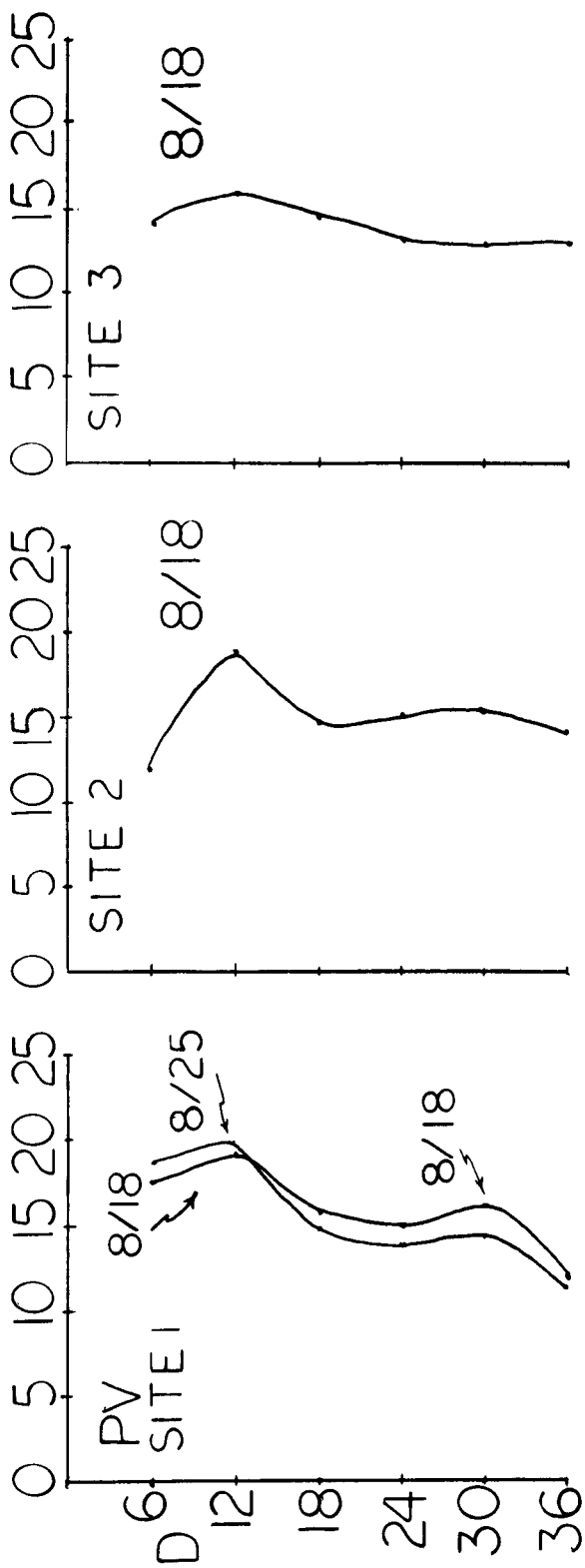


CORN
8/9
IRRIG. ---○---
UNIR. —●—

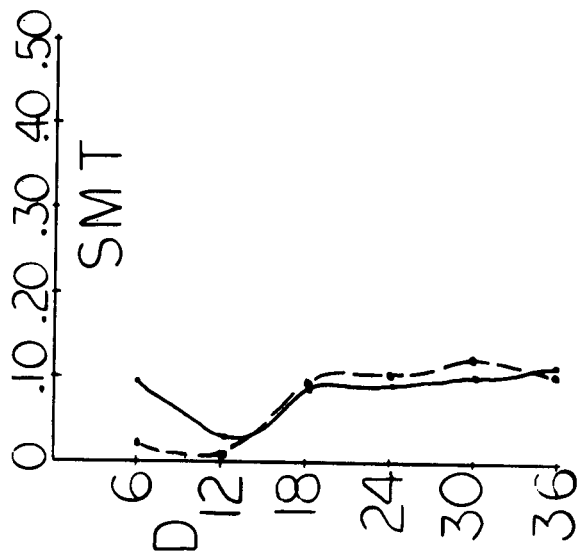
