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EVALUATION OF PROMISING TOBACCO BREEDING LINES UNDER VERTISOLS

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The Flue-cured Virginia (FCV) tobacco grown in rainfed Vertisols of Andhra Pradesh and Telangana has its place in the international market as cheap neutral filler. The productivity of FCV tobacco under black soils is about 1700 kg/ha. In order to improve the productivity a breeding programme was under taken at Central Tobacco Research Institute (CTRI), Rajahmundry and many high yielding, TMV resistant and superior quality FCV tobacco lines were evolved. After checking the yield performance selected entries under row trial, nine breeding lines found promising. These selected nine lines were tested in a replicated trial along with three checks, Hema, Cy-79 and VT-1158 at Katheru farm during 2003-06. Pooled analysis of leaf yields over three seasons indicated significant differences for all the leaf yields. Lines Cy-159, Cy-163 and Cy-156 recorded significantly higher leaf yields over control, Hema and VT-1158. These lines recorded 8-11% increase in green leaf, 9-12% in cured leaf, 12-14% in bright leaf and 8-10% in grade index over VT 1158. The entries Cy-156, Cy-159, Cy-160, Cy-161, Cy-163, Ct-164 and Cy-165 found to be resistant to TMV under artificial conditions. Based on the superiority for yield and TMV resistance, the entries Cy-159, Cy-163 and Cy-156 were promoted for pre-release testing under AINP(T) trials.

INTRODUCTION

Flue Cured Virginia tobacco (*Nicotiana tabacum* L) is an export oriented tobacco type grown mainly in the states of Andhra Pradesh, Telangana and Karnataka in both black and light textured soils. The FCV tobacco produced under black soils conditions in Andhra Pradesh and Telangana is used as neutral filler and blended with other tobacco in the preparation of cigarettes. The black soil grown tobacco is raised in the vertisols of Khammam, Karimnagar, Warangal, Krishna, Gunturu, Prakasam, Nellore, East and West Godavari districts under conserved soil moisture condition. The productivity of black soil grown tobacco is around 1700 kg/ha (Tobacco Board, 2016). There is a need to increase the productivity of black soil tobacco from the present level to meet the ever increasing cost of production and to facilitate the release of additional land to non-tobacco crops (Sarala *et al.*, 2005). One approach to increase the productivity is through the cultivation of high yielding varieties having resistance to major biotic stresses affecting yields. As Tobacco Mosaic Virus (TMV) is a problem affecting yield and quality of tobacco grown in this area, the ICAR- Central Tobacco Research Institute is aiming to breed and release tobacco cultivars having higher yield, quality and TMV resistance for commercial cultivation under Vertisols. The Institute has developed number of breeding lines through conventional breeding utilizing suitable parents. Advanced breeding lines are being analysed in pre-release trials for the identification of superior entries for their further release as varieties. The present study concern with the evaluation of nine promising advanced breeding lines developed at the Institute in replicated trial under Vertisol conditions.

Key words : Breeding lines, Vertisols, Promising lines, FCV tobacco

MATERIALS AND METHODS

Seven crosses viz., Cy-79 x 1099/2/4, Cy-134 x 1099/2/4, Cy-134 x HMR, Cy-128 x HMR, CM-16 x Jayasri, CM-12 x Bhavya and PCT-17 x CM-16 were made in a hybridization programme during 1997-98 (Table 1). Further, selected progeny of CM-16 x Jayasri crossed with TMV resistant entry, HMR and promising selections from crosses, CM-12 x Bhavya and PCT-17 x CM-16 were crossed with high yielding and TMV resistant entry, 1099/2/4. All the resultant progenies were handled following pedigree methods of selection. After ascertaining the performance of stable derivatives in row trials, nine promising advanced selections viz., Cy-159, Cy-160, Cy-161, Cy-162, Cy-163, Cy-

164, Cy-156, Cy-165 and Cy-166 were identified for further evaluation. The selected entries were evaluated in RBD along with two check varieties viz., Hema and VT-1158 at CTRI farm, Katheru during three years 2003-04 to 2005-06 with three replications. Observations recorded on yield parameters viz., Green leaf, Cured leaf, Bright leaf yield and Grade index. The yield data was analyzed statistically (Gomez and Gomez, 1984). Parameters of chemical quality viz., nicotine (%), reducing sugars (%) and chlorides (%) were also recorded. The entries were also screened for Tobacco Mosaic Virus (TMV) resistance under artificial conditions through sap inoculation.

RESULTS AND DISCUSSION:

The parents involved in breeding the advanced breeding lines evaluated in the study are Cy-79, 1099/2/4, Cy-134, HMR, Cy-128, CM-16, Jayasri, CM-12, Bhavya and PCT-17 (Table 1). The entries 1099/2/4 and HMR,are TMV resistant entries and others are lines with high leaf yielding abilities. This indicates that the parents are ideally selected in breeding high yielding and TMV resistance cultivars.

