10-1963

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Bulletin 368 October 1963

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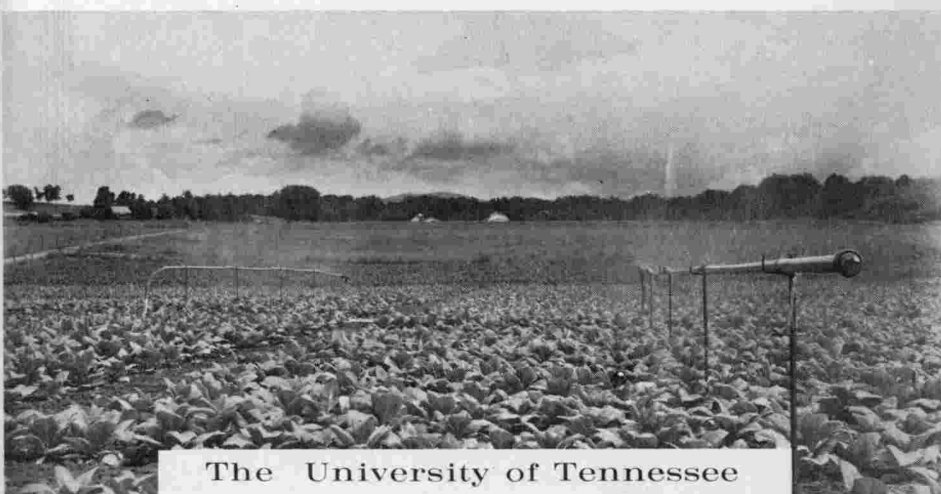

The University of Tennessee
Agricultural Experiment Station
Knoxville
in cooperation with
Crops Research Division
Agricultural Research Service
U. S. Department of Agriculture

Contents

FRONT COVER: Irrigating burley tobacco plots at the Tobacco Experiment Station, Greeneville, Tennessee.

The study reported in this bulletin is a contributing project to Regional Project S-24, "Development and Utilization of Water Resources for Agriculture."

Response of Burley Tobacco to Irrigation and Nitrogen

by

W. L. Parks,[1] B. C. Nichols,[2] R. L. Davis,[2] E. J. Chapman,[1] and J. H. Felts[1]

BURLEY tobacco irrigation experiments were begun in 1955 at the Middle Tennessee Experiment Station, near Spring Hill, and at the Tobacco Experiment Station, near Greeneville. The experiments were located on a Maury soil at the Middle Tennessee Station and on Lindside and Decatur soils at the Tobacco Station. A split-plot design was used with moisture treatments as the main plots and nitrogen treatments as the split plots.

Soil Properties

Maury is a well-drained upland soil developed partly from a mantle of silty material and partly from the heavier underlying residuum of phosphatic limestones. Lindside is a moderately well-drained alluvial soil derived from young alluvium washed mainly from uplands underlain by limestone; however, it may have come in part from soils over other rocks, such as sandstones and shales. Decatur is a well-drained upland soil developed in residuum from limestone.

The moisture release properties of the three soils are shown in Table 1. The surface foot of the Maury, Lindside, and Decatur soils holds 2.91, 2.40, and 2.17 inches of available water, respectively. The moisture held at 2 atmospheres tension or below characterizes the soils better in terms of tobacco production because it is the moisture that is readily available for plant growth. The data in Table 1 show that the Maury soil holds 1.59, the Lindside 1.30, and the Decatur 0.99 inches of available water in the surface foot of soil at tensions less than 2 atmospheres.

Rainfall and Drouth Days[3]

The extremely dry years of 1952 and 1954 greatly increased interest in irrigation. Moisture conditions during the years of these

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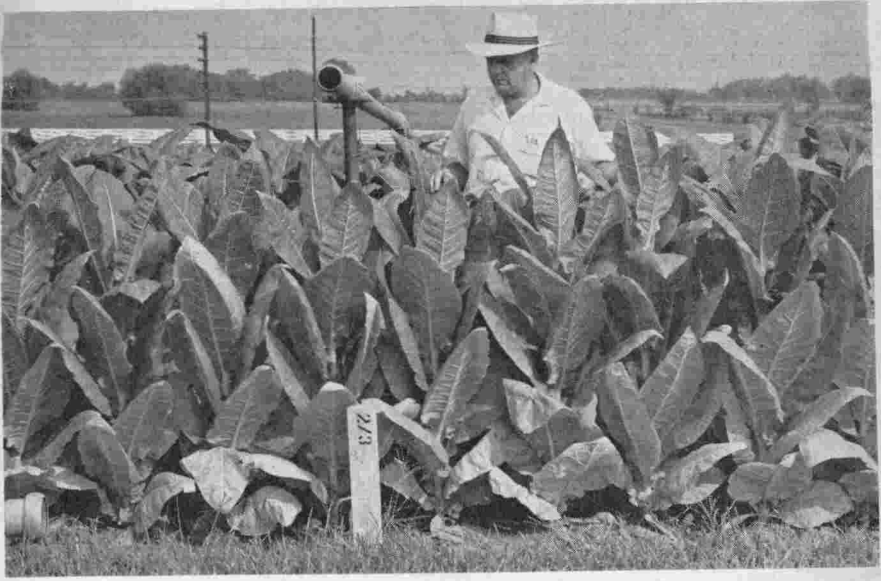
[3]DROUTH DAYS

