

HISTORY OF THE REGIONAL MINIMUM STANDARDS PROGRAM FOR THE RELEASE OF FLUE-CURED TOBACCO VARIETIES¹ IN THE UNITED STATES



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The Regional Minimum Standards Program for the release of flue-cured tobacco varieties in the United States was conceived as a response to the release of undesirable varieties in the mid-1950s. The initial establishment of committees which organized the program occurred at the Tobacco Workers' Conference in Athens, Georgia, in 1958. The program's first field trials were grown in 1963 and constitute the first phase of the program—the regional small plot tests. The second phase consists of the regional farm tests and began in 1964. Minimum standards were set for chemical, physical, and smoke taste evaluation. The program has been a cooperative and volunteer effort among the tobacco industry (cigarette manufacturers and export leaf dealers), growers,

seed companies, USDA, and university research and extension personnel. It is operated through a parent committee and standing subcommittees. Various aspects of the program changed over the years as needs arose, conditions changed, and data accumulated. Since its inception, 138 entries have passed the program, but only approximately 12% of these have been planted extensively. The program is credited with helping to maintain the high quality of US flue-cured tobacco that is known throughout the world. All varieties of flue-cured tobacco currently grown in the USA have met the standards.

Additional key words: tobacco chemistry, nicotine, reducing sugar, total nitrogen, smoke.

INTRODUCTION

Flue-cured tobacco (*Nicotiana tabacum* L.) production in the United States was extremely variable during the period 1900 to 1933 and prices fluctuated widely depending on the size of the crop. A Tri-State Tobacco Growers Cooperative was formed in 1922 to stabilize production and prices. Their efforts failed due to lack of farmer support, incentives for new growers, and contract violations. In 1933, a federal program was initiated to regulate tobacco production and prices. However, farmers voted against the use of marketing quotas in 1939, and acreage increased by 40%, production increased by 50%, and leaf value declined. On 7 August 1939, the Agriculture Adjustment Act was amended to permit the Secretary of Agriculture to convert state marketing quotas into state acreage allotments. The intent was to control production, but growers circumvented this control by managing for maximum yield/unit land area. The circumvention continued until an

acreage/poundage program was initiated in 1964 which took effect with the 1965 crop.

Quality Deteriorates

Quality is the defining factor for United States tobacco. Without high quality, the American tobacco farmer cannot compete with low-cost, low quality foreign tobacco. In 1957, the United States produced about 50% of the world flue-cured tobacco crop and accounted for nearly 60% of the world export market. This was considerably less than the two-thirds of the world crop production and 85% of world exports of flue-cured tobacco during the late 1930s. This decline has been attributed to a decrease in leaf quality and an increase in world production.

In 1954, over 70 varieties of flue-cured tobacco were being grown across the belt; most were selections or reselections of the same variety with various names, and each occupied very small acreages. In the United States, flue-cured tobacco acreage decreased approximately 33% from the late 1930s to 1957, while yield per acre increased more than 65%. Some of the increase in yield was at the expense of quality.

Unacceptable Varieties Released

'Coker 139,' 'Coker 140,' and 'Dixie Bright 244' became available to growers in 1955. Coker 139 was a high-yielding variety which

¹ The term variety is used throughout because it was common practice during the formation of the program and is part of the committee names. Readers may substitute the term cultivar, which is the preferred terminology, wherever variety appears.

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Contribution received March 18, 1996. Tob. Sci. 40:99-110, 1996.

produced 132% of the average yield of the two check varieties. '402' and 'Dixie Bright 101,' in the 1949 through 1956 North Carolina trials. As a result of this increased yield performance, 20% and 50% of the acreage were planted to Coker 139 in 1955 and 1956, respectively.

The cured leaves of Coker 139, Coker 140, and Dixie Bright 244 were light-bodied, low in nicotine, and high in sugars. They lacked the flavor and aroma required by the tobacco industry. The cured leaf was said to be slick, tight-faced, and pale in color. Leaves did not age well during storage prior to cigarette manufacture. Consequently, companies reduced their purchases of these varieties and considerable quantities of them went to the Commodity Stabilization Service in 1956.

Variety Discount Program

The US Department of Agriculture in 1957 reduced the price support rates of these three varieties to 50% of that for comparable grades of other varieties to further discourage their production. This became known as the Variety Discount Program and these varieties became known as the discount varieties.

