1790 Performance of compact cotton genotypes(G.hirsutum) at three spacings and two moisture levels

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A field experiment was conducted during 2001-02 under rainfed and irrigated conditions at the Agricultural Research Station, Dharwad to study the performance of compact cotton genotype under different plant population densities. The experiment consisted 4 genotypes with three spacings in a split plot design with three replications on medium black soil under rainfed and irrigated conditions. Among the genotypes RACH-116 produced significantly higher seed cotton yield (981.6 kg/ha) under rainfed condition in spacings 60x15 cm and 1948.7 kg/ha under irrigated conditions in spacings 60x25 cm. This was mainly attributed to its close association with yield components such as number of bolls / m^2(r=0.745) and harvest index (r=0.860). Genotypes showed significant differences in their growth pattern, morphological characters and phenological characters. Among the genotypes RACH-116 possessed higher dry matter at all the stages mainly because of higher AGR, NAR and leaf area index as compared to other genotypes under both the situations. Correlation studies indicated highly significant positive association of yield with TDM (r=0.863), boll weight (r=0.909) and number of bolls/plant (r=0.745). Among the genotypes RACH-11-8 was comparatively early in phenological characters. However, the spacing did not influenced the phenology. The genotype RACH-116 recorded highest stem diameter.

Key words: Compact cotton, yield and yield components and spacing.

Introduction

The present day cotton genotypes have a long duration of 180-200 days and therefore they are exposed to production risks due to the occurrence of moisture stress of varying degree at different growth stages, incidence of diseases and insect pests for a longer period. As a result the cost of plant protection is increasing and the margin of profit is low and fluctuating in an erratic manner. Cotton hybrids and varieties currently grown are generally very robust, tall and bushy because of this plant protection can be taken only from the sides and not from the top. Under these circumstances compact cotton genotypes are ideally suited for spraying plant protection chemicals in an efficient manner. Shorter growth period also reduce the total pesticide requirement and the stress of prolonged moisture deficit. In addition these compact early maturing cotton can be harvested in one or maximum two picking because of their synchronous maturity, compacts are hence ideally suited for machine pickings. In many countries compact genotypes have been instrumental in raising the productivity for above the world average values.

Material Methods:

A field experiment was conducted during 2001-02 under rainfed and irrigated conditions at the Agricultural Research Station, Dharwad to study the performance of compact cotton genotype under different plant population densities. The experiment consisted 4 genotypes with three spacings in a split plot design with three replications on medium black soil under

rainfed and irrigated conditions. Compact cotton genotypes were selected based on growth and morphological characters like plant height, number of leaves, number of nodes, sympodia and monopodia.

The observations on yield, yield components (number of bolls per plant, boll weight and harvest index) were recorded at the time of harvest. Twenty bolls in each plot were picked randomly and their weight was taken and calculated as per boll weight.

Results and discussion

1. Yield and yield components:

The results on yield and yield components are presented in table 1. Under rainfed conditions significantly highest seed cotton yield was recorded at spacing of 60x15 cm. Among the genotypes RACH-116 has recorded significantly high yield. The yield components boll weight, number of bolls per plant followed the trend of yield. In general the harvest index under rainfed condition was low as compared to irrigated condition. Under irrigated condition the yield increased by two folds. Under irrigated condition the spacing 60x25 cm recorded significantly high yield compare to other spacing. Among the genotypes RACH-116 recorded significantly high yield while RACH-11-8 recorded significantly low yield. Jagtap and Kolhe (1986) observed that boll weight and boll number were negatively associated with days to first flowering in cotton (*G.hirsutum L.)* Mahla and Singh (1988) reported that boll weight is positively correlated with the number of seeds per boll (r=0.64) and ginning out turn (r=0.49). Faqir *et al*. (1984) showed that 69.72 per cent of variability in cotton yield was due to variability in boll number per plant, which has the greatest positive correlation with yield (r=0.835). Kumar and Choudhary (1986) revealed from correlation studies that seed cotton yield per plant was strongly correlated with boll number and boll weight. Similar results were also observed by Jagtap and Kolhe (1986).

The robust and compact types revealed different paths of productivity. Robusts are more productive by verdure of utilization of larger three dimensional space. However, despite utilization of greater three dimensional space there improper or loose packing of bolls in this space leads to lower yielding potentiality than what the space would suggest. Though compact types occupy lesser three dimensional space because of better packing of bolls these types yield more than what their three dimensional space would suggest.

The characteristic features of these diverse plant types suggest that the plus points of the two plant types if superimposed can perhaps lead to a more productive plant type. An intermediate plant type occupying greater three dimensional space like a robust type and ensuring better packing of bolls like a compact type would be the more ideal plant type in cotton. Kanavi *et al 2004*.