The computation necessary to determine drouth days is a simple bookkeeping procedure. Daily losses due to evapotranspiration are subtracted and any rainfall occurring is added to the base amount of available moisture each day. The computations

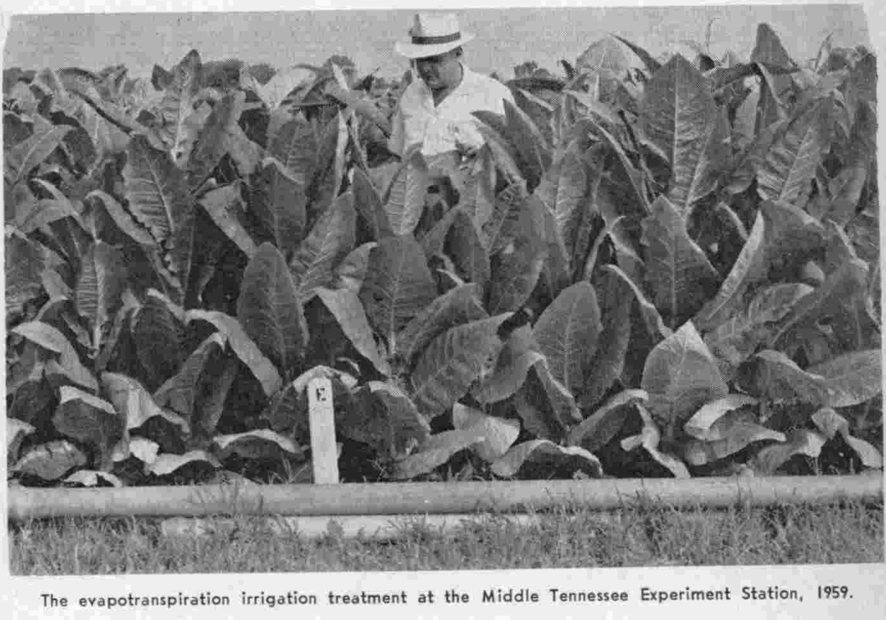
(Continued on page 6)

The unirrigated treatment at the Middle Tennessee Experiment Station, Spring Hill, Tennessee, 1959.

The 2 atmosphere irrigated treatment at the Middle Tennessee Experiment Station, 1959.



The ⅔ atmosphere irrigation treatment at the Middle Tennessee Experiment Station, 1959.



The evapotranspiration irrigation treatment at the Middle Tennessee Experiment Station, 1959.

Table 1. Moisture release data for the Maury, Decatur, and Lindside soils

Soil depth, bulk density, and moisture tension	Soil Moisture Weight %	Soil Moisture Volume %	Acre in. H_2O to reach F.C.*	Soil Moisture Weight %	Soil Moisture Volume %	Acre in. H_2O to reach F.C.*	Total acre in. available H_2O for 0-12"
			MAURY				
Soil depth	0-6 inches			6-12 inches			
Bulk density	1.38			1.47			
1/3 Atmosphere*	26.0	35.9	0	24.9	36.6	0	0
2 Atmospheres	16.6	22.9	.78	15.7	23.1	.81	1.59
5 Atmospheres	10.7	14.8	1.27	12.7	18.7	1.07	2.34
9 Atmospheres	8.7	12.0	1.43	10.7	15.7	1.25	2.68
15 Atmospheres	7.8	10.7	1.51	9.0	13.2	1.40	2.91
			DECATUR				
Soil depth	0-6 inches			6-12 inches			
Bulk density	1.53			1.48			
1/3 Atmosphere*	20.7	31.6	0	21.7	32.2	0	0
2 Atmospheres	15.2	23.3	.50	16.2	24.0	.49	.99
5 Atmospheres	12.1	18.5	.79	11.8	17.5	.88	1.67
15 Atmospheres	9.0	13.8	1.07	9.4	13.9	1.10	2.17
			LINDSIDE				
Soil depth	0-6 inches			6-12 inches			
Bulk density	1.51			1.52			
1/3 Atmosphere*	22.0	33.2	0	22.8	34.6	0	0
2 Atmospheres	14.1	21.3	.71	16.0	24.3	.62	1.30
5 Atmospheres	9.9	14.9	1.10	12.7	19.3	.92	2.00
9 Atmospheres	8.8	13.3	1.19	10.8	16.4	1.09	2.30
15 Atmospheres	8.0	12.1	1.27	10.3	15.6	1.14	2.40

*Field Capacity (sieved samples).

studies were much more favorable than the few years of extreme drouth that preceded them. The rainfall records from April through August for the months that the experiments were in progress at the two locations, the dry year of 1954, and the long-time averages are shown in Tables 2 and 3.

are subject to the conditions that the moisture level is never less than zero or more than the base amount. Moisture in excess of the base amount is disregarded. Each day that the moisture level is zero constitutes a drouth day. The number of drouth days occurring during a growing season is a measure of the intensity of drouth. An example of the computations at several moisture bases is as follows.