A manual was published in 1957 by the US Department of Agriculture to identify the discount varieties (4,5). Growers who planted them were issued a special marketing card for limited price support. Up to the present, all growers who receive a standard marketing card must certify that the flue-cured tobacco varieties grown on their farm are not discount varieties. Identification specialists were trained to identify discount varieties in the field to enforce the program.

The varieties Coker 187-Goldenwilt, Coker 282, Coker 316, and Reams 64 were added to the discount variety list (3) in 1964. Also to be discounted were similar breeding lines and varieties. Coker 187-Goldenwilt and Coker 316 had been released for planting in 1960. Coker 282 was never released, but some growers obtained seed illegally and grew it. Reams 64 was released in 1961.

MINIMUM STANDARDS PROGRAM

Formation of Committees and Standards

Discount varieties caused heightened concern about the quality of American flue-cured tobacco. All elements of the tobacco industry wanted to assure the permanent status of American flue-cured tobacco on the world market. Thus, support for the creation of a Regional Minimum Standards Program for the

development of flue-cured tobacco varieties was universal. It was felt that continuation of release of discount varieties would end world domination and possibly tobacco production in the southeastern United States.

Flue-cured tobacco varieties had been evaluated as early as 1946 in university trials. A Regional Tobacco Variety Evaluation Committee was formed by the Tobacco Workers' Conference in the early 1950s, but it did not attempt to set the criteria that a potential variety should meet before commercialization. Thus, the development of high-yielding varieties continued to be the main objective of most public and private breeding programs.

A prototype of the present Regional Minimum Standards Program for flue-cured tobacco was actually carried out in the early 1950s by the Official Variety Testing Program in the Department of Agronomy at North Carolina State College (North Carolina State University). Small plots on five research stations were used for the first phase of testing of potential varieties and commercial varieties. The second phase of the program consisted of on-farm tests with one-half acre plots. Thirteen North Carolina farms were included with three each in the border, middle, and old belts, and four in the eastern belt. Tobacco company representatives from six domestic and export companies evaluated the cured leaf for quality factors in warehouse displays. The companies were American Tobacco Company, Brown and Williamson Tobacco Corporation, Imperial Tobacco Company, Liggett and Myers Tobacco Company, Philip Morris Inc., and R. J. Reynolds Tobacco Company.

A Regional Flue-Cured Tobacco Quality Evaluation Committee was formed in 1958 under the auspices of the Tobacco Workers Conference held in Athens, Georgia (GA), to focus on quality. It later became the Regional Flue-Cured Tobacco Quality Committee-Varieties and is also known as the Parent Committee of the Regional Minimum Standards Program for Flue-Cured Tobacco. A series of meetings were then held to determine quality factors. A sub-committee presented a set of varietal minimum release standards to the 16th Tobacco Workers' Conference. However, the Regional Flue-Cured Quality Evaluation Committee decided the standards needed to be revised based on the latest information during a meeting in December, 1960.

At the 17th Tobacco Workers' Conference in

1961, the subcommittee on Tobacco Varietal Release Standards proposed the following minimum release standards as had been approved by the Regional Flue-Cured Tobacco Quality Evaluation Committee the previous month: 1) the cured leaf would be analyzed for nicotine, soluble sugars, and total nitrogen beginning in the F₄ generation, 2) physical quality standards would be compared to two check varieties, Hicks and Vesta 5, 3) the cured leaf would be smoked and favorable smoke flavor results from two major tobacco companies would be required, and 4) the tobacco companies would need to accept the tobacco for trade. The subcommittee also proposed that curing tests be conducted to measure the rates of color change and moisture loss, that varieties be tested under differing fertility rates and evaluated for curability and quality, that testing require two years of on-farm tests and two to three years in the official variety tests for yield data, that disease resistance ratings would be taken from separate tests, and that data be collected on maturity, number of ground suckers, and rate of ripening. The subcommittee also proposed that no variety should occupy more than 10% of total tobacco acreage during the first year the seed were available. The intent was to gradually introduce a new variety into the market and avoid situations like 1955 when Coker 139 occupied 20% of the acreage the first year it was released.

