PER SE PERFORMANCE STUDIES ON BIDI TOBACCO (Nicotiana tabacum L.)

Ramachandra, R.K*, Nagappa[1] B.H and Amarananjundeswara[2], H.

*Assistant Professor (GPB), College of Horticulture, Tamaka, Kolar
[1] Scientist Agriculture research station Hanumanamatti Ranibennur
[2] Assistant Professor (Horticulture), College of Horticulture, Tamaka, Kolar

Email: alaverashi@rediffmail.com

(**Received on Date: 10th Septembe,2015** **Date of Acceptance:19th November 2015**)

ABSTRACT

Tobacco is one of the important commercial crops in the world. It has various types such as Flue Cured Virginia, Hookah, Cigar type, Lanka type Bidi type etc . All these are categorized based on their quality and consumption purpose. Among these Bidi tobacco is more widely grown in Pakistan and India. The materials of this experiment consisted of 14 cultivars and 48 F_1 hybrids, which were generated by crossing them in LxT fashion. These hybrids along with parents were grown in plots consisting of two rows following 100 x 100 cm spacing. The recommend cultivation practices were followed to raise the crop. Five competitive plants in each treatment were selected for recording the observations on Days to flower, Plant height (cm), Internodal length (cm), Numbers of leaves ,Leaf length (cm), Leaf breadth (cm) Total dry weight (g/plant), The quality in bidi tobacco is assessed based on the spangle score, nicotine content, chloride content, reducing sugars and the ratios between reducing sugar to nicotine. This work has been carried out in Agricultural Research Station, Nipani at Belgaum district in Karnataka. The quality characters observed for their genetic analysis viz. Nicotine content, spangles score (sort of puckering on the leaves indicates more quality), reducing sugar and chloride content in percentage is recorded using auto analyzer readings at Central Tobacco Research Institute (CTRI) Rajahmundry. From the point of view of *per se* performance, MS PL-5 × Vairam and MS GT-4 × Thangam were found promising in respect of leaf yield. Though, these two hybrids did not show any distinct advantage over check NPN-22 in respect of yield, these were found superior in respect of quality parameters *viz*., spangle score, nicotine and chloride content over check NPN-22. From this point of view, the two hybrids may be considered as promising.

No: of Tables : 5 **No: of References : 5**

INTRODUCTION

Even with anti-tobacco slogans or campaigns all over the world for the past three decades, tobacco production, productivity and consumption have not come down anywhere on the globe. On the other hand, its production has increased from 1.2 to 2 per cent, productivity from 15 to 30 per cent and consumption up to 1.9 per cent. This reflects on the acceptance of crop among public (Anon., 2011). The one consistent goal of the breeder is to increase the yielding ability of a genotype to its optimum potential. Many economically important characters contributing to yield and finally the yield *per se* are polygenically inherited. Such characters are influenced by number of external factors like variation in climate, soil fertility and rainfall. The observed variability in these characters is the product of hereditary effects of the concerned genes and the influence of micro and macro environments and their interaction. This necessitates the partitioning of total variation into its heritable and non-heritable components. However, the inheritance of quantitative characters is influenced often by variation in other characters, which may be due to pleiotropy or genetic linkage.

MATERIALS AND METHODS

The six male sterile lines were crossed with the eight testers following line × tester mating design to produce 48 F_1 hybrids during the Kharif 2001. The field experiment was carried out at Agricultural Research Station, Nipani, and Karnataka in randomized block design With two replications. The materials consisted of 14 cultivars and 48 F_1 hybrids, which were generated by crossing them in LxT fashion during the Kharif 2002 These hybrids along with parents were grown in plots consisting of two rows following 100 x 100 cm spacing. The recommend cultivation practices were followed to raise the crop. Five competitive plants in each treatment were selected for recording the observations on Days to flower, Plant height (cm), Internodal length (cm), Numbers of leaves ,Leaf length (cm), Leaf breadth (cm) Total dry weight (g/plant), The quality parameters viz. Nicotine content (%),Reducing sugar content (%), Chloride content (%), Leaf yield (g/plant) were analysed at Central tobacco research institute at Rajahmundry.