Date	Evapotranspiration	Precipitation	Base amount available soil moisture: 1 inch	2 inches	4 inches
	Inches	Inches	Inches	Inches	Inches
Amount from previous month			0.25	0.48	2.43
1	0.17	—	0.08	0.31	2.26
2	0.17	—	0.00	0.14	2.09
3	0.17	—	0.00	0.00	1.92
4	0.17	0.82	0.65	0.65	2.57
5	0.17	—	0.48	0.48	2.40
6	0.17	1.27	1.00	1.58	3.50
7	0.17	—	0.83	1.41	3.33

Table 2. Rainfall for the Middle Tennessee Experiment Station, Spring Hill, Tennessee (1954-61) and the long-time average (1931-55)

Month	1954	1955	1956	1957	1958	1959	1960	1961	Long-time Average (1931-55)
				Inches					
April	5.64	5.93	4.22	3.83	6.49	3.05	1.68	4.52	4.35
May	3.17	5.76	3.03	8.12	4.19	4.14	2.76	4.76	4.04
June	1.25	2.15	2.59	4.26	3.43	2.78	9.99	5.04	3.40
July	1.22	1.08	2.80	2.13	7.99	6.16	7.43	6.05	4.39
August	0.99	3.43	5.23	1.22	1.88	4.54	4.04	1.06	3.54
5-month total	12.27	18.35	17.87	19.56	23.98	20.67	25.90	21.43	19.72

Table 3. Rainfall for the Tobacco Experiment Station, Greeneville, Tennessee (1954-61) and the long-time average (1931-55)

Month	1954	1955	1956	1957	1958	1959	1960	1961	Long-time Average* (1931-55)
				Inches					
April	2.96	3.34	5.46	4.53	3.91	5.20	1.89	2.66	3.40
May	5.05	2.02	3.35	4.97	4.77	3.47	3.42	2.43	3.56
June	1.52	2.25	3.20	4.82	4.83	1.99	6.57	4.08	3.73
July	5.62	1.84	4.21	3.45	5.51	3.82	6.88	5.72	5.25
August	2.27	5.60	3.67	3.35	2.16	4.26	4.39	3.23	4.02
5-month total	17.42	15.05	19.89	21.12	21.18	18.74	23.15	18.12	19.96

*Long-time average for the Newport station.

During the course of these experiments the year of lowest rainfall was 1956 at the Middle Tennessee Experiment Station and rainfall was only slightly higher in 1955. At the Tobacco Experiment Station, 1955 was the year of lowest rainfall. Soil moisture conditions during June and July are critical for the growth of tobacco. The data in Table 2 show that the June-July rainfall was lowest in 1955 at the Middle Tennessee Station as well as at the Tobacco Experiment Station. Rainfall during June-July as well as the total for the entire growing season was well above the long-time average during several years the experiments were conducted.

Drouth days for the same periods at different moisture bases were computed from the average daily evapotranspiration rates and are shown in Tables 4 and 5. The number of drouth days during June and July at all moisture bases was greatest in 1955 at both locations. However, 1955 was not as dry a year as 1954 at the Middle Tennessee Station, but at the Tobacco Experiment Station it was considerably drier.

Table 4. Drouth days for the Middle Tennessee Experiment Station, Spring Hill, Tennessee, 1954-59

Month	1954	1955	1956	1957	1958	1959
			NO IRRIGATION 1.00-inch base			
April	0	0	5	9	0	2
May	13	14	11	15	7	12
June	26	15	18	8	15	13
July	25	30	16	21	5	17
August	26	12	10	23	16	9
Total	90	71	60	76	43	53
			1.50-inch base			
April	0	0	0	3	0	0
May	5	10	10	15	3	10
June	26	18	18	5	15	10
July	25	23	16	21	3	16
August	26	6	9	22	12	4
Total	82	57	53	66	33	40
			2.00-inch base			
April	0	0	0	0	0	0
May	0	6	7	14	0	6
June	26	18	18	2	14	7
July	25	23	16	21	3	16
August	26	6	9	22	8	0
Total	77	53	50	59	25	29
			IRRIGATED AT 2 ATMOSPHERES TENSION 1.50-inch base			
April	—	0	0	3	0	0
May	—	10	10	15	3	10
June	—	18	18	5	15	10
July	—	8	10	9	3	9
August	—	4	5	8	12	4
Total	—	40	43	40	33	33

Irrigation Dates and Amounts

The number, amounts, and dates of tobacco irrigation at the two locations are shown in Tables 6 and 7. No irrigation was required at either station in 1958 as both stations received about 17½ inches of fairly well distributed rainfall throughout the May-August growing period of burley. At the Middle Tennessee Station during the years when extra water was required, about one irrigation each year was necessary for the 5-atmosphere treatment and about three each year for the 2-atmosphere treatment.