The segregating generations were handled through pedigree method of breeding and stabilised lines are tested under row trials (data not presented). Based on the row trial performance, nine superior entries were selected and tested under replicated trial for three seasons for assessing their leaf yielding potentials under vertisols. Treatments differed significantly for leaf yields of all types except bright leaf in 2003-04 in different years and on pooled basis (Tables 2-6). Most of the times, Cy-159, Cy-163 and Cy-156 found to record superior yields among all the entries tested in all three years. Mean leaf yields are significantly higher over controls, Hema and VT-1158 in these three lines. Cy-156 recorded highest mean cured leaf yield (2234 kg/ha) among the entries and controls followed by Cy-163 (2219 kg/ha) and Cy-159 (2180 kg/ha). The same trend continued with respect to mean green leaf, bright leaf and grade index, also. These lines recorded 8-11% increase in mean green leaf (13969-14334 kg/ha), 9-12% in cured leaf (2180-2234 kg/ha), 12-14% in bright leaf (1139-1163 kg/ha) and 8-10% in grade index (1718-1748 kg/ha) over VT 1158.

Seasons and seasons X entries interaction were significant for all the leaf types except for seasons X entries interaction of cured leaf. Mean leaf yields are higher during 2004-05 season (16131 kg/ha green leaf, 2420 cured leaf, 1435 bright leaf and 2043 grade index). All the leaf yields are significant in all the three seasons, except for bright leaf yield during 2003-04. The entry, Cy-163 recorded highest green leaf (17303 kg/ ha), cured leaf (2649) and, bright leaf (1574) yields and Cy-156 highest grade Index (2233) during 2004-05.

Nicotine ranged from 2.23 to 3.12% and the reducing sugars ranged from 7.11 to 12.57%. The chloride ranged from 0.78 t0 1.42% (Table 7). All these parameters are found to be in acceptable limits (Deo Singh *et al.*, 2003). The entries Cy-156, Cy-159, Cy-160, Cy-161, Cy-163 Cy-164 and Cy-165, found to be resistant to TMV when screened under artificial condition along with control, VT-1158 which is TMV resistant one (Table 8).

Based on the performance of the selections over three years, the selections, Cy-156, Cy-163 and Cy-159 with significantly superior mean yields of all kinds and TMV resistance were identified as better entries and proposed for testing in the Initial Varietal Trial (IVT) under All India Network Project on Tobacco (AINPT). Multi-location testing under AINPT is mandatory for release of any crop variety. Once the superiority of these lines is proved in AINPT trials, these entries can be released for commercial cultivation under vertisols. Further, these selections can also be utilised as parents in the breeding programmes aimed at higher leaf yields and resistance for TMV infection.

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Table 1: Parentage of breeding lines

S. No.	Breeding line	Parentage*
1	Cy-156	(CM-16 x Jayasri) X HMR
2	Cy-159	Cy 79 x 1099/2/4
3	Cy-160	Cy 134 x 1099/2/4
4	Cy-161	Cy 134 x HMR
5	Cy-162	Cy 134 x HMR
6	Cy-163	Cy 134 x HMR
7	Cy-164	Cy 128 x HMR
8	Cy-165	(CM-12 x Bhavya) X 1099/2/4
9	Cy-166	(PCT17 x CM-16) X 1099/2/4

* 1099/2/4 and HMR are TMV resistant entries

Table 2: Leaf yields of breeding lines under replicated trial: Pooled (kg/ha) (2003-06)

S. No.	Line/Entry	Greenleaf	Curedleaf	Brightleaf	GradeIndex
1	Cy-156	14334**(11)	2234**(12)	1163**(14)	1748**(10)
2	Cy-159	13969**(8)	2180**(9)	1148**(12)	1718**(8)
3	Cy-160	11651	1844	949	1447
4	Cy-161	13367*	2096*	1089*	1653*
5	Cy-162	11005	1740	932	1379
6	Cy-163	14159**(9)	2219**(11)	1139**(12)	1732**(9)
7	Cy-164	12585	1978	1031	1554
8	Cy-165	12679	1968	1038	1546
9	Cy-166	13387*	2102*	1089*	1661*
10	Hema	12357	1888	962	1483
11	VT-1158	12936	2001	1027	1588
Mean		12980	2027	1056	1595
S. Em.		351	54	34	45
CD at 5%		972	150	93	125
C.V.%		8.10	8.04	9.56	8.47
Seasons					
2003-04		12998	2026	842	1472
2004-05		16131	2420	1435	2043
2005-06		9812	1634	888	1271
S. E. M.		200	39	25	30
CD at 5%		690	136	86	103
C.V.%		9.22	11.59	14.09	11.15
Seasons X Entries					
S. E. M.		607	94	58	78
CD at 5%		1683	-	161	216

* Significantly superior over Hema.

** Significantly superior over VT 1158.

Figures in the parentheses are percent increase over VT 1158.