Heterosis and *per se* performance across the traits:

The method outlined by Arunachalam *et al.* (1984) was followed for computation of overall better parent heterosis. The procedure is briefly described as follows. A cross was assigned +1 score for each trait when its mean value was significantly superior over the better parent in the desired direction. The score for each cross over all the characters was added to provide its total score. The mean of the total score for each of the cross was computed and the hybrid which had a total score equal to or above the mean were allotted a high and the rest a low status. Similarly, the level of performance of hybrids for each character in comparison with better parent (BP) was

considered to work out overall *per se* performance of cross over characters studied. A cross was assigned +1 score for each trait when its mean value exceeded significantly superior over the better parent in the desired direction. The score for each cross over all the characters were added to provide its total score. The mean of the total score for each of the cross was computed and hybrids which had total score equal to or above the mean were allotted a high (H) and the rest a low status (L)

Classification of parents and hybrids based on combining ability:

The overall status of parents and crosses was ascertained with respect to gca and sca effects, respectively as per the method outlined by Arunachalam et al. (1984). A parent expressing significant gca effect in the desired direction for a character was given a score of +1. Similarly, significant gca effects in undesired direction was given a score of -1. Parents showing non-significant gca (either positive or negative) were given a score of zero. In this manner, all the parents were scored for 22 characters and by adding these values total score secured by a parent was found out. The mean score for all the parents was worked out. The parents whose total score above the mean score were classified as high general combiner (H), the parents having a total score below the mean were considered as low general combiner (L). The same procedure was followed to classify the sca effects of 48 crosses into high and low categories (Table 2 and Table 3)

RESULTS AND DISCUSSIONS

Successful exploitation of heterosis in many of the crops has been one of the significant success story in the science of plant breeding. Efforts have also been made to develop potential hybrids in tobacco. In heterosis breeding, choice of suitable parents is an important criterion in the exploitation of hybrid vigour and it depends on factors like *per se* performance of the parents and their behaviour in hybrid combination (Patel *et al* 2000). The concept of general and specific combining ability helps the breeder to assess the worth of lines for use as parents in the production of hybrids and also in identifying superior hybrids having additive and/or non-additive gene action. Genetic constitution and divergence among the parents involved in hybridization govern the nature of gene action. It is therefore, necessary to assess the genetic potentialities of the parents in hybrid combination through systematic studies in relation to general and specific combining ability which are due to additive and non-additive gene action respectively (Kher *et al* 2001). With the availability of cytoplasmic male sterile lines in tobacco hybrid breeding has been made highly feasible exercise. Six CMS lines with different origin thus representing diversity were crossed to eight tester lines to produce 48 experimental hybrids. The testers were so chosen that they represented diversity, which is basic need of heterosis breeding but also possessed desirable features like resistant to diseases like frog eye leaf spot, root knot nematode and also possessing desired quality traits like high nicotine, high reducing sugar, high

spangles score and low chloride content. The hybrids thus produced were expected to form excellent experimental hybrids. The hybrids were evaluated for various yield and quality parameters. The analysis of variance indicated highly significant (Table 1) differences among the treatments for all the characters studied except for the chloride content. The differences among the parents were also significant for many characters except for root knot nematode, spangle score, reducing sugar and reducing sugar to nicotine ratio indicating presence of sufficient variability among parents.Hybrids showed highly significant variation for days to flower, plant height, and number of leaves, total fresh weight, total dry weight, and stalk weight and frog eye leaf spot. The variance for parents Vs hybrids was highly significant for most of the characters except number of leaves, leaf breadth, leaf area, root knot nematode, reducing sugar, chloride and reducing sugar to nicotine ratio revealing the presence of dominance gene action. Mean squares due to males Vs females were significant except for internodal length, leaf length, root knot nematode resistance, nicotine, reducing sugar and reducing sugar to nicotine ratio revealing the presence of sufficient genetic variability among the male and female parents for characters studied. The two hybrids (table 4) represent L × H type of combination as far as gca status of parents is concerned. The H status is given if gca effect of parents significant in the desired direction and is given L status otherwise. Likewise, the sca status of hybrid is also assigned either the H or L value. It is clear that two hybrids are high specific combiners suggesting that they can be identified for exploitation of heterosis, if they really found to be potential by the proposed evaluation over locations as mentioned earlier. Of the two hybrids however only MS GT-4 × Thangam showed its worth in respect of spangle score showing some slight advantage over the check NPN-22. MS GT-4 × Thangam was H × L type combination with L specific combining ability status, this type of inheritance has been observed by Butorac *et al* 2000).

