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Yield, quality and economics of summer cotton (*Gossypium* species) as influenced by frequency of irrigation and moisture-conservation practices

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ABSTRACT

A field experiment was conducted during summer seasons of 1987 and 1988 at Kanpur with 'Vikas' cotton (*Gossypium* sp.) to study the effect of irrigation schedule in relation to moisture-conservation practices on light-textured alluvial soil. Irrigating the crop at 120 mm pan evaporation (requiring 6 irrigations) and covering the inter-row vacant spaces with polyethylene or organic residue mulch like maize stover gave the highest yield and showed better quality as measured by halo length, fibre fineness, ginning outturn and economics. Application of jalshakti @ 5 kg/ha also improved the yield as well as quality.

Development of 'Vikas' cotton (*Gossypium* sp.) has opened a new avenue of its cultivation as summer crop in areas where irrigation facilities are available. But owing to dry, desiccating and hot environment the irrigation requirement of such a crop is considerably high, particularly in light-textured soils. Any practice which may help in reducing irrigation requirement would go a long way to popularise the crop among the farmers. Raman *et al.* (1990) reported an economy of about 50% in irrigation water by adopting alternate furrows irrigation along with the use of plastic mulch in cotton crop. The water-expense efficiency was doubled by plastic mulching. Hence an experiment was conducted to economize the irrigation water by proper scheduling of irrigation and use of hygroscopic inert chemical like jalshakti and application of mulch in between the vacant spaces of cotton rows.

MATERIALS AND METHODS

The experiment was conducted during the summer seasons of 1987 and 1988 at Kanpur. The treatments comprised all possible combinations of moisture-conservation practices, viz. control, organic residue mulch @ 5 tonnes/ha, black polyethylene mulch (0.09 mm thickness), mixtalol @ 625 ml/ha (3 foliar sprays at an interval of 20 days), jalshakti @ 5 kg/ha in furrows at planting, organic residue mulch + jalshakti, polyethylene mulch + jalshakti and mixtalol + jalshakti, and 4 irrigation levels based on cumulative evaporation from

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Table 1. Effect of moisture-conservation practices (MCP) and irrigation schedules on growth, yield and net return of summer cotton

Treatment	Sympodial branches/plant		Bolls/plant (No.)		Seed-cotton yield (q/ha)		Lint yield (q/ha)		Cotton seed yield (q/ha)		Additional mean net return (Rs/ha)
	1987	1988	1987	1988	1987	1988	1987	1988	1987	1988	
MCP											
Control	16.8	13.8	6.14	5.46	11.21	9.57	3.81	3.23	7.46	6.35	
Organic mulch @ 500 tonnes/ha	24.7	21.6	10.09	9.00	14.55	12.85	4.92	4.39	9.57	8.46	1,030
Polyethylene mulch (0.09 mm thick)	26.5	23.3	11.31	9.43	15.55	13.70	5.29	4.66	10.26	9.10	1,071
Mixtalol @ 625 ml/ha	16.8	16.0	6.60	5.58	11.96	11.21	4.02	3.76	7.94	7.56	134
Jalshakti	15.7	15.1	6.50	5.89	11.53	10.84	3.91	3.65	7.67	7.19	183
Organic mulch + jalshakti	25.9	22.4	10.34	9.10	15.34	13.07	5.18	4.41	10.16	8.68	716
Polyethylene mulch + jalshakti	27.2	23.6	11.31	9.98	15.71	14.02	5.34	4.76	10.37	9.26	636
Mixtalol + jalshakti	18.2	16.8	7.09	6.04	12.33	11.59	4.18	3.91	8.15	7.67	242
CD (P = 0.05)	0.7	1.1	0.67	0.67	2.70	2.50	1.14	0.78	2.73	1.66	
Irrigation at PE											
80 mm (10)	23.8	21.3	11.01	9.13	15.98	14.28	5.40	4.81	10.53	9.47	
120 mm (6)	22.0	19.8	9.66	8.48	15.24	13.65	5.18	4.60	10.10	9.05	
160 mm (5)	20.8	18.4	7.85	6.88	13.01	11.53	4.39	3.91	8.62	7.67	671
200 mm (4)	19.3	16.9	6.17	5.75	9.84	8.94	3.33	3.02	6.51	5.92	1,482
CD (P = 0.05)	0.7	0.7	0.55	0.48	2.10	1.91	0.74	0.64	0.88	0.75	1,333

PE, Pan evaporation

Figures in parentheses are the number of irrigations

'USWB class 'A' Pan at 80, 120, 160 and 200 mm, which were compared in a 3 replicated split-plot design, keeping moisture-conservation practices in main plots and irrigation schedules in subplots. The soil of the experimental field was sandy loam having pH 7.7, organic carbon 0.390%, total nitrogen 0.040%, available P_2O_5 17.4 kg/ha and available K_2O 155 kg/ha. The values of field capacity, permanent wilting point and bulk density were 20.10%, 6.2% and 1.49 g/cc respectively of the surface layer.