Tobacco breeders and seed producers, growers, domestic and export tobacco company personnel, extension specialists, and researchers from the USDA and universities met in Kinston, NC, in October 1962, and a second subcommittee was appointed to determine the quality standards for release of future flue-cured tobacco varieties. Guy L. Jones was chosen as the chairman and the subcommittee met 15 November 1962 at Imperial Tobacco Company in Richmond, Virginia (VA), and 19-20 December 1962 in Raleigh, NC. Other members of the committee included W. W. Bates—Liggett and Myers Tobacco Company, J. M. Moseley—American Tobacco Company, R. B. Griffith—Brown and Williamson Tobacco Corporation, C. M. Sprinkle—R. J. Reynolds Tobacco Company, D. A. Coulson—Imperial Tobacco Company, C. H. Rogers—Coker's Pedigreed Seed Company, J. M. Green—McNair Seed Company, J. B. Speight—Speight Seed Farms, J. F. Chaplin—USDA and South Carolina Agricultural Experiment Station, and R. G. Henderson—

Virginia Agricultural Experiment Station. The committee's goal was to assure that the quality of future flue-cured tobacco varieties would be maintained and to avoid the release of unacceptable varieties. It assumed voluntary cooperation from each segment of the tobacco industry and appointed a Flue-Cured Tobacco Advisory Sub-Committee in 1963 to conduct the program. In 1968, the advisory committee became known as the Flue-Cured Tobacco Variety Evaluation Sub-Committee. This advisory committee was under the auspices of the Regional Flue-Cured Tobacco Quality Committee-Varieties or Parent Committee.

The subcommittee on varietal release standards recommended the following for new variety acceptance: it must be distinguishable from existing varieties in one or more characteristics; it should be an F₆ or later generation and genetically stable; it must be comparable to the check (standard) varieties in color, body, texture, moisture equilibrium, and filling value; undesirable flavor and aroma determined by two smoke panels on cigarettes made of cured leaf would result in further testing; and its leaf chemistry must be compared to the mean values of the two standard varieties (Hicks and NC 95). For leaf chemistry, the standards they proposed were $\pm 15\%$ of the average of the checks for total nitrogen, protein nitrogen, alpha amino nitrogen, total alkaloids, and soluble sugars; nornicotine levels must be 8% or less of the total alkaloids as determined by Cundiff and Markunas method (2).

The first phase of the program was the regional small plot test. To enter this test, levels of nornicotine and total alkaloids had to have been previously determined. Entries would be subject to chemical and smoke taste evaluations and data on yield, leaf number, plant height, days to flower, number of ground suckers, description of the leaf size and shape, and disease resistance would be collected. A maximum of five entries per agency (public and private entities engaged in breeding) would be allowed in the regional small plot test. One test each would be conducted in Virginia, South Carolina, Georgia, and Florida, and three in North Carolina.

The regional farm test would be the second phase of the program. Entries that passed the regional small plot test would be allowed in the second phase and examined again for all parameters in the regional small plot test, and additionally, examined for curability and adaptability. Two farm tests each would be

conducted in Virginia, South Carolina, Georgia, and Florida, with six in North Carolina. Farm test entries would also be included in the regional small plot test and data from both tests would be used during deliberations. All entries in the program were coded during the deliberations so that individuals would not know which entry they were evaluating. The code was broken after the warehouse tobacco displays so individuals could see how the tobacco had been rated.

The final meeting of the subcommittee on quality standards was held at Liggett and Myers Tobacco Company Research Department in Durham, NC, 21 March 1963. Sampling procedures for chemical and smoke analyses were established. The cultural procedures and practices, and the protocol for the tobacco displays were outlined.

The Regional Flue-Cured Tobacco Variety Advisory Sub-Committee was formed at a meeting of the Regional Flue-Cured Tobacco Quality Evaluation (Parent) Committee held on 12 February 1963, and the subcommittee proposals were accepted. The Flue-Cured Tobacco Advisory Sub-Committee met in Durham, NC, at Liggett and Myers Tobacco Company Research Center on 21 March 1963, which was after the final meeting of the subcommittee on Quality Standards. The Flue-Cured Tobacco Advisory Sub-Committee also met again 6 August 1963 in Williams Hall at North Carolina State College, Raleigh, NC where sampling and handling procedures, the making of cigarettes, smoke evaluation, and plans to conduct tours to visit experimental plots were discussed.