Table 1: Analysis of variance (mean sum of sources) for combining ability for yield and quality parameters in bidi tobacco (*Nicotiana tabacum* L.)

Source of variation	DF	Days to flower	Plant height (cm)	Internodal length (cm)	Number of leaves	Leaf length (cm)	Leaf breadth (cm)	Leaf yield (g/pl)	FEL (%)	RKN (%)	Spangle score (%)	Nicotine (%)	Reducing sugars (%)	Chloride (%)	Reducing sugars to nicotine (%)
Replication	2	0.055	94.97	7.29	30.53	233.48	265.71	5536.16	1.55	1.612	0.0141	8.004	11.318	0.0214	0.263
Females	5	397.46**	1521.19**	7.9**	7.45**	149.03**	87.38**	4084.38**	0.646**	0.314**	0.0429	1.251*	2.24*	0.0357*	0.0575
Males	7	210.55**	739.81**	2.21*	18.45**	30.32	63.97**	10432.94**	0.532**	0.214*	0.1911**	1.152*	1.383	0.010	0.0762**
Female x Male	35	57.4**	412.55**	0.97	4.30**	35.17	20.36**	1478.42**	0.263**	0.074	0.6369**	0.4534	0.970	0.0150	0.0398*
Error	94	6.28	89.64	1.02	1.50	26.12	10.28	1077.95	0.0453	0.0930	0.0207	0.496	0.790	0.0195	0.0263
GCA	-	11.74**	34.18**	0.19*	0.41**	2.59	2.63**	275.24**	0.153**	0.0090	0.0038*	0.035	0.0402	0.0037	0.0112
SCA	-	40.52**	176.01**	0.37	1.75**	8.20	8.62**	683.98**	0.103**	0.012	0.0130	0.056	0.140	0.0075	0.0070
GCA/SCA		0.2897	0.1942	0.5135	0.2342	0.3158	3.27	0.4024	1.4854	0.75	0.2923	0.625	0.2871	0.4933	1.6

Various notations used in the study

DFL= days to flower PHT (cm) = plant height NOL= number of leaves INL (cm)= internodal length LFL (cm) = leaf length	LFB (cm) = leaf breadth LFA (cm^2) = leaf area TFW (g/plant)=total fresh weight TDW (g/plant)= total dry weight	STW (g/plant)= stalk weight LFY (g/plant) =leaf yield FEL (%) =frog eye leaf spot RKN (%)=root knot nematode SPA (%)=spangle score	NIC (%)= nicotine RSU (%)=reducing sugar CHL (%)= chloride RSU= reducing sugar to nicotine ratio

Table 2 : The score for gca status of parents for various parameters in bidi tobacco (*Nicotiana tabacum* L.)

