The Agriculturists 10(1): 10-15(2012) ISSN-1729-5211
A Scientific Journal of Krishi Foundation

Performance of Some Introduced Hybrid Cotton (*Gossypium hirsutum*) Varieties in Bangladesh

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Received: 12 June 2011 Accepted: 26 May 2012

Abstract

An experiment was conducted at the Regional Cotton Research Farm, Jagadishpur, Jessore during 2009-10 to evaluate six cotton varieties. Among them, four were hybrid cotton varieties and another two were inbreeds taken as control. Significant differences were found among the varieties for all traits except number of plants/ha and plant height at harvest. Hybrid variety SSC-3 performed well in terms of seed cotton yield (3570.33 kg/ha), lint yield (1404 kg/ha) and ginning out turn (GOT) percentage (43.83%). The highest 2.5% span length (31.44 mm) was found in hybrid HSC-4 and the lowest micronaire value of 3.87 mμ was found in hybrid SSC-2.

***Keywords*: Evaluation, variation, picking, ginning, lint, cotton**

1. Introduction

Bangladesh has a glorious historical reference of growing superfine quality cotton and it is one of the important cash crops. It is mainly used in textile industries. There are more than 140 spinning mills, over 280 weaving and over 60 dying and finishing mills in the country, which consume 2.5 million bales of cotton (BTMA, 2010). However, local production is only about 0.1 million bales which meets up around 4-5% of the national requirement. The remaining 95-96% is fulfilled by importing raw cotton from United States of America (40%), Commonwealth of Independent States (35%), Australia, Pakistan, South Africa and other cotton producing countries (25%) (BTMA, 2010). Though cotton is an important cash crop and is an important raw material, the relative weightage of cotton within the cropping systems scenario is rather marginal. The area under cotton cultivation ranges only between 0.08 (2007-2008) and 0.27 percent (2008-2009) of the total cropped area, respectively (BBS, 2009). The current production of cotton in the country hardly meets up 4-5 percent of the requirement (CDB, 2009). Therefore, increasing domestic production of cotton is an urgent need for the country.

The cotton farmers are not satisfied with the yield performance of the existing cotton cultivars. Development of the short duration and high yielding cotton hybrids is essential for Cotton Development Board. Due to shortage of infra-structure facilities, skilled man power, this work is not possible at this moment. The CDB is trying to introduce cotton hybrid varieties from

the neighboring countries. Cotton Development Board targeted 50000 ha for cotton cultivation and expected production of 94000 bales of lint in the year of 2007-08.

Generally, hybrid varieties exhibit high yield performance over HYV. Xu and Fok (2007) reported that average seed cotton yield of hybrid varieties was 3360 kg/ha and non-hybrid varieties was 3225 kg/ha. Boll size, boll wt. and fiber properties were positively correlated with flowering date and boll retention (Fan *et al.*, 1989). Begum *et al.* (2005) found that, higher average weight of seed cotton/boll increased the highest seed cotton yield. Development of the short duration and high yielding cotton hybrid variety is, therefore essential for Bangladesh. The present investigation was undertaken: to assess the performance of introduced cotton hybrid varieties over local varieties and to select the best performed hybrids among the introduced cotton hybrid varieties.

2. Materials and Methods

The experiment was conducted at the Regional Cotton Research Farm, Jagadishpur, Jessore during the season 2009-10. Six genotypes were included in the experiment of which SSC-1, SSC-2, SSC-3 and HSC-4 were introduced from China. The genotypes CB-9 (developed from S1/91/646) and CB-10 (developed from BC-0397) were taken as control varieties which were collected from Sreepur, Gazipur and Sadarpur, Dinajpur, respectively. The trial was laid out in a Randomized Complete Block Design with three replications. The seeds were sown on 13 August 2009. Unit plot size was 5m×3.6m and plant spacing was 0.90m×0.45m. Data were collected from middle two rows (5m×1.8m) of each plot to minimize border effects. Green manure (Sun-hemp) was plough down at the age of 45 days. Cow-dung (3t/ha) was applied at the time of final land preparation. The nutrient elements such as Nitrogen (N), Phosphorous (P), Potassium (K_2O), Sulpher (S), Boron (B), Magnesium Sulphate ($MgSO_4$) and Zinc Sulphate ($ZnSO_4$) were applied in the row at the rate of 23-48-50-14-8-8 and 8 kg/ha, respectively as basal dose. Then 69 kg N was applied in three equal splits at 25, 42 and 55 days after sowing as top dressing. Another doses of Phosphorus, Potassium, Gypsum, Borax, Zinc Sulphate and Magnesium Sulphate were applied in third top dressing at the rate of 36-39-5-2-2 and 2 kg/ha, respectively. Normal cultural and plant protection measures were followed.

