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Effect of Crop Geometry on Rainfed Cotton

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ABSTRACT

A field experiment was conducted at Gujarat Agricultural University, Arnej during 1994-95 and 1995-96 to find out optimum spacing for rainfed cotton *(Gossypium herbaceum* L) variety G. Cot. 13. The growth and yield attributes were increased with increase in inter and intra row spacings. Seed cotton yield was also increased with increase in inter and intra row spacing particularly during below normal rainfall year. On an average crop geo metry of 180 cm x 45 cm produced the highest seed cotton yield. The wider inter and intra row spacing was also found more economical as it did not only increase the yield but also decreased the cost of cultivation.

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INTRODUCTION

Of the various agronomic factors, optimum plant spacing between and within row plays important role in increasing yield of cotton particularly under rainfed conditions. The varieties of cotton grown in Bhal and Coastal Agro climatic Zone are of long duration (240 days) and often experience moisture stress during the reproductive phase due to interplant competition. Under such situation adoption of appropriate crop spacing helps in efficient utilization of soil moisture and may improve crop productivity. The present investigation was therefore takenup to generate information on optimum inter and intra row spacing for cotton G. Cot. 13.

MATERIALS AND METHODS

Field experiements were conducted during rainy season of 1994-95 and 1995-96 at Regional Research Station, Gujarat Agricultural University, Arnej. The soil of the experimental field was clayey in texture (Chromusterts), low in available nitrogen (203 kg/ha) and phosphorus (12.1 kg/ha) but high in available potash (713 kg/ha). The pH of the soil was 8.1. The treatments comprising five inter row spacings (60, 90, 120, 150 and 180 cm) as main plots and three intra raw spacings (30, 45 and 60 cm) as sub plots were tested in split plot design with four replications. Cotton var. G. Cot.-13 was sown on 2 and 19 July whereas crop was harvested on 15 and 6 March during 1994-95 and 1995-96, respectively. The crop was fertilized with 50 kg N and 25 kg P_2O_5/ha. Half of nitrogen and entire dose of phosphorus were applied at sowing whereas remaining half dose of nitrogen was applied 45 days after sowing (DAS). The total rainfall received during *kharif* seasons of 1994-95 and 1995-96 was 854.2 and 395.5 mm with +37 and -36 per cent deviation from average rainfall (620 mm) of the station, respectively.

RESULTS AND DISCUSSION

Effect on growth and yield attributes

Inter row spacing had a significant effect on growth and yield attributes (Table 1). Plant height, effective and total number of branches/plnat, number of bolls/ plant and seed cotton yield / 100 bolls increased significantly with increased in inter row spacing from 60-180 cm. Thus the highest

TABLE 1

Growth and yield components of cotton as influenced by different inter and intra row spacing (mean data of two years).

Treatment	Plant height, cm	Number of branches per plant		No. of bolls/ Plant	Seed cotton yield/100 bolls, g
		Effective	Total		
Inter row spacing, cm					
60	67.35	4.69	7.25	9.58	179.9
90	75.58	6.04	8.25	13.88	187.5
120	82.83	7.34	9.37	18.73	191.0
150	85.81	8.63	9.87	26.19	196.7
180	89.53	8.63	10.25	32.87	198.4
CD (P=0.05)	4.04	0.67	1.61	8.67	7.1
Intra row spacings, cm					
30	74.68	5.62	7.85	14.13	185.0
45	80.63	7.08	9.16	20.53	190.0
60	85.35	8.08	9.99	26.10	196.8
CD (P=0.05)	NS	0.49	0.80	2.01	NS

value of all the growth and yield attributes were observed with the widest inter and intra row spacing of 180 cm. This might be due to increased reception of sun light and less competition between the plants under wider spacing. Further, the root proliferation is horizontal in this soil because of existence of impervious hard layer below 70 cm soil surface. Intra row spacing did not produce significant effect on plant height and seed cotton yield/100 bolls. However, it had a significant effect on effective and total number of branches/plant as well as on number of bolls/plant. Prasad and Prasad (1993) had also reported that intra row spacing did not alter the plant height but produced more number of bolls/plant.

Effect on yield and harvest index

Different inter row spacings did not significantly influence the seed cotton and stalk yield during first year and in pooled analysis but the effect was found significant in second year (Table 2). In second year seed cotton yield was increased with widening of inter row spacing from 60 to 180 cm. The highest seed cotton yield of 5.34 q/ha was obtained with the widest inter row spacing of 180 cm, but remained at par with that of 150 cm inter row spacing. The trend was almost reverse in case of stalk yield. Inter row spacing of 90 cm remaining at par with 60 cm inter row spacing, produced significantly higher stalk yield as compared to rest of the spacings. These results are not in confirmation with those of Jadhav *et al.* (1993).

