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Evaluation of character association between cured leaf yield and attributing characteristic in F_3 generation of FCV (Flue Cured Virginia) Tobacco (*Nicotiana tabaccum* L.)

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A B S T R A C T

The experiment was carried out at ZAHRS, UAHS, Shivamogga during 2016-2017 *Kharif* to study the character association and path analysis in respect of cured leaf yield and its contributing traits in F_3 generation of FCV (Flue Cured Virginia) tobacco cross TB-70 x TB-102, The component characters *viz.*, green leaf yield, top grade equivalent, stem girth, number of leaves per plant, leaf length, leaf area per plant, plant height and leaf breadth exhibited significant positive correlation with each other and also with cured leaf yield. Path analysis in F_3 generation indicated maximum positive direct effect of number of leaves per plant, top grade equivalent, leaf breadth, leaf length and green leaf yield on cured leaf yield. In the present investigation superior promising individual families were identified in F_3 generation. Therefore, for improving cured leaf yield selection may be based on characters which have shown positive direct association with cured leaf yield.

Introduction

Tobacco (*Nicotiana tabacum* L.) is one of the world's most widely cultivated non-food commercial crop and is chosen by farmers in more than 120 countries because of its performance under widely varying climatic and soil conditions. India is one of the top ten countries cultivating tobacco (*Nicotiana* species) for domestic and international market. The major tobacco producing countries in the world are China, U.S.A., Brazil, India, Turkey and Bulgaria. In FCV tobacco cured leaf yield is of economic importance which is a complex trait influenced by many component character. Hence it is necessary to understand the magnitude and direction of association among these related characters.

Correlation studies provide an opportunity to study the magnitude and direction of association of yield with its direct and indirect components and also among various components. So to identify the suitable selection criteria for improving the yield, correlation analysis is of great importance. Thus helps for effectively measuring the relative importance of causal factors which helps to build an effective selection program. The purpose of this study, therefore, is to estimate phenotypic correlation between leaf yield and yield attributing traits as well as the direct and indirect effects of these component traits on yield. To unravel these direct and indirect effects of different characters on the yield, path coefficient analysis is needed. Correlation and path analysis thus help in identifying suitable selection criteria for improving the yield. Therefore, the present study was undertaken to know the nature of association among different yield attributing characters and with cured leaf yield.

Materials and Methods

Experiment was conducted at ZAHRS, college of agriculture, UAHS Shimogga during Kharif 2016. Experimental material comprised of 25 F_3 families of the cross TB-70 X TB-102 with their parents and 3 checks Thrupti, Kanchan and Sahyadri. They were grown in Randomised block design. Each plot consisted of 10 lines each with 10 plants, with intra and inter row distance of 90X60cm. Fifty plants within each plots were selected for taking the following observations, they are days to 50% flowering, days to maturity, plant height (cm), specific leaf weight(mg/cm^2), stem girth (mm), internodal distance (cm), number of leaves per plant, leaf length (cm), leaf breadth (cm), leaf area (cm^2), green leaf yield (Kg/ha), cured leaf yield (Kg/ha), top grade equivalent (Kg/ha), reducing sugar (%) and nicotine content (%).

Area =Length x Width x 0.6345.

To determine the degree of association of characters with yield and also among the yield components, the correlation coefficients were calculated. Phenotypic coefficients of correlation between two characters were determined by using variance and covariance components as suggested by Al- Jibouri *et al.* (1958). Path coefficient analysis was carried out using the phenotypic correlation coefficients to know the direct and indirect effects of the yield components on yield following the method suggested by Wright (1921) and as illustrated by Dewey and Lu (1959).

Results and Discussion

In this study Phenotypic correlation coefficients between dry leaf and its contributing characters for F_3 generation of the cross TB-70 X TB- 102 were calculated. The overall phenotypic correlations among the traits are presented in Table 1.

Study revealed that cured leaf yield of tobacco was shown highly positive and significant association with top grade equivalent followed by green leaf yield, number of leaves per plant , leaf length, leaf area and plant height. The same findings were obtained by Hamid *et al.*, (2011). Wenping *et al.* (2009) found also positive and significant correlations of dry leaf yield with leaf length and leaf number. In contrary to this leaf breadth were shown low but positive association with cured leaf yield. The association between specific leaf weight, nicotine content and days to 50% flowering was shown negative association with cured leaf yield. The association between cured leaf yield with reducing sugar, days to maturity and internodal distance was shown negative and negligible (As shown in Table 1.)

