

Cotton Growth as Affected by Frequency and Rate of Drip Irrigation

W. C. Hofmann, Crop Physiologist; B. B. Taylor, Extension Agronomist;
C. Michaud, Extension Assistant; R. Tabo, Graduate Associate;
Sam Stedman, Cotton Specialist

Summary

Deltapine 90 was grown under drip irrigation at various rates and frequencies of water application. The eight treatments included 120%, 100%, 80%, and 60% of estimated consumptive use applied on a daily and weekly basis. Only the 60% treatment, applied in small daily doses, showed statistically reduced yield.

Methods

Field plots were established in Stanfield, Arizona on a drip irrigated field owned by Dennis Nowlin. The field was planted with DP 90 on 30 March and replanted on 28 April after the initial stand failed. An above ground drip system, installed by Horizon Irrigation, was used for all irrigation.

There were eight irrigation treatments evaluated in this study. They were arranged in a randomized complete block design with four replications. Each experimental plot consisted of eight rows and ran the length of the field. The drip lines were laid on the wide beds between the two plant rows. The treatments included 120%, 100%, 80%, and 60% of estimated consumptive use. These volumes of water were applied with small daily doses and larger weekly doses. The actual amounts of irrigation water applied ranged from 36.4 inches in the 120% plots to 18.2 inches in the 60% plots (Table 1). There was approximately 8.9 inches of precipitation over the growing season.

Throughout the flowering period, flowers in seven foot long subplots were tagged as they opened. Mature bolls and the dated tags were hand harvested from these subplots at the end of the season. This allowed us to collect detailed information on flowering and boll setting. A second yield estimate was obtained by machine harvesting the four center rows of each plot in early November.

Results

There were no statistical differences or consistent trends in the total number of flowers produced in the eight treatments (Table 1, Figs. 1, 2). However, there did appear to be an irrigation effect on seed cotton production (Table 1, Figs. 3, 4). While the differences were not statistically significant, there was a consistent trend towards reduced yields in the 60%

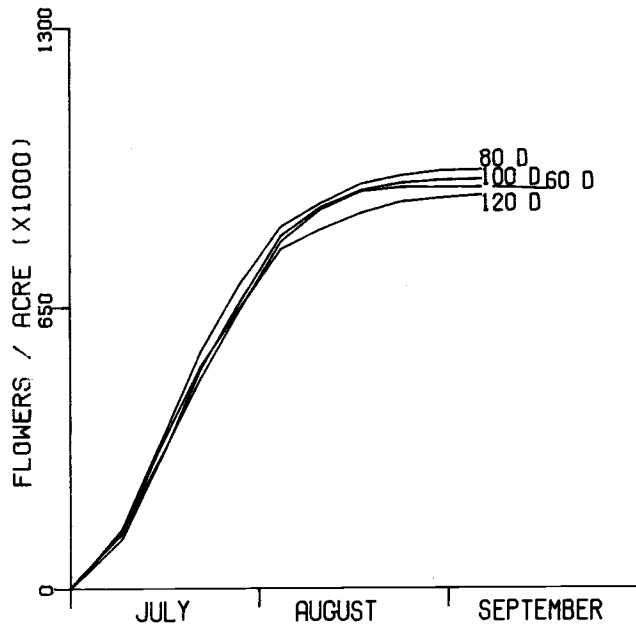


Figure 1. Cumulative flower production in the drip plots which were irrigated daily. Stanfield, 1984.

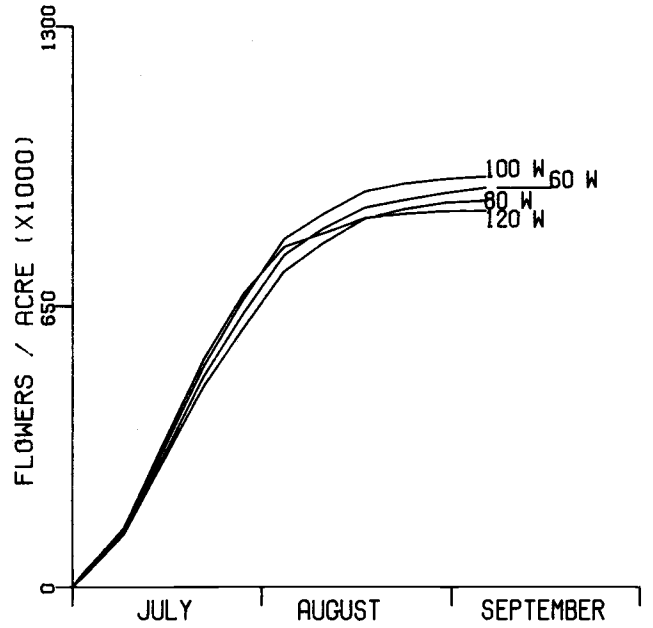


Figure 2. Cumulative flower production in the drip plots which were irrigated weekly. Stanfield, 1984.