Ten plants were chosen at random from each plot to record the number of vegetative branches/plant, primary fruiting branches/plant, secondary fruiting branches/plant, node number of 1st fruiting branches (NFB)/plant, number of burst bolls/plant, number of un-burst bolls/plant, plant height at harvest and average weight of seed cotton/boll. Days to 1st flower and days to 1st boll split were recorded when 50% plants bore flowers and opened bolls. Seed cotton picking percentage and seed cotton yield data were also collected from the harvested areas. Different lint quality was measured after ginning. Ginning out turn (GOT) is the proportion of fiber in seed cotton and was measured and expressed in percentage as follows.

$$\text{GOT (\%)} = \frac{Weight\ of\ lint}{Weight\ of\ seed\ cotton} \times 100$$

Counted 100 dried cotton seed after ginning and then weighed as seed index.

$$\text{Lint index (g)} = \frac{Weight\ of\ lint\ (g)}{Weight\ of\ seed\ (g)} \times 100 \text{ seed weight (g)}$$

The hybrid varieties have simultaneous well bursting quality and simultaneous picking advantages of all bolls of a plant from top to bottom which were not present in the control varieties. A little un-burst bolls (ranged 1-2) were seen in hybrid varieties. For well and simultaneous bursting qualities, maximum seed cotton was picked up from 2nd picking. Data were analyzed using analysis of variance (ANOVA) for completely randomized block design and treatment means were compared by Duncan's Multiple Range Test using MSTAT program.

3. Results and Discussion

Mean performance of the treatments for different agronomic traits, ginning characteristics and fiber quality characteristics are presented in Tables 1, 2 and 3, respectively.

Results shown in Table 1 indicate that the genotypes differ significantly for all the characters studied except plant population/ha and plant height at harvest. Seed cotton yield and related characters of the genotypes are presented in Table 1. Number of vegetative branches/plant, primary fruiting branches/plant, secondary fruiting branches/plant, node number of 1st fruiting branches (NFB)/plant, days to 50% flowering and 50% boll split, average number of burst bolls/plant and un-burst bolls/plant, average weight of seed cotton/bolls, plant height at harvest, and yield of seed cotton characters showed significant variations due to genotypes (Table 1).

HSC-4 (0.93) and CB-9 (2.30) exhibited the lowest and the highest estimates for vegetative branches/plant, respectively. The lowest primary fruiting branches/plant was found in CB-10 (17.60). The genotype CB-9 produced the highest number of secondary fruiting branches per plant. The lowest and the highest NFB/plant were recorded in SSC-3 (5.97) and CB-9 (7.10), respectively. In case of days to 50% flowering, insignificant difference among the varieties was found. Highly significant difference was observed for days to 50% boll split. The lowest and the highest days to 50% boll split were found in SSC-3 and HSC-4 (122.33 days) and CB-9 (129.33 days), respectively. Insignificant difference among the varieties was found for burst bolls/plant. On the other hand, the highest and the lowest number of un-burst bolls/plant were found in CB-9 (6.80) and SSC-2 (1.97), respectively. There were no significant differences between SSC-1, SSC-2, SSC-3 and HSC-4 for un-burst bolls/plant.