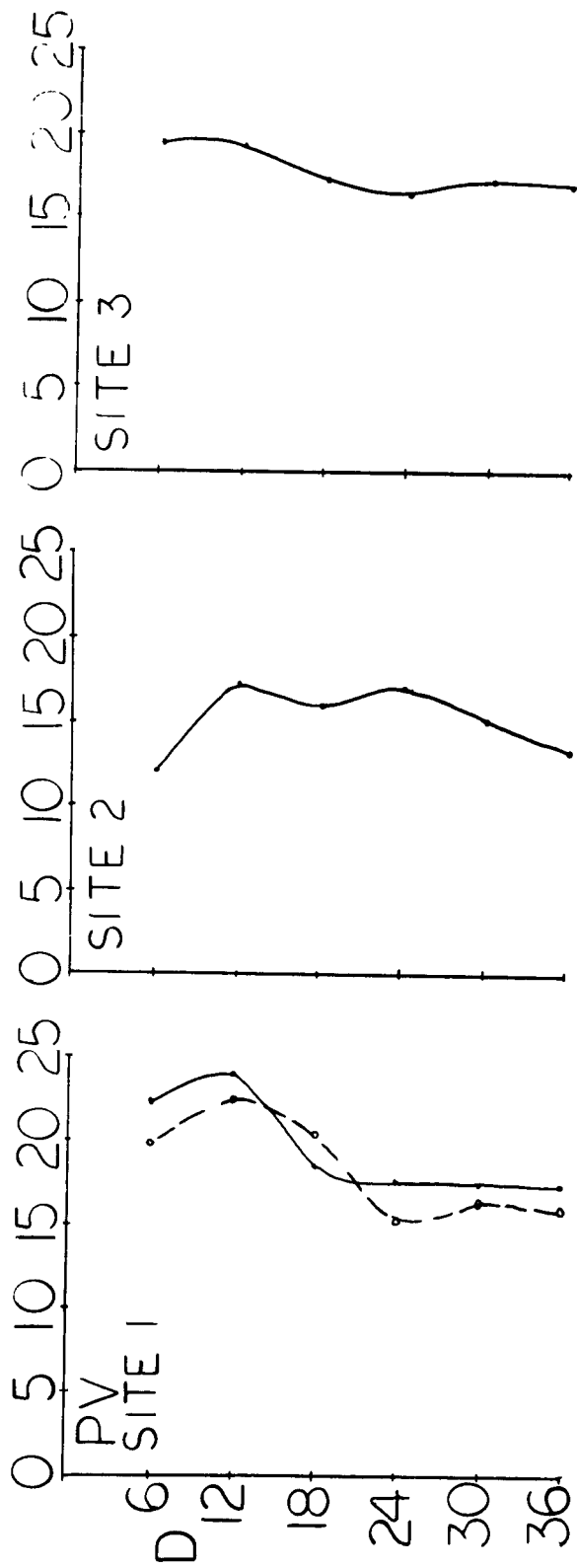


CORN

8/14 — UNIR.
8/15 --- IRRIG.