The Regional Minimum Standards Program for the release of flue-cured tobacco varieties began its field trials in 1963 with 31 experimental lines and only regional small plot data were collected that year. From the beginning, the committee was aware that the program and standards may be too rigid or too loose and that changes in production and industry needs might occur. Therefore, it was generally accepted that the committee should be able to revise the standards accordingly. The committee was prepared to reappraise the standards from time to time as required.

CHANGES IN THE MINIMUM STANDARDS PROGRAM

From 1963 to 1968, chemical data were taken from each stalk position and weighted means were calculated for plant leaf chemistry.

The sampling procedure was changed in 1969 to a weighted composite sample across stalk positions. Analyses included total alkaloids, nicotine, nornicotine, soluble sugars, total nitrogen, soluble nitrogen, alpha amino nitrogen, pH, percent ash, and water soluble ash (wsa). Nitrogen to nicotine and soluble sugars to nicotine ratios were calculated. However, standards were only applied to total nitrogen, protein nitrogen, alpha amino nitrogen, total alkaloids, and soluble sugars. Data were also collected on ground suckers, leaf axial suckers, plant height, leaf number, and days from transplanting to flower.

Changes in Chemical Standards

At the 16 November 1966 meeting of the Flue-Cured Tobacco Variety Advisory Committee, discussions were held about lowering nicotine standards. Concern was expressed that the old and middle tobacco belt needed to lower the level of nicotine in tobacco to be comparable to levels grown in the eastern and border belts. The next month, December 1966, discussions were continued on the proposed lower nicotine standards. It was pointed out that the 1965 conversion to an acreage/poundage program resulted in management practices leading to higher alkaloid content. Data from 1936 to 1961 and 1963 to 1965 confirmed the downward trend in nicotine content while the 1966 crop showed higher nicotine content. The total alkaloid standards were changed from $\pm 15\%$ to $+15\%$ and -20% of the mean of the checks starting with the 1967 crop.

Discussions on lowering nicotine standards continued at a November 1967 meeting. Again the argument was based on the shift in cultural practices following the acreage/poundage program which resulted in higher nicotine. An ad hoc committee was formed to look into changing the standard to $+10\%$ to -30% of the mean of the checks. This proposal was never accepted.

In 1968, a Disease Evaluation Sub-Committee was established and a previously established (date unknown) Genetics Stability Sub-Committee was continued. The Standards Sub-Committee (date of formation unknown) composition was clarified at this meeting.

The Standards Committee recommended changing the wording from total alkaloids to nicotine in 1969. They proposed that standards should include protein nitrogen, total soluble nitrogen, total ash, nicotine, nornicotine, soluble sugars, total nitrogen, and

alpha amino nitrogen. Thus, that year suggestions were made that total nitrogen and protein nitrogen be $\pm 10\%$ of the mean of the checks. No change was made in alpha amino nitrogen which was $\pm 15\%$, in nicotine or total alkaloids which was $+15\%$ to -20% , and in soluble sugars which was $\pm 15\%$ of the mean of the checks. An ad hoc committee was also appointed to study the variation in ash and percent soluble nitrogen. No action was taken as a result of the ad hoc committee study.

At the 23rd Tobacco Workers' Conference in January 1970, the Quality Evaluation Committee met and proposed changing the total soluble nitrogen standards to $\pm 8\%$, establish a total ash standard of $\pm 15\%$, and a filling value standard of no less than 10% of the mean of the checks; none of the proposals were accepted. Changes approved were the wording from "total alkaloids" to "nicotine" and the standard for total nitrogen from $\pm 15\%$ to $\pm 10\%$, which remains the same today. The standard for insoluble nitrogen was changed from $\pm 15\%$ to $\pm 10\%$ of the mean of the checks.

Due to variability in the regional farm test, nornicotine data were only used from the regional small plot tests for regional farm test entries in 1973. In 1975, the Variety Evaluation Sub-Committee did not use the alpha amino nitrogen data due to its variability. In 1976, the Standards Sub-Committee moved to change the standard for alpha amino nitrogen from $\pm 15\%$ to $+15\%$ and -20% and data were to be reported to two decimal places. They also recommended that soluble sugars be reported to one decimal place. Both proposals were accepted.

