

IRRIGATION MANAGEMENT IN COTTON IN PURE STAND AND WITH INTERCROP

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ABSTRACT

A field experiment was conducted in winter season of 1985 on MUC.9 cotton at the Tamil Nadu Agricultural University, Coimbatore to find out the best method of planting of cotton and intercrop of green gram (Co 3) and to find the optimum irrigation regime for scheduling of irrigation to get maximum returns. The results revealed that uniform row planting of cotton with green gram as intercrop irrigated in every furrow at IW/CPE ratio of 0.75 was the most remunerative. Irrigation at IW/CPE ratio of 0.50 and irrigated in every furrow was the optimum irrigation regime for cotton in pure and mixed stand. The yield of seed cotton and net returns were on par with that of irrigation scheduled at IW/CPE ratio of 0.75. Alternate furrow irrigation saved 35 per cent of irrigation water compared to every furrow irrigation, but resulted both in lower yields (15.5 per cent) and net returns

KEY WORDS : Cotton, Pure Crop, Intercrop, Irrigation

Intercropping in cotton is a common agronomic practice to get increased returns without affecting the main crop. For maximum returns, attention must be paid to the proportion and method of planting of component crops. Information is available on the effect of irrigation regimes on pure crop of cotton, but only limited information is available on the water requirement and water use efficiency of cotton under intercropping situation. Scheduling of irrigation and water application have to be carefully done under intercropping situations of cotton - green gram intercropping as green gram is susceptible to excess moisture.

Hence, this study was undertaken (i) to find out the best irrigation regime for cotton in pure and mixed stand (ii) to find out the best method of planting of maincrop and intercrop and (iii) to find out the possibility of economising irrigation water by adopting alternate furrow irrigation.

MATERIALS AND METHODS

A field experiment was conducted at the Tamil Nadu Agricultural University, Coimbatore during winter season of 1985 to evaluate the optimum irrigation regime for cotton in pure stand and under intercropping situation and to find out the best method of planting of maincrop and intercrop (green gram, CO 3.) The experiment was laid out in s.split plot design with three replications. Combination of cropping and irrigation methods

under subplots. Irrigation regimes were scheduled based on climatological and soil moisture depletion approaches.

Mainplot treatments

Notation used	Treatments
P1	: Sole crop of cotton, every furrow irrigation.
P2	: Sole crop of cotton, alternate furrow irrigation.
P3	: Uniform row planting of cotton with intercrop, every furrow irrigation.
P4	: Uniform row planting of cotton with intercrop, alternate furrow irrigation.
P5	: Paired row planting of cotton with intercrop, every furrow irrigation.
P6	: Paired row planting of cotton with intercrop, alternate furrow irrigation.

Sub-plot treatments

I1	: Irrigation at IW/CPE ratio of 0.75
I2	: Irrigation at IW/CPE ratio of 0.50
I3	: Irrigation at 75 per cent depletion of available soil moisture

Sole crop of cotton was sown at the recommended spacing of 75 x 30 cm. In case of

uniform row planting of cotton with intercrop, ridges were formed at 75 cm apart and cotton was sown on one side of the ridge with the spacing of 30 cm and on the other side with the spacing of 15 cm. In paired row system of planting, cotton was sown on the inner aspect of the ridges formed 60 cm apart, leaving 90 cm between pairs of rows. Two rows of intercrop were raised in the interspace of 90 cm. All plots were irrigated immediately after sowing and life irrigation was given on the third day of sowing to all the plots. The amount of water let into each plot was measured with the use of parshal flume.

RESULTS AND DISCUSSION

Growth characters of cotton

Growing green gram as intercrop in cotton did not significantly influence the plant height, leaf area and dry matter production (DMP) of cotton, although sole crop of cotton irrigated in every furrow recorded numerically higher DMP compared to cotton intercropped with green gram irrigated in every furrow (Table 1). However, alternate furrow irrigation significantly reduced the above characters. All the growth characters were

affected by the irrigation regimes with irrigation given at IW/CPE ratio of 0.75 (I₁) recording the highest value and irrigation at 75 per cent depletion of available soil moisture (I₃), the lowest.

