

## Characterization and Similarity index of Flue Cured Tobacco Hybrid, CH3 and its Parental Lines

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**ABSTRACT:** A field experiment was carried out during 2013-14 at M/s ITC Ltd. ABD-ILTD Farm, Rajahmundry for varietal characterization using morphological parameters in CH3 a Flue Cured tobacco hybrid, and compare with its parental lines. The morphological observations were recorded of ten randomly selected plants with three replications in each genotype. The results revealed that out of 35 morphological characteristics studied, in Hybrid CH3, 20 traits were monomorphic, 11 traits were dimorphic and only 4 traits were polymorphic. The similarity index worked out for hybrid and parents revealed that, the hybrid CH3 had maximum similarity (88%) with female parent and minimum similarity with male parent. Statistical analysis showed that hybrid CH3 is better performer in terms of yield compared to its parents, another hybrid CH1, Pureline, Advance Breeding Lines (ABL's) and check variety.

**Key words:** characterization, female, hybrid, male,

### INTRODUCTION

Tobacco is an important commercial crop of India grown in an area of 0.45 M ha (0.31% of net cultivated area) with 800 M kg production). India stands third in tobacco production and exports in the world [3]. Flue Cured tobacco has a major share in exports. It is cultivated in different agro climatic regions like Northern Light Soils (NLS), Southern Light Soils (SLS) and Southern Black cotton soils (SBCS), of Andhra Pradesh and Light Soils (KLS) of Karnataka, regions. Tobacco is a self-pollinated crop and hybrid seed production is practicable using male sterility systems. Currently, the most popular male-sterility system is the cytoplasmic male sterility (CMS), that involves male sterile (A line), their cognate iso-nuclear maintainer (B line). Identification of cultivars/lines and determination of their genetic relations through Distinctness, Uniformity and Stability (DUS) testing are very important for crop improvement program, variety registration system, and protection of plant variety and farmer's rights (PVP&R). Clear-cut identification/demarcation of elite crop varieties and hybrids is essential for protection of purity and prevention of unauthorized commercial use and consequential quality deterioration. With the proliferation of newly developed varieties in

important cultivated crops, the task of establishing the identity of these varieties and of maintaining their pure seed lots has become major concern since the variety gains popularity only when farmers get genetically pure seeds consistently in any crop, especially in highly quality conscious crop like Flue Cured tobacco. Hence each cultivar needs to be properly defined with suitable descriptors, so as to maintain its identity during seed production through field inspection and certification. Knowledge in gene pool of tobacco could assist in selection of materials for breeding or genetic investigations [8]. The hybrid CH3 is considered as first hybrid in FCV tobacco developed from, ITC-ILTD [2]. Thus, the present study was undertaken for phenotypic characterization of hybrid CH3 and its parental lines that are in active seed multiplication chain.

### MATERIAL AND METHODS

Genetically pure seeds of tobacco hybrid CH3 and its parental lines were obtained from M/s ITC Ltd. ABD-ILTD, Rajahmundry and raised at the farm in a plot size of 108 x 6 m per entry. Inter row and intra-row spacing was maintained at 110 and 60 cm, respectively during Rabi 2013-14 season and all the recommended agronomic package of practices were followed to raise

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a healthy crop. The morphological observations were recorded in ten randomly selected and tagged plants in each genotype.

Total eight genotypes *i.e.* hybrid CH3 along with its parents and another contemporary hybrid CH1, Pureline, Advanced Breeding Lines (ABLs) and check variety were planted in Randomized Block Design with three replications.

