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HETEROSIS AND COMBINING ABILITY STUDIES IN INTER-VARIETAL CROSSES OF CHEWING TOBACCO (Nicotiana tabacum L.)

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ABSTRACT

Six elite chewing tobacco varieties were evaluated for heterosis and combining ability for yield and yield component characters F_1-11 (I-115 x VR-2) and F_1-13 (PV-7 x VR-2) recorded maximum heterotic vigour of 14.7% and 17.4% increase over the better parent in total yield and whole leaf yield respectively. The variances of general combining ability (gca) were significant for whole leaf, total yield and leaf area and in general, variance of specific combining ability (sca) were not significant for any character. The magnitude of gca was higher than that of sca indicating predominance of additive gene action. I-64 and PV-7 showed positive and high gca effects and these are ideal parents for future breeding programmes for chewing tobacco crop improvement.

KEY WORDS: Chewing tobacco, Heterosis, Combining ability.

Utilization of hybrid vigour for obtaining higher yields has been exploited successfully in many crops in recent times. Although the crosses were generally superior to their better parents, hybrid vigour could not be successfully exploited on commercial scale in tobacco because of quality and predominantly self pollinating breeding system. Earlier studies on heterosis and combining ability in different types of tobacco resulted in identifying promising parents and suitable breeding procedures for crop improvement. (Sastry and Rao, 1980, Naskar and Rao, 1984 and Sastry et al., 1984).

An attempt was made to identify elite parents and desirable cross combinations to be used in evolving high yielding genotypes of chewing tobacco of Tamil Nadu. The study was carried out in a set of diallel cross excluding reciprocals, for yield and yield component characters amongst the six divergent varieties of chewing tobacco of Tamil Nadu and the results are summarized in this article.

MATERIALS AND METHODS

Six divergent elite tobacco varieties viz, I-64 (Nonnaii sun-cured type), I-375 (Sun-cured type), I-115 (Heenam-palayam sun-cured type), PV-7 (Periavadamugam smoke-cured type), VR-2 (Vedaranyam sun-cured type) and VTK-1 (Vattakappal sun-cured type) were crossed in a diallel fashion to yield 15 F_1 hybrids excluding reciprocals. These hybrids and six parents were raised in randomised block design with two replications at CTRI Research Station farm, Vedasandur during 1977. Data on the whole leaf yield per plot, total yield per plot and four yield component characters, plant height, internodal length, stem girth and leaf area were subjected to analyses of variance. The percentage increase over the better parent (BP) in respect of yield characters was calculated. The data were analysed for combining ability according to model II of Griffing (1956a,b).

RESULTS AND DISCUSSION

Amongst the parents, variety I-64 recorded maximum yield of whole leaf and total yield. I-64 was significantly superior to the rest of the parents in respect of total yield while for whole leaf yield it was significantly superior to the rest excluding I-375 and VTK-1. Variety PV-7 recorded maximum leaf area amongst the parents and was significantly superior to the rest excluding I-64.

Eleven out of 15 hybrids registered higher whole leaf yield and ten hybrids recorded higher total yield over better parents, although the differences were not statistically significant. In general, F_1-11 (I-115 x VR-2) and F_1-13 (PV-7 x VR-2) recorded maximum heterotic vigour with 14.7% and 17.4% increase over better parent in total yield and whole leaf yield respectively (Table 1).

The analysis of variance for combining ability showed significant differences between progenies for leaf area, whole leaf yield and total yield indicating high genetic variability among the progenies (Table 2). The variances of gca were significant for these three characters whilst the variances of sca were found not significant for any character. The variances of gca were larger than sca indicating the predominance of additive gene action and the results are similar to the earlier workers on other types of tobacco (Gopinath et al., 1966, 1967; Sastry et al., 1984; Naskar and Rao, 1984).

Table 1. Mean values for yield components, yield characters and gca effects

Entries	YIELD COMPONENTS				YIELD CHARACTERS		GCA EFFECTS		
	Plant height (cm)	Inter-nodal length (cm)	Stem girth (cm)	Leaf area (cm^2)	Whole leaf yield (Kg/plot)	Total leaf yield (Kg/plot)	Leaf area (cm^2)	Whole leaf yield (Kg)	Total leaf yield (Kg)
1.I-64	37.88	4.00	10.13	1977	4.47	5.43	225.30	0.88	0.97
2.I-375	37.25	3.94	10.13	1706	3.97	4.62	-124.20	-0.12	-0.09
3.I-115	40.25	4.00	9.88	1718	3.17	4.06	-150.90	-0.51	-0.51
4.PV-7	41.75	4.07	10.19	2117	3.51	4.43	289.10	0.07	0.04
5.VR-2	40.00	4.25	10.25	1638	3.40	4.14	-132.40	-0.19	-0.15
6.VTK-1	39.88	4.25	9.75	1765	3.72	4.51	-106.20	-0.22	-0.25
						SE gi:	38.42	0.11	0.10
						CD at 5%:	124.15	0.26	0.24
						CD at 1%:	169.32	0.35	0.32
Hybrids;									
1.(1x2)	36.75	3.94	10.44	1955	4.66 (4.3)	5.63 (3.7)			
2.(1x3)	39.50	4.13	10.00	1918	4.33	5.03			
3.(1x4)	40.75	3.88	10.38	2167	4.55 (1.8)	5.54 (2.0)			
4.(1x5)	39.75	4.00	10.00	1978	4.52 (1.1)	5.40			
5.(1x6)	39.25	4.00	10.32	1903	4.36	5.13			
6.(2x3)	39.38	4.00	10.00	1690	3.60	4.33			
7.(2.4)	40.88	4.00	10.08	1938	4.06 (2.2)	4.70 (3.7)			
8.(2.5)	45.00	3.94	10.32	1848	4.20 (5.8)	4.95 (7.2)			
9.(2x6)	39.50	4.00	10.00	1636	3.86	4.49			
10.(3x4)	39.63	4.13	9.94	1920	4.01(14.2)	4.96(12.0)			
11.(3x5)	40.00	4.07	10.13	1648	3.72 (9.4)	4.75(14.7)			
12.(3x6)	43.13	4.25	9.94	1758	3.79 (1.9)	4.55 (0.9)			
13.(4x5)	38.75	4.00	10.00	1923	4.12(17.4)	4.97(12.2)			
14.(4.6)	41.12	4.25	10.13	1948	3.79 (1.9)	4.70 (4.2)			
15.(5x6)	42.75	4.00	10.13	1772	3.73 (0.3)	4.75 (5.3)			
S.Em	2.11	0.11	0.17	84.22	0.25	0.23			
C.D. at 5%	N.S	N.S	N.S	279	0.82	0.76			
C.V %	7.42	3.95	2.41	6.42	8.84	6.63			