Table.1 Phenotypic Correlation for cured leaf yield F_3 families of FCV tobacco:

	DFF	DM	PH	SLW	SG	ID	NLP	LL	LB	LA	GLY	TGE	RS	NIC	CLY
X1	1	0.8549**	-0.1799	-0.1710	-0.1300	-0.2324	-0.1403	-0.1995	0.0589	-0.1123	-0.1920	-0.1160	0.1076	0.2220	-0.1148
X2		1	-0.1585	-0.1029	-0.0277	-0.1105	-0.0601	-0.0731	0.1519	-0.0005	-0.1104	-0.0637	0.1072	0.0477	-0.0616
X3			1	-0.1667	0.5106**	0.1085	0.4242**	0.4626**	0.1629	0.4324**	0.4883**	0.4416**	0.2066	0.0704	0.4423**
X4				1	-0.0622	-0.1414	-0.1820	-0.0802	-0.1058	-0.1621	-0.1709	-0.2180	-0.2846*	0.0463	-0.2169
X5					1	-0.0473	0.8895**	0.8908**	0.3263*	0.8760**	0.9096**	0.8424**	0.0880	-0.0397	0.8430**
X6						1	0.0410	-0.0479	-0.0986	-0.0192	-0.0152	-0.0612	-0.0035	-0.2203	-0.0612
X7							1	0.8867**	0.2882*	0.9317**	0.9597**	0.9106**	0.0682	-0.1784	0.9103**
X8								1	0.3107*	0.8942**	0.9430**	0.8975**	0.2001	-0.0470	0.8978**
X9									1	0.5988**	0.2590*	0.3165*	0.2906*	0.1374	0.3177*
X10										1	0.9096**	0.8889**	0.0188	-0.0730	0.8892**
X11											1	0.9450	-0.0874	-0.1756	0.9451**
X13												1	-0.1085	-0.1599	0.9999**
X14													1	-0.0901	-0.1084
X15														1	-0.1609
X12															1

** Correlation is significant at the 0.01 level *Correlation is significant at the 0.05 level

X1-Days to 50% flowering
X2- Days to maturity
X3- Plant heght (cm)
X4- Specific Leaf weight(mg/cm^2)
X5- Stem girth (mm)
X6- Internodal distance(cm)
X7- Number of leaves per plant
X8- Leaf length (cm)
X9- Leaf breadth (cm)
X10 Leaf area per plant(cm^2)
X11- Green Leaf yield (Kg/ha)
X12- Cured leaf yield (Kg/ha)
X13- Top Grade Equivalent (Kg/ha)
X14- Reducing sugar (%)
X15- Nicotine content(%)

Table.2 Estimates of direct and indirect effects of yield components on cured leaf yield at phenotypic level in F_3 families derived from cross TB-70 × TB-102

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{13}	X_{14}	X_{15}	**rp value**
X_1	**-0.0272**	-0.0260	0.0031	0.0086	-0.0002	0.0059	0.0003	0.0032	0.0030	0.0019	-0.0013	-0.0012	0.0037	0.0006	-0.0468
X_2	-0.0175	**-0.0183**	0.0023	0.0076	0.0003	0.0047	0.0006	0.0015	0.0023	0.0015	-0.0014	-0.0007	0.0021	0.0003	-0.0350
X_3	0.0049	0.0054	**-0.0430**	-0.0132	-0.0273	0.0120	-0.0093	-0.0202	-0.0046	-0.0150	-0.0194	-0.0271	-0.0002	0.0050	0.5098**
X_4	-0.0027	-0.0036	0.0027	**0.0087**	0.0020	-0.0001	0.0016	0.0015	-0.0017	0.0003	0.0009	0.0012	0.0005	-0.0016	-0.1831
X_5	0.0001	-0.0001	0.0055	0.0020	**0.0086**	-0.0037	0.0037	0.0051	0.0027	0.0054	0.0051	0.0069	-0.0016	0.0000	0.6764**
X_6	0.0095	0.0112	0.0122	0.0003	0.0190	**0.0439**	0.0211	0.0208	0.0091	0.0215	0.0242	0.0279	-0.0048	-0.0035	-0.6790**
X_7	-0.0088	-0.0243	0.1579	0.1305	0.3131	-0.3517	**0.7299**	0.1857	-0.0094	0.4565	0.3172	0.3686	0.0096	-0.0280	0.5782**
X_8	-0.0432	-0.0302	0.1708	0.0618	0.2142	-0.1729	0.0926	**0.3641**	0.1299	0.2451	0.1517	0.2372	-0.1046	-0.0614	0.5566**
X_9	-0.0686	-0.0768	0.0658	-0.1180	0.1918	-0.1285	-0.0080	0.2208	**0.6190**	0.4162	0.0526	0.2085	-0.1479	0.1637	0.1488
X_{10}	0.0742	0.0869	-0.3761	-0.0341	-0.6697	0.5269	-0.6737	-0.7250	-0.7243	**-1.0772**	-0.3956	-0.7551	0.2334	-0.0808	0.5441**
X_{11}	0.0150	0.0250	0.1460	0.0346	0.1909	-0.1790	0.1410	0.1352	0.0276	0.1191	**0.3244**	0.2349	-0.0278	-0.0405	0.8646**
X_{13}	0.0249	0.0222	0.3428	0.0772	0.4362	-0.3460	0.2750	0.3548	0.1834	0.3817	0.3943	**0.5446**	-0.0980	-0.0616	0.8544
X_{14}	-0.0056	-0.0046	0.0002	0.0022	-0.0077	0.0045	0.0005	-0.0118	-0.0098	-0.0089	-0.0035	-0.0074	**0.0411**	0.0004	-0.0967
X_{15}	0.0021	0.0016	0.0113	0.0181	0.0001	-0.0078	0.0037	0.0164	-0.0258	-0.0073	0.1220	0.0110	-0.0010	**-0.0974**	-0.2051