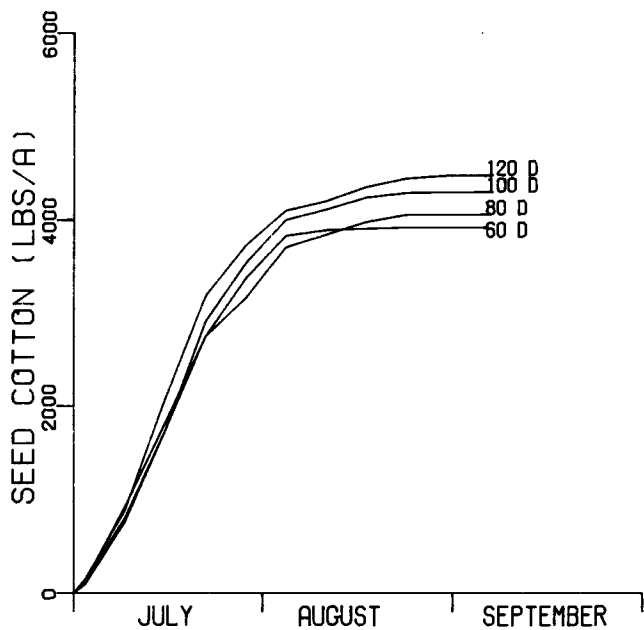


Figure 3. Cumulative seed cotton production versus date of flowering in the drip plots which were irrigated daily. Stanfield, 1984.

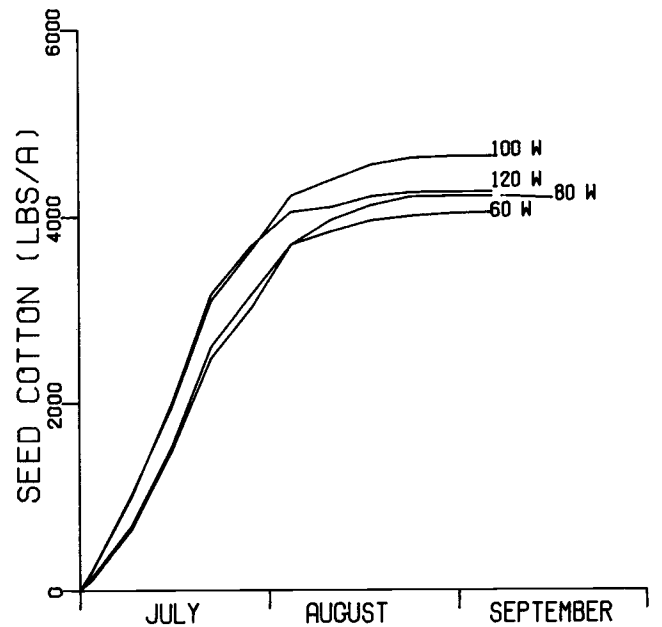


Figure 4. Cumulative seed cotton production versus date of flowering in the drip plots which were irrigated weekly. Stanfield, 1984.

and 80% of consumptive use treatments, regardless of application frequency.

The yields from the machine harvested plots which received daily irrigations showed a consistent reduction in yield as the volume of water decreased from 120% to 60% (Table 1). The yields from the plots which were irrigated on a weekly basis were not correlated with the volume of water applied. When the eight treatments were statistically analyzed, only the 60% treatment applied daily showed significantly reduced yields. When the same amount of water (18.2 inches) was applied in larger, less frequent doses, the yields were statistically not different from the wetter plots. Possibly the less frequent irrigations caused a larger cross section of the soil profile to be moistened and encouraged more extensive root development. This could have allowed the plants in the 60% weekly plots to make better use of stored rain water.

Further work is needed to determine the optimum irrigation rate and frequency for drip irrigated cotton.

Acknowledgments

We gratefully acknowledge the assistance and support of the many people and organizations involved in this project. To list only a few, these include: Mr. Dennis Nowlin, Nowlin Farms, Inc.; Dr. Dean Pennington, Mr. Ron Thorpe, Mr. Bill Young, Horizon Irrigation; The Tennessee Valley Authority, The Phosphate Potash Institute, and the American Fertilizer Solution Foundation.

Table 1. Irrigation treatments, water applied, flowers and seed cotton in the hand harvested plots, and seed cotton yields in the machine harvested plots. Stanfield, 1984.

-----TREATMENT-----		-----HAND HARVEST-----			
Percent of Estimated Consumptive Use	Frequency of Application	Irrigation Applied (Acre Inches)	Flowers Produced Per Acre (X 1000)	Seed Cotton (lbs/a)	Machine Harvest Seed Cotton (First Pick) (lbs/a)
120	Daily	36.4	1138	4322	3727 a ^{1/}
100	Daily	30.3	1184	4139	3686 a
80	Daily	24.2	1212	4014	3591 a
60	Daily	18.2	1162	3944	3167 b
120	Weekly	36.4	1090	4166	3605 a
100	Weekly	30.3	1188	4526	3741 a
80	Weekly	24.2	1119	4071	3591 a
60	Weekly	18.2	1156	3855	3727 a

1. Means not followed by the same letter are statistically different at the 5% level according to the SNK procedure.