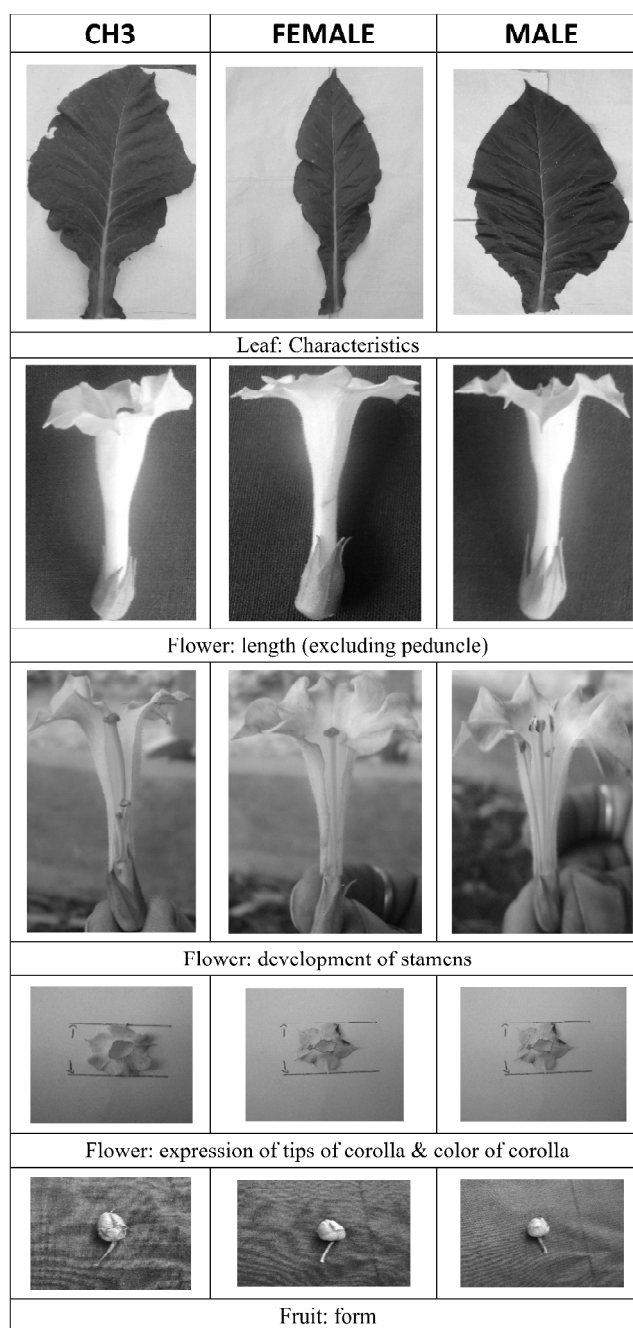
The phenological characteristics with respect to (1) Plant, (2) Leaf (3) Flower (4) Inflorescence (5) Fruit as per the guidelines of International Union for the Protection of New Varieties of Plants (UPOV document no. TG/195/1 Tobacco, 2002-04-17) were recorded under field condition at different stages of crop growth. FCV hybrid CH3 released in India and its parents were studied for 35 morphological characters, total characters observation done at five stages *i.e.* (1) Plant, (2) Leaf (3) Flower (4) Inflorescence (5) Fruit. The observations were recorded on 10 randomly selected plants in each replication at specified stages of crop growth period when the characters under study had full expression.

The similarity index for morphological characters was calculated using statistical package given by Sokal and Sneath [14].

## RESULTS AND DISCUSSIONS

The results obtained from the investigation have been presented in Figure 1 and Table 1. Out of 35 morphological characteristics studied, in Hybrid CH3, 20 traits (plant characters like shape, height of main stem, number of leaves, tendency to produce suckers, type of leaf, angle of insertion, length of blade (excluding auricles), thickness of veins (excluding midrib), angle of lateral veins to midrib, shape in cross section, longitudinal profile, blistering of blade, color of blade, color of midrib on adaxial side, time of flowering, flower characters like expression of tips of corolla, inflorescence characters like shape, position, compactness and fruit traits like form) were found to be monomorphic, 11 traits (plant characters like color of main stem, leaf characters like ratio length/width of blade, width of blade at base, shape of blade, shape of tip, development of auricles, flower characters like length (excluding peduncle), diameter of tube (just above calyx), color of corolla, development of stamens, and length of pistil relative to stamens) were dimorphic and only 4 traits (leaf traits like width of blade, undulations of margin, flower characters like swelling of tube and size of corolla) were polymorphic.

The hybrid CH3 achieved the highest height (185 cm), while its parents expressed relatively lower



**Figure 1: Morphological characters of CH3 Tobacco hybrid and its parents**

values (Table 2). Regarding the number of leaves per plant, the hybrid CH3 had the highest value (28), whereas the female the lowest (22). Investigation of the genetic variability of plant height and number of leaves per plant in some varieties of oriental tobacco and their F1 hybrids is reported as a significant precondition for high and stable yield [7]. The highest (6.5 cm) and lowest (4.5 cm) length of internodes were found for female and male parent respectively. The greatest leaf size was found in the hybrid CH3 with

