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APRIL 1975

Irrigating Corn in Extreme West-Central Kansas

Merlin A. Dillon, Crops Research Agronomist
Roy E. Gwin, Supt., Tribune Experiment Station

Declines in groundwater levels in this area have sharpened interest in irrigation efficiency. During the last three years we evaluated irrigation amounts and timing influence on corn yields at Tribune. Results indicated that careful timing of irrigation will maintain corn yields and use less water.

Our 3-year test was with furrow irrigation on Ulysses silt loam. All plots received a pre-plant irrigation. Each in-season irrigation was approximately 7.5 inches. Application efficiency may range from 50 to 75% for furrow irrigation. Phosphorus was applied uniformly each year. We compared irrigation schedules using **pre-plant** only and at three soil-moisture tensions with two nitrogen fertilizer levels, two plant population levels, and three commercial corn hybrids.

When to irrigate was determined by monitoring soil moisture tension. Tension is the relative difficulty of extracting moisture from the soil. Watering when the soil water tension was **0.8**

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Kansas State University, Manhattan

Floyd W. Smith, Director

bar at 2 feet deep required watering an average 2.7 times a season: twice in 1973 and three times in 1972 and 1974 (Table 1). Watering when soil water tension was **0.8 bar** produced the highest yield, 134 bushels an acre (Figure 1). When pre-plant irrigation filled the soil profile to six feet, then either two or three in-season irrigations (depending on the year) produced maximum yields. Irrigating up to eight times a year produced no higher yields during three years, 1972-1974. Irrigating **preplant only**, produced 85% as much grain as the top yield with 43% as much applied water.

The **0.8 bar** treatment required that the first in-season irrigation be applied July 7; later irrigations were 22 days apart (3-year average). Irrigating when soil moisture tension was lower required earlier and more frequent irrigations. The **0.6 bar** tension required irrigation by June 30 with later irrigations averaging 16 days apart; the **0.4 bar** tension, by June 19 and 10 days apart. The intervals between irrigations varied with plant-use and rainfall. An entire field cannot be watered so precisely as our plots were; however, our results should be used

as a management guide to timing or scheduling irrigation.

Regardless of other treatments, 160 lbs/A nitrogen was required and resulted in 139 bushels an acre versus 113-bushel average with 80 lbs/A of nitrogen (Figure 1). So, it would be a mistake to sharply reduce nitrogen applied, anticipating a water shortage. Nitrogen rates might be reduced slightly but our 50% nitrogen reduction cut yields too much.

The effect of plant population depended on other treatments (Figure 2). The higher population was favored where nitrogen was adequate. However, when nitrogen was short (80 lbs/A), the high population reduced yield. That was more apparent when both water and nitrogen were in short supply. Most surprising was that plant population did not affect yields for the **pre-plant** only treatment. We expected the lower population to be favored under pre-plant irrigation only.

The three commercial hybrids averaged about the same over the three years. They responded differently but their responses varied from year to year giving no clear-cut conclusions. It is im-

Table 1. Effects of plant populations, nitrogen rates, and irrigation¹ schedules on yields of irrigated corn, Tribune, Kansas, 3-year averages, 1972-74.

Population Plants/A	Nitrogen lbs/A	Yield, bu/A @ 15.5% moisture				Average bu/A
		Pre-plant	0.8 bar	0.6 bar	0.4 bar	
16,000	80	110	124	110	119	115
24,000	80	100	119	112	116	112
16,000	160	121	143	142	142	137
24,000	160	126	149	144	149	142
Average		114	134	127	131	126

1. Irrigation was scheduled by soil moisture tension. Irrigated as follows:

Pre-plant irrigated only

0.8 bar irrigated 3 times in 1972 and 1974, 2 times in 1973

0.6 bar irrigated 4 times in 1972 and 1974, 3 times in 1973

0.4 bar irrigated 8 times in 1972 and 1974, 7 times in 1973.

Approximately 7.5 inches per application applied in furrows 1/4 mile long, 12-hour set; watered pre-plant to saturate the soil profile to six feet.

Warm season

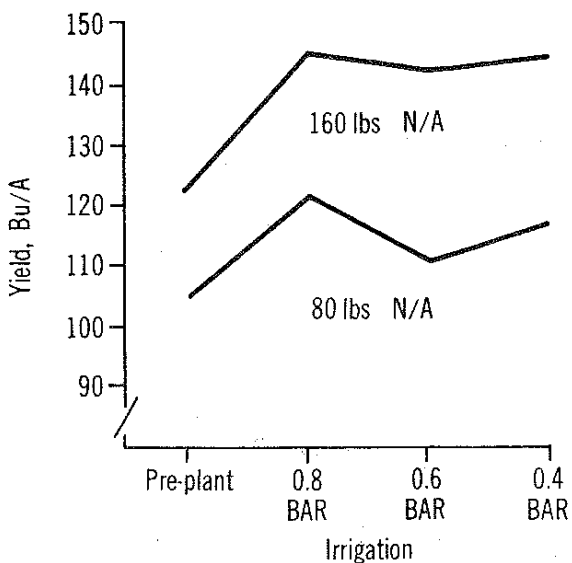
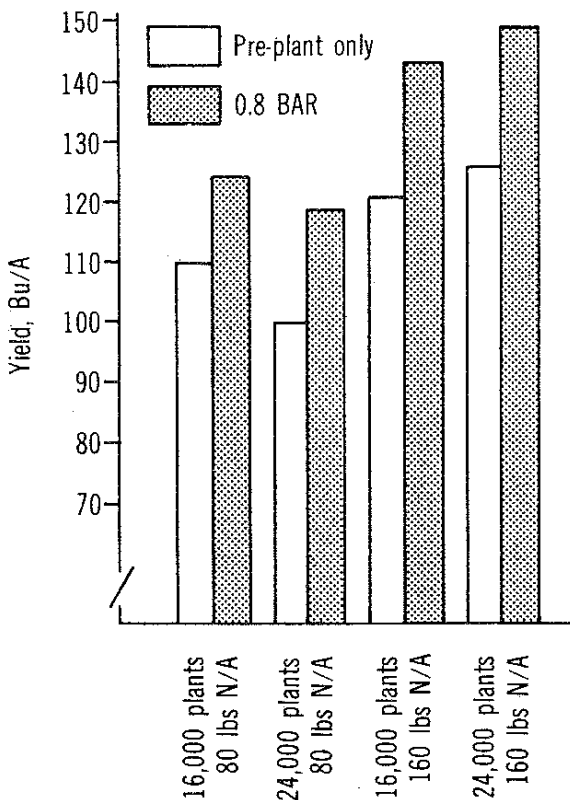


Figure 1. Effects of nitrogen rate and irrigation frequency on corn yields, Tribune, Kansas, 3-year avg., 1972-74.



portant to recognize that hybrids react individually to various environmental conditions.

Results of our tests are summarized in more detail in Table 1. Highest yields were from 2 or 3 in-season irrigations with 24,000 plants ar acre and 160 pounds per acre of applied nitrogen. Limited in-season irrigation is most practical when a moderate to large amount of available water is stored before planting.

Soil moisture tension can be monitored by tensiometers or electrical resistance blocks. Tensiometers, limited to tensions below 0.85 bar, cost about \$20 each. Tensiometers used in this test were obtained from Soil Moisture Equipment Corporation, Santa Barbara, California.

Information in this report is for farmers, producers, colleagues, industry cooperators, and other interested persons. It is intended to help in irrigation management. It is not a recommendation but represents three years' research at one location.

Contribution 27, Tribune Branch Experiment Station, Kansas Agricultural Experiment Station, Manhattan, Kansas 66506.

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