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Effect of Soil-moisture Depletion on Corn Production

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Since 1974 we have evaluated corn grain yields as influenced by irrigation scheduling in relation to stage of growth and soil moisture depletion. The results could help irrigators who want to extend their supply of water and reduce water application costs.

The study was conducted on the Irrigation Experiment Field, approximately 5 miles northwest of Scandia. The soil is a Crete silt loam developed from wind blown deposits. Information pertaining to planting, rainfall, and physiological stage of growth is listed in Table 1. Available soil water for plant use in the top three feet of the soil profile is approximately 4.3 inches at field capacity. Precipitation for the period from harvest until planting time (October of the previous year to May), Table 1, was fairly uniform. The greatest difference in precipitation was from May until October. In 1976 precipitation from May until October was only 7.8 inches. Six irrigations were applied

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in relation to physiological age and soil moisture depletion as described in Table 2.

Irrigating when 40% of the available soil moisture was depleted (an average of 6 irrigations per season) did not produce yields greater than irrigating at tasseling, 1 week post tasseling, and 2 weeks post tasseling (an average of 3 irrigations per season). Delaying the first irrigation until one week after tasseling significantly reduced yield when compared to applying the first irrigation at time of tasseling, Table 3.

A mid-season corn hybrid will tassel approximately 8 weeks after the plant emerges, which often is at wheat harvest time. Harvesting wheat instead of irrigating corn at tasseling will limit the corn crop.

Figure 1, shows soil moisture depletion and

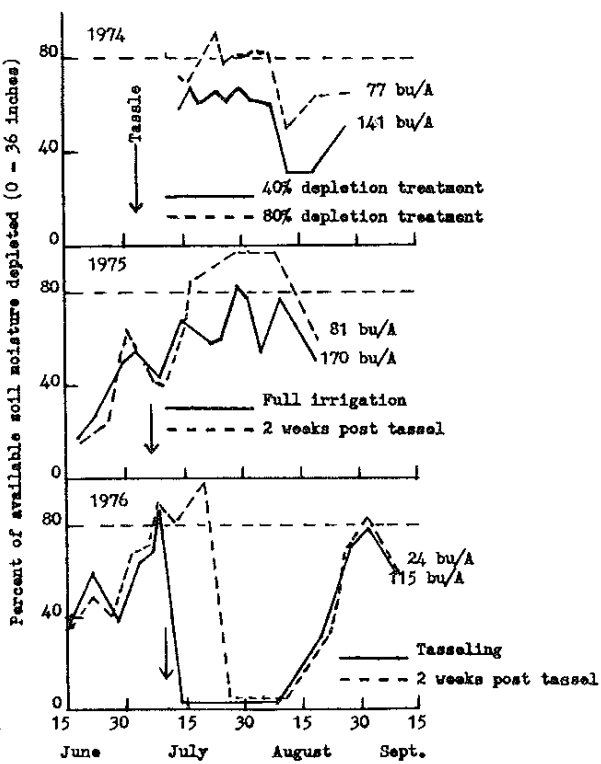

Figure 1—Soil moisture depletion curves for the 0- to 36-inch rooting zone in relation to time and level of irrigation. Yield in bu/A shown for each year and irrigation treatment.

Table 1—Information pertaining to planting, rainfall, and physiological stage of growth on corn test plots, Irrigation Experiment Field, Scandia.

	1974	1975	1976
Planting date	Apr. 24	Apr. 25	May 4
Hybrid	NC+ 85	NC+ 85	NC+ 85
Plants per acre at harvest	21,544	23,304	23,982
Row width (inches)	30	30	30
Row length (feet)	300	300	300
Precipitation, October of previous year to May (inches)	13.4	10.2	12.1
Precipitation, May to October (in.)	10.4	15.0	7.8
Tasseling date	July 2	July 6	July 9
Harvest date	Sept. 25	Sept. 12	Sept. 22

Table 2—Irrigation scheduling treatments, Scandia.

Code	Number of irrigations[1]	Time irrigation water was applied
Physiological timing:		
Full irrigation	4	at 8-leaf; tasseling; 1 week post tasseling; 2 weeks post tasseling
Tasseling	3	at tasseling; 1 week post tasseling; 2 weeks post tasseling
1 wk. post tasseling	2	at 1 week post tasseling; 2 weeks post tasseling
2 wk. post tasseling	1	at 2 weeks post tasseling
Percent depletion timing:		
40% depletion	6	deplete 40% of the available soil moisture in 0-3 ft. depth
80% depletion	2	deplete 80% of the available soil moisture in 0-3 ft. depth

[1] Because of drought in 1976, we also irrigated 3 weeks after tasseling in the 4 physiological timing treatments. 40% depletion received 6 irrig. in 1974, 5 irrig. in 1975, and 7 irrig. in 1976. 80% depletion received 2 irrig. in 1974, 1975, and 3 irrig. in 1976.

Table 3—Grain yield and ear weight as influenced by irrigation, Scandia, 1974-76 with 3-year average.

Schedule for applying irrigation water	1974 Ear wt. lb.	1974 Yield bu/A[2]	1975 Ear wt. lb.	1975 Yield bu/A[2]	1976[1] Ear wt. lb.	1976[1] Yield bu/A[2]	3 year average Ear wt. lb.	3 year average Yield bu/A[2]
8-leaf; tasseling; 1 week post tasseling; 2 weeks post tasseling	.43	123.2	.63	170.0	.42	109.9	.49	134.4
Tasseling; 1 week post tasseling 2 weeks post tasseling	.41	124.6	.54	153.7	.43	114.9	.46	131.1
1 week post tasseling	.32	79.2	.39	113.2	.30	70.9	.34	87.8
2 weeks post tasseling	.25	31.3	.30	81.4	.18	24.2	.24	45.6
40% depletion of available moisture	.42	141.4	.66	171.3	.46	113.8	.51	142.2
80% depletion of available moisture	.33	77.4	.61	143.0	.39	93.4	.44	104.6
LSD (.05)	.07	21.4	.12	26.4	.10	27.3	.09	16.3

1. Because of drought in 1976, we also irrigated at 3 weeks post tasseling.
2. All grain yields are corrected to 15.5% moisture.

resultant yield for two treatments from June until September for each of the years. Soil moisture depletion was determined with the aid of a neutron soil probe. Dates on tasseling are indicated by the arrow. It appears that the greatest reduction in grain yield occurs if soil moisture depletion exceeds 80% during the six-week period after tasseling. Excessive irrigation after that stress period cannot compensate for the damage done, Fig. 1, 1976.

Information in this report is intended as an aid for irrigation management. Results are based on three years' research at one location. If limited irrigation water is available, it appears that it could best be used by delaying irrigation until time of tasseling, if a moderate amount of soil water is stored before planting time. Irrigating when 50% to 60% of the available soil water has been depleted until the soft dough stage of maturity is reached should produce optimum yields.

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