FURROW IRRIGATION TERMINATION TIMING EFFECTS ON SOUTHWEST OKLAHOMA COTTON

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Abstract

Crop irrigation water use is a major concern, and producers continue to seek ways to reduce water usage. This project was furrow irrigated and was located in the Lugert-Altus Irrigation District, near Altus. The objectives of this project were to evaluate the effects of 3 weekly irrigation termination timings in furrow irrigated cotton in the Lugert-Altus Irrigation District. The site is classified as a Hollister silty clay loam, with 0-1 percent slopes. Typically about 3 acre-inches are applied per irrigation using gravity flow through concrete ditch/siphon tubes. Producers historically terminate irrigation in this area around September 1 each year, so targeted termination dates of August 16, August 23 and August 30 were used for a 3-year period. Results indicate that yield and fiber quality responses are seasonally dependent. In years with hot, dry September conditions, irrigation termination at the end of August is critical for maintaining yield and quality. There is no indication that final irrigation dates near the end of August have any detrimental effect on fiber quality in the 3 years evaluated, even when followed by high rainfall. No termination date effects were observed for any reported AFIS fiber quality characteristics in any year.

Introduction

Crop irrigation water use is a major concern, and producers continue to seek ways to reduce water usage. This project was furrow irrigated and was located in the Lugert-Altus Irrigation District, near Altus. Typically about 3 acre-inches are applied per irrigation using gravity flow through concrete ditch/siphon tubes. Producers historically terminate irrigation in this area around September 1 each year. Questions have been asked concerning the long-term impact of earlier irrigation termination, and is there a potential water savings without sacrificing yield and quality? The objectives of this project were to evaluate the effects of 3 weekly irrigation termination timings in furrow irrigated cotton in the Lugert-Altus Irrigation District.

Materials and Methods

This project was furrow irrigated and was located in the Lugert-Altus Irrigation District, near Altus. The site is classified as a Hollister silty clay loam, with 0-1 percent slopes. Target termination dates of August 16, August 23 and August 30 were used for a 3-year period (2015, 2016, and 2017). Crop maturity was tracked using nodes above white flower and nodes above cracked boll (data not presented). In order to determine soil profile moisture, WaterMark sensors were installed at 10, 20 and 30 inch depths in each plot and were monitored weekly (data not presented). Three replicates of 8-row plots x field length resulted in 24 rows/replicated or a total of 72 rows for the test. Normal fertilizer, insect, herbicide, plant growth regulator, and harvest aid management as well as irrigation practices were used at the site. Table 1 presents various cultural practices used for the project. About 3 acre-inches were applied per irrigation using a siphon tube/concrete ditch system. Harvested plot size included the center 4 rows x 50 ft of each plot with a John Deere 482 modified plot stripper (without field cleaner). Grab samples were taken from each plot and were ginned on a plot gin. Lint turnout for each plot was used to convert plot bur cotton weights to lint per acre. Lint yield and high volume instrument (HVI) and advanced fiber information system (AFIS) fiber quality data were obtained. Ginned lint samples from each plot were submitted for the HVI/AFIS analyses. These lint samples were analyzed at the Cotton Phenomics Laboratory at the Fiber and Biopolymer Research Institute at Texas Tech University. Lint Commodity Credit Corporation Loan values were determined for each year using HVI data and the respective Upland Cotton Loan Valuation Model (Falconer, 2015). The GLM procedure in SAS version 9.4 for Windows was used for data analysis, and the Fisher's Protected LSD was used for mean separation.

Table 1. Cultural practices used for furrow irrigation termination project.

