

## STUDIES ON HETEROSIS BREEDING IN CHEWING TOBACCO (*NICOTIANA TABACUM* L.)

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**Development of hybrid varieties will be one of the approaches in crop improvement programme and in this direction eleven chewing tobacco hybrids developed utilizing the popular chewing tobacco cultivars were evaluated in a replicated trial along with Bhagyalakshmi, Vairam and Abirami as checks for two consecutive years (2005-07), revealed that seven hybrids recorded significantly higher whole leaf yields ranging from 2514 to 2977 kg/ha over the best check Bhagyalakshmi. Five hybrids viz., PV-7 x Abirami, VD-1 x Abirami, Vairam x Abirami, Abirami x KV-1 and ms Meenakshi x GT-6 recorded significantly higher total leaf yields ranging from 3590 to 3914 kg/ha compared to the best check Abirami with the standard heterosis ranging from 9.81 to 19.73%. Variability in respect of yield component attributes such as leaf length, leaf width, stem girth etc., were also significant. In the bulk evaluation of the five promising hybrids (VDH-1 to VDH-5) selected from the said trial during 2006-09 in the out station centers, the hybrid Abirami x KV-1 (VDH-3) uniformly performed well registering highest mean cured leaf yield of 3962 kg/ha with an increase of 13.3% against the best check Abirami. It has got good chewing and chemical quality characters, less susceptibility to TMV, leaf curl, black shank, caterpillar and aphid attack.**

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### INTRODUCTION

Chewing tobacco is cultivated in about 30,000 acres in Tamil Nadu. Ilyas Ahmed and Rao (1985) summarized genetic improvement of chewing tobacco in Tamil Nadu. High yielding varieties Bhagyalakshmi, Meenakshi (Moses *et al.*, 1992) and Abirami developed through pedigree method has given good dividends to the tobacco farmers. Further improvement in chewing tobacco has been envisaged through heterosis breeding.

### MATERIALS AND METHODS

Eleven tobacco hybrids made during 2005-06 involving diverse genotypes *viz.*, four sun-cured (Bhagyalakshmi, Abirami, VR-2 and VTK-1), two pit-cured (VD-1 and Vairam ) and one smoke-cured (PV- 7) chewing tobacco cultivars as well as two cigar filler cultivars (KV-1 and Comstock Spanish), one Gujarat chewing variety (GT-6) and a male sterile derivative (ms Meenakshi) were evaluated along with standard checks Bhagyalakshmi, Abirami and Vairam for two years from 2005-2006 to 2006-2007 in a randomized block design with four replications. The plot size was 36 plants with 75 x 75 cm spacing and recommended crop husbandry practices were followed. Data on whole leaf and total leaf yield on plot basis were subjected to statistical analysis for individual seasons and on pooled basis. Morphological characters like plant height, leaf length, leaf width, internodal length, stem girth at topping and harvest and number of leaves at topping stage were also recorded on five random plants and mean data plot-wise for all the characters were subjected to statistical analysis.

Five promising hybrids identical to chewing tobacco types (broad leaf) *viz.*, PV-7 x Abirami (VDH-1), Vairam x Abirami (VDH-2), Abirami x KV-1 (VDH-3), Bhagyalakshmi x VD-1 (VDH-4) and Bhagyalakshmi x KV-1 (VDH-5) selected from the above trial were evaluated during 2007-2008 and 2008-2009 in five out-station centers as well as at CTRI Research Station, Veda sandur in bulk plots of 250 plants each along with check varieties Bhagyalakshmi and Abirami. Cured leaf weight was recorded at each center. The quality

parameters such as taste, aroma, pungency, elasticity and body were recorded. The chemical characters nicotine and chlorides were analyzed by standard methods (Harvey *et al.*, 1969; Hanumantharao *et al.*, 1981)