SN	Parents	DFL	PHT (cm)	INL (cm)	NOL	LFL (cm)	LFB (cm)	LFA (aq/ cm)	TFW (g/pl)	TDW (g/pl)	STW (g/pl)	LFY (g/pl)	FEL (%)	RKN (%)	SPA (%)	NIC (%)	RSU (%)	CHL (%)	RSU/ NIC	Total	Status
1	A-2	1	0	0	0	-1	0	0	0	0	0	0	1	1	0	0	0	1	-1	2	L
2	A-119	1	0	0	0	-1	0	-1	0	0	0	0	0	0	0	-1	0	0	0	-2	L
3	PL-5	-1	1	0	1	-1	-1	-1	0	0	0	0	-1	0	0	0	0	0	0	-2	L
4	GT-4	-1	-1	0	0	1	1	1	0	0	0	0	1	0	1	0	0	0	0	3	L
5	NPN-190	-1	1	-1	1	1	0	0	1	1	1	0	0	0	0	0	0	0	1	5	L
6	S-20	1	0	1	0	1	-1	-1	-1	-1	-1	-1	0	-1	0	1	0	0	0	-3	L
7	Bhagyashree	-1	0	0	0	0	-1	0	0	0	0	0	-1	0	0	0	0	0	0	-3	L
8	NPN-22	1	1	0	0	1	1	1	1	1	1	1	0	1	0	0	0	0	0	10	H
9	Maragadham	1	-1	0	0	-1	1	1	0	1	0	0	0	0	1	0	0	0	0	3	L
10	DWFC	1	-1	0	-1	0	0	0	-1	-1	-1	-1	0	0	0	0	0	0	0	-5	L
11	Kunkumatri	-	0	1	0	0	-1	-1	-1	-1	0	-1	0	0	0	1	0	0	-1	-4	L
12	Thangam	1	1	0	1	0	0	0	1	1	0	1	0	0	0	1	0	0	-1	6	L
13	Vairam	0	0	0	0	-1	0	0	1	1	0	1	0	0	-1	0	0	0	0	1	L
14	F_7-127	1	-1	0	-1	1	-1	0	-1	-1	-1	0	-1	0	-1	0	1	0	1	-4	L

Table 3: Score for sca status of crosses for various parameters in bidi tobacco (*Nicotiana tabacum* L.)

		DFL	PHT	INL	NOL	LFL	LFB	LFA	TFW	TDW	STW	LFY	FEL	RKN	Total	SCA	SPA	NIC	RSU	CHL	RSN	Total	SCA
		1	2	3	4	5	6	7	8	9	10	11	12	13			14	15	16	17	18		
1.	MS A-2 × Bhagyashree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	H	0	0	0	0	0	0	L
2.	MS A-2 × NPN-22	0	0	0	0	-1	0	0	0	0	0	1	0	0	0	H	0	0	0	0	0	0	L
3.	MS A-2 × Maragadham	0	0	0	0	-1	0	0	0	0	0	0	1	0	0	H	0	0	0	0	-1	-1	L
4.	MS A-2 × DWFC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	L
5.	MS A-2 × Kunkumatri	1	0	0	0	0	0	0	0	0	0	0	-1	0	0	L	0	0	0	0	0	0	L
6.	MS A-2 × Thangam	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	1	0	0	-1	-2	L
7.	MS A-2 × Vairam	0	0	0	0	0	0	0	-1	0	0	0	-1	0	-2	L	0	0	0	0	0	0	L
8.	MS A-2 × F_7-127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	L
9.	MS A-119 × Bhagyashree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	1	0	1	H
10.	MS A-119 × NPN-22	0	0	0	0	0	0	0	0	0	0	0	1	0	1	L	0	0	0	0	0	0	L
11.	MS A-119 × Maragadham	-1	1	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	L
12.	MS A-119 × DWFC	1	0	0	-1	-1	0	0	-1	0	0	-1	0	0	3	H	0	0	0	-1	0	-1	L
13.	MS A-119 × Kunkumatri	-1	0	0	0	0	0	0	0	0	0	0	0	0	-1	L	0	0	0	0	0	0	L
14.	MS A-119 × Thangam	1	0	0	0	1	0	0	0	0	0	0	0	0	2	L	0	0	0	0	0	0	L