In 1979, the Standards Sub-Committee proposed to reduce nicotine standards to $+5\%$ and -30% of the mean of the checks but no action was taken. The Liggett-Meyers Tobacco Company could not perform alpha amino nitrogen analyses; therefore this standard was dropped. R. J. Reynolds Tobacco Company used chloroform instead of benzene to extract nornicotine, which resulted in higher numbers, so nornicotine data was not used for the 1979 crop.

Because of chemical analyses changes, the Standards Sub-Committee met 15 December 1979 and appointed an ad hoc committee to look at nicotine and nornicotine. The Standards Sub-Committee voted to eliminate alpha amino nitrogen and insoluble nitrogen from the standards. The following year the ad hoc committee recommended not to change the nicotine standards while the nornicotine ad hoc committee suggested the use of 12.3% for

maximum limit for the percentage of total secondary alkaloids to total alkaloids. The Standards Sub-Committee later suggested the use of 13%, and it was adopted at the December 1983 meeting of the Variety Evaluation Sub-Committee. The Parent Committee approved this at the January 1985 meeting at the 31st Tobacco Workers' Conference. Wording for "soluble sugars" was changed to "reducing sugars" in 1987.

The percentage of total secondary alkaloids to total alkaloids (TSA/TA) was again discussed at the December 1990 meeting suggesting that those limits be raised. Reasons for suggesting changes included a true converter would have a TSA/TA percentage value above 24% while curing times have an impact on conversion to nornicotine. No action was taken. This issue was also raised at the January 1991 Parent Committee Meeting held at the 34th Tobacco Workers Conference. Again, no action was taken.

Due to highly variable chemical data in the 1994 crop year, the Flue-Cured Variety Evaluation Sub-Committee used standard deviations (s) for limits. They used ± 0.8 s for reducing sugars and ± 1.0 s for nicotine. These standard deviation limits were based on historical averages to achieve the same average limits.

Changes in Physical Properties

Variety potential, a subjective estimate, was used as a criteria in the beginning of the program. Variety potential was rated on a scale of 1 to 4 with 1 being good, 2 fair, 3 showed some promise, and 4 showed no promise as a potential variety. Regional small plot and farm test entries were rated by tobacco company personnel during the warehouse evaluations. At the same time each entry was rated for usability. This variety potential rating was eliminated in 1977.

Discussions were held at the 9 December 1965 meeting of the Variety Advisory Committee at the University of Florida on setting definite limits for filling value, but no action was taken at that time. However, on 7 December 1966, filling value was set at no less than the average of the two check varieties for that year. Filling value was discussed at the 8 January 1967 Parent Committee Meeting at the Tobacco Workers' Conference and it was referred back to the Variety Advisory Committee. No action was taken.

The standard for usability has not been a permanent standard but was established each

year at the Variety Evaluation Sub-Committee meeting. Usability is determined by whether or not a particular company can use the tobacco in their purchases. In some years the entries which appeared to have low usability were rejected using no set criteria. Usability was set at 15% in 1976 and increased to 20% in 1977. In some years no entries were rejected for usability. The Standards Sub-Committee, in 1976, discussed the possibility of evaluating the varieties on a basis of domestic and export usability but no agreement was reached.

At a Parent Committee Meeting on 10 January 1983 in Williamsburg, VA, the committee disapproved of wording of using 50% of the average of the checks for usability because some members thought 50% of the average of the checks was too low. The range of usability has been established as low as the minimum of 50% of the checks to a high of the mean of the check varieties. This criteria has been the lone factor in rejecting some entries over the years.

Changes in Smoke Taste Evaluations

Cigarettes were made for seven tobacco company panels to evaluate for smoke flavor and aroma in the early years of the program. Preparation of samples was detailed in the 1963 report. All seven tobacco companies who were involved in the program initially were also involved in some sort of chemical analysis. Some of the tobacco was to be aged; some was not aged. Currently, the tobacco is not aged prior to making of cigarettes.