2. Total dry matter production:

The total dry matter produced at various growth stages is presented in table 2. The data shows that 60x15 cm spacing under rainfed condition and 60x25 cm spacing under irrigated condition gave significantly high yield than other two spacing. Among the genotypes RACH-116 recorded more total dry matter compare to other genotypes. Meredith and Wells (1989) opined that increased seed cotton yield in cotton (*G. hirsutum. L*) genotypes can be achieved through enhanced partitioning of dry matter from vegetative to reproductive structures. Unruah and Silvertooth (1996) reported that cv. DPL 90 (*G. hirsutum L.*) gave

higher yield than Pima 5-6 (*G. barbadense L*.) which was due to greater total biomass production and more efficient partitioning of dry matter into reproductive organs.

3. Leaf area:

The leaf area recorded at various growth stages is presented in table 3. Among these spacing 60x15 cm in rainfed and 60x25 cm in irrigated condition recorded significantly high leaf area than other spacing. Among the genotypes RACH-116 recorded significantly more leaf area than other genotypes. However under irrigated condition there was no significantly difference. Ashley *et al*. (1965) reported that the relationship between LAI and fruiting were dependent on concurrent vegetative growth. They observed that late season boll set increases as long as LAI was at or above 5.0. When LAI fell below 5.0, the number bolls did not increase further. Bhat *et al*. (1974) notice that higher leaf area index occurred two weeks before the first boll opening in cultivar PRH-30/2, after 30 days of first boll opening in cultivar MCU-3 and at first boll opening in cultivar PRS-74. Landiver *et al*. (1988) reported that maximum assimilation rate was obtained with LAI greater than 3.0. Late maturing cultivars achieved LAI of 3.0 earlier period was correlated with vegetative, reproductive and total dry weight.

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Table 1: Genotypic variation in yield and yield components of compact cotton genotypes

Rainfed condition						Irrigated condition					
Spacing (cm)	Genotypes	Yield (kg/ha)	Boll wt (g)	No. of bolls/ pl	Harvest index	Spacing (cm)	Genotypes	Yield (kg/ha)	Boll wt (g)	No. of bolls/ pl	Harvest Index
60x10	RACH-116	825.6	3.55	16.98	14.80	60x20	RACH-116	1786.7	3.97	24.63	33.80
	RACH 11-8	570.9	3.29	14.23	7.20		RACH 11-8	1248.7	3.23	21.60	16.49
	RACH 16	694.4	3.38	15.05	12.60		RACH 16	1613.9	3.67	22.70	27.97
	RACH 119	679.0	3.38	14.9	8.40		RACH 119	1436.7	3.43	21.80	21.87
	Mean	692.5	3.4	15.29	10.70		Mean	1521.5	3.57	22.68	25.03
60x15	RACH-116	981.6	3.92	17.73	15.37	60x25	RACH-116	1948.7	4.51	25.75	35.83
	RACH 11-8	671.3	3.37	14.73	8.30		RACH 11-8	1395.7	3.40	21.79	25.07
	RACH 16	779.3	3.49	15.68	13.80		RACH 16	1752.2	3.83	22.81	31.08
	RACH 119	694.4	3.38	15.05	12.48		RACH 119	1581.4	3.63	21.89	24.86
	Mean	784.6	3.54	15.79	12.46		Mean	1669.4	3.84	23.06	27.96
60x20	RACH-116	833.3	3.68	17.25	14.68	60x30	RACH-116	1859.4	4.63	24.65	34.22
	RACH 11-8	594.1	3.29	14.59	8.30		RACH 11-8	1371.9	3.37	21.75	17.98
	RACH 16	725.1	3.38	15.32	13.50		RACH 16	1741.3	3.67	22.75	30.57
	RACH 119	686.1	3.38	14.91	12.10		RACH 119	1501.5	3.60	21.85	23.34
	Mean	709.8	3.43	15.53	12.10		Mean	1619.5	3.66	22.75	26.53
Mean	RACH-116	880.1	3.71	17.32	14.94	Mean	RACH-116	1865.4	4.17	25.01	34.68
	RACH 11-8	612.1	3.31	14.51	7.89		RACH 11-8	1338.8	3.33	21.71	18.18
	RACH 16	713.0	3.31	15.34	13.22		RACH 16	1702.5	3.72	22.75	29.87
	RACH 119	686.7	3.38	14.98	10.97		RACH 119	1506.5	3.45	21.84	23.36
	Grand Mean	728.0	3.45	15.54	11.67		Grand Mean	1603.2	3.69	22.83	26.51
For comparing:						For comparing:					
Spacing (S) SEm±		3.04	0.613	0.063	0.069	Spacing (S) SEm±		16.81	0.017	0.092	0.130
C.D. at 5%		11.91	0.056	0.247	0.272	C.D. at 5%		66.02	0.066	0.362	0.150
Genotypes (G) SEm±		38.66	0.148	0.897	0.665	Genotypes (G) SEm±		34.29	0.158	0.975	1.139
C.D. at 5%		113.65	0.539	2.665	1.974	C.D. at 5%		101.65	0.469	2.897	3.382
SxG at same S SEm±		69.93	0.256	1.554	1.151	SxG at the same S SEm±		59.28	0.274	1.690	1.972
C.D. at 5%		195.81	0.761	4.610	3.419	C.D. at 5%		176.07	0.813	5.018	5.858
SxG at same/diff. S SEm±		57.18	0.222	1.340	0.990	SxG at same/diff. S SEm±		54.02	0.238	1.466	1.713
C.D. at 5%		169.18	0.660	4.000	2.970	C.D. at 5%		116.45	0.766	4.354	5.088