**Table 1**  
**Morphological descriptors of CH3 tobacco hybrid and its parents**

<i>Sl. No.</i> <i>Traits</i>	<i>CH3</i>	<i>Female</i>	<i>Male</i>
1. Plant: shape	conical	conical	conical
2. Plant: height of main stem (including inflorescence)	medium	medium	medium
3. Plant: color of main stem	medium green	medium green	dark green
4. Plant: number of leaves	medium	medium	medium
5. Plant: tendency to produce suckers	medium	medium	medium
6. Leaf: Type	sessile	sessile	sessile
7. Leaf: angle of insertion	right angle	right angle	right angle
8. Leaf: length of blade (excluding auricles)	medium	medium	medium
9. Leaf: width of blade	wide	medium	very wide
10. Leaf: ratio length/width of blade (excluding auricles)	medium	medium	small
11. Leaf: width of blade at basis (sessile types only)	narrow	narrow	medium
12. Leaf: thickness of veins (excluding midrib)	medium	medium	medium
13. Leaf: angle of lateral veins to midrib	moderately acute	moderately acute	moderately acute
14. Leaf: shape of blade	narrow elliptic	narrow elliptic	broad elliptic
15. Leaf: shape of tip	strongly pointed	strongly pointed	medium pointed
16. Leaf: shape in cross section	convex	convex	convex
17. Leaf: longitudinal profile	moderately recurved	moderately recurved	moderately recurved
18. Leaf: blistering of blade	medium	medium	medium
19. Leaf: undulations of margin	medium	weak	strong
20. Leaf: development of auricles	medium	medium	strong
21. Leaf: color of blade	medium green	medium green	medium green
22. Leaf: color of midrib on lower side	green	green	green
23. Time of flowering (50% of plants with at least one corolla open)	medium	medium	medium
24. Flower: length (excluding peduncle)	medium	medium	short
25. Flower: diameter of tube (just above calyx)	small	small	large
26. Flower: swelling of tube	medium	weak	strong
27. Flower: size of corolla	medium	large	small
28. Flower: expression of tips of corolla	very	very	very
29. Flower: color of corolla	medium pink rose	medium pink rose	dark pink rose
30. Flower: development of stamens	none or rudimentary	none or rudimentary	full
31. Flower: length of pistil relative to stamens	none	none	shorter to same length
32. Inflorescence: shape	inverted conical	inverted conical	inverted conical
33. Inflorescence: position (relative to upper leaves)	above	above	above
34. Inflorescence: compactness	medium	medium	medium
35. Fruit: form	ovate	ovate	ovate

an average length of 66 cm, 72 cm and 68 cm and an average width of 32 cm, 34 cm and 30 cm. The female parent had the small leaf with an average length of 50 cm, 56 cm and 54 cm and an average width of 20 cm, 24 cm and 22 cm at bottom, middle and top positions respectively. The female showed the greatest

value (2.5, 2.3 & 2.4), while the lowest value (1.9, 2.0 & 2.2) was found for the male parent for the ratio of leaf length to width. The correlation between leaf size and its chemical composition, relation of length and width of the leaf is an important parameter for the quality of FCV tobacco.

**Table 2**  
**Morphological characteristics of tobacco hybrid CH3**

Hybrid/ Parents	Plant height (cm)	Days to 50% flowering	Number of leaves /plant	Internodes length (cm)	Length of leaf (cm)	Width of leaf (cm)	Ratio leaf length/width
					B M T	B M T	B M T
Female	173	75 days	20-22	6.5	50, 56, 54	20, 24, 22	2.5, 2.3, 2.4
Male	160	65 days	25-28	4.5	52, 53, 55	27, 27, 25	1.9, 2.0, 2.2
Hybrid CH3	185	65-75 days	28	6.0	66, 72, 68	32, 34, 30	2.0, 2.1, 2.2

Plant height is an important agronomic character in tobacco because quite often it is directly related to number of leaves borne on tobacco plant and yield. Hence this character may be used as an indicator for the potential number of leaves. According to the previous reports, the inheritance of plant height [4, 13] and days to flowering [5, 6, 10] are more governed by non-additive gene action.

The variation was noticed among the genotypes for their color of main stem. CH3 and female parent exhibited medium green color of main stem while male parent had dark green color of main stem. The genotypic variation in the colour of the main stem may be either due to genetic character of the parents or due to edaphic and environmental conditions such as nutritional factors and light intensity during crop growth. The genotypes exhibited variation for width of blade and classified as wide (CH3) medium (Female parent) and very wide (male parent). Shape of blade (leaf) was classified into narrow elliptic in CH3 and female parent and broad elliptic in male parent. The variation in the shape of the leaf in genotypes is attributed to mainly to the genetic characters and leaflet shape is genetically controlled as it was reported by Verma [16]. Shape of tip (leaf) was strongly pointed in CH3 and female parent and medium pointed in male parent. Development of auricles in leaf were categorized into medium in CH3 and female parent and strong in male parent. Undulations of margin (leaf) grouped into medium in CH3, weak in female parent and strong in male parent. Similarly, on the basis of time of flowering (50% of plants with at least one corolla open) all three genotypes were grouped as medium. The reasons attributed for differences in the days to 50 percent flowering among the genotypes is due to genetic effect and least influenced by environment and dominance gene action [12]. Flower length (excluding peduncle) categorized as medium in CH3 and female parent and short in male parent, similarly flower diameter of tube (just above calyx) grouped into small in CH3 and female parent and large in male parent. Swelling of tube (Flower) were classified into medium in CH3, weak in female parent and strong in male parent. Size

