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Short Communication

Selection indices for cured leaf yield and nicotine content in tobacco (*Nicotiana tobacum* L.)@

V. Devanand, A. Manjunath[1], S. Rangaiah[2] and S. D. Nehru[1]

Department of Genetics and Plant Breeding, UAS, GKVK, Bangalore 560 065

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The average yield of FCV (Flue Cured Verginia) tobacco (*Nicotiana tobacum* L.) in India is low (1519 kg/ha) when compared to its potential realized in some countries like Zimbabwe (2645 kg/ha), USA (2238 kg/ha) and the China (1770 kg/ha). Therefore, there is a need to involve new sources of base material for the plant breeding programmes to develop high yielding varieties, and when a new source material is to be involved, selection indices constructed by applying simultaneous selection model to the data collected in that material are supposed to be helpful in successfully selecting for the desirable characters. Information on such indices is lacking in tobacco as compared to other crops [1-3].

A set of 41 tobacco genotypes was evaluated in a randomized complete block design with three replications, during *kharif* 2001. Observations were recorded on 16 characters (X_1 to X_{16}) *viz.*, days to flowering, plant height, internodal length, number of leaves per plant, leaf area per plant, fresh leaf yield, cured leaf yield, per cent loss of weight, grade index, top grade equivalent, reducing sugar (X) (i.e., reducing sugar content in the leaves at "X" position), reducing sugar (L), nicotine content (X), nicotine content (L), proportion of reducing sugar to nicotine (X) and proportion of reducing sugar to nicotine (L). The characters days to flower, fresh leaf yield, cured leaf yield, reducing sugar content and nicotine content were recorded on plot basis, while for other characters, five plants means were recorded. Selection indices were constructed using the selection model proposed by Smith [4] for several characters simultaneously, using the discriminant function of Fisher [5].

Selection indices were formulated for three sets of characters. The indices from the first, second and third sets were meant for the comparison against straight selection for the three dependent characters i.e. cured leaf yield, nicotine (X) and nicotine (L) respectively. In each set, the characters were chosen on the basis of correlations, high magnitudes of direct and indirect effects and also high genetic advance. In all the three sets, there were a number of indices with higher relative efficiency (RE) than straight selection for the corresponding dependent character. The indices occupying the first five positions in respect of RE in each of these sets are presented in Table 1.

Eight characters *viz.*, leaf area per plant, fresh leaf yield, per cent loss in weight, reducing sugar (L), nicotine (X), nicotine (L), reducing sugar to nicotine ratio (X) and reducing sugar to nicotine ratio (L) were involved to construct selection indices for cured leaf yield which are presented in Table 1. On the whole, among the 255 indices formulated for cured leaf yield, 67 were superior to straight selection. Of those 67, the index, $- 0.05\ X_6 - 637.6\ X_{12} + 110.7\ X_{16}$ recorded the highest RE (319.49) and involved only three characters. Further, among the characters involving less than three characters, none was having a RE that was on par with the RE of this index. Therefore, this index appeared to be appropriate for adoption in achieving improvement for cured leaf yield.

Seven characters *viz.*, leaf area per plant, fresh leaf yield, per cent loss in weight, reducing (L), nicotine (L), reducing sugar to nicotine (X) and reducing sugar to nicotine (L) were considered for constructing the selection indices for nicotine content (X) (Table 1). Out of 127 indices formulated for nicotine (X), 42 were found superior over straight selection, the highest RE (386.74) having been recorded by the index involving four characters ($0.0003X_6 - 0.01X_{12} + 3.29\ X_{14} - 0.56\ X_{16}$). Interestingly, the index, $0.0003X_6 + 3.27\ X_{14} - 0.56\ X_{16}$ (three character index) which ranked second

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[1]AICRP for Dryland Agriculture, UAS, GKVK, Bangalore 560 065

[2]AICRP (Tobacco), Regional Research Station, Post Box # 125, Shimoga 577 204

Table 1. Promising selection indices for cured leaf yield, nicotine (X) and nicotine (L) in tobacco with higher relative efficiency as compared to direct selection.

