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Productivity of upland cotton (*Gossypium hirsutum*) genotypes under different levels of fertility and spacing

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ABSTRACT

A field experiment was conducted during rainy (*kharif*) season of 1993 and 1994 at Indore, to evaluate the productivity of different plant types ('KH 100-2237' and '79 BH 5-3') of upland cotton (*Gossypium hirsutum* L.) under various fertility levels (i.e. 40 : 20 : 10, 60 : 30 : 15 and 80 : 40 : 20 kg N : P : K/ha) and planting geometries (60 cm x 30 cm, 60 cm x 45 cm and 60 cm x 60 cm). 'KH 100-2237' had higher cotton yield, lint yield, bolls/plant and yield/plant but significantly low seed and lint index. Plant spacing did not have significant effect on seed-cotton yield, lint yield, boll size and physical parameters. However, closer intra-row planting gave numerically higher seed-cotton yield than wider inter-row spaced crop at 60 cm x 60 cm, but reverse trend was noted for bolls/plant and yield/plant. Application of 80, 40 and 20 kg N,P and K/ha recorded significantly higher yield of cotton, lint yield and seed index. However, the various F levels did not have any impact on yield attributes.

Key words : Cotton, Fertility levels, Spacing, Seed-cotton yield

Maximum yield potential of cotton can be exploited by utilizing agronomic manipulations in semi-arid tropics under rainfed conditions. Promising genotypes, optimum fertilizer, sowing time and plant density are the important aspects of yield exploitations which may reduce it to a undesirable extent. Bapana *et al.* (1976) opined that crop phenology in cotton is substantially influenced by nitrogen, varieties and plant density, while Singh (1972) stressed on maintaining optimum plant population for improving cotton yield. The present investigation was an attempt to study the various aspects of crop management, particularly fertilizer application and optimum plant density for newly introduced genotypes of cotton.

MATERIALS AND METHODS

The field experiment was conducted at AICCIP, College of Agriculture, Indore, during rainy (*kharif*) season of 1993 and 1994. The soil of experimental field was medium black clay (50% clay) with pH 7.5, low in organic carbon (0.38%) and

available N (158 kg/ha) and available P (9.2 kg/ha) and high in available K (715 kg/ha). The total precipitation received during the respective season was 964 and 1,094 mm respectively. The trial was laid out in randomized block design with 3 replications.

The treatments consisted of 2 cotton cultivars ('H 100-2237') and '79 BH 5-3'), 3 plant spacings (60 cm × 30 cm, 60 cm × 45 cm and 60 cm × 60 cm) and 3 levels of N,P, and K (40 : 20 : 10, 60 : 30 : 15 and 80 : 40 : 20 kg/ha). Treatments allotted to plots were fixed for 2 seasons on same site. The crop was sown on 27 and 24 June during first and second year respectively.

Cotton seeds were dibbled using 3–4 seeds/hill. Two seedlings/ hill were retained 20 days after sowing. One-fourth quantity of nitrogen and 50% each of P and K were applied as basal in the form of urea, single superphosphate and muriate of potash respectively. Remaining 75% N was applied in 3 equal splits at 40, 55 and 70 days after sowing, and 50% dose of each P and K was given 40 days after sowing in both the seasons. The lint index and lint yield were computed.

RESULTS AND DISCUSSION

Performance of varieties

Varietal difference was significant in 1993, while it remained unaffected during 1994 (Table 1). The crop had suffered a setback in 1993 due to bad weather conditions including attack of sucking pests like jassids and further devastating incidence of cotton bollworm (*H. armigera*) in July and September 1993, resulting in low yield levels. However, on an average, cultivar 'KH 100-2237' gave the highest yield, being 10.73% higher than that of '79 BH 5-3,' which had contributed more bolls and yield/plant (Table 1). Similar trend in lint yield, and no remarkable variations in ginning outturn due to varieties were recorded. Higher seed and lint index was observed in '79 BH 5-3' (Table 2). The results confirm the findings of Shrivastava *et al.* (1988) and Tomar and Julka (1997). Significant enhancement in plant height was recorded (Table 1). Prasad and Prasad (1993) also observed similar results in cotton varieties.

Effect of spacing

Of the 3 spacings tried, none of them had shown any impact on yield of cotton. However, narrow planting geometry (60 cm × 30 cm and 60 cm × 45 cm) resulted in the maximum mean seed-cotton yield/ha owing to higher plant population/unit area (Table 1). Similar results were also observed by Ahlawat *et al.* (1973).

The higher plant population alone compensated the low yield/plant, though there was less mature bolls/plant in closer spacing. Lower seed-cotton yield at relatively wider plant distance confirmed the findings of Brar and Singh (1978). Except seed index, in 1993 similar trend was also observed in lint yield, qualitative and physical parameters like ginning outturn, seed index and lint index in both the seasons. The findings are in accordance with those of Sharma and Tomar (1994). As reported by Prasad and Prasad (1993) the maximum and minimum spacings did not alter the plant height (Table 1).