## RESULTS AND DISCUSSION

### Replicated evaluation

It is inferred from the combined analysis of data over two seasons (Table 1 & 2) revealed that differences among hybrids and the checks were significant in respect of both whole leaf and total leaf yields. Eight of the hybrids, Bhagyalakshmi x Abirami, PV-7 x Abirami, VD-1 x Abirami, VR-2 x Abirami, Vairam x Abirami, Abirami x KV-1, Bhayalakshmi x VD-1 and ms Meenakshi x GT-6 recorded significantly higher whole leaf yields ranging from 2514 to 2977 kg/ha over the best

check Bhagyalakshmi. Five hybrids PV-7 x Abirami, VD-1 x Abirami, Vairam x Abirami, Abirami x KV-1 and ms Meenakshix x GT-6 recorded significantly higher total leaf yields ranging from 3590 to 3914 kg/ha compared to 3269 kg/ha of the best check Abirami with the standard heterosis ranging from 9.8 to 19.7%. Positive heterosis was reported earlier by Ramana Rao *et al.* (1993) in FCV tobacco.

Variability in respect of yield component attributes such as leaf length, leaf width, internode length and stem girth both at topping and at harvest stages as well as plant height and number of leaves per plant at topping stage were also significant. It is interesting to note that four out of five hybrids showing appreciable standard heterosis had the high yielding chewing tobacco variety Abirami as one of the parents.

**Table 1: Morphological characters of chewing tobacco hybrids at topping (2005-2007)**

S. No	Hybrid /Variety	Plant height (cm)	No. of leaves per plant	Leaf length (cm)	Leaf width (cm)	Inter node length (cm)	Stem girth (cm)
1.	F1-1 (BL x Abirami)	131.2	21.8	69.7	42.1	5.8	9.3
2.	F1-2 (PV7 x Abirami)	140.6	24.0	69.5	42.2	5.4	8.6
3.	F1.3 (VD1 x Abirami)	133.1	21.2	65.8	35.6	5.3	8.0
4.	F1-4 (VR2 x Abirami)	132.3	23.2	66.1	36.7	5.7	8.9
5.	F1-5 (Vairam x Abirami)	133.1	21.8	68.7	39.3	5.6	8.4
6.	F1-6 (Abirami x KV1)	131.7	22.3	71.4	38.2	5.8	9.3
7.	F1-7 (BL x VD1)	132.9	21.5	67.2	36.4	5.6	9.1
8.	F1-8 (BL x VTK1)	138.9	22.0	65.8	37.2	5.5	7.8
9.	F1-9 (BL x KV1)	135.4	21.3	68.3	38.0	6.1	8.1
10.	F1-10 (ms Meenakshi x ComstockSpanish)	121.5	20.5	68.3	38.1	5.6	8.9
11.	F1-11(ms Meenakshi x GT6)	130.3	21.2	65.2	39.9	5.8	8.1
12.	Bhagyalakshmi ( C )	126.5	20.0	52.3	38.6	5.7	7.7
13.	Vairam ( C )	129.2	20.8	65.3	37.9	5.3	8.1
14.	Abirami ( C )	137.4	21.8	66.3	40.9	4.9	8.8
	<b>SEm±</b>	<b>1.02</b>	<b>0.11</b>	<b>0.45</b>	<b>0.36</b>	<b>0.10</b>	<b>0.04</b>
	<b>CD (P=0.05)</b>	<b>2.8</b>	<b>0.3</b>	<b>1.2</b>	<b>1.0</b>	<b>0.2</b>	<b>0.1</b>
	<b>CV (%)</b>	<b>1.89</b>	<b>1.2</b>	<b>1.6</b>	<b>2.3</b>	<b>4.5</b>	<b>1.0</b>
	<b>Seasons</b>						
	<b>SEm±</b>	<b>6.61</b>	<b>0.60</b>	<b>1.38</b>	<b>0.94</b>	<b>0.40</b>	<b>0.31</b>
	<b>CD (P=0.05)</b>	<b>N.S</b>	<b>2.3</b>	<b>N.S</b>	<b>N.S</b>	<b>N.S</b>	<b>N.S</b>

