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Research Article

Cotton hybrid SVPR 1 (TSHH 0629) – A high yielding long staple intra *hirsutum* cotton hybrid for southern zone of India and winter/summer irrigated tracts of Tamil Nadu

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Abstract
Cotton Hybrid SVPR 1 is a promising long staple intra *hirsutum* hybrid developed at Cotton Research Station, Srivilliputtur. It was identified by the Central Varietal Identification Committee in the year of 2015 and notified in 2016 for *kharif* season of southern zone of India for irrigated condition and winter/summer irrigated tracts of Tamil Nadu. It is a cross between cultures TSH 311 and TSH 306. Cotton Hybrid SVPR 1 is open type in architecture with determinant growth habit and maturing in 165 days. It has recorded a mean seed cotton yield of 2216 kg/ha which is 16.4 % increase over the check Bunny (1904 kg/ha). This hybrid comes under the long staple category with 2.5% span length of 28.5 mm, fibre strength of 21.9 g/tex and micronaire value of 4.0. It can spin to 40's counts. It is moderately resistant to leaf hopper, Bacterial Leaf Blight and Alternaria Leaf Spot. Hence, the cotton hybrid SVPR 1 (TSHH 0629) was released for the winter/summer irrigated areas of Tamil Nadu and Kharif season of South Zone of India

Key words
Cotton hybrid, long staple, intra *hirsutum*, 40's counts

Introduction

Cotton is an important commercial crop which provides raw material in the form of lint to the textile industry besides, as an important source of edible oil throughout the world. India is the pioneer country for the cultivation of hybrids on commercial scale. Tamil Nadu spinning mill lint consumption increased progressively and reached beyond 100 lakhs bales per annum. However, our production level has remained static, *i.e* 5 lakhs bales/annum (1998-2010) and further declined to 3.8 lakhs bales in the year 2016. The area of cotton also declined from 5.0 lakhs ha (1998-99) to 1.47 lakhs ha (2015-16). None of the Bt. Hybrids released sofar by private firms could not fit to grow all four different seasons namely, winter irrigated, summer irrigated, rice fallow and winter rainfed season. The obvious reason is in summer, the leaf hopper incidence will be high and the night temperature is more than 27° C which affect the seed cotton yield to a greater extent. Therefore, none of the Bt. Cotton hybrids excel over the performance of ruling varieties like SVPR 2 and SVPR 4 under summer irrigated situation. Hence, there is need for location specific cotton hybrid for summer irrigated conditions to enhance the yield from 15-20q/ha to more than 20-30q/ha. The phenomenon's of hybrid vigour in cotton is being exploited successfully since, the release of commercial intra hirsutum and inter specific hybrids. Thus research has initiated to develop hybrid and has resulted in the release of cotton hybrid SVPR 1.

Materials and Methods

None of the intra *hirsutum* hybrids has surpassed consistently over the ruling varieties like SVPR 2 under summer irrigated situation and MCU 7 and SVPR 3 in rice fallow situation. Hence to overcome the above constrains, a hybrid development project was initiated and from which, a high yielding genotype TSH 311 was identified as base parent and a high yielding leafhopper resistant and drought tolerant genotype TSH 306 was identified as donor parent in the development of the above hybrid. Based on the consistent performance in station yield trials (Table 1), the cotton hybrid TSHH 0629 was selected for large scale testing and forwarded to multi location trials for testing in three research station of TNAU during summer 2010. The performance of the hybrid TSHH 0629 was evaluated in coordinated varietal trials of AICCIP from 2011 to 2013. Adoptive Research Trials (ART) was also conducted over 64 locations during 2011, 2012 under summer irrigated conditions in Tamil Nadu.

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Results and Discussion

The intra *hirsutum* cotton hybrid TSHH 0629 was tested at Cotton Research Station, Srivilliputtur from the year 2007-2012. The mean of six yield trials conducted over six years indicated consistent superiority of the hybrid over the check Bunny. It has recorded an average seed cotton yield of 2353 kg/ha as against for Bunny (2056 kg/ha), accounting 14.5% increase over check Bunny (Table 1).

In All India Coordinated Cotton Improvement Project (AICCIP) trials, the hybrid TSHH 0629 was tested in Br. 05 (a) NT, in Br. 05 (a) ZT and Br. 05 (a) ZT during 2011-2013. The overall performance (2011-2014) of the hybrid TSHH 0629 revealed that it recorded a mean seed cotton yield of 2275 kg/ha as against zonal check Bunny (1828 kg/ha). The increase in kapas yield was 24.5 % over check. (Table 2).