Sl. No.	Selection index	Relative Efficiency (%)	*Genetic advance
	A. Selection indices for cured leaf yield		
1.	$-0.057X_6 + -637.6888X_{14} + 110.7632X_{16}$	319.49@	201.46
2.	$-0.0562X_6 + 4.1829X_{12} - 649.9598X_{14} + 111.7708X_{16}$	319.12	201.86
3.	$-2.24X_8 + 7.52X_{12} - 432.78X_{14} + 74.47X_{16}$	251.63	159.17
4.	$7.249X_{12} - 429.75X_{14} + 73.971X_{16}$	251.07	157.82
5.	$-1.5035X_8 - 407.507X_{14} + 71.853X_{16}$	243.73	154.17
	B. Selection indices for nicotine (X)		
1.	$0.0003X_6 - 0.0104X_{12} + 3.29\ X_{14} - 0.565X_{16}$	386.74	0.946
2.	$0.0003X_6 + 3.27X_{14} - 0.5634X_{16}$	386.53@	0.945
3.	$-0.025X_{12} + 1.964X_{14} - 0.336X_{16}$	298.01	0.729
4.	$-0.007X_8 + 1.876X_{14} - 0.327X_{16}$	290.14	0.710
5.	$1.882X_{14} - 0.328X_{16}$	289.93	0.709
	C. Selection indices for nicotine (L.)		
1.	$0.0X_5 + 0.0X_6 - 0.02X_8 + 0.017X_{12} + 0.13X_{15} - 0.04X_{16}$	121.33	0.307
2.	$0.0X_5 + 0.0X_6 - 0.02X_8 + 0.18X_{13} + 0.005X_{15} - 0.03X_{16}$	120.61	0.305
3.	$0.0X_5 - 0.09X_8 + 0.15X_{12} + 0.15X_{13} - 0.04X_{16}$	120.28	0.304
4.	$0.0X_5 + 0.02X_{12} - 0.03X_{15} - 0.039X_{16}$	118.89	0.300
5.	$0.0X_5 + 0.015X_{12} + 0.118X_{13} - 0.012X_{15} - 0.038X_{16}$	119.56	0.302
6.	$0.0X_5 + 0.21X_{13} - 0.03X_{16}$	118.51@	0.299

X_5 = Leaf area/plant; X_6 = Fresh leaf yield; X_8 = Per cent loss in weight; X_{12} = Reducing sugars (L); X_{13} = Nicotine (X); X_{14} = Nicotine (L); X_{15} = Reducing sugars/Nicotine (X); X_{16} = Reducing sugars/Nicotine (L)

*Genetic advance (through direct selection) figures for the three dependent characters were as follows :

Cured leaf yield : 63.26

Nicotine (X) : 0.24

Nictoine (L) : 0.25

@Suggested for adoption in selecting for yield

had the RE value (386.52) that was almost equal to four combination index that ranked first for RE (386.74). Therefore, this index involving three characters appeared to be suitable for adopting in selection for high nicotine content (X).

The characters considered for constructing the selection indices for nicotine content (L) were same as the ones considered for nicotine (X) except that nicotine (L) was replaced by nicotine (X) (Table 1). Among 127 indices formulated for comparison with straight selection for nicotine (L), 89 indices were found superior to straight selection. The first ranking index ($0.00\ X_5 + 0.21\ X_{13} - 0.03\ X_{16}$) among the indices involving only three characters for nicotine (L) had a RE of 118.51, which was almost on par with the RE of top ranking indices involving six characters. Therefor, this index, which involves less labour for field and laboratory work was considered appropriate for adoption in selecting for higher nicotine content (L).

As could be seen from the foregoing paragraphs pertaining to selection indices, the indices suggested for cured leaf yield, nicotine content (X) and nicotine (L) differ from one another. Therefore, the overall selection strategy has to be to first select promising genotypes based on visually appreciable characters from the ones involved in the three indices, and then to select from among those genotypes, a few that record top scores when the three selection indices are applied separately.

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