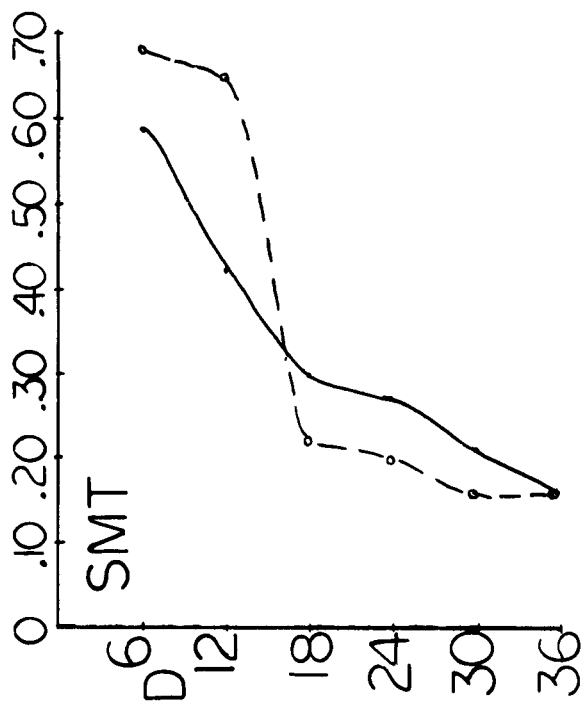


CORN
8/18-25
— UNIR.

