

Effect of Methods and Scheduling of Irrigation and Mulching on Yield of Cotton

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ABSTRACT

A field experiment was conducted on deep black soil of Main Cotton Research Station, Gujarat Agricultural University, Surat (Gujarat) during *kharif* season of 1992-93 and 1993-94 to study the effect of methods and scheduling of irrigation and mulching on growth, yield and quality of G. Cot. Hy-6 under South Gujarat condition. Eighteen treatment combinations of two irrigation methods (I_1 : All furrow irrigation and I_2 : alternate furrow irrigation) ; three irrigation scheduling (R_1 : 0.3 IW / CPE ratio, I_2 : 0.5 IW/CPE ratio and R_3 : 0.7 IW/CPE ratio) at the depth of 70 mm and three mulching (M_0 : No mulch, M_1 : Soil mulch and M_2 : Paddy straw mulch @ 5 t/ha) were tested in split plot design with three replications. Irrigation methods did not show significant effect on yield of cotton. However 50 per cent saving in irrigation water was obtained with alternate furrow irrigation. Irrigating cotton at 0.7 IW/CPE ratio resulted in significantly higher yield and net returns. This crop required 5 or 6 irrigation each of 70 mm depth. The first irrigation should be one month of the cessation of monsoon. Soil mulch resulted in higher incremental cost benefit over no mulch. Consumptive use of water was higher with more frequent irrigations and no mulch treatments. However, WUE has reverse trend for this treatment.

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INTRODUCTION

Irrigation is one of the most important inputs for crop production as water is a pre-requisite for an efficient utilization of all farming inputs. Cotton crop is sensitive to water scarcity and to excess water. At the same time water being a costly input, its saving is very much essential in crop production. Exploration of the possibility of curtailment in irrigation requirement through regulating the evaporation from the soil surface by irrigating the crop as per climatic requirement and use of mulch becomes important. Therefore, method of irrigation, irrigation scheduling and mulching assumes special importance in cotton cultivation.

Keeping this idea in view, an attempt was made to study the effect of irrigation methods, irrigation scheduling and mulching on growth and yield of cotton.

MATERIALS AND METHODS

The experiment was conducted at the Main Cotton Research Station (20°-12' N latitude, 72°-52' E longitude) of Gujarat Agricultural University, Surat (Gujarat) during 1992-93 and 1993-94 with cotton hybrid G. Cot.-6. The soil of the experimental field was deep, moderately drained which contain 56 to 64% clay, 18 to 21 % silt, 16 to 22% sand and bulk density is 1.30, which is classified as clayey. Which represents the typical black

cotton soils of South Gujarat. Chemically low in nitrogen (234 kg/ha) and phosphorus (23.53 kg/ha) and high for potassium (486 kg/ha) with a pH of 7.7. The moisture content at field capacity was 33% while at permanent wilting point it was 18 %. The experiment were laid out in split plot design with two irrigation methods (I_1 : Irrigation in all furrow and I_2 : irrigation in alternate furrow alternatively). Three irrigation scheduling (R_1 : 0.3 IW/CPE ratio R_2 : 0.5 : 0.5 IW/CPE ratio and R_3 : 0.7 IW/CPE ratio IW = 70 mm) as main plot treatments and three mulches (M_0 : No mulch, M_1 : Soil mulch / soil stirring and M_2 : Paddy straw mulch @ 5 t/ha) treatment as a sub plot treatment replicated thrice in 7.2 m x 4.8 m plots. The crop was dibbled on the onset of monsoon (25 and 18 June during 1992 and 1993, respectively) at the spacing of 120 x 45 cm. All the plots received a common dose of 320 kg N/ha phosphorus and potash fertilizer was not given. The nitrogen fertilizer was applied in four equal splits at 25-30 days interval starting from 20 days after sowing in the form of urea. The crop was adequately protected from diseases and insect pests. Total rainfall received during rainy season of the year 1992-93 and 1993-94 was 1142 mm and 1408 mm, respectively. However, during experimental period effective rain was not recorded during both the year of study. The irrigation treatment started one month after cessation of rainfall. At that time crop completed four to five month stage get a height of 82 cm in 1992-93 and 124 cm in 1993-94. Measured quantity of irrigation water given in furrow through throat parshall flume as per CPE recorded near the experimental plot. Soil mulch was done by stirring the

soil after each irrigation on 4th day of irrigation. Paddy straw mulch (5 t/ha) was applied as per the treatment on the third day from the commencement of irrigation with the manual labour. It was spread uniformly on the soil surface in between the two rows and the two plants of cotton.