**Table 2: Morphological characters of chewing tobacco hybrids at harvest and yield (2005-2007)**

S. No.	Entry /Variety	Leaf length (cm)	Leaf width (cm)	Inter node length (cm)	Stem girth (cm)	Whole leaf yield (kg/ha)	Total leaf yield (kg/ha)	Standard heterosis percentage over Abirami
1.	F1-1 (BL x Abirami)	80.6	49.8	6.0	9.9	2613	3340	2.1
2.	F1-2 (PV7 x Abirami)	81.0	54.9	5.6	10.4	2661	3784	15.8
3.	F1.3 (VD1 x Abirami)	76.7	41.7	5.5	9.8	2773	3613	10.5
4.	F1-4 (VR2 x Abirami)	79.2	48.2	5.7	9.8	2631	3399	4.0
5.	F1-5 (Vairam x Abirami)	76.9	45.8	5.8	9.9	2977	3914	19.73
6.	F1-6 (Abirami x KV1)	82.6	46.0	5.7	9.9	2915	3590	9.8
7.	F1-7 (BL x VD1)	78.4	43.7	5.5	9.6	2737	3445	5.4
8.	F1-8 (BL x VTK1)	78.8	47.3	5.8	9.7	2470	3292	-
9.	F1-9 (BL x KV1)	82.0	44.1	5.8	9.3	2514	3274	-
10.	F1-10 (ms Meenakshi x ComstockSpanish)	80.2	47.9	5.9	9.4	2447	3183	-
11.	F1-11(ms Meenakshi x GT6)	76.1	47.3	6.0	9.9	2670	3619	10.7
12.	Bhagyalakshmi ( C )	76.4	43.4	5.9	9.7	2412	3079	
13.	Vairam ( C )	74.6	43.4	5.9	10.0	2406	3112	
14.	Abirami ( C )	74.0	43.8	5.9	9.9	2344	3269	
	<b>SEm±</b>	<b>0.33</b>	<b>0.43</b>	<b>0.07</b>	<b>0.06</b>	<b>40.13</b>	<b>78.38</b>	
	<b>CD (P=0.05)</b>	<b>0.9</b>	<b>1.2</b>	<b>0.2</b>	<b>0.2</b>	<b>111</b>	<b>217</b>	
	<b>CV (%)</b>	<b>1.0</b>	<b>2.2</b>	<b>2.8</b>	<b>1.4</b>	<b>3.7</b>	<b>5.6</b>	
	<b>Seasons</b>							
	<b>SEm±</b>	<b>1.83</b>	<b>1.78</b>	<b>0.19</b>	<b>0.24</b>	<b>176.39</b>	<b>166.59</b>	
	<b>CD (P=0.05)</b>	<b>7.2</b>	<b>7.0</b>	<b>N.S</b>	<b>1.0</b>	<b>N.S</b>	<b>N.S</b>	
	<b>Seasons x Treatments</b>							
	<b>SEm±</b>	<b>0.47</b>	<b>0.60</b>	<b>0.10</b>	<b>0.08</b>	<b>56.75</b>	<b>110.8</b>	
	<b>CD (P=0.05)</b>	<b>1.3</b>	<b>1.7</b>	<b>0.3</b>	<b>0.2</b>	<b>157</b>	<b>307</b>	

**Bulk evaluation**

The overall mean performance of hybrids (VDH-1 to VDH-5) against the check varieties Bhagyalakshmi and Abirami at different centers (Table 3) and at CTRI Research Station, Vedsandur revealed that the hybrid VDH-3 registered the highest mean cured leaf yield of 3962 kg/ha against the best check Abirami with an increase of 13.3 %.

**Quality parameters and pests & diseases**

The chemical parameters like nicotine and chlorides of the hybrid VDH-3 are in the acceptable range (Deo Singh *et al.*, 2003). The hybrid VDH-3 possessed better chewing quality characters as compared to the best check Abirami (Table 4). The hybrid VDH-3 was found to have less susceptibility to diseases TMV, leaf curl and black shank as well as to leaf eating caterpillar and aphid as compared to the best check Abirami.