Significant difference among the varieties was also observed for the trait average weight of seed cotton/boll. The highest and the lowest were produced by SSC-3 (4.93 g) and CB-10 (4.37 g), respectively. The higher average number of burst bolls/plant (33.63) in SSC-3 enhanced the highest seed cotton yield (3570.33 kg/ha) (Table 1), which is in agreement with that of Fan *et al.* 1989. Hybrid varieties could not show bigger boll size than the existing varieties. No significant difference was observed in respect of plant height, whereas the highest and the lowest plant heights were observed in SSC-2 (153.80 cm) and CB-10 (115.47 cm), respectively. In case of seed cotton yield, highly significant difference among the varieties was found. The highest amount of seed cotton yield was produced by SSC-3 (3570.33 kg/ha) that was followed by SSC-2 (2840.67 kg/ha) and HSC-4 (2674.33 kg/ha). The four cotton hybrids gave higher yield than the control CB-9. SSC-3 produced 116%, SSC-2 produced 72%, HSC-4 produced 61% and SSC-1 produced 45% more yield than the control CB-9. This result is in agreement with that of other studies (Anonymous, 2010).

All the hybrid varieties produced statistically similar percent of Ginning Out Turn (GOT). The highest GOT was found in SSC-3 (43.83%), which was closely followed by HSC-4 (43.42%) and SSC-2 (43.37%). The lowest GOT was found in CB-9 (36.78%). CB-10 produced the second lowest GOT (37.82%) percentage (Table 2).

All six varieties of cotton were significantly different in respect of lint yield (Table 2). The highest yield of lint was in SSC-3 (1404.00 kg/ha) and the lowest was in CB-9 (631.30 kg/ha). The hybrid varieties SSC-3, SSC-2, HSC-4 and SSC-1 produced 123, 95, 86 and 66% more lint than CB-9, respectively.

The highest seed index was found in CB-9 (11.11 g). The lowest seed index was found in CB-10 (9.40 g). The second lowest seed index was found in SSC-1 (9.83 g). The highest lint index was found in HSC-4 (8.05 g) followed by SSC-3 (7.99 g). The lowest lint index was found in CB-10 (5.86 g). The genotype SSC-3

Table 1. Mean performance of cotton varieties at Jagadishpur in 2009-2010

Varieties	Number				NFB/ Plant	Days to		Average number		Average weight of seed cotton /boll (g)	Plant height at harvest (cm)	Seed Cotton Yield	
	Plant population/ ha.	Vegetative branches/ plant	Primary fruiting branches/ plant	Secondary fruiting branches/ plant		50% flowering	50% boll split	Burst bolls/ plant	Un-burst bolls/ plant			(kg/ha)	as % of CB-9
SSC-1	25555.00a	0.93c	19.07a	5.30b	6.10b	55.00a	123.00c	32.93a	2.27c	4.53c	127.13b	2403.67b	145
SSC-2	26666.00a	1.03bc	20.20a	5.73b	6.47b	54.67a	123.67bc	35.37a	1.97c	4.87a	153.80a	2840.67b	172
SSC-3	26666.00a	1.17bc	19.37a	6.73b	5.97b	53.00a	122.33c	33.63a	2.27c	4.93a	136.63ab	3570.33a	216
HSC-4	24814.33b	0.93c	19.93a	6.03b	6.30b	55.67a	122.33c	33.60a	2.13c	4.80ab	136.47ab	2674.33b	161
CB-9	26295.67a	2.27a	18.80a	12.63a	7.10a	56.00a	129.33a	35.07a	6.80a	4.57bc	131.27ab	1655.67d	100
CB-10	26666.00a	1.43b	17.60b	8.30b	6.43b	53.00a	127.33ab	35.77a	5.23b	4.37c	115.47b	2066.67c	125
SE (±)	1475.99	0.127	0.269	0.809	0.108	0.506	0.745	1.010	0.475	0.052	4.174	153.096	----
Sign. level	NS	**	*	**	*	*	**	**	**	**	NS	**	------
CV (%)	3.11	20.03	4.26	21.11	5.37	3.37	1.22	7.23	14.59	2.05	9.77	9.58	----
LSD	1475.99	0.67	1.49	4.07	0.62	3.25	3.92	6.43	1.30	0.25	23.72	628.69	----