About two irrigations were required each year for the 5-

Table 5. Drouth days for the Tobacco Experiment Station, Greeneville, Tennessee, 1954-61

Month	1954	1955	1956	1957	1958	1959	1960	1961
				NO IRRIGATION				
				1.00-inch base				
April	0	0	4	12	0	0	10	5
May	3	14	10	10	9	14	14	16
June	22	18	14	3	18	14	4	6
July	8	23	8	11	6	8	6	5
August	15	8	20	12	13	10	3	7
Total	48	63	56	48	46	46	37	39
				1.50-inch base				
April	0	0	0	6	0	0	6	0
May	0	10	5	9	4	10	14	15
June	21	18	14	0	18	14	1	6
July	4	23	3	7	0	5	2	5
August	15	6	17	7	13	9	0	2
Total	40	57	39	29	35	38	23	28
				2.00-inch base				
April	0	0	0	1	0	0	0	0
May	0	6	1	9	0	6	13	10
June	17	18	14	0	18	14	1	6
July	1	23	3	4	0	5	0	5
August	14	6	16	3	8	9	0	0
Total	32	53	34	17	26	34	14	21
				IRRIGATED AT 2 ATMOSPHERES TENSION				
				1.50-inch base				
April	—	0	0	6	0	0	6	0
May	—	10	5	9	4	10	14	15
June	—	8	13	0	18	8	1	6
July	—	14	2	3	0	0	0	0
August	—	0	2	0	13	3	0	0
Total	—	32	22	18	35	21	21	21

atmosphere treatment and three for the 2-atmosphere treatment at the Tobacco Experiment Station. In the second experiment conducted in 1959, 1960, and 1961 maintaining the moisture level at ⅔ atmosphere or irrigating by evapotranspiration[4] on a 1.1-inch base required more water than the 2-atmosphere irrigation treatment and in general kept the soil more moist.

[4]This requires that the calculated average daily evapotranspiration rate is subtracted from the moisture base each day. When this value reaches zero, water is applied. Rainfall and irrigation are treated as water added. Regardless of the amount of rainfall or irrigation, the upper limit is the moisture base.

Table 6. Number, amount, and dates of irrigation of burley tobacco at the Middle Tennessee Experiment Station, Spring Hill

Irrigation treatment	1955			1956			1957			1958			1959		
	No. of irri-gations	In. of water applied	Dates of irri-gation	No. of irri-gations	In. of water applied	Dates of irri-gation	No. of irri-gations	In. of water applied	Dates of irri-gation	No. of irri-gations	In. of water applied	Dates of irri-gation	No. of irri-gations	In. of water applied	Dates of irri-gation
Irrigated at 5-atmospheres tension	1	2.7	8-2	1	2.7	7-31	1	2.7	8-15	0	0	—	—	—	—
Irrigated at 2-atmospheres tension	3	4.8	7-6 7-22 7-28	2	3.2	7-13 7-30	3	4.8	7-13 7-29 8-13	0	0	—	1	1.6	7-10
Irrigated at 2/3 atmosphere tension	—	—	—	—	—	—	—	—	—	—	—	—	3	2.5	6-22 7-10 7-15
Irrigated on 1.1-inch base by evapotrans-piration	—	—	—	—	—	—	—	—	—	—	—	—	4	5.6	6-20 6-29 7-9 7-13
Inches rainfall May-August		12.4			13.6			15.7			17.5			17.6	

Table 7. Number, amount and dates of irrigation of burley tobacco at the Tobacco Experiment Station, Greeneville, Tennessee.

Irrigation treatment	1955			1956			1957			1958			1959			1960			1961		
	No. of irrigations	In. of water applied	Dates of irrigation	No. of irrigations	In. of water applied	Dates of irrigation	No. of irrigations	In. of water applied	Dates of irrigation	No. of irrigations	In. of water applied	Dates of irrigation	No. of irrigations	In. of water applied	Dates of irrigation	No. of irrigations	In. of water applied	Dates of irrigation	No. of irrigations	In. of water applied	Dates of irrigation
Irrigated at 5-atmosphere tension	2	3.8	6-8 8-8	1	2.2	8-9	2	3.4	7-11 7-31	0	0	—	—	—	—	—	—	—	—	—	—
Irrigated at 2-atmosphere tension	4	5.8	6-7 7-16 7-26 8-2	3	4.3	6-21 8-2 8-11	3	3.0	7-10 7-30 8-10	0	0	—	5	4.9	6-16 6-24 7-1 7-11 7-29	3	3.0	7-19 7-25 8-2	3	3.0	7-1 7-13 8-4
Irrigated at ⅔ atmosphere tension	—	—	—	—	—	—	—	—	—	—	—	—	8	4.0	6-12 6-18 6-24 6-30 7-10 7-16 7-22 7-28	4	2.0	7-19 7-22 8-2 8-5	4	2.0	6-30 7-11 7-26 8-3
Irrigated on 1.1-inch base by evapotranspiration	—	—	—	—	—	—	—	—	—	—	—	—	5	7.0	6-11 6-18 7-2 7-14 7-28	4	5.6	7-8 7-18 7-23 8-1	3	4.2	6-30 7-12 8-2
Inches rainfall May-August	11.7			14.4			16.6			17.3			13.5			21.3			15.5		