RESULTS AND DISCUSSION

Height of the plant, seed cotton yield and stalk yield recorded at last picking showed that it did not differed markedly between two methods of irrigation during both the years of study (Table - 1). The tallest plants with highest yield of seed cotton and stalk was recorded with frequent irrigation i.e. at 0.7 IW/CPE ratio (R_3) during both the years and in pooled result, except plant height during 1993-94 (Table-1). Among mulching treatments application of paddy straw mulch recorded significantly tallest plants and yield during course of study except for plant height during 1993-94 (Table-1). Higher growth and yield was due to more moisture available with more frequent irrigation and in mulching with paddy straw. Similar result was also reported by Singh *et al.* (1990); Verma *et al.* (1991) and Singh and Surajbhan (1993). Among quality characters lint yield and oil yield also have similar trend as shown in growth the yield attributes. Highest lint and oil yield was reported with higher rate of irrigation application at 0.7 IW/CPE ratio (R_3) and with mulch treatments (Table-1). This was also due to more moisture availability which increase uptake and so the yield output. However, treatments R_2 and R_3 , R_1 and R_2 , M_0 and M_1 as well as M_1 and M_2 remain at par for growth, yield and quality characters. Net return from irrigation

[illegible]

TABLE 2

CU & WUE as influenced by various treatments.

Treatments	Consumptive use		Water use efficiency kg seed cotton/ha.mm	
	1992-93	1993-94	1992-93	1993-94
Irrigation methods				
I ₁ : Irrigation in all furrow	317	247	8.07	12.27
I ₂ : Irrigation in alternate furrow alternatively	293	233	8.69	12.81
Irrigation scheduling				
R ₁ : 0.3 IW/CPE ratio	208	139	10.53	17.91
R ₂ : 0.5 IW/CPE ratio	331	263	7.32	10.50
R ₃ : 0.7 IW/CPE ratio	376	317	7.31	9.21
Mulching				
M ₀ : No mulch	323	255	7.13	10.62
M ₁ : Soil mulch	309	245	8.26	12.36
M ₂ : Paddy straw mulch @ 5 t/ha	284	220	9.76	14.64

TABLE 3

Number of irrigation, interval between successive irrigation turns and average interval between two irrigation as per IW/CPE ratio.

	Number of irrigation	Interval between					Average interval
		Commomn-1	1-2	2-3	3-4	4-5	
1992-93							
R ₁ (0.3)	3	41	56	-	-	-	49
R ₂ (0.5)	5	23	30	34	28	-	29
R ₃ (0.7)	6	16	18	24	24	22	21
1993-94							
R ₁ (0.3)	2	69	-	-	-	-	69
R ₂ (0.5)	4	36	44	26	-	-	36
R ₃ (0.7)	5	23	30	30	20	-	26

methods shows that all furrow method of irrigation gave marginally higher return i.e. Rs. 52 per hectare. However, alternate furrow method save 50 per cent irrigation water.

Among irrigation scheduling treatments highest net return (Rs. 28935) was realised from frequent irrigation (i.e. 0.7 IW/CPE ratio, R_3) which also gave higher return per rupee invested (Rs. 1.98). While, R_1 treatment gave Rs. 1.55 per rupee invested. The incremental cost benefit ratio over R_1 shows that R_3 treatment have higher (Rs. 12.26) value than R_2 (Rs. 9.35).

Among mulching treatments higher net return may reported from (Rs. 27514) paddy straw mulch treatment. However, CBR value were similar for soil mulch and straw mulch treatment and were higher than no mulch treatments. The ICBR over no mulch shows that soil mulch gave higher return than paddy straw mulch treatments (Table-1). It was due to higher cost of paddy straw. Similar result was also reported by Nikolar (1992); Singh and Surajbhan (1993) and Anonymous (1993).

CONSUMPTIVE USE OF WATER & WUE

Higher CU (317 and 247) was reported with all furrow method of irrigation (I_1) than irrigation in alternate furrow (I_2) (293 and 233). While WUE showed reverse trend (Table-2). Among IW/CPE ratio treatments, increase in CU was reported with increase in IW/CPE ratio from 0.3 to 0.7 during both the years of study while WUE reported

reverse trend and recorded higher with lower IW/CPE ratio i.e. 10.53 and 17.91 kg seed cotton/ha-mm during 1992-93 and 1993-94, respectively. While that for higher frequency treatment R_3 were 7.31 and 9.21 kg seed cotton/ha-mm. Among mulching treatments higher CU was reported with no mulch treatment, while lower CU was with paddy straw mulch treatment (Table-2). While WUE was reported higher 9.76 and 14.64 kg seed cotton/ha-mm with paddy straw mulch treatment.

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