15.	MS A-119 × Vairam	1	0	0	1	0	0	0	0	0	0	0	-1	0	1	L	0	0	0	0	0	0	L
16.	MS A-119 × F_7-127	-1	0	0	1	0	0	0	0	0	0	0	-1	0	-1	L	0	0	0	0	0	0	L
17.	MS PL-5 × Bhagyashree	0	0	0	0	1	0	0	0	0	0	0	0	0	1	L	0	0	0	0	0	0	L
18.	MS PL-5 × NPN-22	0	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-6	L	1	0	0	0	0	0	L
19.	MS PL-5 × Maragadham	-1	0	0	0	0	0	-1	-1	0	-1	0	-1	0	-5	L	0	0	0	1	0	1	H
20.	MS PL-5 × DWFC	0	0	0	0	1	1	1	0	0	0	0	0	0	3	L	0	0	0	0	0	-1	L
21.	MS PL-5 × Kunkumatri	0	0	0	0	1	0	0	0	0	1	0	0	0	2	L	0	0	0	0	0	0	L
22.	MS PL-5 × Thangam	1	0	0	0	0	0	0	0	0	0	0	0	0	1	L	0	0	0	0	0	0	L
23.	MS PL-5 × Vairam	-1	-1	0	1	0	0	0	1	1	1	1	1	0	6	L	0	1	0	0	0	0	L
24.	MS PL-5 × F_7-127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	1	L
25.	MS GT-4 × Bhagyashree	0	0	1	0	0	0	0	0	0	0	0	1	0	2	L	0	0	0	0	0	0	L
26.	MS GT-4 × NPN-22	0	0	0	0	0	1	0	0	0	0	0	0	0	1	L	0	0	0	0	0	0	L
27.	MS GT-4 × Maragadham	-1	0	0	0	1	1	1	0	0	0	0	1	0	3	L	0	0	0	0	0	0	L
28.	MS GT-4 × DWFC	1	-1	-1	0	0	0	0	1	0	0	0	0	0	0	L	1	0	0	0	0	0	H
29.	MS GT-4 × Kunkumatri	0	0	0	0	-1	-1	-1	0	0	0	0	1	0	-2	L	0	0	1	0	0	0	H
30.	MS GT-4 × Thangam	0	0	0	0	0	0	0	0	0	0	1	-1	0	0	L	0	0	-1	0	0	-1	L
31.	MS GT-4 × Vairam	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	L
32.	MS GT-4 × F_7-127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	-1	0	0	-1	L
33.	MS NPN-90 × Bhagyashree	0	-1	0	1	-1	0	0	0	0	0	0	1	0	0	L	0	0	-1	0	0	-1	L
34.	MS NPN-190 × NPN-22	0	0	0	0	1	0	1	0	1	1	0	0	0	4	L	0	0	0	0	0	0	L
35.	MS NPN-90 × Maragadham	1	0	0	0	0	0	0	0	0	0	0	1	0	2	L	0	0	0	0	0	0	L
36.	MS NPN-190 × DWFC	0	1	0	0	0	0	0	0	0	-1	0	0	0	0	L	0	1	0	0	0	1	H
37.	MS NPN-190 × Kunkumatri	1	0	0	0	0	0	0	0	0	0	0	-1	0	0	L	0	1	0	0	0	1	H
38.	MS NPN-190 × Thangam	-1	0	0	0	0	0	0	0	0	0	0	0	0	-1	L	0	0	0	0	0	0	L
39.	MS NPN-190 × Vairam	-1	1	0	0	0	0	0	0	-1	-1	0	-1	0	-3	L	0	0	0	0	0	0	L
40.	MS NPN-190 × F_7-127	0	0	0	1	0	0	0	0	0	0	0	0	0	1	L	0	-1	1	1	0	1	H
41.	MS S-20 × Bhagyashree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	1	0	0	0	1	H
42.	MS S-20 × NPN-22	0	-1	0	0	0	0	0	0	0	0	0	0	0	-1	L	0	0	0	0	0	1	H
43.	MS S-20 × Maragadham	0	0	0	0	1	0	0	0	0	0	0	0	0	1	L	-1	0	0	0	0	-1	L
44.	MS S-20 × DWFC	-1	0	0	0	0	0	0	0	0	0	0	0	0	-1	L	-1	0	0	0	0	-1	L
45.	MS S-20 × Kunkumatri	0	0	0	0	0	0	0	0	0	0	0	0	0	0	L	0	0	0	0	0	0	L
46.	MS S-20 × Thangam	0	1	0	0	0	0	0	0	0	0	0	0	0	1	L	0	0	0	0	0	0	L
47.	MS S-20 × Vairam	1	1	1	0	0	0	0	0	0	0	0	1	0	4	L	1	1	0	-1	0	1	H
48.	MS S-20 × F_7-127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	H	0	0	0	0	0	0	L

Table 4: Score for heterosis status of crosses various parameters in bidi tobacco (*Nicotiana tabacum* L.)