Yields and Acre-Value of First Experiments

The mean annual yields of tobacco at both locations in the first experiment are shown in Tables 8 and 9. During the first 3 years of the experiment when irrigation was required a significant response to irrigation was obtained each year at the Middle Tennessee Station and for 2 of the 3 years at the Tobacco Experiment Station. The greatest response to irrigation occurred in 1955 at the Middle Tennessee Station and in 1957 at the Tobacco Experiment Station. For the 4-year period a significant response to irrigation was obtained at the Middle Tennessee Station. The average yield increase was about 200 pounds per acre per year for irrigation. The 4-year average yield at the Tobacco Experiment Station

Table 8. Yields of burley tobacco at three irrigation and four nitrogen levels on a Maury soil at the Middle Tennessee Experiment Station for a 4-year period, 1955-58

Tmt. No.	Irrigation treatment	Nitrogen lb./A	1955	1956	1957	1958**	Avg.
				Pounds per acre			
1	No irrigation	40	1779	1756	1415	1586	1634
2	No irrigation	80	1740	1685	1434	1706	1641
3	No irrigation	120	1611	1666	1458	1992	1682
4	No irrigation	160	1712	1660	1552	2085	1752
5	5 atmospheres tension*	40	1580	1672	1385	1586	1556
6	5 atmospheres tension*	80	1986	1753	1512	1706	1739
7	5 atmospheres tension*	120	1995	1690	1567	1992	1811
8	5 atmospheres tension*	160	1950	1698	1583	2085	1829
9	2 atmospheres tension	40	2008	1772	1392	1586	1690
10	2 atmospheres tension	80	2309	1823	1600	1706	1860
11	2 atmospheres tension	120	2298	1947	1772	1992	2002
12	2 atmospheres tension	160	2770	1916	1680	2085	2113

*This was 9 atmospheres in 1955.
**No irrigation applied.

RESPONSE TO IRRIGATION

	1955	1956	1957	1958	Avg.
No irrigation	1710	1692	1465	1842	1677
5 atmospheres tension	1878	1703	1512	1842	1734
2 atmospheres tension	2346	1864	1611	1842	1916
L. S. D. (5%)	300	93	98	N.S.	77
(1%)	454	141	N.S.	N.S.	103

RESPONSE TO NITROGEN

	1955	1956	1957	1958	Avg.
40	1788	1733	1397	1586	1626
80	2012	1754	1515	1706	1747
120	1968	1768	1599	1992	1832
160	2144	1758	1605	2085	1898
L. S. D. (5%)	237	N.S.	78	87	67
(1%)	320	N.S.	106	116	89

Table 9. Yields of burley tobacco at three irrigation and four nitrogen levels on Lindside and Decatur soils at the Tobacco Experiment Station for a 4-year period, 1955-58

Tmt. No.	Irrigation treatment	Nitrogen lb./A	1955	1956	1957	1958**	Avg.
				Pounds per acre			
1	No irrigation	40	1712	1832	1574	2034	1788
2	No irrigation	80	2035	1842	1752	1946	1894
3	No irrigation	120	1953	1967	1875	2137	1983
4	No irrigation	160	1956	2090	1854	2139	2010
5	5 atmosphere tension*	40	1948	1710	1752	2034	1861
6	5 atmospheres tension*	80	1945	1838	1940	1946	1917
7	5 atmospheres tension*	120	2044	1936	2009	2137	2032
8	5 atmospheres tension*	160	2200	1949	2159	2139	2112
9	2 atmospheres tension	40	1893	1631	1869	2034	1857
10	2 atmospheres tension	80	2139	1814	2001	1946	1975
11	2 atmospheres tension	120	2227	2008	2211	2137	2146
12	2 atmospheres tension	160	2183	2063	2134	2139	2130

*This was 9 atmospheres in 1955.
**No irrigation applied.

RESPONSE TO IRRIGATION

	1955	1956	1957	1958**	Avg.
No irrigation	1914	1933	1764	2064	1919
5 atmospheres tension	2034	1858	1965	2064	1980
2 atmospheres tension	2111	1879	2053	2064	2027
L. S. D. (5%)	72	N.S.	134	N.S.	N.S.
(1%)	108	N.S.	203	N.S.	N.S.

