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Influence of First Irrigation Time on Yield and Quality of Different Cotton Varieties

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Abstract: This study was carried out to determine the most suitable first time of irrigation depending on different flowering periods two standard cotton varieties (Nazilli 84 and Nazilli M-503). Field trials were conducted at Nazilli Cotton Research Institute in Meander Valley of Aegean Region in 1999- 2001. The first irrigation time were applied in four different flowering periods (after 10 days from squaring; beginning of flowering; 50% flowering; peak flowering). Seed cotton yield, fiber length, fiber strength and fiber fineness were measured. The differences among years were significant for all characteristics except fiber length. Seed cotton yield and fiber length had affected from first irrigation time. Genotypic differences were found to be significant for the investigated characteristics. Finally, early first irrigation time was recommended depending on sudden July temperatures.

Key words: Cotton, first irrigation time, agronomical and quality characters

INTRODUCTION

Cotton irrigation is an essential component of cotton production in Meander Valley of Aegean Region. Beneficial uses of irrigation water include soil moisture replenishment, leaching for salinity control and climatic control. Applying irrigation water efficiently means that most of the water is used by the crop and that water losses from deep percolation, surface runoff and evaporation are minimal (Hanson *et al*., 1996).

Adverse effects on cotton yield are generally more pronounced when water stress occurs during the reproductive stage than during vegetative growth (Doorenbos and Kassam, 1979; Guinn *et al*., 1981). Radin *et al*. (1989) suggested that long irrigation cycles during the fruiting period reduces the effectiveness of the root system to transport water and nutrients to plant leaves. Vories and Glover (2000) also stated that water requirements for cotton vary throughout the season, or the yield response associated with early irrigation is not consistent from year to year, with low use during vegetative period and needs increasing rapidly during the reproductive growth stage.

Ferry *et al*. (1974) emphasized that it is particularly so with the first one after planting, although timing is important with all irrigations. Using early moisture stress to control plant growth is generally unnecessary unless early fruiting forms are lost. Due to factors such as cultivation, fertilization and preparing other crops on the farm, the first irrigation in cotton is often applied later than recommended and it is generally believed that maintaining well watered conditions until the first bolls open provides sufficient moisture to mature the remaining bolls (Vories and Glover, 2000).

Kerby, speaking at the 2000 Bootheel Irrigation Conference, pointed out that too-late first application can lead to early cutout of cotton crop, late-maturing varieties can handle more water stress early on. He also said that the object is not how many bolls you have at the end of the season, it is how many you have open (Robinson, 2001).

The objective of this study was to determine the effects of first irrigation time on yield and yield components and quality parameters depending on genotypic differences.

MATERIALS AND METHODS

The mathematical position of Nazilli Cotton Research Institute were latitude; 37°44'-37°-49' N and longitude; 27° 44'-27°50' E. The standard cotton varieties, Nazilli 84 and Nazilli M 503 (*Gossypium hirsutum* L.) were used for materials.

Soil texture of experimental cite was loamy and field capacity and wilting point of 20 cm soil depth were 23.4 and 7.4%, respectively. The climate data of research region for three years were given at Table 1.

The climate data of cotton growing seasons showed that the highest mean temperatures were in August and July for all years, the relative humidity increased in September and October.

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Table 1: The climate data for 1999, 2000 and 2001

	1999		2000		2001	
	Mean temp. (°C)	Relative hum. (%)	Mean temp. (°C)	Relative hum. (%)	Mean temp. (°C)	Relative hum. (%)
May	23.0	47.9	20.5	50.4	21.3	49.2
June	27.1	44.0	27.3	40.8	27.0	37.0
July	29.0	46.8	30.0	41.0	30.5	39.8
August	29.0	47.6	28.5	47.9	29.5	48.2
September	23.8	52.8	23.8	52.8	23.9	53.3
October	19.7	57.0	17.6	58.2	18.9	52.1

Experimental design was a Split Plot Block Design with three replications and main and sub parcels were first irrigation times and cultivars, respectively. The first irrigation time were after 10 days from squaring (A), beginning of flowering (B), 50% flowering period (C) and peak flowering period (D). The dosages of first irrigation for each application were 800 T ha^{-1}. Other irrigations were applied in order to fill out the Field Capacity (FC) when approximately 70% of the available soil moisture was consumed in the 90 cm soil profile.

Cotton cultivars were planted in the first half of May for all years. Plots were 12 m length and consisted of eight each row. The fertilizer program were 55.2 kg ha^{-1} P_2O_5 from triple super phosphate, 63 kg ha^{-1} N from ammonium sulfate (21%) at pre-planting and 86.8 kg ha^{-1} N from ammonium nitrate at before flowering and first irrigation.

In this study, measured characteristics were seed cotton yield (kg ha^{-1}), fiber length (mm), fiber strength (Pressley) and fiber fineness (mic.). The statistical analyses were done using by JUMP statistical program and Duncan test was used at comparing means.

RESULTS AND DISCUSSION

Irrigation data for year and cultivar were showed that irrigation time (DAP) varied between 50 and 75 depending on year and squaring dare of cultivar (Table 2). The number of irrigation changed from 4 to 5. The amount of total irrigation water in cotton growing season increased gradually from 1999 to 2001.

From Table 3, it was found that differences among years were significant for all characters except fiber length. Moreover, the effects of first irrigation time on seed cotton yield and fiber length were found to be significant but these effects were changed from year to year for seed cotton yield, fiber strength and fiber fineness. The significant differences between cultivars were significant for all characters except seed cotton yield. Year × first irrigation time × cultivar interaction was only significant for fiber strength.