Table 3: Green leaf yields of breeding lines under replicated trial Pooled (Kg/ha) (2003-06)

S. No.	Line/Entry	2003-04	2004-05	2005-06	Mean
1	Cy-156	14028	17226	11748**	14334**(11)
2	Cy-159	15017*	16840	10050	13969**(8)
3	Cy-160	11823	15085	8044	11651
4	Cy-161	13576	16339	10185	13367*
5	Cy-162	11719	12809	8488	11005
6	Cy-163	14410	17303	10764*	14159**(9)
7	Cy-164	12118	16801	8835	12585
8	Cy-165	11649	16319	10069	12679
9	Cy-166	11823	16628	11709**	13387*
10	Hema	12708	15721	8642	12357
11	VT-1158	13403	15818	9587	12936
	Mean	12998	16131	9812	12980
	S. Em.	462	773	543	351
	CD AT 5%	1354	2268	1592	972
	C.V.%	6.15	8.30	9.58	8.10

* Significantly superior over Hema.

** Significantly superior over VT 1158.

Figures in the parentheses are percent increase over VT 1158.

Table 4: Cured leaf yields of breeding lines under replicated trial Pooled (Kg/ha) (2003-06)

S. No.	Line/Entry	2003-04	2004-05	2005-06	Mean
1	Cy-156	2174	2647**	1881**	2234**(12)
2	Cy-159	2319	2542	1680	2180**(9)
3	Cy-160	1883	2245	1404	1844
4	Cy-161	2121	2450	1719*	2096*
5	Cy-162	1845	1960	1431	1740
6	Cy-163	2227	2649**	1782*	2219**(11)
7	Cy-164	1920	2523	1491	1978
8	Cy-165	1791	2452	1661	1968
9	Cy-166	1875	2508	1923**	2102*
10	Hema	1970	2265	1429	1888
11	VT-1158	2090	2297	1615	2001
	Mean	2027	2420	1634	2027
	S. Em.	79	112	88	54
	CD AT 5%	232	328	259	150
	C.V.%	6.75	8.00	9.35	11.59

* Significantly superior over Hema.

** Significantly superior over VT 1158.

Figures in the parentheses are percent increase over VT 1158.

Table 5: Bright leaf yields of breeding lines under replicated trial Pooled (Kg/ha) (2003-06)

S. No.	Line/Entry	2003-04	2004-05	2005-06	Mean
1	Cy-156	865	1563*	1061**	1163**(14)
2	Cy-159	1020	1491	934*	1148**(12)
3	Cy-160	731	1335	781	949
4	Cy-161	867	1454	945*	1089*
5	Cy-162	836	1167	792	932
6	Cy-163	876	1574*	968*	1139**(12)
7	Cy-164	826	1501	766	1031
8	Cy-165	789	1445	880	1038
9	Cy-166	736	1483	1047**	1089*
10	Hema	759	1335	793	962
11	VT-1158	871	1379	831	1021
	Mean	842	1435	890	1055
	S. Em.	62	68	41	34
	CD AT 5%	_	201	121	93
	C.V.%	12.69	8.25	8.04	9.56

* Significantly superior over Hema.

** Significantly superior over VT 1158.

Figures in the parentheses are percent increase over VT 1158.

Table 6: Grade Index values of breeding lines under replicated trial Pooled (Kg/ha) (2003-06)

S. No.	Line/Entry	2003-04	2004-05	2005-06	Mean
1	Cy-156	1484	2233*	1527**	1748**(10)
2	Cy-159	1697	2139	1318*	1718**(8)
3	Cy-160	1334	1890	1118	1447
4	Cy-161	1549	2065	1345*	1653*
5	Cy-162	1371	1650	1117	1379
6	Cy-163	1565	2228*	1404*	1732**(9)
7	Cy-164	1394	2133	1135	1554
8	Cy-165	1323	2065	1250	1546
9	Cy-166	1362	2111	1509**	1661*
10	Hema	1427	1924	1099	1483
11	VT-1158	1592	1960	1210	1588
	Mean	1472	2043	1271	1595
	S. Em.	66	97	67	45
	CD AT 5%	194	283	198	125
	C.V.%	7.79	8.19	9.19	8.47

* Significantly superior over Hema.

** Significantly superior over VT 1158.

Figures in the parentheses are percent increase over VT 1158.

Table7: Chemical quality characteristics (%) of the advance breeding lines (2005-06)

S. No.	Line/ Entry	Nicotine	Reducing Sugars	Chlorides
1	Cy-156	2.82	10.91	1.41
2	Cy-159	3.12	7.11	1.09
3	Cy-160	2.28	12.57	1.11
4	Cy-161	2.76	9.37	1.37
5	Cy-162	2.37	12.11	1.08
6	Cy-163	2.48	9.78	1.40
7	Cy-164	2.49	9.37	1.42
8	Cy-165	2.23	8.96	1.16
9	Cy-166	2.76	10.30	0.79
10	Hema	2.76	11.39	0.78
11	VT-1158	2.42	8.71	1.16

Table 8: Screening of breeding lines against TMV (2005-06)

S.No.	ENTRY	TMV reaction
1	Cy-156	R
2	Cy-159	R
3	Cy-160	R
4	Cy-161	R
5	Cy-162	S
6	Cy-163	R
7	Cy-164	R
8	Cy-165	R
9	Cy-166	S
10	Hema	S
11	VT-1158	R

Figure 1: Performance of superior breeding lines for leaf yields compared to controls