In the beginning, cigarettes were made from cured leaf of both the regional small plot and farm tests. If unfavorable ratings came from any two smoke panels, the entry was subject to retesting. In 1965, three groups of cigarettes were made based on location. One group of cigarettes came from tobacco composited from the regional small plots in Georgia, South Carolina, and Whiteville, NC. A second group was composited from regional small plot entries from Rocky Mount and Oxford, NC, as well as from Blackstone, VA. The third group was composited from the regional farm tests in Georgia (2 tests), South Carolina (2 tests), and North Carolina (6 tests). This latter group was changed in 1972 when the North Carolina contribution was reduced to three farms, with Georgia and South Carolina remaining as before. Also, in 1972, cigarettes from regional small plots were combined over the Tifton, GA, Florence, SC, Whiteville, NC, and Rocky Mount, NC, locations. Smoke panels were requested to use the terms

"acceptable" and "unacceptable."

At a December 1988 meeting, the Variety Evaluation Sub-Committee petitioned the Standards Sub-Committee to drop smoke flavor, filling value, and moisture equilibrium evaluations of the regional small plot entries. This was approved at the 33rd Tobacco Workers' Conference in Nashville in 1989. The primary reason behind the request for elimination of this requirement was the historical evidence that very few entries had ever been rejected in the regional small plot based on smoke evaluation alone. Those that had been rejected under smoke evaluation were also rejected for at least one or more chemical constituents. Currently, there are four tobacco company smoke panels that evaluate the regional farm test cigarettes for smoke flavor and aroma.

Changes in Protocol

At the final meeting of the subcommittee on Quality Standards which was held 21 March 1963 in Durham, NC, the Committee set up protocols for sampling and testing. The cultural practice recommendations included fertilization, topping, and suckering. Plot sizes were standardized in 1970. The regional small plot test initially used 40 plant plots; that was later changed to 20 plant plots. They also listed the row spacing as well as the spacing within the row.

A delayed release program was initiated in 1968 that provided for one year of seed increase after an entry passed the regional program prior to sale on the market. The intent was to allow time for data to be collected in the Official Variety Trials as well as lower the expense required for the sponsoring agencies to produce seed of the varieties that might not be released. This provision was later annulled in 1987 at the 32nd Tobacco Workers' Conference. The Parent Committee allowed the breeders to release new varieties the next year. The reasoning for the change was the possible development of new varieties that may have some traits or characteristics not found in current commercial varieties. The impetus for this was the passage of 'Coker 371 Gold' which had extremely high levels of resistance to black shank (*Phytophthora parasitica* Dastur var. *nicotianae* (Bredan de Haan) Tucker). University breeders were incorporating blue mold (*Peronospora tabacina* D.B. Adam) resistance, and if a blue mold epidemic occurred, then the growers would need immediate access to seed of a blue mold

resistant variety. At this time, no varieties have been released that are blue mold resistant.

As early as 1966, state coordinators of the regional minimum standards program wanted to allow growers to use maleic hydrazide (MH) for sucker control. Coordinators were having a difficult time finding growers who would hand sucker the entire crop. Chemical sucker controls were not allowed until 1973.

In November 1966, it was shown that all three replicates in the regional small plot test could be combined at each location to produce one sample for chemical analysis without any significant loss of data. At that time, samples were analyzed by stalk position which was changed to a composite sample in 1969. The regional small plot test was handled in this manner from 1967 until 1994 when it was then decided to return to sampling each replicate at a Parent Committee Meeting in Tampa, FL. The reason for the reversion to sampling each replicate was highly variable data in the regional small plot test in the 1992, 1993, and 1994 crops.

An ad hoc committee was established in 1966 to look into developing procedures for testing varieties of differing maturity dates but no action was taken. A New Procedures Sub-Committee was formed in 1971 to consider variety performance under varying harvest management practices. The committee conducted tests in 1972 comparing conventional methods with a low-profile, three-harvest regime and a once-over harvest regime. They examined five varieties for physical and chemical traits. This committee was terminated at the 25th Tobacco Workers' Conference in Hamilton, Ontario, 6 August 1973.