		DFL	PHT	INL	NOL	LFL	LFB	LFA	TFW	TDW	STW	LFY	FEL	RKN	Total	SCA	SPA	NIC	RSU	CHL	RSN	Total	SCA
1.	MS A-2 × Bhagyashree	-1	-1	-1	-1	1	0	0	0	0	0	0	-1	1	-3	L	-1	1	1	-1	1	1	H
2.	MS A-2 × NPN-22	0	0	-1	-1	1	-1	0	0	0	0	0	-1	1	-2	L	-1	1	1	-1	-1	0	H
3.	MS A-2 × Maragadham	0	0	-1	1	0	1	0	0	0	0	0	-1	1	1	H	-1	1	-1	-1	-1	-3	L
4.	MS A-2 × DWFC	1	0	-1	-1	1	1	0	0	0	0	0	1	1	3	H	-1	1	1	-1	-1	-1	L
5.	MS A-2 × Kunkumatri	1	0	-1	-1	1	1	0	0	0	0	0	-1	1	1	H	-1	1	-1	-1	-1	-3	L
6.	MS A-2 × Thangam	0	-1	-1	-1	0	-1	0	0	0	0	0	-1	-1	-6	L	-1	-1	1	-1	1	-1	L

7.	MS A-2 × Vairam	-1	0	-1	1	0	-1	0	0	0	0	0	-1	-1	-4	L	-1	1	1	-1	-1	-1	L
8.	MS A-2 × F_7-127	0	0	-1	-1	1	1	0	0	0	0	0	-1	1	0	H	-1	1	1	-1	1	1	H
9.	MS A-119 × Bhagyashree	0	0	-1	0	0	-1	0	0	0	0	0	-1	-1	-4	L	0	1	-1	1	-1	0	H
10.	MS A-119 × NPN-22	1	-1	-1	-1	0	-1	0	0	0	0	0	-1	1	-5	L	-1	1	0	-1	-1	-2	L
11.	MS A-119 × Maragadham	0	0	0	0	0	0	0	0	0	0	0	-1	1	-1	L	-1	-1	-1	1	-1	-3	L
12.	MS A-119 × DWFC	1	0	-1	-1	0	1	0	0	0	0	0	0	-1	-2	L	-1	-1	-1	-1	-1	-5	L
13.	MS A-119 × Kunkumatri	-1	0	-1	-1	0	1	0	0	0	0	0	-1	-1	-4	L	-1	-1	-1	1	-1	-3	L
14.	MS A-119 × Thangam	1	-1	-1	-1	0	-1	0	0	0	0	0	-1	-1	-5	L	-1	-1	1	1	-1	-1	L
15.	MS A-119 × Vairam	1	0	-1	0	1	-1	0	0	0	0	1	-1	-1	-1	L	-1	1	1	1	-1	1	H
16.	MS A-119 × F_7-127	1	0	-1	1	1	1	0	1	1	0	1	1	1	8	H	-1	-1	1	1	1	1	H
17.	MS PL-5 × Bhagyashree	-1	1	1	0	0	0	0	0	0	0	0	-1	1	1	H	-1	1	1	-1	1	1	H
18.	MS PL-5 × NPN-22	-1	1	1	-1	-1	-1	0	0	0	0	0	-1	-1	-4	L	1	1	1	-1	1	3	H
19.	MS PL-5 × Maragadham	-1	1	1	-1	-1	-1	0	0	0	0	0	-1	-1	-4	L	-1	-1	1	-1	1	-1	L
20.	MS PL-5 × DWFC	0	1	0	-1	0	1	0	0	0	0	0	0	1	2	H	-1	-1	1	-1	1	-1	L
21.	MS PL-5 × Kunkumatri	0	0	1	0	0	1	0	0	0	0	0	-1	1	2	L	-1	-1	1	1	1	1	H
22.	MS PL-5 × Thangam	0	0	1	-1	0	-1	0	0	0	0	0	-1	-1	-3	L	-1	0	1	-1	1	0	H
23.	MS PL-5 × Vairam	-1	0	-1	1	0	0	0	1	1	1	1	1	-1	3	H	-1	0	1	-1	1	0	H
24.	MS PL-5 × F_7-127	-1	1	-1	0	0	0	0	0	0	0	0	1	0	0	H	-1	1	1	-1	1	1	H