The pooled data revealed that the effect of inter row spacings on seed cotton and stalk yield was not consistant over years. This could be attributed to the variation in amount and distribution of rainfall during the years of experimentation. In 1994-95, total rainfall of 854.2 mm was received in 44 rainy days which was higher than average rainfall of 620 mm. In the good rainfall year, the yield of seed cotton was not influenced due to inter row spacings. In 1995-96, when receipt of rainfall was less than the average, the inter row spacing showed their significant effect on seed cotton yield. Thus, wider row spacing was found better during below normal rainfall year.

Intra row spacings failed to produce their

TABLE 2

Seed cotton yield (kg/ha) as influenced by different inter and intra row spacing.

Treatment	Seed cotton yield, q/ha			Stalk yield, q/ha			Harvest index		
	1994-95	1995-96	Mean	1994-95	1995-96	Mean	1994-95	1995-96	Mean
Inter row spacing, cm									
60	7.35	2.65	5.00	12.80	12.19	12.50	0.36	0.17	0.27
90	6.99	3.81	5.40	13.06	12.68	12.87	0.35	0.23	0.29
120	6.93	4.38	5.65	12.37	11.62	12.00	0.36	0.27	0.32
150	7.87	4.91	6.39	12.47	10.12	11.30	0.38	0.33	0.36
180	7.83	5.34	6.59	12.96	10.25	11.60	0.38	0.34	0.36
CD (P=0.05)	NS	1.04	NS	NS	0.95	NS	NS	0.047	0.039
Intra row spacing, cm									
30	7.32	3.68	5.50	13.61	12.58	13.09	0.35	0.23	0.29
45	7.38	4.37	5.87	12.30	11.19	11.75	0.38	0.28	0.33
60	7.48	4.60	6.04	12.28	10.35	11.32	0.38	0.31	0.34
CD (P=0.05)	NS	0.58	NS	1.08	0.72	0.64	0.024	0.032	NS

significant effect on seed cotton yield during first year and in pooled analysis. But in second year, wider intra row spacings of 60 and 45 cm produced significantly higher seed cotton yield than that of 30 cm intra row spacing. With regard to the effect of intra row spacings on stalk yield, it was noted that stalk yield of cotton decreased significantly with increase in intra row spacing during both the years of experimentation as well as on pooled basis.

Harvest index did not vary much due to variation in inter row spacing during first year but in second year and in pooled analysis, it increased markedly due to increase in inter row spacing from 60 to 180 cm (Table 2). The results further indicated that there was a tendency of increasing harvest index due to increase in intra row spacing from 30 to 60 cm during both the years. But the differences in harvest index due to different intra row spacings did not reach level of significance in pooled analysis. The results thus indicated that plants raised at narrow spacing enhanced vegitative growth rather than reproductive one and results in low harvest index.

Interaction effect

The interaction between inter and intra row spacings was not found significant in individual years but it was significant in pooled analysis (Table 3). Among the various combinations, 180 cm x 45 cm spacing produced the highest yield of 7.45 q/ha. It was at par with those of 150 cm x 30 cm, 150 cm x 45 cm, 120 cm x 60 cm and 180 cm x 60 cm spacings.

TABLE 3

Seed cotton yield (Q/ha) as influenced by interaction between inter and intra row spacing (R x P).

Pooled

Inter row spacing, cm	Intra row spacing, cm			Mean
	30	45	60	
60	4.60	4.87	5.53	5.00
90	4.94	5.20	6.05	5.40
120	5.12	5.43	6.41	5.65
150	6.96	6.42	5.78	6.38
180	5.88	7.45	6.43	6.59
Mean	5.50	5.88	6.04	5.81
S.Em. + = 0.40			C.D. 0.05 = 1.13	

Economics

The widest inter row spacing recorded the highest net return (Rs. 6285/ha) and the highest B : C ratio (1.75) as it did not only increase the yield but also lowered the cost of cultivation. Similarly, the widest intra row spacing also proved the best on the basis of economics, net return being Rs. 4956/ ha and B : C ratio of 1.21. Manjappa *et al.* (1997) also observed maximum net return and the highest B : C ratio with widest spacing.

TABLE 4

Monetary return and benefit : cost ratio as influenced by different inter and intra row spacings.

Treatment	*Gross monetary return, Rs./ha*	*Cost of cultivation, Rs./ha*	*Benefit, Rs./ha*	*B : C Ratio*
Inter row spacing, cm (R)				
60	7500	4600	2900	0.63
90	8100	4313	3787	0.88
120	8475	4020	4455	1.11
150	9585	3986	5599	1.40
180	9885	3600	6285	1.75
Intra row spacing, cm (p)				
30	8250	4104	4146	1.01
45	8805	4104	4701	1.15
60	9060	4104	4956	1.21

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