At the 31st Tobacco Workers' Conference, the Parent Committee met on 7 January 1985 and approved one-quarter acre plots in the regional farm test when there were 12 or more entries in the trial and at least three acres total in the test if there were less than 12 entries. In 1987, the committee assured that public breeders would have one entry in the regional farm test and second entries would be placed in a lottery. It also allowed private breeders to have two entries in the regional farm test, and stipulated the test would have a maximum of 12 entries plus the two check varieties. At a 1993 meeting of the Flue-Cured Tobacco Variety Evaluation Sub-Committee, the number of entries in the farm test remained the same but each breeder, whether public or private, would get one space and a lottery would be

conducted for the second space. This became effective with the 1994 crop. The legitimate commercial breeder agencies in 1987 were Northrup King, Speight Seed Farms, Reams, and Coker Pedigreed Seed Co. The public breeders were the USDA, Virginia, North Carolina, and South Carolina.

At the 9 December 1987 Parent Committee Meeting it was decided that growers would be paid at the selling price or the current season average, whichever is higher, for tobacco produced in the farm test. Previously, growers would be paid the highest of the selling price, the current season average, or the previous week's average.

It was decided filters would be put on cigarettes for smoke evaluation at the December 1989 meeting of the Variety Evaluation committee. This procedure was standard for burley tobacco.

At the 4 December 1990 Variety Evaluation Sub-Committee Meeting it was established that a maximum of 40 entries would be allowed in the regional small plot tests. Sponsors would be allowed to enter additional (over 2) previously approved small plot entries in the regional farm tests if all 12 spaces were not used.

Beginning with the 1993 season, chemical data for deliberations would be the weighted averages of the regional small plot and regional farm test when considering the regional farm test entries since there were a maximum of six regional small plot tests and 13 regional farm tests. Prior to this, equal weight was given to the regional small plot and the regional farm test in calculating average values for regional farm test entries.

An ad hoc committee was established at the December 1993 Variety Evaluation Sub-Committee meeting to study the qualification of breeders and decide who should be allowed to place entries in the testing program. The following year they recommended that the program be limited to bona fide U.S. tobacco breeders, since this was a voluntary program. It defined a 'bona fide' breeder as someone engaged in improving tobacco germplasm for use by commercial growers.

Transgenic tobaccos were discussed at the December 1994 meeting. It was decided that whoever wishes to enter transgenic tobaccos would inform the chairman by July 1 of the preceding year so that ample time would be given to obtain permits from state agencies. The first transgenic tobacco line was entered in 1996.

Table 1. Entries that have passed the Regional Minimum Standards Program for Flue-Cured Tobacco (1964-1995).

Year	Entry	Year	Entry	Year	Entry
1964	Coker 298 NC 2326 Speight G-36 VA 115	1978	McNair 373 NC 16 NC 82 NC 682	1987	NC 4027 USDA NC TG-37 NK 5168
1965	Speight G-7		Speight G-58	1988	NC 5130 USDA NC TG-42 NK 646
1966	Coker 258 PD5	1979	Speight G-70 Coker 51 McNair 3199		Coker 86 I-49 Reams 134
1967	Bell 93 Coker 254 McNair 14 Speight G-13		PD4 VA 81	1989	Coker I-39 NK 730 NK 7160 VA 116
1968	Coker 213 Coker 411 McNair 133 Speight G-28	1980	Coker 78-209MM NC 67 NC 7556 VA 182	1990	NC 6085 USDA NC 7029 USDA Reams 137 RG 8
1969	Coker 347 GA 1469 McNair 135 Speight G-41	1981	Coker 79-176MM McNair 926 MaNair 9107 PD 11		RG 22 Speight G-117 NC TG-52
1970	Bell 110 Coker 68-354-IM GA 1470 SC 71 Speight G-33 VA 770	1982	NC 50 NC 7567	1991	NC 8053 USDA Reams 44 Reams 126 RG 11 RG 13
1971	NC 88 NC 8090 PD 79 SC 72 Speight G-140	1983	Coker 206Y NC 48 USDA NC TG-24 NK 94 PD 88	1992	Speight G-111 NC 9140 USDA NK 939 Reams M-1 RG A-9
1972	McNair 944 Speight G-15 VA 080	1984	Speight G-80 Coker 82-211Y NK 2117 PD 279 VA 102		Speight G-126 NC 0002 USDA NC 0007 USDA NC 0015 USDA RG 0B17
1973	McNair 160 McNair 187 NC 79	1985	Coker 83-379Y Golden 141 NC 2060 USDA NC TG-27 NC TG-28	1993	CU 263 NC 1108 NC TG-55 RG 0B18 RG 2H4
1974	Coker 86 NC 12 NC 98 Speight G-23 VA 283	1986	Reams 158 Coker 84-371Y NC 3415 NC 3003 USDA NC 3027 USDA PD 48	1994	Speight 152 NC TG-71 OX 2007 RG3A16 RG 3H-61
1975	NC 13		Speight G-102		
1976	Coker 48 NC 89 NC 3150 VA 644		Speight G-108		
1977	Speight G-52		VA 110		