RESPONSE TO NITROGEN

	1955	1956	1957	1958**	Avg.
40	1851	1724	1732	2034	1835
80	2040	1831	1898	1946	1929
120	2075	1970	2031	2137	2053
160	2113	2034	2049	2139	2084
L. S. D. (5%)	102	133	128	N.S.	61
(1%)	138	179	173	N.S.	81

showed essentially no difference between the irrigated and non-irrigated treatments.

A significant yield increase from nitrogen applications above 40 pounds per acre was obtained at both locations in 3 of 4 years. The 4-year average indicates that nitrogen applications on burley tobacco should be at or slightly above 120 pounds of nitrogen per acre each year for the highest yield of burley tobacco. Application of 160 pounds of nitrogen per acre produced the highest average yield for the 4 years at both locations. At each of the moisture levels at the two locations, 160 pounds of nitrogen per acre produced the highest average yields in 5 of the 6 moisture-location averages observed.

The dollar-acre values of the tobacco from these experiments are shown in Tables 10 and 11. A significant increase in acre value was obtained with irrigation for 3 years at the Middle Tennessee Station and for 2 years at the Tobacco Experiment Station. However, the 4-year average showed essentially the same relation as did the pounds per acre yield in that a significant response to irrigation was obtained at the Middle Tennessee Station, while at the Tobacco Experiment Station essentially no difference occurred in the acre value of the irrigated and nonirrigated tobacco.

Applications of nitrogen above 40 pounds per acre significantly increased the acre value in 3 of the 4 years at the Middle Tennessee Station and in all 4 years at the Tobacco Experiment Station. The 4-year average also indicated that nitrogen applications up to or slightly above 120 pounds would be profitable at each location.

Table 10. Dollar-acre value of burley tobacco at three irrigation and four nitrogen levels on a Maury soil at the Middle Tennessee Experiment Station for a 4-year period, 1955-58

Tmt. No.	Irrigation treatment	Nitrogen lb./A	1955	1956	1957	1958**	Avg.
				Dollar-acre value			
1	No irrigation	40	761	798	501	814	719
2	No irrigation	80	752	682	520	919	718
3	No irrigation	120	681	684	516	1193	769
4	No irrigation	160	745	733	600	1215	823
5	5 atmospheres tension*	40	758	811	481	814	716
6	5 atmospheres tension*	80	963	789	531	919	801
7	5 atmospheres tension*	120	1051	689	594	1193	882
8	5 atmospheres tension*	160	1006	774	586	1215	895
9	2 atmospheres tension	40	1266	767	544	814	848
10	2 atmospheres tension	80	1626	805	674	919	1006
11	2 atmospheres tension	120	1530	915	714	1193	1088
12	2 atmospheres tension	160	2158	798	680	1215	1213

*This was 9 atmospheres tension in 1955.
**No irrigation applied.

RESPONSE TO IRRIGATION

	1955	1956	1957	1958**	Avg.
No irrigation	735	724	534	1035	757
5 atmospheres tension	944	766	548	1035	823
2 atmospheres tension	1645	821	653	1035	1039
L. S. D. (5%)	223	61	77	N.S.	62
(1%)	338	N.S.	N.S.	N.S.	92

RESPONSE TO NITROGEN

	1955	1956	1957	1958**	Avg.
40	928	792	509	814	761
80	1114	759	575	919	841
120	1087	763	608	1193	913
160	1303	768	622	1215	977
L. S. D. (5%)	221	N.S.	43	101	62
(1%)	299	N.S.	58	136	83

Table 11. Dollar-acre value of burley tobacco at three irrigation and four nitrogen levels on Lindside and Decatur soils at the Tobacco Experiment Station for a 4-year period, 1955-58

Tmt. No.	Irrigation treatment	Nitrogen lb./A	1955	1956	1957	1958**	Avg.
				Dollar-acre value			
1	No irrigation	40	1170	1222	504	1244	1035
2	No irrigation	80	1540	1146	577	1176	1110
3	No irrigation	120	1368	1267	548	1372	1139
4	No irrigation	160	1520	1431	562	1313	1207
5	5 atmospheres tension*	40	1421	963	607	1244	1059
6	5 atmospheres tension*	80	1473	1158	659	1176	1117
7	5 atmospheres tension*	120	1627	1273	710	1372	1246
8	5 atmospheres tension*	160	1812	1241	768	1313	1284
9	2 atmospheres tension	40	1409	841	675	1244	1042
10	2 atmospheres tension	80	1747	1020	761	1176	1176
11	2 atmospheres tension	120	1841	1233	804	1372	1313
12	2 atmospheres tension	160	1858	1264	741	1313	1294

*This was 9 atmospheres tension in 1955.
**No irrigation applied.

RESPONSE TO IRRIGATION

	1955	1956	1957	1958**	Avg.
No irrigation	1399	1266	543	1276	1123
5 atmospheres tension	1583	1159	686	1276	1176
2 atmospheres tension	1714	1089	745	1276	1206
L. S. D. (5%)	94	N.S.	88	N.S.	N.S.
(1%)	142	N.S.	134	N.S.	N.S.