During summer 2010, the intra *hirsutum* hybrid TSHH 0629 was tested in three TNAU research station trials (MLT) in which TSHH 0629 registered an average seed cotton yield of 2262 kg/ha over the check Bunny (1981 kg/ha). The yield increase of TSHH 0629 was 14.2 % over Bunny (Table 3).

In Adaptive Research Trials at 64 locations conducted during summer 2011 and 2012 revealed that the hybrid TSHH 0629 (1975 kg/ha) recorded its superiority over Bunny (1752 kg/ha) with yield increase of 12.7 % (Table 4).

Besides its high seed cotton yield, it possess notable lint yield (752 kg/ha) than check Bunny (637 kg/ha). This hybrid comes under the long staple category with the 2.5% span length of 28.5 mm, fibre strength of 21.2 g/tex and micronaire value of 4.0. It can spin to 40's counts. (Table 5a & b). The hybrid TSHH 0629 has registered Moderate Resistance to leafhopper in South Zone (Guntur, Raichur, Coimbatore and Srivilliputtur), with Mean Leaf Hopper Injury Grade of 2.11, whereas, DCH 32 (Susceptible Check to leafhopper) recorded mean Injury Grade of 3.71 and zonal check recorded Injury Grade of 2.44. This hybrid is also registered moderately resistant to Bacterial Leaf Blight and Alternaria Leaf Spot (Table 6 and 7).

Morphological descriptions of TSHH 0629

- Plant is bushy with hairy stem. Boll is medium, oblong with pointed tip and having 4-5 locules.
- Light yellow petal with cream pollen

The overall performance revealed that the cotton hybrid TSHH 0629 was superior over the check Bunny with an average seed cotton yield of 2216 kg/ha against 1904 kg/ha of Bunny. The yield increase of TSHH 0629 is 16.4% over Bunny (Table 8). It has recorded the maximum yield potential of 3435 kg kapas per hectare at Gopi, Erode district in the Adoptive Research Trials and 3105 kg/ha at Rahuri in the National trial under AICCIP programme. Based on the above desirable features the intra *hirsutum* cotton hybrid TSHH 0629 was released as Cotton Hybrid SVPR 1 by the Central Variety Release Committee (CVRC) during 2015 for irrigated areas of Andhra Pradesh, Telangana and Karnadaka in kharif season and winter irrigated and summer irrigated conditions in Tamil Nadu and notified during 2016 (Notification No: S.O. 3540 (E) dated 22.11.2016).

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The other morphological and DUS characters for TSHH 0629 & Bunny

S. No.	Characteristics	TSHH 0629
1.	Hypocotyl: Pigmentation	Absent
2.	Leaf : Colour	Green
3.	Leaf : Hairiness	Medium
4.	Leaf : Appearance	Flat
5.	Leaf : Gossypol glands	Present
6.	Leaf : Nectaries	Present
7.	Leaf : Petiole pigmentation	Absent
8.	Leaf : Shape	Normal
9.	Plant : Stem hairiness	Medium
10.	Plant : Stem pigmentation	Absent
11.	Plant : Height (cm)	Medium Tall (110-120 cm)
12.	Plant : Growth habit	Spreading
13.	Bract : Type	Normal
14.	Flower : Time of flowering (50% of plants with at least one open flower)	Medium
15.	Flower : Petal colour	Light Yellow
16.	Flower : Petal spot	Absent
17.	Flower : Stigma	Protruded
18.	Flower : Anther filament colouration	Absent
19.	Flower : Pollen colour	Cream
20.	Flower : Male sterility (Only for A and B lines)	-
21.	Boll : Bearing habit	Solitary
22.	Boll : Colour	Green
23.	Boll : Shape (Longitudinal section)	Round to Oblong
24.	Boll : Surface	Smooth
25.	Boll : Prominence of tip	Pointed
26.	Boll : Opening	Open
27.	Boll : Weight of seed cotton / boll (g)	Medium (4.3)
28.	Seed : Fuzz	Dense
29.	Seed : Fuzz colour	White
30.	Seed : Index (100 seed wt in gram)	Medium (8.1 g)
31.	Ginning (%)	High (35.8 %)
32.	Fibre : Colour	White
33.	Fibre : Length (2.5 % span length) (mm)	Long (28.5 mm)
34.	Fibre : Strength (g/tex)	Medium (21.9 g/tex)
35.	Fibre : Fineness (Micronaire value)	Medium (4.0)
36.	Fibre : Uniformity (%)	Good (47 %)
37.	Fibre : Maturity (%)	Good (73 %)

