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Effect of Soil Moisture Depletion on Soybeans

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Since 1974 we have evaluated soybean yields and lodging as influenced by scheduling irrigations during stage of bloom and by soil moisture depletion. The results could help irrigators who want to use water more efficiently.

The study was on the Irrigation Experiment Field, approximately 5 miles northwest of Scandia. The soil is a Crete silt loam developed from wind blown deposits. Data from the study are given in Table 1. Plots received approximately 4 inches of water each irrigation. Available moisture for plant use in the top 3 feet of the soil profile was approximately 4.3 inches. Tables 2, 3, and 4 present soybean yield and lodging data for 1974-76.

Precipitation for the period after harvest until May, (Table 1), was fairly uniform. The greatest difference was from May until October. In 1974 and 1975, when rainfall from May to October exceeded 10 inches, irrigating at early bloom and again at late bloom produced equal yields from plots with 30% and 60% of their available soil moisture depleted before being irrigated.

In 1976, when precipitation from May to October was only 7.8 inches, scheduling irrigations by stage of bloom

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Table 1.—Information on soybean test plots, Irrigation Experiment Field, Scandia.

| | 1974 | 1975 | 1976 |
|--|----------|----------|----------|
| Planting date | May 28 | May 16 | May 14 |
| Variety | Cutler | Calland | Mitchell |
| Row width (inches) | 30 | 30 | 30 |
| Plant spacing (inches) | 1.7 | 1.6 | 2.7 |
| Plot size (feet) | 15 x 350 | 15 x 350 | 15 x 350 |
| Precipitation, October of previous year to May | 13.40 | 10.15 | 12.05 |
| Precipitation, May to Oct. | 10.35 | 15.01 | 7.80 |
| Early bloom date | July 10 | July 6 | July 7 |
| Harvest date | Oct. 17 | Oct. 3 | Oct. 8 |

Table 2.—Soybean yield and lodging as influenced by irrigation, Scandia, 1974.

| Schedule for applying irrigation water | Number of irrigations | Lodging % | Yield* bu./acre |
|--|-----------------------|-----------|-----------------|
| Early bloom stage | 1 | 1.2 | 35.0 |
| Late bloom stage | 1 | 1.6 | 36.1 |
| Early bloom + late bloom | 2 | 0.2 | 42.9 |
| 30% available soil moisture depleted** | 5 | 2.3 | 43.7 |
| 60% available soil moisture depleted** | 1 | 0.7 | 39.1 |
| LSD (.05) | | 1.8 | 2.0 |

* Grain yields corrected to 12.5% moisture.

** Soil moisture depletion measured in top 36 inches.

Table 3.—Soybean yield and lodging as influenced by irrigation, Scandia, 1975.

| Schedule for applying irrigation water | Number of irrigations | Lodging % | Yield* bu./acre |
|--|-----------------------|-----------|-----------------|
| Early bloom stage | 1 | 2.2 | 37.6 |
| Late bloom stage | 1 | 0.9 | 40.9 |
| Early bloom + late bloom | 2 | 1.7 | 45.0 |
| 30% available soil moisture depleted** | 5 | 4.1 | 49.8 |
| 60% available soil moisture depleted** | 2 | 0.4 | 48.8 |
| LSD (.05) | | 2.3 | 8.9 |

* Grain yields corrected to 12.5% moisture.

** Soil moisture depletion measured in top 36 inches.

was significantly inferior to scheduling by either 30% or 60% depletion of the available soil moisture. Irrigating at 30% depletion did not increase grain yield but significantly increased lodging for the 3 years, (Table 5).

Figure 1 shows soil moisture depletion and resultant yields for two treatments from June 15 until September each year. Apparently stresses during the early bloom stage are less detrimental than during bean development.

Figure 1.—Effect of soil moisture depletion on grain yields for selected irrigation treatments (1974-76).

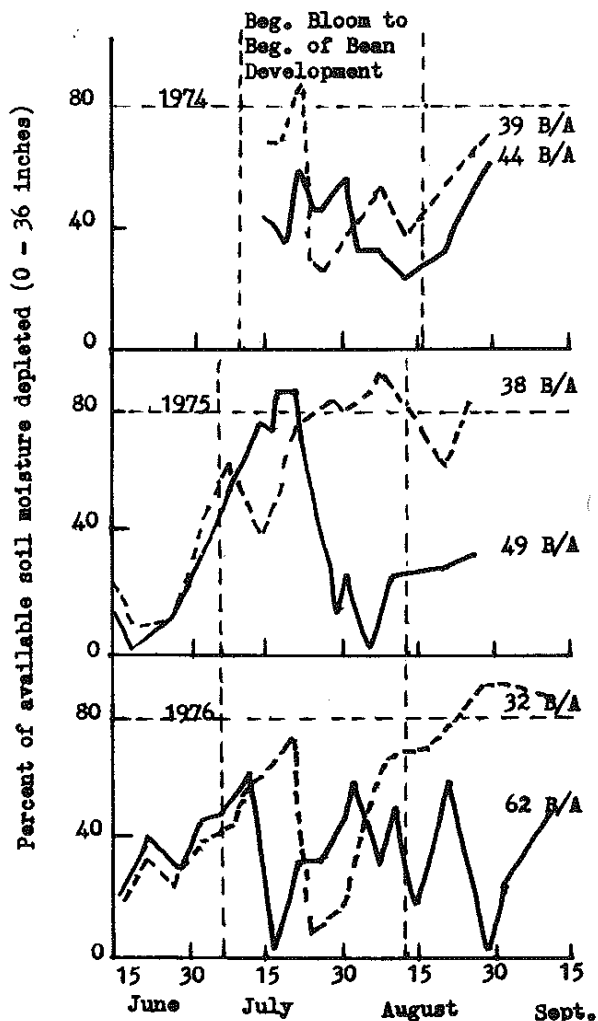


Table 4.—Soybean yield and lodging as influenced by irrigation, Scandia, 1976.

| Schedule for applying irrigation water | Number of irrigations | Lodging % | Yield* bu./acre |
|--|-----------------------|-----------|-----------------|
| Early bloom stage | 1 | 0.7 | 19.5 |
| Late bloom stage | 1 | 5.3 | 31.9 |
| Early bloom + late bloom | 2 | 4.8 | 26.0 |
| 30% available soil moisture depleted** | 7 | 4.6 | 51.7 |
| 60% available soil moisture depleted** | 4 | 4.0 | 61.8 |
| LSD (.05) | | 4.7 | 12.2 |

* Grain yields corrected to 12.5% moisture.

** Soil moisture depletion measured in top 36 inches.

Table 5.—Soybean yield and lodging as influenced by irrigation. Three-year average 1974-76, Scandia.

| Schedule for applying irrigation water | Number of irrigations | Lodging % | Yield* bu./acre |
|--|-----------------------|-----------|-----------------|
| Early bloom stage | 1 | 1.4 | 30.7 |
| Late bloom stage | 1 | 2.6 | 36.3 |
| Early bloom + late bloom stage | 2 | 2.2 | 38.0 |
| 30% available soil moisture depleted** | 5.7 | 3.7 | 48.4 |
| 60% available soil moisture depleted** | 2.3 | 1.7 | 49.9 |
| LSD (.05) | | 1.6 | 8.3 |

* Grain yields corrected to 12.5% moisture.

** Soil moisture measured in top 36 inches.

Information in this report is intended to help in 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 the late bloom and pod development stages of growth when a moderate amount of soil water is stored before planting time.

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