25.	MS GT-4 × Bhagyashree	-1	-1	-1	0	0	0	0	0	0	0	0	-1	0	-4	L	-1	1	1	-1	1	1	H
26.	MS GT-4 × NPN-22	-1	-1	-1	-1	0	0	0	0	0	0	0	-1	-1	-6	L	-1	1	-1	-1	1	-1	L
27.	MS GT-4 × Maragadham	-1	0	-1	-1	0	1	0	0	0	0	0	-1	-1	-4	L	0	1	1	-1	1	2	H
28.	MS GT-4 × DWFC	0	-1	-1	-1	0	1	1	0	0	0	0	-1	-1	-3	L	1	-1	1	-1	1	2	H
29.	MS GT-4 × Kunkumatri	0	-1	-1	-1	0	1	0	0	0	0	0	-1	-1	-4	L	0	0	1	-1	1	0	H
30.	MS GT-4 × Thangam	-1	-1	-1	-1	0	1	0	0	0	0	0	-1	0	-4	L	-1	-1	-1	-1	-1	-5	L
31.	MS GT-4 × Vairam	-1	-1	-1	-1	0	0	0	0	0	0	1	-1	-1	-5	L	-1	-1	1	1	1	3	H
32.	MS GT-4 × F_7-127	0	-1	-1	0	0	1	0	0	0	0	0	-1	-1	-3	L	0	1	-1	-1	1	0	H
33.	MS NPN-90 × Bhagyashree	-1	-1	-1	1	0	-1	0	0	0	0	0	-1	-1	-5	L	-1	1	-1	-1	-1	-3	L
34.	MS NPN-190 × NPN-22	-1	-1	-1	-1	1	0	0	0	0	0	0	-1	-1	-5	L	-1	1	-1	-1	-1	-3	L
35.	MS NPN-90 × Maragadham	0	-1	-1	1	1	-1	0	0	0	1	0	-1	-1	-2	L	0	-1	-1	-1	-1	-4	L
36.	MS NPN-190 × DWFC	-1	-1	-1	-1	1	1	0	0	0	0	0	-1	-1	-4	L	-1	1	1	-1	-1	-1	L
37.	MS NPN-190 × Kunkumatri	0	-1	-1	-1	1	1	0	0	0	0	0	-1	-1	-3	L	0	1	-1	-1	-1	-2	L
38.	MS NPN-190 × Thangam	-1	-1	-1	-1	1	-1	0	0	0	0	0	-1	-1	-6	L	-1	1	0	-1	-1	-2	L
39.	MS NPN-190 × Vairam	-1	-1	-1	0	1	-1	0	0	0	0	1	-1	0	-3	L	-1	1	1	-1	1	1	H
40.	MS NPN-190 × F_7-127	0	-1	-1	1	1	1	0	0	0	0	0	-1	-1	1	H	-1	-1	1	1	1	1	H
41.	MS S-20 × Bhagyashree	-1	-1	-1	-1	1	-1	0	0	0	0	0	-1	-1	-6	L	0	1	-1	-1	-1	-2	L
42.	MS S-20 × NPN-22	0	-1	-1	-1	1	-1	0	0	0	0	0	-1	-1	-5	L	0	1	-1	1	-1	0	H
43.	MS S-20 × Maragadham	-1	-1	-1	-1	1	-1	0	0	0	0	0	-1	-1	-6	L	-1	-1	1	1	1	1	H
44.	MS S-20 × DWFC	-1	-1	-1	-1	0	0	0	0	0	0	0	-1	-1	-6	L	-1	-1	1	1	1	1	H
45.	MS S-20 × Kunkumatri	0	-1	-1	-1	1	1	0	0	0	0	0	-1	-1	-3	L	0	-1	-1	-1	-1	-4	L
46.	MS S-20 × Thangam	1	-1	-1	-1	1	-1	0	0	0	0	0	-1	-1	-4	L	-1	0	-1	1	-1	-2	L
47.	MS S-20 × Vairam	0	-1	-1	-1	0	-1	0	0	0	0	0	-1	-1	-6	L	-1	1	1	-1	-1	-1	L
48.	MS S-20 × F_7-127	0	-1	-1	-1	1	1	0	0	0	0	0	-1	0	-2	H	-1	1	-1	1	-1	-1	L

