



## ASSESSMENT OF *per se* PERFORMANCE OF PARENTS AND HYBRIDS FOR YIELD AND ITS COMPONENT TRAITS IN UPLAND COTTON (*GOSSYPIUM HIRSUTUM* L)

S. Vennila\*, P. Siva Ranjani, T. Balakrishnan and K.R. Saravanan

Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalainagar-608002, Cuddalore district, Tamil Nadu, India.

\*Author for correspondence : S.Vennila, pals.vens@yahoo.com

### Abstract

In Cotton, through line  $\times$  tester ( $7 \times 3$ ) analysis, the combination SVPR 4  $\times$  SURAJ was identified as the high yielder. It recorded maximum mean value for number of bolls per plant, average bolls per plant, lint index, seed cotton yield per plant. The hybrid SVPR 4  $\times$  SURAJ recorded higher mean value for days to 50 per cent flowering, number of bolls per plant, average bolls per plant, lint index, seed cotton yield per plant and the hybrid MCU 13  $\times$  SURAJ recorded highest mean value for plant height at maturity, number of sympodial branches per plant, seed index and the hybrid MCU 13  $\times$  SVPR 3 for number of monopodial branches per plant.

**Keywords:** Cotton, line  $\times$  tester, hybrids, *per se* performance, yield.

### Introduction

*Gossypium hirsutum* L. is a new world species. The centre of variability for this species is Central America. It comprises a large number of varieties or races. Only three races - punctatum, marie galante and latifoliam - extend beyond Central America. It is of great importance agriculturally, as it comprises the Upland cotton, which has spread over vast areas in America, Asia and Africa. (Anonymous, 2017).

The types of cotton belonging to this race constitute the bulk of long staple cottons grown at present in India. The fibers are white with a considerable range in staple length, from  $5/8$  to  $1\frac{3}{8}$  inch. The diversity of cotton cultivars and cotton agro climatic zones in India is considerably larger as compared to other major cotton growing countries in the world. (Monicashree *et al.*, 2017). The five leading exporters of cotton in 2019 are India, The United States, China, Brazil, and Pakistan. Cotton is providing livelihood directly and indirectly to over 60 million people and accounting for about 16 per cent of India's export earnings. Hybrid have occupied nearly 90% area of cotton cultivated in India. (Pushpam *et al.*, 2015).

Cotton is a principle fiber crop of global importance and has high commercial value which provides raw material in the form of lint to the textile industry. India remains the leading country in terms of area under cotton cultivation and raw cotton production in the world. Cotton is harvested as seed cotton, which is ginned to separate the seed and lint.

The long lint fibres are further processed by spinning to produce yarn that is knitted or woven into fabrics (Sivia *et al.*, 2017).

As per CAB estimate, India got 1st place in the world in cotton acreage with around 126.07 lakh hectares under cotton cultivation i.e. around 37% of the World area of 336.3 lakh hectares. Approximately 62% of India's Cotton is produced on rain-fed areas and 38% on irrigated lands. In terms of productivity, India ranks poorly compared to USA (955 kgs/ha) & China (1764 Kg/ha). During 2018-19 ( $P^*$ ), India's Productivity is estimated at 454.43 kg/ha and Cotton production was 337 lakh bales of 170 kg. In the year 2018 - 19, Gujarat, Maharashtra and Telangana were the major cotton growing states covering around 70% (87.4 lakh hectare) in area under cotton cultivation and 63% (211 lakh

bales) of cotton production with Yield 1301.26 Kgs/hectare in India. (CAB, 2019).

In Tamil Nadu, cotton consumption is increasing day by day, beyond 100 lakhs bales per annum while our production remains static i.e. 6 lakhs bales per annum (in lakh bales of 170 kg). The area of cotton has declined from 2.5 lakhs ha (1998-99) to 1.48 lakhs ha (Cotton Statistics & News 2018-19). There was significant increase (22%) in area under cotton estimated in South zone this year.

(Annual Report 2017-2018). The selection of parents for hybridization programme is relatively easy in case of inherited characters which are controlled by a few genes. But in case of complex traits like yield and its components which are controlled by many genes, choice of desirable parents is a serious problem. Gilbert (1958) suggested that the parents with high order of mean expression would be much useful in producing better genotypes. Amarnath and Subramaniyam (1992) suggested that selection of parents for a breeding programme could be done based on *per se* performance as well as combining ability. Hence in the present study, these two parameters were taken into consideration for choice of desirable parents.