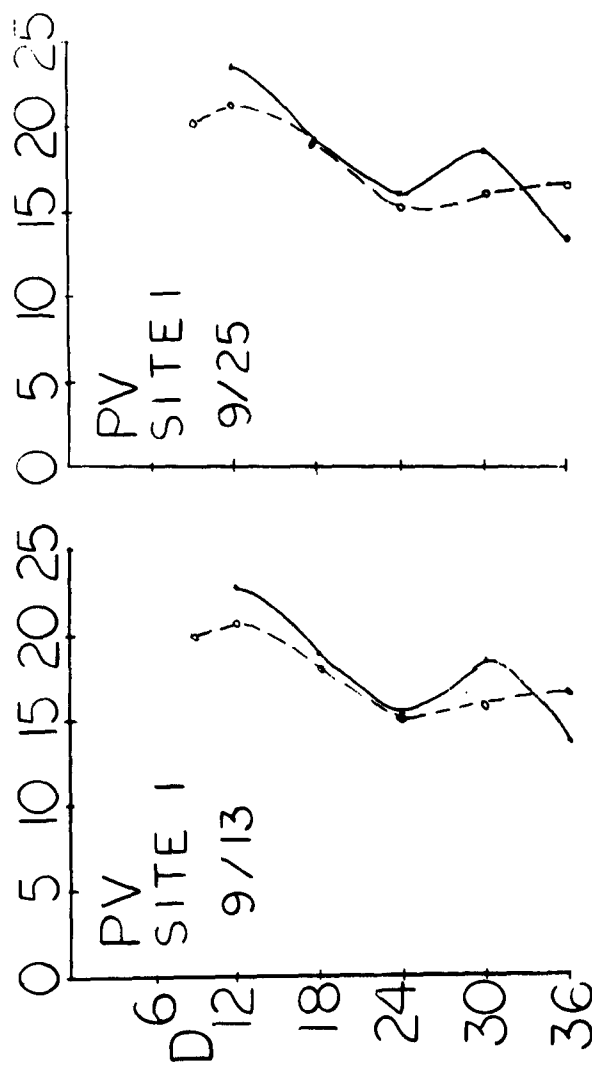


CORN
8/30

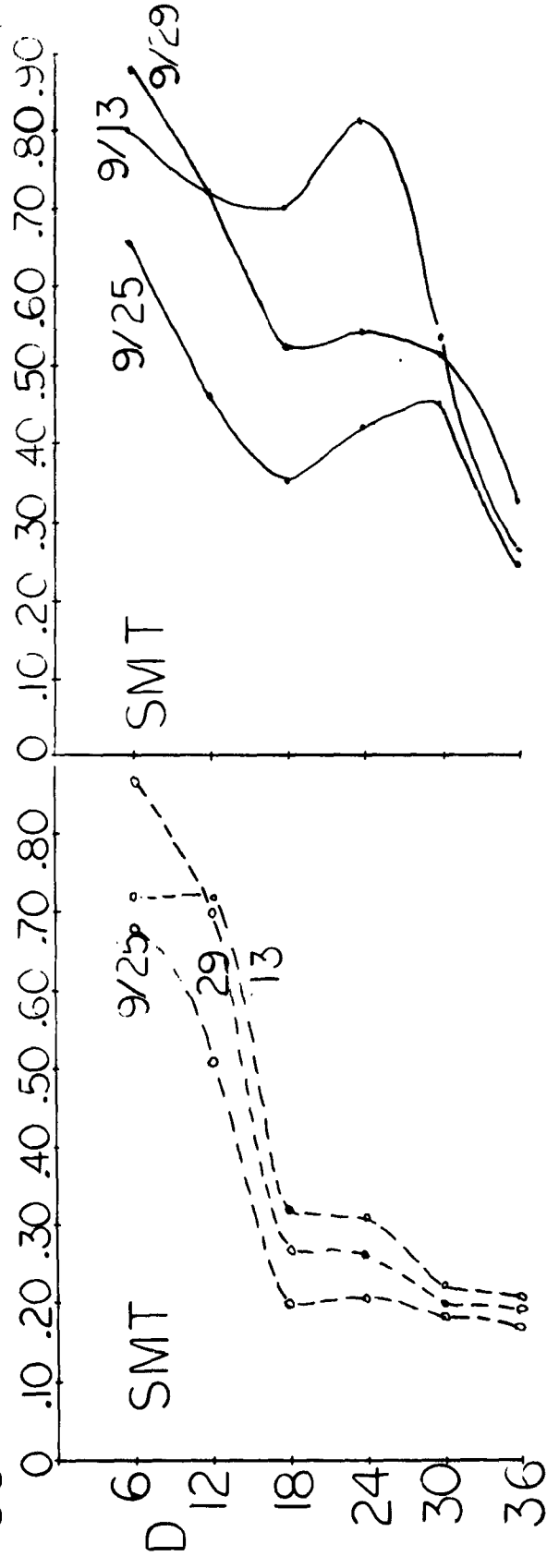
