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Water Requirement and Yield Response of Irrigated Cotton

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ABSTRACT

The findings from an irrigation experiment on cotton MCU. 1. conducted during *kharif* for three years at Bhavanisagar are presented. The optimum moisture regime was found to be from field capacity to 40 per cent moisture availability. The water requirement for this moisture regime was found to vary from 674.9 mm to 770.6 mm depending upon the rainfall. The total number of irrigations varied from nine to thirteen. Highest irrigation responses were at highest levels of nitrogen fertilization.

INTRODUCTION

The necessity for efficient and proper water management in cotton in in Tamil Nadu where more than one-fourth of the area under the crop is irrigated, can hardly be emphasised. This paper deals with the investigations recently conducted to determine the water requirement of the winter cambodia cotton MCU. 1, under an irrigation Research Project partly financed by the Indian Council of Agricultural Research, New Delhi at Bhavanisagar.

MATERIALS AND METHODS

A field experiment to determine water requirements of winter cambodia cotton MCU. 1 was laid out during the *kharif* season for three years from 1965-66 onwards at Bhavanisagar in the command area of the Lower Bhavani Project. The soil type was red gravelly loam with low available N and P. The pH and bulk density of the soil were 7 and 1.23 respectively. The average water table was below 12 m. During the crop periods the mean maximum temperature ranged from 88 to 104°F and minimum temperature ranged from 59 to 92°F. The percentage of relative humidity ranged from 59 to 91. The rain was received only during the month of October, November and December and the details of rainfall are given in Table 2

The experiment was in split plot design with 4 replications. There were four regimes of irrigation based on available moisture percentage in combination with 4 levels on nitrogen and 2 levels of Farm Yard Manure. The moisture regimes were fixed after determining permanent wilting point in the laboratory by the sunflower plant technique described by Briggs

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and Shantz (1912) and field capacity under field conditions by the method adopted by Veihmeyar and Hendrickson (1949). The value of permanent wilting point was 8.5 per cent and field capacity 20 per cent and the irrigation treatments were fixed at different levels within this range. There were 4 levels of irrigation viz., (I_0) Irrigation to field capacity at 0 per cent available

TABLE 1 Yield response by moisture regime, farm yard manure and nitrogen (kg/ha)

Treatments	Year			Pooled analysis
	1965–66	1966–67	1967–68	
I. Moisture regimes				
I_0	1177	1031	1473	1228
I_1	1351	1310	1967	1543
I_2	1332	1435	2051	1606
I_3	1383	1481	2118	1661
S. E.	30.3	66.4	75.4	35.0
C. D. (P = 0.01)	88.8	195.2	222.0	98.8
II. Farm yard manure				
F_0	1188	955	1627	1270
F_1	1433	1633	2177	1748
S. E.	21.3	46.9	53.4	24.7
C. D. (P = 0.01)	62.9	137.8	157.0	69.9
III. Nitrogen				
N_0	917	999	1587	1171
N_1	1171	1240	1810	1407
N_2	1451	1444	2088	1661
N_3	1694	1574	2123	1798
S. E.	24.0	40.9	50.4	23.1
C. D. (P = 0.01)	67.9	115.3	143.0	64.4

moisture (i. e., 8.5 per cent); (I_1) at 20 per cent available moisture (i. e , at 10.8 per cent); (I_2) at 40 per cent available moisture (i. e., at 13.1 per cent); and (I_3) at 60 per cent available moisture (i. e., at 15.4 per cent) and 2 levels of farm yard manure viz., (F_0) no manure and (F_1) 12.55 t./ha constituting the 8 main plot treatments. The The sub plot treatments were 4 levels of nitrogen viz. (N_0) 0 kg N/ha; (N_1) 22.4 kg N/ha; (N_2) 44.8 kg N/ha and (N_3) 67.3 kg N/ha. A basal dressing of 16.9 kg P^2O_5 and 16.9 kg K_2O per ha was common to all treatments. The soil moisture was determined up to a depth of 30 cm. The sowing of cotton was done during 1st week of October and the picking of cotton was commenced late in January and completed by the end of March during all the years. The unit plot size was 0.62 cent and the spacing adopted was 75 × 22.5 cm allowing one plant per hole. The irrigation treatments were commenced 30 days