Correlation coefficients (phenotypic) of reducing sugar were non significant with almost all the traits except leaf breadth and specific leaf weight. Hence, there is no effect of reducing sugars on yield and its related traits but effect the taste quality of tobacco leaves. Gopalakrishna and Rao (1980) also reported no associations of alkaloid contents with yield and its components among Natu tobacco cultivars.

Path coefficient analysis was carried out to partition the correlation coefficients in to direct and indirect effects of component traits on cured leaf yield in F_3 families of the cross TB-70 x TB-102 and results are presented in Table. 2.

When the correlation between a dependent character and an independent character is not significant, the direction of selection for that independent character has to be decided based on the magnitude and direction of its direct effect and also on the direction in which its majority of indirect effects (of considerable magnitude) are operating. While dealing with a more complex character like yield, it enables the breeders to identify the important component traits of such a nature so that differential emphasis can be laid on such component characters for selection.

The correlations have to be significant and the direct and indirect effects have to be of substantial magnitude for direct selection of the trait to improve the dependent character.

Internodal length, reducing sugar, specific leaf weight and reducing sugar exhibited low positive direct effect on cured leaf yield. Patel (1989) also found positive direct effect of reducing sugar with cured leaf yield. Leaf area per plant exhibited maximum negative direct effect. Whereas plant height, chlorophyll content, Days to 50 per cent flowering and days to maturity exhibited minimum negative direct effect on cured leaf yield. These results are on par with the findings of Ramachandra (2014) who reported the negative direct effect of plant height and days to 50per cent flowering on cured leaf yield. Correlation of these traits with cured leaf yield are mainly due to indirect effect of these character through other component traits. So indirect selection for these traits through such component trait will be desirable for yield improvement.

The correlation study revealed the importance of characters like green leaf yield, top grade equivalent, stem girth, number of leaves per plant, leaf length, leaf area per plant, plant height and leaf breadth for increasing cured leaf yield. Further, path coefficient analysis revealed that number of leaves per plant, top grade equivalent, leaf breadth, leaf length and green leaf yield in that order, were major characters having positive direct effects and significant positive association with cured leaf yield, indicating due weightage need to be given to these characters in selection programme for bringing out an improvement in cured leaf yield of flue cured virginia tobacco.

Maximum indirect effects for yield were exhibited by leaf area per plant through number of leaves per plant, leaf breadth, top grade equivalent and leaf length. Direct effect of this trait with cured leaf yield was highly negative but the correlation was positive significant. So indirect selection also should be practised for this trait through number of leaves per plant, leaf breadth, top grade equivalent and leaf length while selecting cured leaf yield. Information obtained by this will helps in indirect selection for component traits.

Moreover, leaf area per plant exerted moderate to high positive indirect effect on cured leaf yield and thereby, greater importance should be given to indirect selection for this trait through it’s attributing traits for improving cured leaf yield.

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