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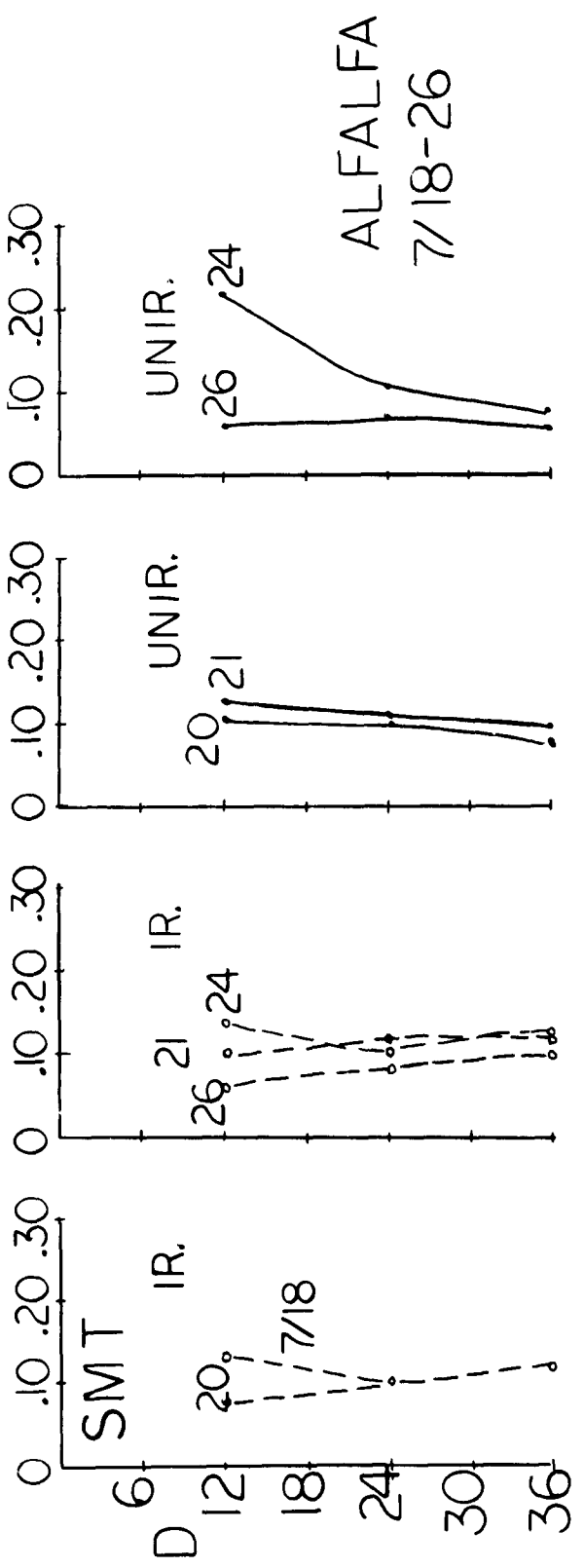
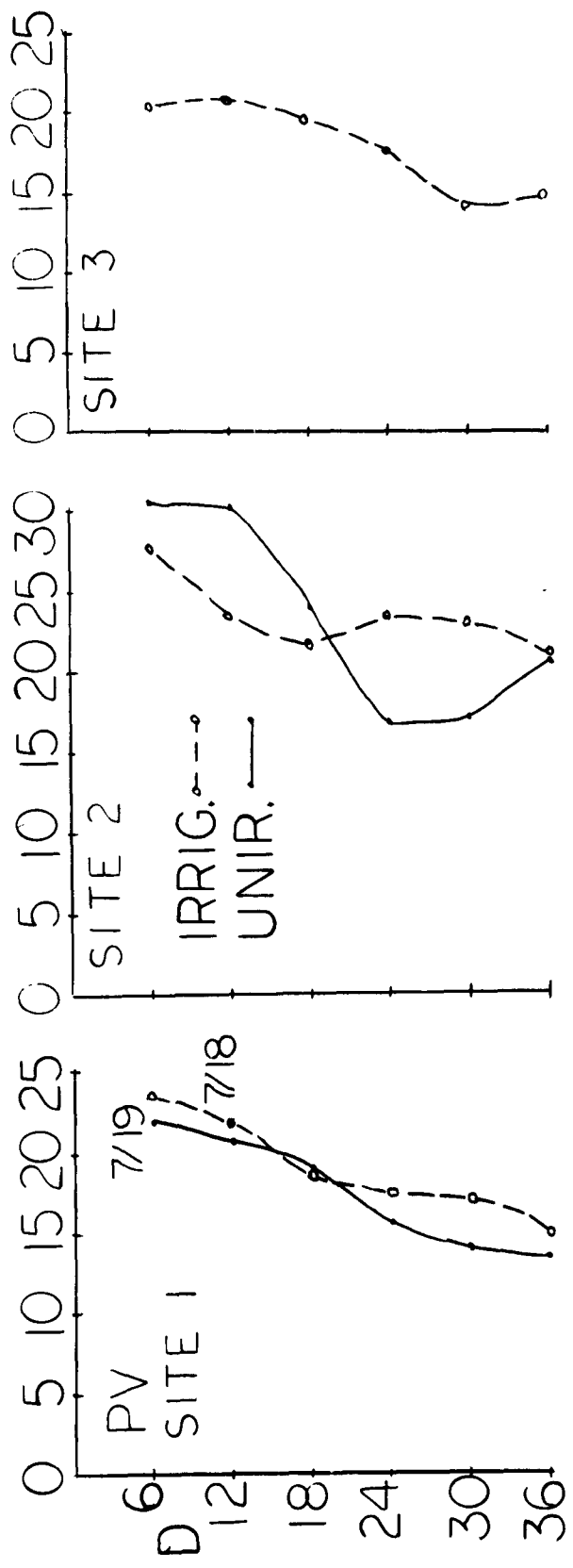