Table 2: Genotypic variation in Total dry matter production (g/plant) at different growth stages in compact cotton genotypes

Rainfed condition							Irrigated condition						
Spacing (cm)	Genotypes	Days after sowing					Spacing (cm)	Genotypes	Days after sowing				
		30	60	90	120	Harvest			30	60	90	120	Harvest
60x10	RACH-116	1.67	10.32	38.92	59.78	50.27	60x20	RACH-116	2.18	19.50	40.87	64.52	58.56
	RACH 11-8	0.82	7.82	35.16	53.57	47.80		RACH 11-8	2.48	17.92	40.40	58.72	56.80
	RACH 16	1.26	8.92	38.10	57.93	49.48		RACH 16	2.66	19.69	43.50	61.98	58.19
	RACH 119	1.14	8.86	36.49	56.03	48.58		RACH 119	2.51	17.53	38.15	57.35	57.35
	Mean	1.22	8.99	37.16	56.82	49.03		Mean	2.61	18.66	40.73	60.643	57.72
60x15	RACH-116	1.96	13.92	49.52	77.88	54.18	60x25	RACH-116	3.12	25.98	51.61	77.81	61.61
	RACH 11-8	1.13	8.55	35.88	55.75	48.17		RACH 11-8	2.5	19.18	40.90	59.21	57.16
	RACH 16	1.43	9.60	38.89	59.52	50.16		RACH 16	2.79	19.23	43.74	64.31	58.45
	RACH 119	1.24	8.96	37.41	57.70	49.26		RACH 119	2.64	19.34	41.29	63.57	57.57
	Mean	1.44	10.25	40.42	62.73	50.44		Mean	2.76	20.93	44.38	66.22	58.69
60x20	RACH-116	1.71	10.83	39.31	60.80	51.80	60x30	RACH-116	2.84	27.54	45.27	65.00	59.58
	RACH 11-8	1.1	8.22	35.35	55.31	48.08		RACH 11-8	2.48	19.99	42.80	59.10	57.02
	RACH 16	1.42	9.25	38.18	58.53	49.58		RACH 16	2.78	19.16	43.70	62.04	58.36
	RACH 119	4.19	8.95	36.58	57.24	48.60		RACH 119	2.63	18.05	42.98	63.48	57.46
	Mean	1.35	9.31	37.35	57.97	49.51		Mean	2.683	19.93	43.68	62.40	58.10
Mean	RACH-116	1.78	11.69	42.58	66.15	52.08	Mean	RACH-116	2.92	22.67	45.91	69.11	59.91
	RACH 11-8	1.01	8.19	35.46	54.87	48.01		RACH 11-8	2.48	19.03	41.36	59.01	56.99
	RACH 16	1.37	9.27	38.39	58.67	49.74		RACH 16	2.74	19.36	43.64	62.77	58.33
	RACH 119	1.19	8.92	36.82	57.60	48.81		RACH 119	2.59	18.30	40.80	61.46	57.46
	Grand Mean	1.33	9.52	38.31	59.17	49.66		Grand Mean	2.68	19.84	42.93	63.09	58.17
For comparing:							For comparing:						
Spacing (S) SEm±		0.007	0.079	0.197	0.236	0.191	Spacing (S) SEm±		0.008	0.113	0.206	0.446	0.210
C.D. at 5%		0.029	0.311	0.774	1.279	0.748	C.D. at 5%		0.031	0.446	0.966	1.750	0.825
Genotypes (G) SEm±		0.058	0.566	2.018	2.458	2.865	Genotypes (G) SEm±		0.183	0.1098	2.490	0.749	2.483
C.D. at 5%		0.122	1.680	5.993	7.567	8.508	C.D. at 5%		0.544	3.261	7.395	2.522	7.544
SxG at same S SEm±		1.010	0.980	3.495	4.413	4.962	SxG at the same S SEm±		0.316	1.902	4.313	1.471	4.300
C.D. at 5%		0.299	2.910	10.38	13.106	14.737	C.D. at 5%		0.942	5.649	12.806	4.369	12.710
SxG at same/diff. S SEm±		0.087	0.852	3.330	3.386	4.320	SxG at same/diff. S SEm±		0.275	1.651	3.743	1.350	3.330
C.D. at 5%		0.260	2.531	9.008	11.391	12.744	C.D. at 5%		0.816	4.904	11.117	4.008	11.070