Cultural practice	2015	2016	2017
Planting date	4-Jun	28-May	25-May
Cultivar	Deltapine DP 1044 B2RF	Deltapine DP 1044 B2RF	Deltapine DP 1044 B2RF
Final plant stand (plants/acre)	67,000	41,000	38,000
Irrigations across entire project	16-Jul, 22-Jul, 30-Jul, 11-Aug, 17-Aug	27-Jul, 2-Aug, 9-Aug, 16-Aug	22-Jul, 29-Jul, 10-Aug
Final irrigation dates	17-Aug, 24-Aug, 31-Aug	16-Aug, 23-Aug, 30-Aug	10-Aug, 10, Aug, 29-Aug
Harvest date	12-Nov	21-Nov	1-Nov
Comments	near normal Aug temperature, very hot, dry Sep	Bacterial blight infection cool, wet Aug wet Sep	excessive Aug rainfall prevented second termination cool, wet Aug Sep dry for first 2 weeks

Results and Discussion

Results are presented in Table 2. In 2015, late planted (June 4) cotton with hot, dry conditions in September benefitted significantly from furrow irrigation through the end of August. Both yield and some HVI fiber quality attributes were significantly improved by the latest irrigation termination.

In 2016, average rainfall in August and above average rainfall in September resulted in no differences in yield or quality among irrigation termination dates. No negative yield and fiber quality differences were observed with irrigation through the end of August, even with above average September rainfall.

In 2017, above average August rainfall affected the treatment structure, and effectively only 2 termination dates were possible (August 10 and 29). In spite of above average August rainfall, August 29 irrigation resulted in a significant increase in yield (350+ lb/acre) compared to earlier termination dates. No fiber qualities reported were economically impacted.

Summary and Conclusions

Results from the 3-year project indicate that yield and fiber quality responses are seasonally dependent. In years with hot, dry September conditions, irrigation termination at the end of August is critical for maintaining yield and quality. There is no indication that final irrigation dates near the end of August have any detrimental effect on fiber quality in the 3 years evaluated, even when followed by high rainfall. No termination date effects were observed on any AFIS fiber quality characteristics in any year.

Acknowledgements

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Reference

Falconer, L. 2015. 2015 Upland Cotton Loan Valuation Model. Available online at: http://www.cottoninc.com.

Table 2. Lint yield, loan value and HVI and AFIS fiber properties for furrow irrigation termination project.

			HVI data				AFIS data			
	Lint yield lb/acre	Lint loan value $/lb	Mic units	Length inches	Uniformity %	Strength g/tex	Neps count/g	Short fiber content %	Fineness mtex	Maturity ratio units
2015										
Termination dates										
17-Aug	718	0.5250	2.9	1.14	80.7	28.8	464	10.5	143	0.83
24-Aug	862	0.5265	2.9	1.16	82.5	30.8	415	9.7	144	0.84
31-Aug	1139	0.5525	3.3	1.15	82.4	30.6	414	10.4	153	0.83
CV, %	2.0	2.9	4	0.7	0.7	1.4	20	19.4	2.5	1.9
Pr>F	<0.0001	0.1454	0.0178	0.0400	0.0351	0.0081	0.7344	0.8642	0.0758	0.7575
LSD 0.05	40	NS	0.3	0.02	1.3	1	NS	NS	NS	NS
2016										
Termination dates										
16-Aug	1778	0.5772	4.4	1.16	82.4	31.8	181	8.5	165	0.87
23-Aug	1762	0.5772	4.4	1.15	82.7	31.3	219	9.8	163	0.85
30-Aug	1862	0.5783	4.5	1.17	83.4	31.3	185	8.8	164	0.86
CV, %	3.4	0.12	4.8	1.3	0.7	2.4	13.6	10.5	3.3	1.2
Pr>F	0.2201	0.1736	0.9070	0.5848	0.2325	0.6701	0.26	0.3149	0.8711	0.1736
LSD 0.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
2017										
Termination dates										
10-Aug	1009	0.5482	3.7	1.13	82.1	29.8	261	10.6	164	0.84
10-Aug B	920	0.5364	3.6	1.11	81.5	29.4	303	12.9	157	0.82
29-Aug	1321	0.5466	3.9	1.12	82.5	30.9	249	11.1	166	0.85
CV, %	4.4	1.4	2.4	1.3	0.8	3.5	12.2	12.1	1.8	1.5
Pr>F	0.0011	0.2451	0.0348	0.3265	0.2792	0.3011	0.2192	0.2054	0.0511	0.0913
LSD 0.05	108	NS	0.2	NS	NS	NS	NS	NS	NS	NS

CV - coefficient of variation, percent

Pr>F - Probability of a greater F value.

LSD - least significant difference at the 0.05 level, NS - not significant.