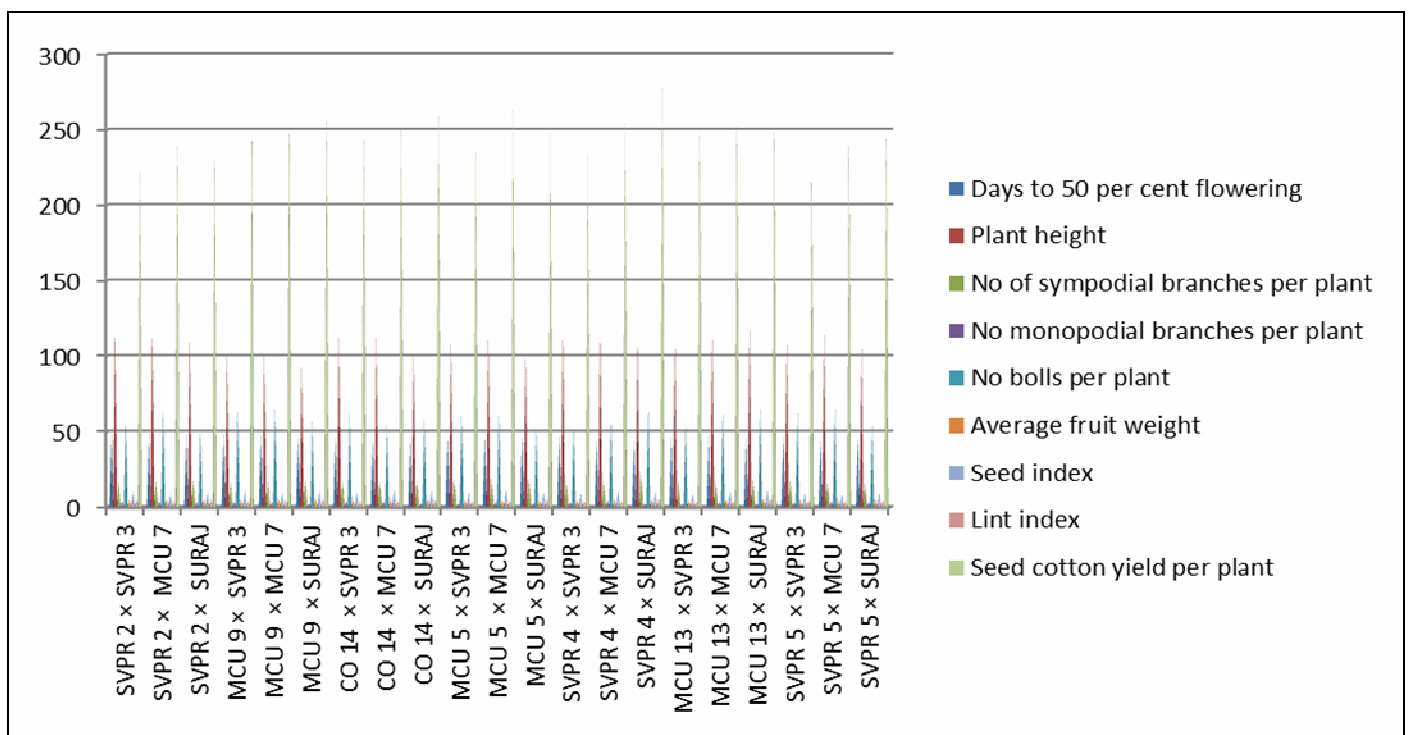
### MATERIALS AND METHODS

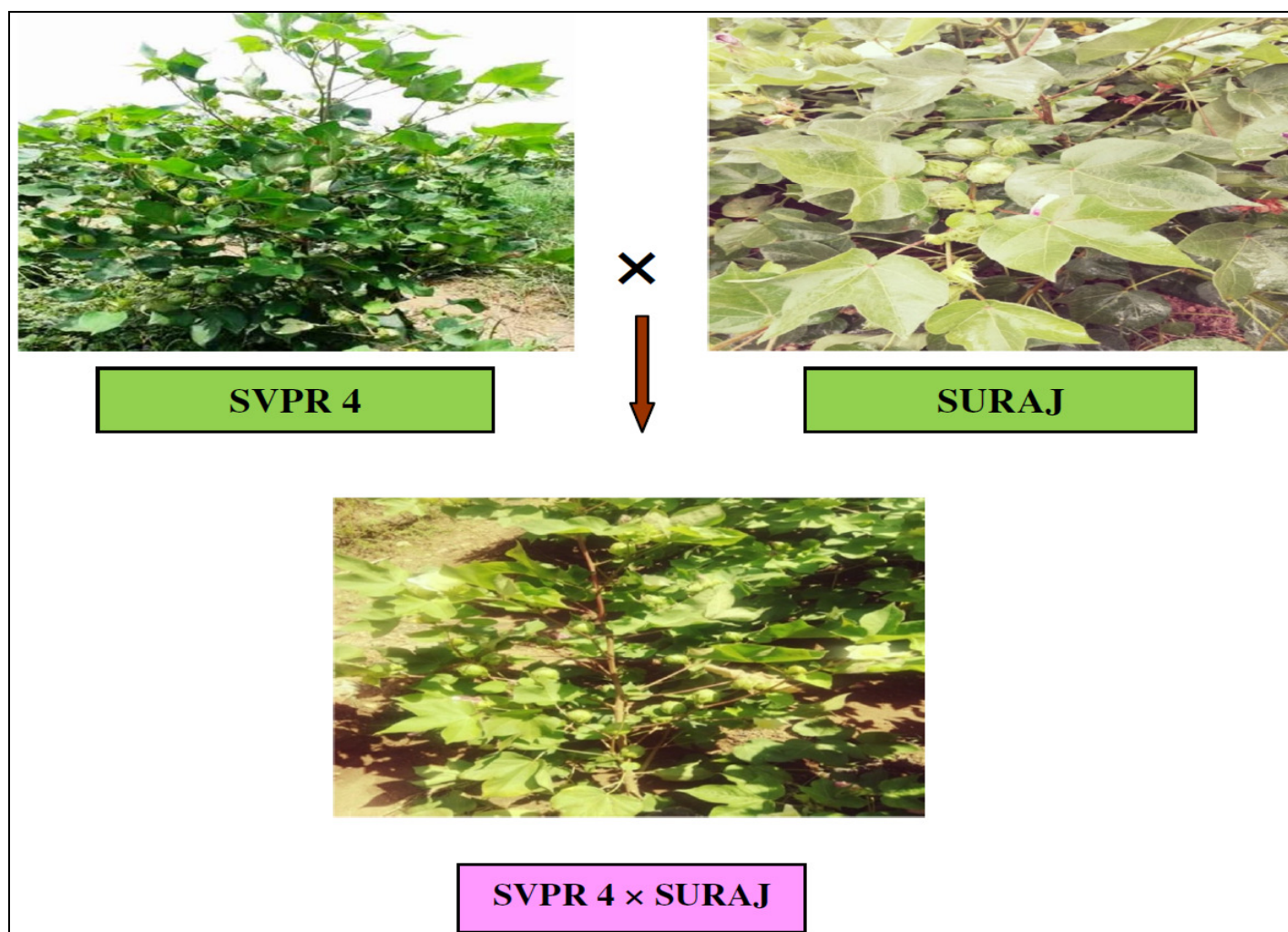
The present investigation was carried out at the Plant Breeding farm, Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalainagar during November to March (rabi season) 2019-2020.

Twenty one  $F_1$  hybrids were obtained by crossing 7 lines and 3 testers adopting L $\times$ T mating design. The hybrids along with the parents were raised in Randomized block design with three replications. Cultural and agronomic practices were followed as per the standard recommendations and need based plant protection measures were taken up to maintain healthy crop stand. The data recorded in five randomly selected plants in each replication for yield and its component traits were subjected to statistical analysis. The mean values were computed for each genotype over three replication for each cross combinations. The variances and the corresponding standard errors of the mean were computed from the deviations of the individual values (Panse and Sukhatme, 1978).