The 'Vikas' cotton was sown on ridges on 5 March 1987 and 27 February 1988 after a deep (10 cm water depth) presowing irrigation. Post-sowing irrigations each of 8 cm were given as per treatment. A fertilizer dose of 70 kg N and 35 kg P_2O_5 was applied in furrows at planting and remaining half of N in 2 equal splits, at flowering and boll-formations stages. Organic and polyethylene mulches were applied in between the rows 3 weeks after planting. A rainfall of 23.9 mm and 79.4 mm was recorded during the cropping seasons of 1987 and 1988 respectively, which was accounted for while scheduling the irrigation.

RESULTS AND DISCUSSION

Yield and its attributes

Yield and yield epithets were greatly influenced by the weather conditions during the 2 seasons. Higher seed-cotton yield and

Table 2. Effect of moisture-conservation practices (MCP) and irrigation schedules on quality chracters of summer cotton

Treatment	Halo length (mm)		Fibre finenesss (millitex)		Ginning outturn (%)	
	1987	1988	1987	1988	1987	1988
MCP						
Control	20.48	20.98	164.82	167.63	33.66	33.55
Organic mulch @ 500 tonnes/ha	23.73	23.95	166.41	169.33	33.93	33.77
Polyethylene mulch (0.09 mm thick)	24.20	24.08	165.99	169.50	33.93	33.82
Mixtalol @ 625 ml/ha	22.68	21.91	165.88	168.70	33.69	33.61
Jalshakti @ 5 kg/ha	21.93	21.58	165.48	167.73	33.67	33.58
Organic mulch + jalshakti	23.80	24.40	166.60	170.24	33.91	33.83
Polyethylene mulch + jalshakti	23.35	24.61	166.80	170.30	33.93	33.86
Mixtaiol + jalshakti	22.70	21.86	165.55	168.70	33.75	33.66
CD (P = 0.05)	0.66	0.70	1.15	0.96	NS	0.11
Irrigation at PE						
80 mm (10)	23.34	23.11	166.05	169.76	33.87	33.74
120 mm (6)	23.05	23.01	165.89	168.64	33.82	33.72
160 mm (5)	22.79	22.79	166.06	168.81	33.80	33.70
200 mm (4)	22.75	22.72	165.36	168.84	33.77	33.68
CD (P = 0.05)	NS	NS	NS	0.77	NS	NS

PE, Pan evaporation

Figures in parentheses are the number of irrigations

yield characters were recorded in 1987 than in 1988. The factors responsible for lower yield was excessive rainfall which closely coincided with boll mutration and bursting. The seed-cotton yield, lint production and cotton seed yields were increased significantly by moisture-conservation practices over the control during both the years (Table 1). The maximum yield was found in polyethylene + jalshakti treatment which was at par with organic mulch alone or along with jalshakti, whereas the lowest yield in the control. The seed-cotton yield is the direct outcome of growth and yield attributes of plant which were found to be improved by the better soil-moisture conditions brought about by the application of mulches.

Irrigating the crop at 90 mm pan evaporation (10 irrigations) proved to be best emongest all irrigation levels, which significantly improved all epithets, whereas restricted irrigation 200 mm pan evaporation (4 irrigations) showed the poorest performance. Irrigation at 200mm pan evaporation led to moisture-stress condition, particularly during the reproductive period, which might have affected the accumulation and translocation of photosynthates to the reproductive organs eventually affecting the yield.

Quality characters

Moisture-conservation practices improved the halo length, but not the fibre fineness and ginning outturn (Table 2). The halo length and fibre fineness were the longest and finer fibre in polytheylene mulch + jalashakti, which were at par with organic mulch and shortest and coarser in the control respectively. Ginning outturn did not differ due to moisture-conservation practices due to the fact that it is a genetically controlled character of the variety. Increase in irrigation level did not significantly differ in these characters. The results confirm the findings of Hutchinsson *et al.* (1985).

Economics

Maximum additional return of Rs 1,071/ha accrued by the use of polyethylene mulch, followed by organic residue mulch (Rs 1,030/ha) (Table 1). All other moisture-conservation practices were not found economical. From the economic point of view organic mulch was suitable and easily available than polyethylene mulch. Bhan and Singh (1979) also reported increased yield with polyethylene mulch, however, its shighe cost was not economical and suggested use of rice straw ass mulch material.

Scheduling of irrigation at 120 mm (6) was highly remunerative (Rs 1,402/ha), followed by irrigation at 80 mm (10) compared with irrigation at 200 mm (4). Six irrigations gave the highest profit but beyond or below this resulted in lesser net profit.

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