RESPONSE TO NITROGEN

	1955	1956	1957	1958**	Avg.
40	1333	1008	595	1244	1045
80	1587	1108	666	1176	1134
120	1612	1258	687	1372	1232
160	1730	1312	690	1313	1261
L. S. D. (5%)	137	122	74	132	60
(1%)	297	165	N.S.	N.S.	79

Yields and Acre-Values of Second Experiments

The second phase of this study involved irrigation at 2-atmospheres tension and two treatments that maintained the available moisture at a higher level than the 2-atmosphere treatment. This study was conducted for 1 year at the Middle Tennessee Station (Table 12) and for 3 years at the Tobacco Experiment Station (Tables 13 and 14). The study at the Middle Tennessee Station was discontinued after the first year because of black shank. This was done to avoid spreading the disease over a larger area.

A significant response to irrigation was obtained in the 1 year at the Middle Tennessee Station (Table 12). However, in 2 of the 3 years at the Tobacco Experiment Station a significant decrease in yield from irrigation was obtained and in the third year there

Table 12. Yield and dollar acre value of burley tobacco on Maury soil at the Middle Tennessee Experiment Station for 1959

Tmt. No.	Irrigation treatment	Nitrogen	Manure	Yield	Acre value
		Lb./A	Tons/A	Lb./acre	Dollars
1	No irrigation	80	0	1332	660
2	No irrigation	120	0	1268	613
3	No irrigation	200	0	1261	700
4	No irrigation	120	10	1394	734
5	2 atmospheres tension	80	0	1481	643
6	2 atmospheres tension	120	0	1581	745
7	2 atmospheres tension	200	0	1584	914
8	2 atmospheres tension	120	10	1558	759
9	⅔ atmosphere tension	80	0	1701	831
10	⅔ atmosphere tension	120	0	1481	752
11	⅔ atmosphere tension	200	0	1521	748
12	⅔ atmosphere tension	120	10	1559	761
13	Irrigate by	80	0	1559	728
14	evapotranspiration	120	0	1708	961
15	on a 1.10"	200	0	1777	850
16	base	120	10	1532	692
	RESPONSE TO IRRIGATION				
	No irrigation			1314	677
	2 atmospheres tension			1551	765
	⅔ atmosphere tension			1565	773
	By evapotranspiration			1644	808
	L. S. D. (5%)			189	N.S.
	RESPONSE TO NITROGEN				
	80 lb. nitrogen/A			1518	716
	120 lb. nitrogen/A			1510	768
	200 lb. nitrogen/A			1536	803
	120 lb nitrogen/A plus 10 tons manure/A			1511	736
	L. S. D. (5%)			N.S.	N.S.

was no difference between the irrigated and nonirrigated tobacco (Table 13). At the Middle Tennessee Station there was an increase of about 300 pounds per acre from irrigation by the evapotranspiration procedure and about 200 pounds per acre from irrigating at 2-atmospheres and ⅔-atmospheres tension. In 2 of the years at the Tobacco Experiment Station, a decrease in yield of about 200 pounds per acre from irrigation was obtained. The average for the 3 years showed a decrease of about 150 pounds per acre from irrigation.

The large decrease in yield in 1959 was due to a hailstorm. The irrigated tobacco was far ahead of the unirrigated in growth and was approaching maturity at the time of the hailstorm. Wind and hail associated with this storm caused considerable damage to the tobacco which had been irrigated shortly before the storm. The

Table 13. Yield of burley tobacco on a Decatur soil at the Tobacco Experiment Station for a 3-year period, 1959-61

Tmt. No.	Irrigation treatment	Nitrogen	Manure	1959	1960	1961	Avg.
		Lb./A	Tons/A		Pounds per acre		
1	No irrigation	80	0	1761	2195	1661	1872
2	No irrigation	120	0	1977	2140	1825	1981
3	No irrigation	200	0	2060	2195	2030	2095
4	No irrigation	120	10	2048	2216	2071	2112
5	2 atmospheres tension	80	0	1692	1826	1778	1765
6	2 atmospheres tension	120	0	1833	2012	1938	1928
7	2 atmospheres tension	200	0	1783	1947	1966	1899
8	2 atmospheres tension	120	10	1796	1821	1895	1837
9	⅔ atmosphere tension	80	0	1771	1858	1736	1788
10	⅔ atmosphere tension	120	0	1735	1975	1878	1863
11	⅔ atmosphere tension	200	0	1786	2062	1836	1895
12	⅔ atmosphere tension	120	10	1676	2030	1884	1880
13	Irrigate by	80	0	1670	1796	1717	1723
14	evapotranspiration	120	0	1747	1926	1858	1844
15	on a 1.10"	200	0	1847	1865	1949	1837
16	base	120	10	1662	1837	1914	1804
	RESPONSE TO IRRIGATION						
	No irrigation			1961	2186	1897	2015
	2 atmospheres tension			1776	1901	1894	1857
	⅔ atmosphere tension			1742	1994	1833	1856
	By evapotranspiration			1731	1856	1859	1815
	L. S. D. (5%)			115	131	N.S.	61
	(1%)			166	188	N.S.	82
	RESPONSE TO NITROGEN						
	80 lb. nitrogen/A			1723	1919	1723	1788
	120 lb. nitrogen/A			1823	2013	1874	1904
	200 lb. nitrogen/A			1869	2017	1945	1944
	120 lb. nitrogen/A plus 10 tons manure/A			1795	1988	1941	1908
	L. S. D. (5%)			92	72	104	51
	(1%)			N.S.	N.S.	139	68