Table 5: Relevant genetic information in respect of potential hybrids in bidi tobacco for leaf yield and some quality parameters

Entry	Leaf yield				Spangle score				Nicotine content				Rducing sugar content				Chloride content			
	Per se performance (g/plant)	Standard heterosis (%)	gca status of parent	sca status of hybrid	*Per se* performance (g/plant)	Standard heterosis (%)	gca status of parent	sca status of hybrid	*Per se* performance (g/plant)	Standard heterosis (%)	gca status of parent	sca status of hybrid	*Per se* performance (g/plant)	Standard heterosis (%)	gca status of parent	sca status of hybrid	*Per se* performance (g/plant)	Standard heterosis (%)	gca status of parent	sca status of hybrid
Hybrids																				
MS PL-5 × Vairam	240.00	0.00	L × H	H	2.00	-7.40	L × L	L	5.26	18.46	L × L	L	2.60	4.83	L × L	L	0.39	-11.36	L × L	L
MS GT-4 × Thangam	243.33	1.38	L × H	H	2.23	3.24	H × L	L	5.81	30.85	L × L	L	1.80	-27.41	L × L	L	0.39	-11.36	L × L	L
Parents																				
PL-5	150.00	-	L	-	2.38	-	L	-	5.63	-	L	-	1.7	-	L	-	0.36	-	L	-
Vairam	116.67	-	H	-	2.38	-	L	-	5.30	-	L	-	2.43	-	L	-	0.51	-	L	-
GT-4	166.67	-	L	-	2.16	-	H	-	6.73	-	L	-	3.09	-	L	-	0.36	-	L	-
Thangam	186.67	-	H	-	2.45	-	L	-	6.30	-	L	-	2.43	-	L	-	0.75	-	L	-
Check																				
NPN-22	240.00	-	H	-	2.16	-	L	-	4.44	-	L	-	2.48	-	L	-	0.44	-	L	-

High nicotine content, high reducing sugar and low chloride content are desired in bidi tobacco. In this regard, hybrids were found to be promising with some exception like in case of reducing sugar content in MS GT-4 × Thangam. Since the GCA and SCA variances were non-significant for these three quality parameters, the gca and sca effects were also generally non-significant. Therefore, ignoring gca and sca status of parents and the hybrids based on the *per se* performance and standard heterosis, these two potential hybrids may be recorded as highly promising. In addition, these two hybrids also exhibited desired level of resistance against frog eye leaf spot disease compared to check NPN-22.

SUMMARY

Relevant genetic information of two potential hybrids from the point of view of leaf yield is given in Table 4. From the point of view of *per se* performance, MS PL-5 × Vairam and MS GT-4 × Thangam were found promising in respect of leaf yield. Though, these two hybrids did not showed any distinct advantage over check NPN-22 in respect of yield, these were found superior in respect of quality parameter *viz*., spangle score, nicotine and chloride over check NPN-22. From this point of view, the two hybrids may be considered as promising.

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