**Table 1:** Mean performance of cotton genotypes and their hybrids

SL NO	Characters	Days to 50 per cent flowering	Plant height at maturity	Number of sympodial branches per plant	Number of monopodial branches per plant	Number of bolls per plant	Average boll weight per plant	Seed index	Lint index	Seed cotton yield per plant
	Treatments									
1.	SVPR 2	51.83	126.07	17.30	2.87	50.67	4.53	8.47	5.23	222.67
2.	MCU 9	50.83	86.30	16.40	2.87	51.33	4.87	10.63	5.23	254.67
3.	CO 14	48.50	107.57	15.60	3.97	58.00	4.87	8.50	4.27	231.33
4.	MCU 5	52.00	110.27	15.60	2.83	63.67	5.10	8.47	4.13	230.00
5.	SVPR 4	51.83	125.07	17.30	4.17	56.33	5.00	9.70	5.30	265.00
6.	MCU 13	48.83	125.77	17.37	4.30	60.00	4.77	10.90	4.43	257.00
7.	SVPR 5	48.50	110.63	15.50	4.50	59.33	4.33	8.40	4.10	221.00
8.	SVPR 3	53.50	113.70	17.87	2.83	66.33	4.53	10.13	5.00	250.67
9.	MCU 7	48.83	106.70	16.30	4.93	51.00	5.17	8.57	4.23	260.33
10.	SURAJ	48.67	119.30	18.07	2.80	66.67	5.37	10.20	5.10	292.33
11.	SVPR 2 × SVPR 3	49.17	121.80	17.63	3.60	58.00	4.73	10.37	5.70	233.67
12.	SVPR 2 × MCU 7	48.67	119.27	18.38	4.20	66.67	5.23	9.30	4.70	254.67
13.	SVPR 2 × SURAJ	47.83	115.00	18.83	3.50	51.67	5.33	10.37	5.80	250.00
14.	MCU 9 × SVPR 3	48.67	103.53	17.50	4.17	65.33	4.60	11.40	4.50	266.00
15.	MCU 9 × MCU 7	48.17	102.73	17.83	3.30	66.00	5.10	10.13	4.63	267.67
16.	MCU 9 × SURAJ	47.77	93.70	18.80	2.30	56.67	5.20	11.40	5.73	273.33
17.	CO 14 × SVPR 3	47.67	112.63	17.07	3.50	63.00	4.50	10.13	4.30	257.33
18.	CO 14 × MCU 7	46.33	113.00	16.97	3.93	55.67	4.97	11.90	4.70	260.33
19.	CO 14 × SURAJ	46.17	103.77	17.63	2.20	59.00	5.40	11.47	5.57	267.00
20.	MCU 5 × SVPR 3	48.33	111.57	17.73	2.30	62.67	4.47	10.13	4.53	238.67
21.	MCU 5 × MCU 7	48.33	116.07	18.30	3.63	63.67	4.83	12.07	4.20	264.33
22.	MCU 5 × SURAJ	48.67	104.37	18.83	2.30	53.33	4.83	10.23	5.70	250.00
23.	SVPR 4 × SVPR 3	48.67	119.27	17.63	3.50	55.00	4.67	9.37	4.30	237.00
24.	SVPR 4 × MCU 7	46.17	118.90	17.20	4.17	60.00	5.10	11.13	4.30	261.33
25.	SVPR 4 × SURAJ	45.17	115.13	21.97	2.07	68.00	5.77	10.63	6.10	289.67
26.	MCU 13 × SVPR 3	47.67	112.50	17.83	2.60	56.00	4.60	9.47	4.20	260.67
27.	MCU 13 × MCU 7	47.67	117.40	17.63	3.60	65.00	4.90	10.80	4.30	270.33
28.	MCU 13 × SURAJ	46.33	121.83	19.17	2.07	67.67	5.17	12.20	5.80	270.67
29.	SVPR 5 × SVPR 3	48.00	110.90	18.27	3.37	63.67	4.30	9.57	4.40	236.33
30.	SVPR 5 × MCU 7	46.17	116.20	16.97	4.07	65.67	4.40	8.83	4.40	258.00
31.	SVPR 5 × SURAJ	47.33	105.53	16.30	3.40	53.67	4.60	10.00	4.70	259.67

**Fig. 1:** Graphical representation of Mean values of the hybrids



**Plate 1 : Best identified parents and its cross**

## Results and Discussion

Data obtained on yield and quality traits of 21 hybrids were evaluated along with their parents in presented Table 1. Significant difference were detected among the parents and hybrids with respect to all the characters studied (Fig. 1). The days to 50 per cent flowering ranged from 48.50 days (SVPR 5) to 52.00 days (MCU 5) in lines and among the testers, it ranged from 48.67 days (SURAJ) to 53.50 days (SVPR 3). The highest mean value was recorded by the hybrid SVPR 2 × SVPR 3 (49.17 days).