CORN
9/6
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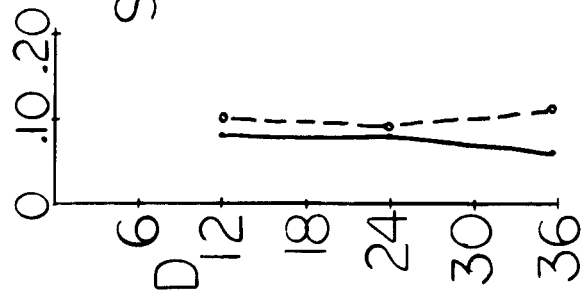
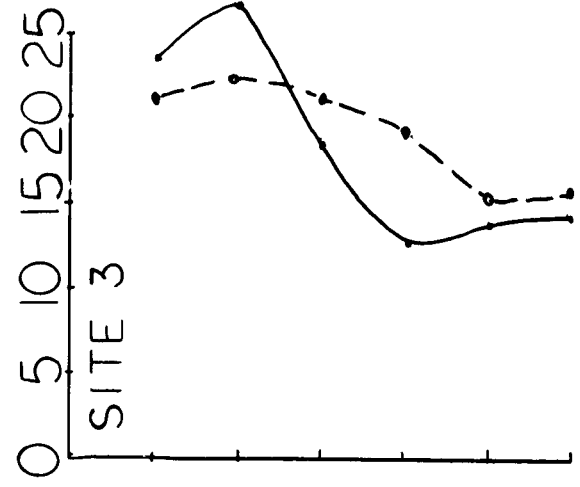
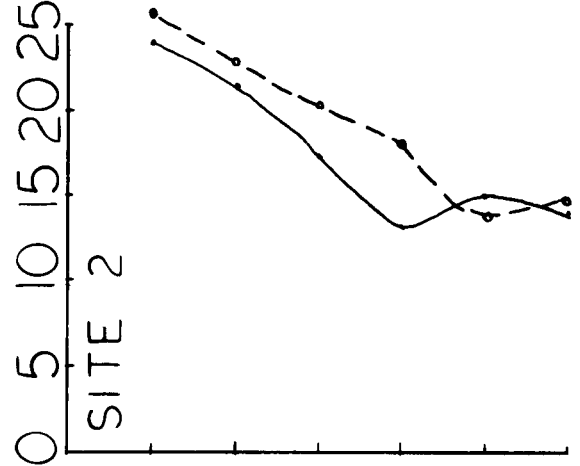
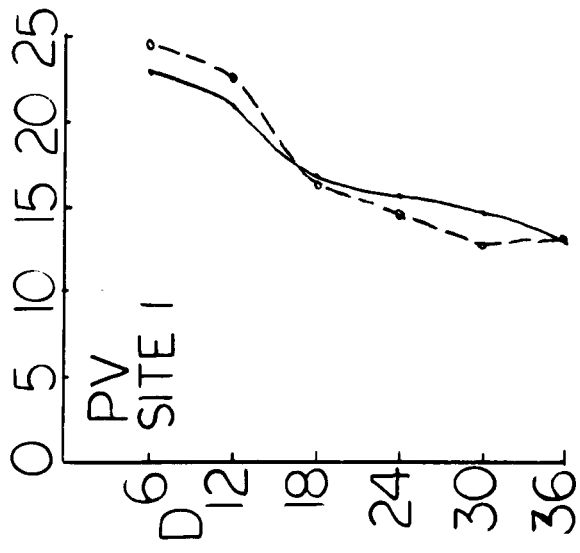