Figures in parantheses in respect of yield characters indicate percentage increase over better parent

N.S: Non-Significant.

Table 2. Analysis of variance of means and combining ability of yield component and yield characters in chewing tobacco

Sources of variation	df	Plant height (cm)	Internodal length (cm)	Stem girth (cm)	Leaf area (cm^2)	Whole leaf yield (Kg)	Total leaf yield (Kg)
Replications	1	1.25	0.11	0.42	21488.10	0.003	0.05
Progenies	20	7.35	0.03	0.06	46777.43**	0.33*	0.39**
General combining ability	5	8.64	0.05	0.11	161202.27**	0.91**	1.21**
Specific combining ability	15	6.91	0.02	0.04	8635.82	0.14	0.12
Error	20	8.85	0.03	0.06	14172.55	0.12	0.10
g.c.a. : s.c.a		1.25 : 1	2.80 : 1	2.50 : 1	18.66 : 1	6.64 : 1	9.83 : 1

** - Highly significant

* - Significant.

Since the additive genetic variance was high, the most appropriate and effective breeding approach would be blending and fixing maximum favourable genes (Rai and Das, 1974).

Varieties I-64 and PV-7 recorded high and positive gca effects in respect of all the three characters and proved to be good general combiners and these parents would be of much practical utility for future hybridisation work. Since high gca effect was reported to be related to additive or additive x additive interaction (Griffing, 1956 a, b; Sprague, 1966) and represents the fixable genetic component of variation, these parents would be of paramount importance in future breeding programme on chewing tobacco crop improvement.

REFERENCES

GRIFFING, B. 1956a. A generalised treatment of use of diallel cross in quantitative inheritance. Heredity, Lond. 10: 31-50.

GRIFFING, B. 1956b. Concept of general and specific combining ability in relation to diallel crossing system. Aust. J. Biol. Sci. 9: 463-93.

GOPINATH, D.M., RAMANA RAO, V.V., SUBRAMANYAM, M. and NARAYANA, C.L. 1966. A study of diallel crosses between varieties of Nicotiana tabacum L. for yield components. Euphytica., 15: 171-8.

GOPINATH, D.M., LAKSHMINARAYANA, R. and NARAYANA, C.L. 1967. The mode of gene action in flue cured tobacco. Euphytica., 16: 293-99.

NASKAR, S.K. and RAO, R.V.S. 1984. Combining ability analysis in cigar-filler tobacco. Indian J. agric. Sci., 54(8): 651-4.

RAI, M. and DAS, K. 1974. Combining ability components of yield in Linseed. Indian J. Genet., 34(3): 371-5.

SPRAGUE, G.F. 1966. Quantitative genetics in plant improvement. pp.315-54. Frey, K.J. (Ed) Iowa State University Press, Ames, Iowa.

SASTRY, A.B. and RAO, PRASADA,P.V. 1980. Genetic analysis of certain quantitative characters in intervarietal crosses of Nicotiana tabacum L. Tob. Res., 6(1): 32-38.

SASTRY, A.B., RAO,R.V.S., SUBRAMANYAM,M. and PRASADA RAO, P.V. 1984. Heterosis and combining ability studies in intervarietal crosses of flue cured tobacco (Nicotiana tabacum L.). Tob. News. 7(2): 7-12.

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STUDIES ON IMPAIRED SEED-SET IN THE MOTHER PLANT (ms 2219A) DURING SORGHUM COH2 HYBRID SEED PRODUCTION

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ABSTRACT

Studies on the impaired seed-set during CoH2 hybrid seed production in Coimbatore district during December-January season of 1983-84 revealed that 61 per cent of female (ms 2219A) plants exhibited the symptom of impaired seed-set. Cent per cent of the affected plants were producing side shoot from any of the leaf axils. The problem of impaired seed-set relative to observations recorded is discussed.

KEY WORDS: Sorghum hybrid, Seed production, Seed-set.