Table 1. Effect of variety, spacing and fertility levels on growth, yield and yield parameters of upland cotton

Treatment	Plant height (cm)		Seed-cotton yield/plant (g)		Bolls/ plant		Boll weight (g)		Seed-cotton yield (kg/ha)		
	1993	1994	1993	1994	1993	1994	1993	1994	1993	1994	Pooled
Variety											
'KH 100-2237'	85.60	81.75	16.62	65.32	6.41	23.67	2.62	2.71	562	1,254	908
'78 BH 5-3'	96.05	91.18	12.25	63.36	4.23	20.46	2.89	3.19	423	1,217	820
CD (P = 0.05)	3.54	4.13	1.82	NS	0.63	2.51	NS	0.42	50.00	NS	63.23
Spacing (cm × cm)											
60 × 30	90.73	85.98	12.58	53.70	4.50	18.20	2.85	3.12	494	1,280	887
60 × 45	88.90	87.04	14.01	65.53	5.20	23.05	2.73	2.86	487	1,278	883
60 × 60	92.85	86.37	16.71	70.80	6.25	24.95	2.68	2.87	496	1,149	823
CD (P = 0.05)	NS	NS	2.23	8.76	0.77	3.08	NS	NS	NS	NS	NS
N : P : K (kg/ha)											
40 : 20 : 10	88.65	84.13	13.44	59.81	4.77	20.15	2.85	2.98	458	1,141	800
60 : 30 : 15	90.85	87.90	15.01	61.05	5.47	22.14	2.75	2.80	467	1,220	844
80 : 40 : 20	92.97	87.37	14.85	69.16	5.70	23.91	2.66	3.07	551	1,345	948
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	61.28	149.17	77.44

Table 2. Effect of variety, spacing and F levels on qualitative and physical parameters of upland cotton

Treatment	Lint yield (kg/ha)		Ginning outturn (%)		Seed index (g)		Lint index (g)		Plant population/ ha	
	1993	1994	1993	1994	1993	1994	1993	1994	1993	1994
Variety										
'KH 100-2237'	187	418	33.19	33.35	7.20	7.91	3.60	3.96	38,600	38,272
'79 BH 5-3'	140	403	32.99	33.14	9.00	8.47	4.40	4.19	38,800	38,310
CD (P = 0.05)	31.81	NS	NS	NS	0.82	0.25	0.60	0.14		
Spacing (cm × cm)										
60 × 30	165	426	33.42	33.31	7.30	8.17	3.70	4.08	53,162	51,220
60 × 45	161	423	33.08	33.08	8.00	8.00	3.95	3.99	36,250	34,995
60 × 60	163	383	32.77	33.34	8.20	8.40	3.99	4.15	27,096	25,890
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS		
N : P : K (kg/ha)										
40 : 20 : 10	154	383	33.57	33.53	7.20	7.90	3.60	4.00	38,501	36,700
60 : 30 : 15	152	404	32.57	33.10	8.00	8.30	3.90	4.08	38,316	37,295
80 : 40 : 20	183	445	33.14	33.10	8.50	8.40	4.20	4.14	38,658	36,137
CD (P = 0.05)	26.54	46.20	0.71	NS	0.95	0.31	0.39	NS		

Effect of fertility

Various levels of fertility had very good impact on yield of seed cotton (Table 1). The seed-cotton yield increased with the increase in each successive levels of fertility up to 80, 40 and 20 kg N,P and K/ha. The increase in mean seed-cotton yield/unit of 20, 10 and 5 kg N,P and K/ha was about 6% for the first instalment (i.e. 40 : 20 : 10 to 60 : 30 : 15 kg N:P:K/ha) and 12.3% for the last instalment (i.e. 60 : 30 : 15 to 80 : 40 : 20 kg N:P:K/ha). The results confirms the findings of Sharma and Tomar (1995).

Though the yield attributes like yield/plant, bolls/plant and weight of boll did not differ significantly due to various levels of fertility (Table 1), lint yield did get affected (Table 2). The mean values of physical parameters like seed index and lint index were recorded higher (8.45 g and 4.17 g respectively) with 80, 40 and 20 kg N,P and K/ha confirming the findings of Tomar and Julka (1997). Higher fertility levels resulted in maximum mean ginning out turn (Table 2).

No remarkable variation was noted in plant height. Similar trend was also reported by Shrivastava *et al.* (1988) in cotton. None of the interaction was significant.

Thus cultivar 'KH 100-2237' yielded higher at closer planting of 60 cm × 30 cm and 60 cm × 45 cm with 80, 40 and 20 kg N, P and K/ha.

Table 3. Effect of interaction of variety, fertility level and spacing on yield of cotton (kg/ha) (pooled data of 2 years)

Variety (V)	Fertility			
	F_1	F_2	F_3	Mean
Variety				
V_1	862	873	988	908
V_2	738	814	908	820
Mean	800	844	948	
CD (P = 0.05)		NS		

Variety	Spacing			
	S_1	S_2	S_3	Mean
Variety				
V_1	963	907	854	908
V_2	811	858	791	820
Mean	887	883	882	
CD (P = 0.05)		NS		

Spacing	Fertility			
	F_1	F_2	F_3	Mean
Spacing				
S_1	832	864	966	887
S_2	827	854	967	883
S_3	741	814	912	822
Mean	800	844	948	
CD (P = 0.05)		NS		

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