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LINE x TESTER ANALYSIS IN CHEWING TOBACCO

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Seven females were crossed with three males in a line x tester mating design. The resulting 21 hybrids along with 10 parents were evaluated for combining ability and gene effects. The results revealed significant differences among genotypes (parents and crosses) for yield and its components. Combining ability variance and the ratio of GCA versus total genetic variance showed predominance of non-additive gene action for all the characters except plant height and days taken for maturity where additive gene action was predominant. Lines, Lichchavi and Bori Bargama were found to possess significantly high GCA effects for yield and its components while the crosses Lichchavi x Vaishali special and Sonapatti-2 x PT-76 exhibited significant desired SCA effects for first grade leaf yield and spangle score, respectively. Parents Lichchavi and Bori Bargama can be subjected to diallel selective mating for fostering greater recombinations, if simultaneous improvement of developmental characters related to productivity is sought. The results suggest adoption of reciprocal recurrent selection for improving the yield potential in chewing tobacco.

INTRODUCTION

Chewing tobacco (*N. tabacum* L.) is grown in Bihar state in an area of 20,000 ha, producing about 30,000 tonnes of cured leaf annually. Breeding programs for varietal improvement in this type of tobacco has been based mainly on the selection in locally adopted and hybrid populations. Selection of parents is important for developing superior hybrids and varieties. Applications of biometric techniques like 'line x tester analysis' has helped to select suitable parents and cross combinations from a large collection of germplasm. It also provides information on gene action involved in the inheritance of quantitative character and helps in the selection of breeding method for the improvement of yield and its components. In the present study, line x tester analysis was employed to determine combining ability in respect of yield and its components in chewing tobacco.

MATERIALS AND METHODS

Seven diverse female lines of chewing tobacco viz., D.S. Sitamarhi (DSS), C.T. Parihar Range (CTPR), K.G. Simari (KGS), Bandi Birauli (BB), Sonapatti-2 (SPT), Bori Bargama (BBG) and Lichchavi (LICH), with desirable agronomic characters were crossed with three male parents viz., PT-76 (PT), Vaishali Special (VSP) and Sona (SO) in line x tester mating design. Twenty one hybrids with ten parents were transplanted in randomized block design with three replications at Crop Research Programme Farm, Pusa during *rabi* season of 2001-02. Each genotype was planted in two-row plot of 5.4 meters length. Spacing of 90 cm was kept both between rows and plants. One border row was planted around each replication. Apart from FYM@ 45 t/ha uniform based dose of 250 kg N and 60 kg each of P_2O_5 and K_2O were applied plant row plough furrow a week before planting. Other cultural practices were followed as per the recommendation. Observations were recorded on 5 randomly selected plants for plant height, leaf length, leaf breadth, internode length and number of leaves and on plot basis for total cured and first grade leaf yields, spangling and puckering scores and days taken for maturity. The analysis of variance was done according to the procedure developed by Kempthorne (1957) for obtaining the combining ability effects and variances.

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RESULTS AND DISCUSSION

Analysis of variance for combining ability (Table 1) indicated significant variances due to females for all the characters studied except leaf length. The mean squares due to female were of larger magnitude in comparison to those due to male or female x male for all the characters except plant height, scores of spangling and puckering which indicate greater diversity among females and males for respective characters.

Combining ability variance showed higher specific combining ability variance than general combining ability variance for all the characters except plant height and days taken for maturity. The variances due to GCA and SCA were not significant, however, the ratio of variance components due to GCA versus total genetic variance was less than 0.5 for all the characters except plant height and days taken for maturity where it was greater than 0.5 indicating predominance of non-additive and additive gene action, respectively (Table 2). The ratio of variance components has similarly been reported by Kumar *et al.* (2005) in potato. In the present study, for the character which showed predominant role of additive gene action can be best improved upon following pedigree method of breeding and those showing predominance of non-additive gene action could be improved by cyclic method of breeding. Role of non-additive gene action for yield and related components have similarly been reported in tobacco by several workers (Gopinath *et aI.*, 1967; Jadeja *et aI.*, 1984; Swami *et al.*, 1995)

Table1: Combining ability: Analysis of variance for different characters in chewing Tobacco

Source of variance	d.f.	Plant height	Leaf length	Leaf breadth	Inter-node length	No. of leaves	Total cured leaf yield	First grade leaf yield	Spangl-ing score	Pucker-ing score	Days to maturity
Rep.	2	196.671	51.487	10.405	4.930	0.979	0.581	0.244	1.044	0.334	92.149
Treat.	30	116.213**	41.834**	49.074**	1.247**	2.722**	0.382**	0.088**	0.463**	0.372**	24.716**
Parent	9	179.456**	42.563**	86.435**	2.304**	4.881**	0.739**	0.133**	0.130	0.506*	49.144**
Cross	20	49.242**	43.467**	34.714**	0.657			0.070**	0.626**	0.330	14.920*
Female	6	70.143*	65.913	79.916**	1.288**	4.997**	0.567**	0.131*	0.903**	0.683**	31.405**
Male	2	111.943*	30.167	31.932	0.869	1.351 **	0.187	0.047	1.994**	0.730**	1.643
Female x Male	12	28.926	34.457	12.577	0.306	0.385	0.075	0.043	0.259	0.088	8.891
Error	60	24.565	18.396	7.439	0.653	0.940	0.053	0.032	0.191	0.208	8.707