Table 2. Ginning characteristics and growth period of different cotton varieties

Varieties	GOT (%)	Lint yield		Seed index (g)	Lint index (g)	Fuzz grade (eye estimation)	Growth period (Days to 100% seed cotton harvest)
		(kg/ha)	as % of CB-9				
SSC-1	43.14 a	1045 d	166	9.83 c	7.63 b	7	198 b
SSC-2	43.37 a	1227 b	195	10.26 b	7.69 b	7	200 b
SSC-3	43.83 a	1404 a	223	10.37 b	7.99 a	6	2001 b
HSC-4	43.42 a	1175 c	186	10.25 b	8.05 a	8	199 b
CB-9	36.78 b	631.3 f	100	11.11 a	6.88 c	8	220 a
CB-10	37.82 b	817.3 e	128	9.40 d	5.86 d	7	218 a
CV(%)	1.86	0.34	-	2.02	2.14	-	2.81
LSD at 5%	1.397	6.514	-	0.3728	0.2877	-	8.955

Table 3. Fibre quality characteristics

Varieties	Staple length (mm)		Presley strength (PSI)	Micronaire value (mμ)	Uniformity ratio (%)
	50% span	2.5% span			
SSC-1	13.68 b	26.31 d	83.82 b	4.03 bc	52.88
SSC-2	12.73 c	27.40 c	82.61 c	3.87 c	45.86
SSC-3	13.70 b	29.87 b	86.21 a	4.33 ab	46.16
HSC-4	12.82 c	31.44 a	84.09 b	4.30 b	40.32
CB-9	14.47 a	26.10 d	82.72 c	4.60 a	56.78
CB-10	14.53 a	26.86 cd	82.66 c	4.13 bc	54.29
CV (%)	1.80	1.72	0.45	3.67	-
LSD at 5%	0.4456	0.8744	0.6904	0.2818	-

produced highest seed cotton yield and lint yield. Begum and Hossain (2011), Begum *et al*. (2005) and (Anonymous, 2009) revealed that the highest average weight of seed cotton enhances the highest yield of seed cotton in SR-5. Stoilova *et al*. (2003) also showed that seed cotton yield is positively correlated with boll weight. Highest number of bolls/plant also increased highest yield of seed cotton in SR-12 (Anonymous, 2006). The fuzz ranged from 6 to 8 and the highest grade was observed in HSC-4 and CB-9. The lowest fuzz grade was observed in SSC-3 (Table 2).

There were significant differences among the genotypes for growth period/days to 100% seed

cotton harvest (Table 2). It is one of the index of earliness. The hybrid varieties showed earliness for seed cotton harvesting compared to control varieties. About 100% seed cotton was picked up from the hybrid varieties within ± 200 days, whereas control varieties were harvest within ± 219 days. It was observed that the hybrid varieties could be completely picked up before nineteen days earlier than the control varieties. Similar findings were reported by Rahman *et al*. (2005) and Begum and Hossain (2011).

Fiber quality characteristics of the genotypes are presented in Table 3. If the uniformity ratio is increased, the fiber quality is also increased. Mainly fiber length is measured by 2.5% span length in mm. The highest 2.5% span length was obtained from the hybrid variety HSC-4 (31.44 mm) and the lowest was obtained from CB-9 (26.10 mm). Only hybrid variety HSC-4 produced the longest (2.5% span) staple (Table 3). Pressley strength index ranged from 82.61 to 86.21. The highest value was recorded in SSC-3 (86.21) and the lowest value was found in SSC-2 (82.61).

The micronaire values ranged from 4.o3 to 4.87 mμ (Table 3). Among the varieties, SSC-2 showed the lowest micronaire value (3.87 mμ) and control variety CB-9 showed the highest micronaire value (4.60 mμ). Considering seed cotton yield, the hybrid varieties performed better than the control varieties.

4. Conclusions

From the above results and discussion it can be concluded that, SSC-3 should better performance according to its high yield potential than the other genotypes. Earliness were present in the hybrid cottons due to seed cotton picking percentage, but control variety CB-9 produced the highest weight of seed cotton/boll, longest (50%) span length and best uniformity ratio.

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