of corolla is categorized into medium in CH3, large in female parent and small in male parent. The petal colour of the flower is one of the important characters for characterization and the genotypes were categorized as medium pink rose in CH3 and female parent and dark pink rose in male parent. The present results are in conformity to the findings of Murthy [9]. The variation in petal colour is due to genetic constituent of the genotypes which has cumulative effect and is governed by dominant gene as it was reported by Ahuja *et al.* [1] in cotton. Another important flower character used for grouping of cultivars were development of stamens and the genotypes were grouped into none or rudimentary in CH3 and female parent and full in female parent. While, length of pistil relative to stamens (varieties with fully developed stamens only) in flower were grouped into none in CH3 and female parent and shorter to same length in male parent. By studying these two flower characteristics, we can conclude the type of hybrids *i.e.* fertile or sterile. However, fruit form was ovate present in all the three genotypes, hence these characters can be used for grouping of the genotypes.

The similarity index (Table 3) worked out for hybrid and parents revealed that, the hybrid CH3 expressed highest similarity (88%) with female parent (color of main stem, width of blade, shape of blade, development of auricles, color of corolla and development of stamens) and minimum similarity was observed with male parent (petal colour). This may be due to the inheritance of majority of the characters that transfer from female parent in hybrid. Thus the female influence was found to be of greater extent in F1 hybrid as reported in sunflower [11].

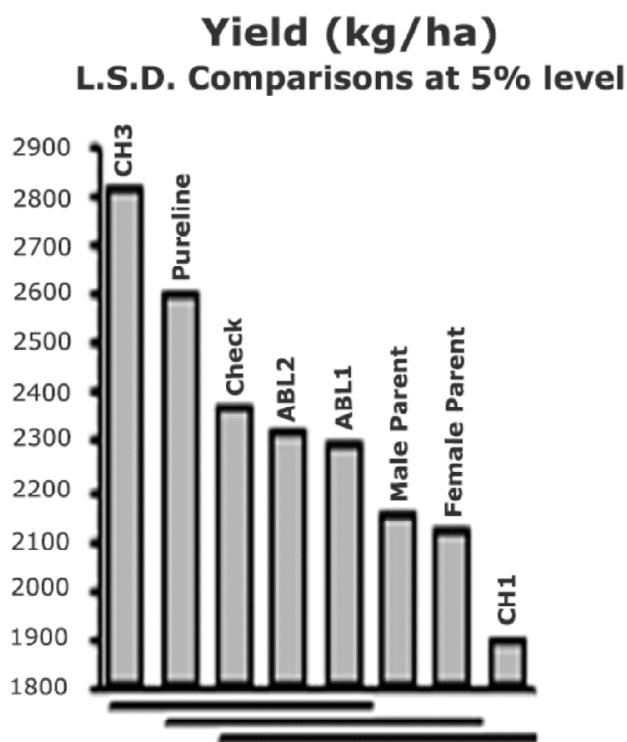
**Table 3**  
**Percent similarity index of CH3 Tobacco hybrid and its parents based on morphological characters**

Hybrid/Parents	Female	CH3	Male
Female	100	88	0
CH3		100	12
Male			100

The leaf yield is a trait that is influenced by many interrelated factors. Genetic properties of tobacco hybrids and agro-ecological conditions of production are the decisive factors in formation of organic and mineral complex of substances, affecting the corresponding leaf yield. The ANOVA (analysis of variance) enlisted in Table 4 and Graph 1 reveals that there is significant difference between the hybrid CH3 and its parents as well as hybrid CH1, in terms of yield it tops the list. The hybrid CH3 recorded 2818 kg/ha cured leaf with 60% bright grades against the check variety Kanchan, with cured leaf yield of 2368 kg/ha with 51% bright grades. A similar trend in yield parameters was reported in farmer fields [15].

**Table 4**  
**Performance of Hybrid CH3 in replicated yield trial**

Hybrids/Varieties	Yield of leaves (kg/ha)	Rank
Female Parent	2125	7
Male Parent	2157	6
Hybrid CH3	2818	1
Hybrid CH1	1895	8
Check variety	2368	3
Pure Line	2597	2
ABL 1	2296	5
ABL 2	2322	4
LSD 5%	12.14	
C.V. (%)	17.17	



**Graph 1: Performance of Hybrid CH3 in replicated yield trial**

The study reveals that hybrid exhibits several of the characters of its parents and also a few (width of leaf blade), development of auricles, swelling of tube and size of corolla.) which are different from its parents due to interaction effects. The inheritance of majority of the characters is from female parent by the hybrid. Thus the extent of female influence was found to be greater in F1 hybrid.

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