Table 3: Genotypic variation in Leaf area (dm^2/plant) at different growth stages in compact cotton genotypes

Rainfed condition							Irrigated condition						
Spacing (cm)	Genotypes	Days after sowing					Spacing (cm)	Genotypes	Days after sowing				
		30	60	90	120	Harvest			30	60	90	120	Harvest
60x10	RACH-116	1.85	11.83	17.15	28.88	18.92	60x20	RACH-116	4.75	29.28	23.24	35.7	23.24
	RACH 11-8	1.09	9.92	20.92	21.96	14.94		RACH 11-8	4.71	27.64	19.05	32.56	19.05
	RACH 16	1.39	12.15	21.53	25.98	17.19		RACH 16	4.74	28.54	21.4	33.48	21.4
	RACH 119	1.19	11.89	21.08	22.95	16.54		RACH 119	4.73	27.65	21.05	32.7	21.05
	Mean	1.38	11.44	20.17	24.94	16.89		Mean	4.73	28.27	21.18	33.61	21.18
60x15	RACH-116	2.94	12.98	19.17	33.5	23.84	60x25	RACH-116	4.89	31.35	25.4	37.85	25.4
	RACH 11-8	1.15	10.62	20.99	22.39	15.98		RACH 11-8	4.72	27.65	22.1	32.65	22.1
	RACH 16	1.53	12.54	21.97	26.39	17.85		RACH 16	4.74	28.6	21.85	33.87	21.85
	RACH 119	1.24	12.05	21.35	23.12	16.94		RACH 119	4.73	27.68	21.8	32.85	21.8
	Mean	1.71	12.04	20.87	26.35	18.65		Mean	4.77	28.82	22.78	34.3	22.78
60x20	RACH-116	1.93	11.95	15.79	29.13	19.3	60x30	RACH-116	4.75	29.3	23.85	35.75	23.85
	RACH 11-8	1.13	9.98	20.95	22.05	15.37		RACH 11-8	4.72	27.64	19.08	32.57	19.08
	RACH 16	1.45	12.25	21.88	26.17	17.19		RACH 16	4.47	28.57	21.65	33.67	21.65
	RACH 119	1.2	12	21.17	22.95	16.88		RACH 119	4.73	27.68	21.09	32.8	21.09
	Mean	1.42	11.54	19.94	25.07	17.18		Mean	4.73	28.29	21.41	33.69	21.41
Mean	RACH-116	2.24	12.25	17.37	30.5	20.68	Mean	RACH-116	4.79	29.97	24.16	36.43	21.16
	RACH 11-8	1.12	1.17	20.95	22.13	15.43		RACH 11-8	4.71	27.64	20.07	32.59	20.07
	RACH 16	1.45	12.3	21.79	26.18	17.41		RACH 16	4.74	28.57	21.63	33.67	21.63
	RACH 119	1.21	11.98	21.2	23	16.78		RACH 119	4.73	27.67	21.31	32.78	21.31
	Grand Mean	1.5	11.67	20.32	25.45	17.57		Grand Mean	4.74	28.46	21.79	33.87	21.79
For comparing:							For comparing:						
Spacing (S) SEm±		0.017	0.044	0.065	0.139	0.096	Spacing (S) SEm±		0.016	0.069	0.120	0.135	0.049
C.D. at 5%		0.066	0.171	0.255	0.545	0.379	C.D. at 5%		0.064	0.271	0.471	0.530	0.194
Genotypes (G) SEm±		0.068	0.495	0.873	1.093	0.756	Genotypes (G) SEm±		0.207	0.764	1.650	1.783	0.963
C.D. at 5%		0.200	1.470	2.594	3.245	2.246	C.D. at 5%		0.601	2.268	4.900	5.296	2.781
SxG at same S SEm±		0.118	0.857	1.512	1.893	1.310	SxG at the same S SEm±		0.351	1.323	2.858	3.089	1.622
C.D. at 5%		0.351	2.46	4.493	5.621	3.891	C.D. at 5%		1.042	3.940	8.480	9.173	4.812
SxG at same/diff. S SEm±		0.104	0.744	1.312	1.645	1.139	SxG at same/diff. S SEm±		0.304	1.148	2.470	2.678	1.406
C.D. at 5%		0.308	2.208	2.896	4.880	3.382	C.D. at 5%		0.904	3.408	7.350	7.954	4.174