The plant height is an important trait by which growth and vigour of plants are measured. Among the parents, the plant height for lines ranged from 126.07 cm (SVPR 2) to 119.30 cm (MCU 13) and among the testers, it ranged from 106.70 cm (SURAJ) to 119.30 cm (MCU 7). The highest mean value was recorded by the hybrid MCU 13 × SURAJ (121.83 cm).

The number of sympodial branches per plant ranged from 15.50 (SVPR 5) to 17.37 (MCU 13) among the lines and 16.30 (MCU 7) to 18.07 (SURAJ) among the testers. The maximum number of sympodial branches per plant was observed in the MCU 13 × SURAJ (21.97). The number of monopodial branches per plant ranged from 2.83 cm (MCU 5) to 4.50 cm (SVPR 5) among the lines and 2.80 cm (SURAJ) to 4.93 cm (MCU 7) among the testers. The maximum number of monopodial branches per plant was observed in the hybrid 4.20 cm (SVPR 2 × MCU 7).

The number of bolls per plant ranged from 50.67 (SVPR 2) to 63.67 (SVPR 4) among the lines and 51.00 (MCU 7) to 66.67 (SURAJ) among the testers. The maximum and minimum number of bolls per plant was observed in the hybrid SVPR 4 × SURAJ (68.00) and SVPR 2 × SURAJ (51.67) respectively.

The average boll weight per plant ranged from 4.33 gm (SVPR 5) to 5.10 gm (SVPR 4) among the lines and 4.53 gm (SVPR 3) to 5.37 gm (SURAJ) among the testers. The mean value of hybrids ranged from 4.30 gm (SVPR 5 × SVPR 3) to 5.77 gm (SVPR 4 × SURAJ).

The seed index ranged from 8.40 gm (SVPR 5) to 10.90 gm (MCU 13) among the lines and 8.57 gm (MCU 7) to 10.20 gm (SURAJ) among the testers. The maximum and minimum seed index was observed in the hybrid SVPR 5 × MCU 7 (8.83 gm) and MCU 13 × SURAJ (12.20 gm).

The lint index ranged from 4.10 gm (SVPR 5) to 5.30 gm (SVPR 4) among the lines and 4.25 gm (MCU 7) to 5.10 gm (SURAJ) among the testers. The mean value of hybrids ranged from 4.20 gm (MCU 5 × MCU 7) & (MCU 13 × SVPR 3) to 6.10 gm (SVPR 4 × SURAJ).

The seed cotton yield per plant ranged from 221.00 gm (SVPR 5) to 265.00 gm (SVPR 4) among the lines and 250.67 gm (SVPR 3) to 292.33 gm (SURAJ) among the testers. The highest mean value was recorded by the hybrids 289.67 gm (SVPR 4 × SURAJ) while the lowest was recorded in 233.67 gm (SVPR 2 × SVPR 3).

Singh *et al.*, (1983) opined that the parents with high order of mean performance would be greater significant in breeding programmes. Therefore, the parents were assessed for *per se* performance in this study. Among the lines, SVPR 4 was outstanding with high *per se* values for yield and its components traits like number of bolls per plant, average boll weight per plant, seed index, seed cotton yield per plant. The line *viz.*, MCU 13 was also worthy with high *per se* for plant height and lint index. Among the testers, SURAJ recorded high *per se* performance for the yield attributing characters like number of bolls per plant, average boll weight per plant, lint index, seed cotton yield per plant. The other tester *viz.*, SVPR 2 also showed high *per se* performance for number of sympodial branches per plant and seed index. This showed that the above mentioned parents might be useful for the incorporation of the respective traits in hybridization programme.

The mean performance is the primary criterion for evaluation of a hybrid. Kadambavanasundaram (1980) reported that *per se* performance of hybrid appeared to be the useful index for judging the hybrids. The cross combination SVPR 4 × SURAJ is adjudged as the best for the traits *viz.*, days to fifty per cent flowering, number of bolls per plant, average boll weight per plant, lint index and seed cotton yield per plant (Plate 1). The best performing hybrid SVPR 4 × SURAJ from the combination in which both the parents of a cross had higher mean value when compared to other for most of traits studied.

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