Table 2: Estimates of variance components and their relative importance for yield and yield components

Characters	δ^2 GCA	δ^2 SCA	δ^2 GCA / δ^2 GCA + δ^2 SCA
Plant height (cm)	2.012	1.906	0.514
Leaf length (cm)	0.957	5.286	0.153
Leaf breadth (cm)	2.306	6.851	0.252
Internode length (cm)	0.037	0.462	0.073
No. of leaves (No)	0.154	0.740	0.172
Total cured leaf yield (kg)	0.017	0.030	0.352
First grade leaf yield (kg)	0.003	0.015	0.160
Spangling score (1-5)	0.038	0.091	0.296
Puckering score (1-5)	0.025	0.160	0.136
Days to maturity (Days)	0.628	0.246	0.719

The GCA effects of parents are presented in Table 3. Among the females, Lichchavi showed significantly positive GCA for leaf length, leaf breadth, total cured leaf yield and days taken for maturity. Significant negative GCA effect for plant height was observed, which is considered useful in chewing tobacco. Line Bori Bargama showed significant positive GCA for total cured and first grade leaf yields. Significant positive GCA effect was observed in line DSS for quality attributes eg. spangling and puckering scores and in SPT for spangle score. Parents LICH and BBG could be successfully utilized for improvement of yield and yield components in chewing tobacco subjecting them to diallel selective mating for fostering greater recombinations, if simultaneous improvement of developmental characters related to productivity is sought. Amarnath and Murthy (1998) have reported that improvement for total cured leaf yield in chewing tobacco is possible through selection for leaf length. Non-significant GCA effects were observed in males. Crosses LICH x PT-76 and DSS x SO exhibited significant negative SCA effects for total cured leaf yield and leaf length, respectively. Significant positive SCA effects were observed in crosses LICH x VSP and SPT x PT for first grade leaf yield and spangle score, respectively (Table 4). In both these crosses, the GCA effect of male parent was non-significant.

Table 3: Estimates of GCA effects of parents for yield and yield components in chewing tobacco

Source	Plant height (cm)	Leaf length (cm)	Leaf breadth (cm)	Inter-node length (cm)	No. of leaves (No)	Total cured leaf yield (g)	First grade leaf yield (g)	Spangl-ing score (1-5)	Pucker-ing score (1-5)	Days to maturity (Days)
Females										
DSS	-0.644	0.471	-3.543**	-0.124	-0.451	-0.353**	-0.128	0.484*	0.540*	-2.714*
CTPR	-0.267	-1.973	-1.987	0.221	0.449	0.023	0.065	-0.1 05	-0.049	0.175
KGS	2.789	-0.451	0.868	-0.035	0.771	-0.046	-0.041	-0.182	-0.182	1.730
BB	1.589	-0.006	1.657	0.432	-0.573	-0.006	-0.077	-0.271	-0.094	0.175
SPT	2.333	-3.239*	-1.387	0.421	-1.195*	-0.230*	-0.115	0.429*	0.151	-2.048
BBG	-0.578	-0.195	-1.098	-0.535	0.694	0.236*	0.177*	-0.216	-0.06	0.175
LICH	-5.122**	5.394**	5.491**	-0.379	0.305	0.377**	0.115	-0.138	-0.305	2.508*
Males										
PT	-1.652	0.991	1.189	-0.118	-0.208	-0.700	-0.300	0.352	0.176	-0.206
VSP	2.690	0.381	0.084	0.235	-0.075	-0.037	-0.024	-0.133	0.019	-0.111
SO	1.038	-1.371	-1.273	-0.117	0.282	0.107	0.054	-0.219	-0.195	0.317
SEfemale	1.583	1.428	0.909	0.269	0.323	0.076	0.060	0.146	0.152	0.984
SE	1.036	0.935	0.595	0.173	0.212	0.050	0.039	0.095	0.099	0.644

* and ** significant at 5% and 1%, respectively

Table 4: Crosses with significant SCA effects for different characters in chewing tobacco

Cross	Character	Value	SE
DSS x SO	Leaf length	-5.495	2.474
LlCH x PT	Total cured leaf yield	-0.341	0.132
LlCH x VSP	First grade leaf yield	0.253	0.104
SPT x PT	Spangle score	0.534	0.252

The genotype with good general combining ability and the crosses with significant positive specific combining ability identified in this study could be utilized in further breeding programmes for improving yield and its related traits in chewing tobacco.

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