unirrigated tobacco was still small and was not damaged as much. The rains associated with the hailstorm during the weeks following provided favorable moisture conditions for the unirrigated tobacco to grow and produce a good crop.

No significant increase from nitrogen applications above 80 pounds of nitrogen per acre was observed in the 1 year at the Middle Tennessee Experiment Station, while the results at the Tobacco Experiment Station showed that 120 pounds of nitrogen per acre was significantly better than 80 pounds during each of the 3 years of the experiment. The yields obtained with 200 pounds of nitrogen per acre and with 10 tons of manure plus the 120 pounds of nitrogen were not significantly better than the yields obtained with 120 pounds of nitrogen.

Table 14. Dollar acre value of burley tobacco at the Tobacco Experiment Station for a 3-year period, 1959-61

Tmt. No.	Irrigation treatment	Nitrogen	Manure	1959	1960	1961	Avg.
		Lb./A	Tons/A		Dollars per acre		
1	No irrigation	80	0	775	1260	1149	1061
2	No irrigation	120	0	989	1247	1269	1168
3	No irrigation	200	0	919	1215	1383	1172
4	No irrigation	120	10	860	1297	1400	1186
5	2 atmospheres tension	80	0	652	958	1226	945
6	2 atmospheres tension	120	0	730	1160	1329	1073
7	2 atmospheres tension	200	0	629	1034	1333	999
8	2 atmospheres tension	120	10	546	928	1273	916
9	⅔ atmosphere tension	80	0	686	931	1194	937
10	⅔ atmosphere tension	120	0	681	959	1289	976
11	⅔ atmosphere tension	200	0	648	1053	1251	984
12	⅔ atmosphere tension	120	10	479	1152	1275	969
13	Irrigate by	80	0	669	906	1177	917
14	evapotranspiration	120	0	668	1050	1266	995
15	on a 1.10"	200	0	733	907	1323	988
16	base	120	10	551	852	1286	896
	RESPONSE TO IRRIGATION						
	No irrigation			885	1255	1300	1147
	2 atmospheres tension			639	1020	1290	983
	⅔ atmosphere tension			623	1024	1252	967
	By evapotranspiration			655	929	1263	949
	L. S. D. (5%)			60	172	34	71
	(1%)			86	N.S.	N.S.	95
	RESPONSE TO NITROGEN						
	80 lb. nitrogen/A			695	1014	1187	965
	120 lb. nitrogen/A			767	1104	1288	1053
	200 lb. nitrogen/A			732	1052	1322	1036
	120 lb. nitrogen/A plus 10 tons manure/A			609	1057	1308	992
	L. S. D. (5%)			85	N.S.	72	44
	(1%)			114	N.S.	97	58

The dollar-acre value was significantly increased by irrigation at the Middle Tennessee Station (Table 12) but significantly decreased in each of the 3 years at the Tobacco Experiment Station with an average decrease of about $150 per acre per year from irrigation over the 3-year period (Table 14). There was an increase from nitrogen applications at the Middle Tennessee Experiment Station but no significant difference among the different rates of nitrogen. In 2 of the 3 years at the Tobacco Experiment Station nitrogen applications above 80 pounds nitrogen per acre did significantly increase the dollar acre value and the 3-year average shows an increase of about $100 per acre, which was significant at the 5% level. The 120 pounds nitrogen per acre plus 10 tons manure per acre treatment did not increase the value of the tobacco over that produced with only 120 pounds nitrogen.

Summary and Conclusions

IRRIGATION of burley tobacco in the Central Basin area might be expected to increase tobacco yields as a significant increase was obtained in 4 of the 5 years the experiments were conducted in this area. Rainfall during the period of these experiments was somewhat above normal and it might be expected that irrigation over time would result in yield increases greater than those obtained in these studies.

- At the Tobacco Experiment Station in the East Tennessee Valley it appears that irrigation might be a questionable practice. This is because during the 7 years the experiments were conducted, 2 years gave a significant response to irrigation, 2 gave a significant decrease to irrigation, and in 3 of the years no significant difference was found between the irrigated and nonirrigated treatments.

- Yield increases with the higher nitrogen application were generally greater in the irrigated treatments than in the unirrigated treatments. However, no consistently significant interaction between irrigation and nitrogen was observed.

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