Yield attributes

Planting methods affected the number of bolls per plant, being the lowest in uniform row planting of cotton irrigated in alternate furrows (9.49). Alternate furrow irrigation resulted in reduction in boll number compared to every furrow irrigation. However, number of monopodial branches per plant, number of fruiting points per plant, and boll weight were not affected by the planting methods.

Irrigation regimes affected only the number of bolls per plant, being lowest (9.83) in plots irrigated at 75 per cent depletion of available soil moisture (I₃). The increase in number of bolls per plant in I₁ and I₂ could be attributed to higher ASM (41.7 and 24.2% respectively) at each irrigation and higher total water applied. Moursi *et al.* (1976) also observed a decrease in number of bolls with irrigation after an increasing depletion of available soil water.

Table 1. Effect of treatments on various factors

Treatments	DMP of cotton at first boll bursting stage (g/plant)	Sympodial branches/plant (No./plant)	Bolls/plant (No.)	Boll weight (g/boll)	Seed cotton yield (kg/ha)	Plant ht. of inter crop at harvest (cm)	Yield of intercrop (kg./ha)	Net Returns (Rs/ha)
Main Plot								
P1	150.70	18.06	11.01	5.04	1718	-	-	4108
P2	129.17	17.20	10.19	4.76	1441	-	-	2704
P3	150.47	17.31	10.74	4.83	1685	47.81	396	5245
P4	120.54	15.49	9.49	4.43	1380	46.05	302	3309
P5	128.18	17.74	10.49	4.75	1619	48.88	336	4668
P6	131.92	17.68	10.07	4.56	1424	47.20	312	3618
SED	8.255	1.235	0.253	0.450	47.428	1.685	27.83	245.80
CD	18.391	NS	0.564	NS	105.670	NS	NS	547.64
Sub Plot								
I ₁	142.77	17.69	10.79	4.83	1606	48.66	346	4139
I ₂	138.51	17.57	10.38	4.85	1552	47.70	336	4033
I ₃	124.06	16.47	9.83	4.50	1476	46.09	328	3652
SED	6.525	1.297	0.219	0.262	30.087	1.007	17.015	119.24
CD	13.467	NS	0.452	NS	62.099	NS	NS	246.12

Table 2. Water requirement (mm)

Irrigation regime	Irrigation (No.)	Amounts of water applied per irrigation (mm)	Total water applied (mm)	Water requirement (mm)
IW/CPE ratio of 0.75 (I ₁)				
Every furrow irrigation	10	50	480.0	693.1
Alternate furrow irrigation	10	25	280.0	493.1
IW/CPE of 0.50 (I ₂)				
Every furrow irrigation	7	50	330.0	550.9
Alternate furrow irrigation	7	25	205.0	425.9
75 per cent depletion of ASM (I ₃)				
Every furrow irrigation	6	46.23	264.9	502.4
Alternate furrow irrigation	7	23.12	195.6	433.1

Seed cotton yield

The planting methods affected the seed cotton yield. Sole crop of cotton irrigated in every furrow recorded the highest seed cotton yield while uniform row planting of cotton with intercrop irrigated in alternate furrows recorded the lowest seed cotton yield. The seed cotton yield of sole crop of cotton (1580 kg/ha) was on par with cotton intercropped with green gram (1527 kg/ha). Alternate furrow irrigation resulted in reduction in seed cotton yield (15.5 per cent) compared to every furrow irrigation.

Irrigation regimes affected the yield of seed cotton. No significant differences in seed cotton yields was recorded between scheduling of irrigation at IW/CPE ratio of 0.75 and IW/CPE ratio of 0.50 but scheduling of irrigation at 75 per cent depletion of ASM reduced the seed cotton yield. This may probably be due to low ASM at this irrigation treatment (25%) compared to irrigation at IW/CPE ratio of 0.75 and 0.50 (41.7% and 34.3% respectively). Under low moisture level, the growth of the crop was stunted and less number of fruit bearing branches and bolls were recorded. This resulted in poor yield because of moisture stress.