**Table 3: Performance of hybrids - On-farm trials 2006-09**

Location	Year	VDH-1	VDH-2	VDH-3	VDH-4	VDH-5	BL (C)	Abirami (C)
CTRIRS,VDR	07-08	429	2683	3972	3117	3056	2845	3137
	08-09	383	3151	3588	3174	3230	3237	3333
Savapatty	06-07	167	3167	3333	3370	4237	-	3378
	07-08	253	4000	4266	3200	3911	3235	3378
	08-09	118	3289	4518	4355	3970	3718	3881
Alukuli	07-08	259	2963	3674	2725	2844	3081	3318
	08-09	822	4000	4178	3644	3733	3822	3911
A. Puram	07-08	378	3022	3555	2667	3093	2844	3200
	08-09	648	3065	4160	3698	3224	3730	3762
S.G. Pudur	08-09	696	3497	3762	3563	3497	3371	3420
M.N. Patty	08-09	426	4204	4578	3804	4373	3929	4240
Mean		598 (2.9)	3367	3962 (13.3)	3392	3570 (2.1)	3381	3496

Note : Figures in parentheses indicate per cent increase over the best check Abirami

**Table 4: Data on Physical quality/chewability**

S. No.	Quality characteristics	Year	Trader's opinion		Consumer's preference	
			Hybrid VDH-3	Best Check variety Abirami	Hybrid VDH-3	Best Check variety Abirami
1.	Body (10)	2007-2008	8.5	7.5	8.0	8.0
		2008-2009	8.5	7.0	8.0	7.0
		Mean	<b>8.5</b>	<b>7.3</b>	<b>8.0</b>	<b>7.5</b>
2.	Aroma (10)	2007-2008	8.0	7.0	8.5	8.5
		2008-2009	8.0	7.0	8.5	7.5
		Mean	<b>8.0</b>	<b>7.0</b>	<b>8.5</b>	<b>8.0</b>
3.	Incrustation (10)	2007-2008	8.0	7.0	8.0	7.5
		2008-2009	8.0	7.0	8.0	6.5
		Mean	<b>8.0</b>	<b>7.0</b>	<b>8.0</b>	<b>7.0</b>
4.	Taste (10)	2007-2008	9.0	8.0	8.0	7.0
		2008-2009	9.0	8.0	8.0	7.0
		Mean	<b>9.0</b>	<b>8.0</b>	<b>8.0</b>	<b>7.0</b>
5.	Pungency (10)	2007-2008	7.5	8.0	7.0	7.0
		2008-2009	7.5	6.0	7.0	8.0
		Mean	<b>7.5</b>	<b>7.0</b>	<b>7.0</b>	<b>7.5</b>
6.	Saliva secretion (10)	2007-2008	8.5	8.0	8.0	7.0
		2008-2009	8.5	7.0	8.0	7.0
		Mean	<b>8.5</b>	<b>7.5</b>	<b>8.0</b>	<b>7.0</b>
7.	Duration of pungency (10)	2007-2008	7.0	7.5	7.0	7.5
		2008-2009	7.0	7.5	7.0	7.5
		Mean	<b>7.0</b>	<b>7.5</b>	<b>7.0</b>	<b>7.5</b>
8.	Stiffness in the mouth(10)	2007-2008	8.0	7.5	7.0	6.5
		2008-2009	8.0	8.0	8.0	7.5
		Mean	<b>8.0</b>	<b>7.8</b>	<b>7.5</b>	<b>7.0</b>
<b>Mean score out of 80</b>			<b>64.5</b>	<b>59.1</b>	<b>62.0</b>	<b>58.5</b>

Thus the present study indicated that the productivity level of chewing tobacco can be improved to the tune of 10-15% as compared to the standard chewing tobacco cultivars in vogue. The yield enhancement will greatly help the farmer for increasing the profitability and to divert some land to other commercial/food crops.

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