It was seen that differences among first irrigation time were significant for 2000 and 2001 (Table 4). Also, it was stressed by Vories and Glover (2000) that the yield response associated with early irrigation was not consistent from year to year. The highest seed cotton yields were obtained from A (10 days after squaring) and B (beginning of flowering), then seed cotton yields reduced in 50% flowering period (C) and peak flowering period (D) for both years. Ferry *et al.* (1974) revealed that using early moisture stress to control plant growth and later the first irrigation is generally unnecessary. The results of this study showed that first irrigation time should not be late because of increasing the seed cotton yield. Similarly, it was pointed out that too-late first application can lead to early cutout of cotton crop; late-maturing varieties can handle more water stress early on (Robinson, 2001). In this study, the non-significant differences between cultivar demonstrated that the maturity of cultivars were similar to each other.

The highest fiber length (29.7 mm) resulted in A (10 days after squaring) and the values of fiber length decreased as first irrigation time was delayed. When the difference between cultivar was taken into consideration, Nazilli M-503 had significantly higher fiber length (29.8 mm) than the other (Table 5).

The differences among first irrigation time were significant for 1999 and 2000. It was shown that early first

Table 2: Irrigation application and total water amount in 1999, 2000 and 2001

		1999		2000			2001		
	Irrig. S.	First irrig. (DAP)	Irrig. No.	Total water (T ha^{-1})	First Irrig. (DAP)	Irrig. No	Total water (T ha^{-1})	First Irrig. (DAP)	Irrig. No	Total water (T ha^{-1})
N 84	A	50	5	5170	51	5	5600	55	5	6970
	B	62	4	4760	61	5	5210	66	5	6830
	C	65	4	4590	64	5	5100	69	5	6870
	D	73	4	4390	71	4	4890	75	4	5810
M-503	A	50	5	5170	51	5	5600	55	5	6560
	B	60	4	4920	61	5	5210	66	5	6240
	C	63	4	4760	64	5	5100	69	5	6420
	D	71	4	4370	71	4	4890	75	4	6030

DAP: Days After Planting

Table 3: The results of variance analysis for observed characters

Source of variance	df	Seed cotton yield	Fiber length	Fiber fineness	Fiber strength
Year (A)	2	225221.1**	0.24	1.30**	185.10**
Block	6	1609.2	1.12	0.09**	1.53
First irrigation time (B)	3	9994.2**	1.88*	0.02	6.17
A × B	6	4719.0**	0.90	0.10**	19.41*
Error 1	18	943.5	0.44	0.02	5.94
Cultivar (C)	1	168.1	20.16*	2.76**	1089.67*
A × C	2	1217.1	0.07	0.14	3.76
B × C	3	236.8	0.59	0.05	7.11
A × B × C	6	439.5	0.20	0.11	11.85*
Error 2	24	466.4	0.40	0.06	3.47
Total	71	7782.0	0.83	0.13	26.68

*, **; Significant at 0.05 and 0.01 probability level, respectively

Table 4: The seed cotton yield (kg ha $^{-1}$) for first irrigation time

	Year		
First irrigation time	1999	2000	2001
A	483.0	511.3a	367.0a
B	477.2	484.3a	309.3ab
C	481.5	461.5ab	298.0b
D	502.3	422.2b	268.7b
Mean	486.0	469.9	310.8

Values followed by different letters are significantly different at p<0.05

Table 5: Fiber length values for first irrigation time and cultivars

First irrigation time	Fiber length (mm)
A	29.7a
B	29.2ab
C	29.0b
D	29.1ab
Cultivar	
Nazilli 84	28.7b
Nazilli M-503	29.8a

irrigation time, A (10 days after squaring), had the finest fiber values in 1999, but other first irrigation times resulted in sigmoid values, or it was not shown a consistent increasing or decreasing. The similar curve was found in 2000. The applied irrigations during peak flowering period (D) had the finest fiber values in 2000. When the cultivars were evaluated from the point of fiber fineness, it was expected that Nazilli 84 had thinner fiber values because of its high lint percentage (Table 6).

The interaction of year × first irrigation time × cultivar was found to be significant for fiber strength (Table 3). In 1999 and 2000, the differences among first irrigation time were significant for Nazilli 84 (Table 7). The highest values were in A and B irrigation subjects for 1999, whereas applied irrigations during 50% flowering period (C) were given the highest values in 2000. The results of 2001 data were indicated that the latest irrigation time (D) for both cultivars was the highest fiber strength, although the data for M-503 showed sigmoid curve.

In conclusion, the interaction between year and first irrigation time for seed cotton yield was found to be significant. This interaction was shown that the response of seed cotton yield to first irrigation time was not consistent from year to year. The irrigations after 10 days

Table 6: Fiber fineness values for first irrigation time and cultivar

	Year		
First irrigation time	1999	2000	2001
A	4.4b	5.1ab	4.8
B	4.8a	5.0ab	4.7
C	4.5ab	5.2a	4.8
D	4.7ab	4.9b	4.8
Cultivar			
Nazilli 84	5.0a		
Nazilli M-503	4.6b		

Table 7: Fiber strength values for the interaction of year, first irrigation time and cultivar

	1999		2000		2001	
	N 84	M-503	N 84	M-503	N 84	M-503
A	89.5a	81.4	83.1b	79.5	90.4ab	82.0ab
B	89.2a	80.2	85.0ab	79.6	88.3b	84.4a
C	84.4b	79.4	87.7a	77.0	91.5ab	80.0b
D	85.5ab	79.8	85.7ab	77.2	95.0a	84.4a

Values followed by different letters are significantly different at p<0.05

from squaring and beginning of flowering resulted in higher seed cotton yield. This explains can be valid for especially 2000 and 2001 which had low temperature in May and June in spite of high temperature values in July. Therefore, meteorological data should be evaluated before first irrigation time was decided.

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