Effect of planting methods and irrigation regimes on green gram

Plant height and DMP

The plant height of intercrop was not affected by planting methods and irrigation regimes. The

cotton in uniform rows than in paired rows, which is probably due to more population of intercrop in uniform row planting.

Yield of intercrop

Highest yield (396 kg/ha) of intercrop was recorded in uniform row planting of green gram with cotton irrigated in every furrow, through it failed to attain the level of significance. Irrigation regimes did not significantly affect the green gram yield. This could be due to the fact the green gram is a low water requiring crop.

Total water requirement

The total water consumed under different irrigation regimes varied from 425.9 mm to 693.1 mm (Table 2). Though seed cotton yield, gross returns and net returns were higher when irrigation was scheduled at IW/CPE ratio of 0.75, it was on par with that of irrigation scheduled at IW/CPE ratio of 0.50. Hence, irrigation at IW/CPE ratio of 0.50 is the optimum irrigation regime for cotton. On an average alternate furrow irrigation consumed 35 per cent less of irrigation water compared to every furrow irrigation but resulted in lower seed cotton yields.

Water use efficiency (WUE)

In case of every furrow irrigation, highest WUE (3.63 kg/ha/mm) was recorded when cotton was irrigated at 75 per cent depletion of ASM. In case of alternate furrow irrigation, irrigation

Table 3. Water use efficiency (kg/ha/mm)

Treatment		Yield of seed cotton (kg/ha)	Yield of intercrop (kg grains/ha)	Water used (mm)	WUE (kg/ha/mm)
P ₁	I ₁	1805	-	693.1	2.604
	I ₂	1750	-	550.9	3.176
	I ₃	1600	-	502.4	3.184
P ₂	I ₁	1500	-	493.1	3.041
	I ₂	1424	-	425.9	3.344
	I ₃	1400	-	433.1	3.232
P ₃	I ₁	1780	376	693.1	3.111
	I ₂	1710	395	550.9	3.821
	I ₃	1564	418	502.4	3.945
P ₄	I ₁	1403	341	493.1	3.536
	I ₂	1385	297	425.9	3.949
	I ₃	1353	267	433.1	3.739
P ₅	I ₁	1690	327	693.1	2.910
	I ₂	1618	341	550.9	3.550
	I ₃	1550	341	502.4	3.753
P ₆	I ₁	1459	339	493.1	3.645
	I ₂	1422	311	425.9	4.069
	I ₃	1392	286	433.1	3.873

highest (3.787 kg/ha/mm) WUE. Irrigation scheduled at IW/CPE ratio of 0.75 recorded the lowest WUE in both every furrow (2.875 kg/ha/mm) and alternate furrow (3.407 kg/ha/mm) irrigation. Irrespective of planting methods, alternate furrow irrigation resulted in higher WUE compared to every furrow irrigation. Reduction in WUE when more quantity of water was applied could be because, in higher moisture regimes more moisture is used for evaporation rather than for production, thereby reducing the WUE. The WUE under cotton intercropped with green gram was found to be more (3.659 kg/ha/mm) than that in cotton in pure stand (3.096 kg/ha/mm).

Net returns

Highest net return of Rs.5,244/ha was realised from uniform row planting of cotton with green gram as intercrop irrigated in every furrow (Table 1). Sole crop of cotton irrigated in alternate furrows recorded reduced net returns (Rs.2,704/ha) compared to all other planting methods. Intercropping of cotton with green gram resulted in increased net returns (Rs.4,209/ha) compared to

sole crop of cotton (Rs.3,406/ha). The results clearly reveal that irrespective of the method of irrigation followed highest net returns could be obtained by intercropping green gram with cotton, than sole crop of cotton.

Irrigation regimes affected the net returns with irrigation scheduled at IW/CUE ratio of 0.75 recording the highest net returns and irrigation at 75 per cent depletion of ASM, the lowest.

From this study, it was concluded that uniform row planting of cotton with green gram as intercrop irrigated in every furrow is the most remunerative system of irrigation scheduled for cotton. Alternate furrow irrigation resulted in saving of 35 per cent of irrigation water but seed cotton yield was reduced.

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