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Table 1. Performance of TSHH 0629 at Cotton Research Station, Srivilliputtur (2007-12)

S.No.	Name of the Trial	Year	Kapas Yield (Kg/ha)			% over Bunny
			TSHH 0629	Bunny	SVPR 2	
1.	PHT I	Summer 2007	1957	1814	1450	+7.8
2.	PHT I	Summer 2008	1711	1525	1550	+12.2
3.	PHT I	Summer 2009	3003	2480	1555	+20.7
4.	AHT I	Summer 2010	2482	2254	1827	+10.0
5.	AHT I	Summer 2011	2381	2030	1737	+22.9
6.	AHT	Summer 2012	2581	2230	1880	+15.7
Over all mean			**2353**	**2056**	**1667**	**+14.4**

PHT- Preliminary Hybrid Trial ; AHT - Advanced Hybrid Trial

Table 2. Performance of TSHH 0629 in All India Coordinate Cotton Improvement Project trials

Name of proposed variety: TSHH 0629 Adaptability Zone: South Zone
Production condition: Irrigated

Particulars	Year of Testing	No. of Locations	Hybrid (TSHH 0629)	Hybrid (Bunny)	LC (DHH 11/ LAHH 5/ Mallika)
Mean Yield (kg/ha)					
I.(a) South Zone Mean	I year (2011-12) NT	**6**	**2360**	**1989**	**-**
II. (a) South Zone Mean	II year (2012-13) ZT	**8**	**2122**	**1638**	**1609**
III. (a) South Zone Mean	III year (2013-14) ZT	**7**	**2377**	**1910**	**1784**
	Weighted mean		**2275**	**1828**	**1691**
Percentage increase/decrease over the checks and qualifying varieties					
I.(a) South Zone Mean	I year (2011-12) NT	**6**		**+18.7**	**-**
II. (a) South Zone Mean	II year (2012-13) ZT	**8**		**+29.5**	**+31.9**
III. (a) South Zone Mean	III year (2013-14) ZT	**7**		**+24.5**	**+33.2**
	Weighted mean			**+24.5**	**+34.5**
Frequency in the group (pooled for 3 years)			**10/21**	**10/21**	**6/15**

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Table 3. MLT. Performance of TSHH 0629 in Research Stations Trials of TNAU, conducted during summer 2010

S.No.	Entry	Duration (days)	Cotton Research Station, Srivilliputtur	TRRI, Aduthurai	PAJANCOA & RI, Karaikal	Average Seed cotton yield (kg/ha)	% over Bunny
1.	TSHH 0629	165	2540	2122	2125	2262	+14.2
2.	Bunny	180	2210	1809	1925	1981	-

Table 4. Performance of TSHH 0629 in Adaptive Research Trial conducted during summer 2011 and 2012

ART 02/2010-11				
District/Location	**TSHH 0629**	**Bunny**	**SVPR 2**	**% over Bunny**
Madurai	1534	1228	1166	+24.9
Salem	1979	2083	1727	-5.0
Tuticorin	1600	1490	1198	+7.4
Trichy	1497	1305	1275	+14.7
Erode	3231	2486	2550	+30.0
Virudhunagar	2309	2080	1849	+11.0
Dindigul	2754	2214	2250	+24.4
Nagapattinam	3000	2334	2292	+28.5
ART 06/2011-12				
Salem	2099	1949	-	+7.7
Virudhunagar	1454	1365	-	+6.5
Madurai	1219	1197	-	+1.9
Tirunelveli	1720	1781	-	-3.4
Trichy	1276	1270	-	+0.4
Overall Mean over 64 locations	**1975**	**1752**	**-**	**+12.7**

(TSHH 0629 recorded higher yield in 47 locations out of 64 locations evaluated)

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Table 5. a. Fibre and Spinning test of TSHH 0629