CORN
9/13-29
— UNIR.
-- IRRIG.



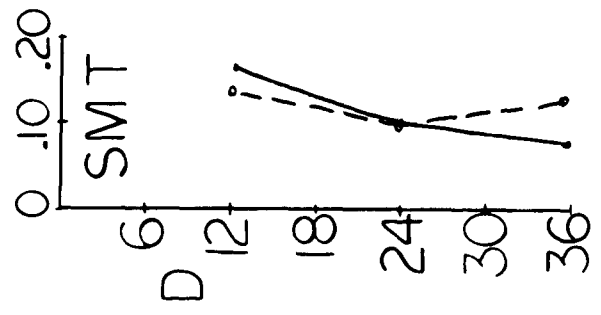
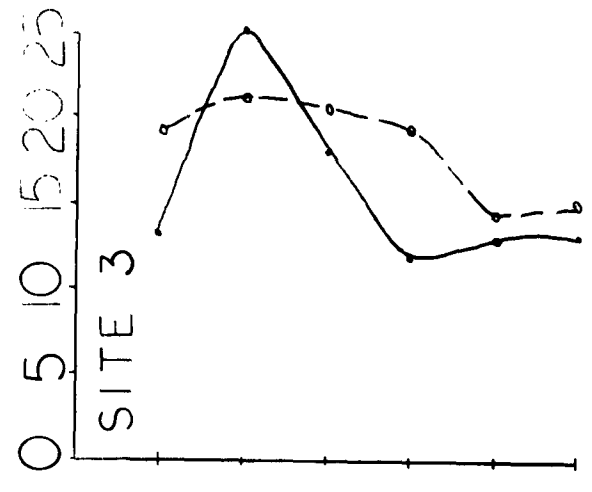
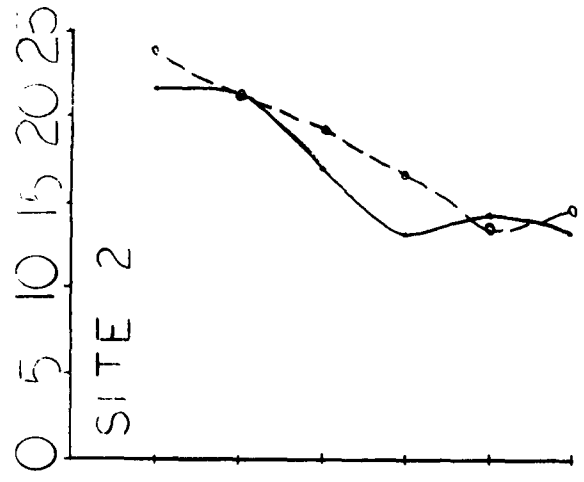
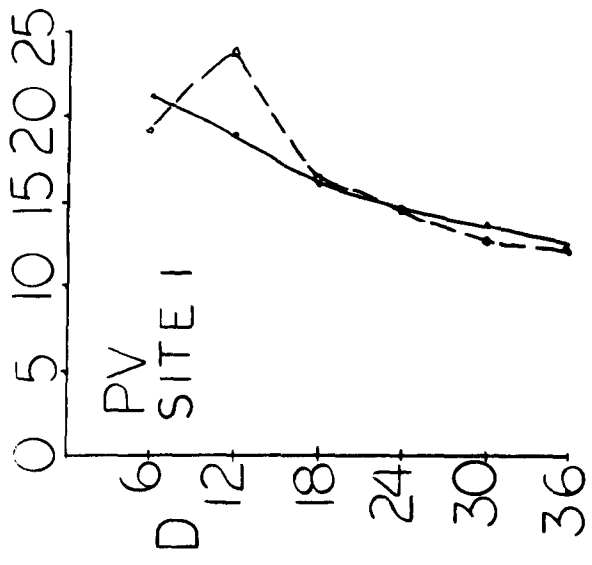


ALFALFA
7/18-26



ALFALFA

- UNIR. 8/4
- - IRRIG. 8/5



ALFALFA

— UNIR. 8/7

- - - IRRIG. 8/8

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SOIL MOISTURE ANALYSES, ELLIS HOLLAND, ITHACA, N. Y., 1960 and 1961 by J. H. Shinn, K. W. Brown, and R. F. West	
Interim Report Nr. 62-6, September 1962 USAEFG Technical Program, DA Project 3A99-27-005	
53 p. incl. illus., tables. Unclassified report.	
This report is a summary of soil moisture data taken in connection with an energy balance and evapotranspiration study during 1960 and 1961 in fields of corn and alfalfa at Ithaca, N. Y. Soil moisture measurements were made in the laboratory on undisturbed core samples using the pressure plate apparatus, and measurements were made in the field using tensiometers and the neutron probe.	
UNCLASSIFIED	Soils— Moisture content Moisture measurements
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