TABLE 2. Water requirement at moisture regimes

Moisture regimes	Years	No. of irrigations	Qty. of irrigation (mm)	Rain fall (mm)	Water requirement (mm)
I_0	65–66	5	119.5	304.9	424.4
	66–67	3	83.0	509.8	592.8
	67–68	6	259.3	230.9	499.2
I_1	65–66	9	295.0	304.9	599.9
	66–67	6	214.8	509.8	724.6
	67–68	10	342.8	239.9	582.7
I_2	65–66	11	370.0	304.9	674.9
	66–67	9	260.8	509.8	770.6
	67–68	13	455.1	239.9	695.0
I_3	65–66	14	488.5	304.9	793.4
	66–67	13	382.3	509.8	892.1
	67–68	17	530.5	239.9	770.4

after sowing and the irrigation was given to the plants when the soil moisture level fell below the treatmental specifications. The irrigation water was measured by means of 90 degree triangular weirs. The sub plot treatments viz., the nitrogen levels, were applied as top dressing in the form of ammonium sulphate 45 days after sowing and the crop was earthed up.

RESULTS AND DISCUSSION

The statistical scrutiny of the data for individual years as well as pooled over three years given in Table 1 showed that the difference in kapas yield between the moisture regimes, farm yard manure, nitrogen were significant.

The results showed that all the higher levels of irrigation are superior in terms of Kapas yield to the control treatment i. e. irrigation at 0 per cent available moisture. Among the higher levels of irrigation the difference in kapas yield between I_1 and I_2 is very much more than the difference between I_3 and I_2 and statistically I_3 and I_2 on a par in the results of pooled analysis. As such it is clearly seen that the optimum soil moisture regime for cotton is I_2 viz , irrigation at field capacity to 40 per cent availability. The extra yield got from the highest level of irrigation viz. I_3 is not commensurate to the larger quantum and higher frequency of irrigation.

TABLE 3. Interaction of moisture regimes with manures (kg/ha)

Manures	Moisture Regimes				S. E.	C. D. (P = 0.01)
	I_0	I_1	I_2	I_3		
I. Farm yard manure						
F_0	1075	1320	1279	1407	44 9	139.8
F_1	1380	1766	1933	1914		
II. Nitrogen levels						
N_0	984	1182	1246	1273	75 2	148.8
N_1	1147	1492	1478	1512		
N_2	1324	1691	1820	1810		
N_3	1454	1807	1881	2048		
S. E.	65.3					
C. D. (P = 0.01)	128.8					

Water requirement:

The schedule of irrigation given to various moisture regimes are given in Table 2.

For giving irrigation at I_2 level i e., (Field capacity to 40 per cent moisture availability) which is found to be optimum for cotton, the irrigation delta for 1965-66 was 674.9 mm in 11 irriagations, for 1966-67 it was 770.6 mm in 9 irrigations and for 1967-68 it was 695.0 mm in 13 irrigations depending upon the rainfall. Thus any irrigation given more than this is only a waste. It is interesting to note that consistent results have been obtained for valid conclusions. Thus the important finding is that winter cambodia cotton MCU.1, requires the optimum water regime of field capacity to 40 per cent moisture availability.

Interaction of moisture regimes with manure:

The pooled analysis data given in Table 3 showed that in all levels of irrigation, application of 12.5 tonnes farm yard manure significantly increased the yield than no manure.

It also indicated that in all levels of irrigation positive response was seen for the application of nitrogen whereas at nitrogen levels, N_0 N_1 and N_2 higher levels of irrigations viz., I_3, I_2, I_1 which were on par influenced the yield than the lowest level viz., I_0. At the highest nitrogen level N_3 the highest irrigation level I_3 significantly increased the yield than other levlels. This shows that a higher irrigation delta is required at higher doses of N fertilization for getting the maximum yield in cotton. Khan and Nathuram (1947) who conducted some trials at Lyallpur found that the yield of cotton increased with increase in quantity of water as well as manure. Mukerji and Chatterjee (1967) have reported that application of fertilizers in conjunction with water showed an increase of 114 per cent in the yield of cotton at Siruguppa against 37 per cent with irrigation alone. Dastur and Singh (1943) have also recorded significant increase in boll weight under heavy irrigation in combination with nitrogen.

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