Quality Characteristics	Years	Hybrid (TSHH 0629)	Hybrid (Bunny)
GOT (%)	2011-12	36.4	34.1
	2012-13	35.5	35.3
	2013-14	35.6	33.2
	Mean	**35.8**	**34.2**
2.5% Span Length (mm)	2011-12	28.7	31.7
	2012-13	27.4	30.5
	2013-14	27.7	31.5
	2012*	30.2	29.1
	Mean	**28.5**	**30.7**
Micronaire value	2011-12	4.2	3.6
	2012-13	4.1	3.5
	2013-14	4.0	3.7
	2012*	3.6	3.7
	Mean	**4.0**	**3.6**
Bundle Strength (g/tex)	2011-12	20.3	23.6
	2012-13	21.5	23.8
	2013-14	20.9	22.7
	2012*	21.9	20.7
	Mean	**21.2**	**23.4**
Uniformity Ratio (%)	2011-12	46	45
	2012-13	46	45
	2013-14	48	46
	2012*	47	48
	Mean	**47**	**46**

Table 5.b. Full scale spinning test report of TSHH 0629 conducted at CIRCOT, Mumbai during 2012 and 2015

Variety	2.5% SL	UR	MIC	Strength (g / tex)	E%	CSP
TSHH 0629*	30.2	47	3.6	21.9	7.1	**2410 (50s)** **2022 (60s)**
TSHH 0629**	27.4	49	4.0	20.7	5.0	**1994 (50s)** **2138 (40s)**
Mean	**28.2**	**48**	**3.8**	**21.3**	**6.1**	

Standard CSP for 40 s count: 2208; Standard CSP for 50 s count: 2300; Standard CSP for 60 s count: 2392

AICCIP Annual Report 2011-12, 2012-13, 2013-14
*Fibre and Spinning test report No.52/12 dated 03.10.2012 of the Director, CIRCOT, Mumbai
**Technological Report of CIRCOT, Mumbai for Annual Group Meet 2014-15 held on 8-10th April 2015 at TNAU, Coimbatore

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Table 6. Reaction of TSHH 0629 to leafhopper under field condition (2011-13)

Location	Insect Pest	Item	Year	TSHH 0629	Check Hybrid (DCH 32)	ZC (Bunny/ Mallika)
Srivilliputtur	Leafhopper	Injury Grade	2011	2	4	2
			2012	1	4	3
			2013	2	3	2
TNAU,CBE	Leafhopper	Injury Grade	2011	-	-	-
			2012	2	-	2
			2013	3	4	2
Raichur	Leafhopper	Injury Grade	2011	-	-	-
			2012	2	-	4
			2013	3	-	1
Lam, Guntur	Leafhopper	Injury Grade	2011	-	4	-
			2012	2	4	3
			2013	2	3	3
		Mean IG		**2.11**	**3.71**	**2.44**
Srivilliputtur	Leafhopper	Population (No./3leaves)	2011	3.05	8.90	2.10
			2012	1.00	8.33	4.33
			2013	7.42	13.55	5.83
TNAU,CBE	Leafhopper	Population	2011	-	-	-
			2012	3.3	-	2.2
			2013	3.2	-	2.7
Raichur	Leafhopper	Population	2011	-	-	-
			2012	5.33	-	6
			2013	5.6	7	3.6
Lam, Guntur	Leafhopper	Population	2011	-	14.1	-
			2012	9.1	24.6	8.5
			2013	6.3	14	6.2
		Mean population		**5.16**	**12.93**	**4.61**

Table 7. Reaction of TSHH 0629 to major diseases under field condition (2011-13)

Diseases	Location	Year	Hybrid (TSHH 0629)	Check Hybrid (Bunny)
Bacterial Leaf Blight	Guntur	2011	1	1
Alternaria Leaf Spot	Guntur	2011	2	3
		2012	2	2
		2013	3	3
	Coimbatore	2011	-	-
		2012	0.0	0.0
		2013	2	0.0

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Table 8. Overall performance of cotton culture TSHH 0629 in different trials (2007-2013)

S.No	Particulars	No. of Trials	Higher Yield		Kapas Yield (kg/ha)		% over Bunny
			TSHH 0629	Bunny	TSHH 0629	Bunny	
1.	Station Trial (2007-12) (Cotton Research Station, Srivilliputtur)	6	6	-	2353	2056	+14.4
2.	TNAU, Research Station Trials (MLT) - Summer 2010	3	3	-	2262	1981	+14.2
3.	All India Co-ordinated Cotton Improvement Project trials (2011-2013)	21	10	10	2275	1828	+24.5
4.	Adoptive Research Trials (Summer 2011,12)	64	47	16	1975	1752	+12.7
	Over all Mean	**94**	**66**	**36**	**2216**	**1904**	**(+) 16.4**