At the Tobacco Workers' Conference in Tampa, FL, (January 1995) the Parent Committee decided to make changes relative to the regional farm test and chemical analyses of the regional small plot tests. The farm test data would stand on its own and not be included with the regional small plot data; the regional farm test entries would not be included in the regional small plot test; and the regional small plot tests would be analyzed chemically by replicate to try to improve the precision of

estimates due to the high variability of the data of the previous three seasons.

Lamina to stem ratio was considered but not proposed by the Standards Sub-Committee at their meeting in 1976. The Standards Sub-Committee also discussed the stem-lamina ratio at the 13 December 1979 meeting but no action was taken. The first mammoth variety, NC TG-22NF, passed the program in 1981 (Table 1). There was concern raised by the tobacco industry because in the field the leaves

had large midribs. The following year the Variety Evaluation Sub-Committee set up an ad hoc committee to study the stem-lamina ratio. Data were collected from regional farm tests, as well as the Official Variety Test of North Carolina, from 1983, 1984, and 1985 and included the mammoth variety. The ad hoc committee submitted stem-lamina content data from the three years. This issue was again brought up at the 12 January 1987 Parent Committee Meeting at the 32nd Tobacco Workers' Conference. In essence, the variability among farms was greater than among varieties; they did not suggest using stem-lamina ratio as a criteria. The data revealed that drought-stressed farms had more acceptable stem-lamina ratios than farms that received adequate rainfall or were irrigated.

At the Parent Committee Meeting in College Park, Maryland, in January 1970 the Genetics Stability Sub-Committee was charged with examining only released varieties. Selected varieties would be examined for cherry red and off types. In 1971, this committee tested commercial varieties and remnant seed of nine varieties and did not feel that genetic drift was a problem. It recommended this committee be dissolved. However, it was not until the Parent Committee meeting at the 32nd Tobacco Workers' Conference in January 1987 that the Genetics Stability Sub-Committee was dissolved.

Attempts were made to combine the Standards Sub-Committee with the Variety Evaluation Sub-Committee in July 1968, but they failed. However, these two committees were combined at the 34th Tobacco Workers' Conference in 1991 by the Parent Committee with the stipulation that any changes in standards by the new joint committee should not be applicable until one year following the approval.

At the 23rd Tobacco Workers' Conference in 1970, wording was added to the standards stating that any line segregating would not be recommended for release. Since that time most lines that were found segregating in the field were withdrawn from the testing program. In 1979, it was established that an entry should be withdrawn prior to the Georgia Tobacco Display to avoid collecting unnecessary data.

In the beginning of the program, Hicks and NC 95 were chosen as the standard varieties to compare with all new lines. 'NC 2326' was substituted for Hicks in 1969 because Hicks was highly susceptible to black shank. Subsequent studies of chemical composition

stability revealed that NC 2326 was the most stable over the years for chemistry (1); but it is not currently grown by any growers because it is not agronomically acceptable. NC 2326 and NC 95, the two current standards, do contain the cured-leaf chemistry and smoke flavor and aroma that are desired by the tobacco companies which are the primary bases for their use as standard (check) varieties.

Disease resistance became a concern in 1971 when 'GA 1470' was found to be highly susceptible to race one of black shank. This concern was again raised in 1995 when one of the farm test entries was even more vulnerable to black shank than the check NC 2326. However, standards have not been set for disease resistance.

The reason for the Regional Flue-Cured Minimum Standards Program was brought up again in 1982 when there was concern about commercially grown varieties that may fall under the discount category. 'Reams 266' was evaluated in Florida, Georgia, North Carolina, South Carolina and Virginia in 1983 and found to be low (comparable to Coker 139) in nicotine. It had previously been declared a non-discount variety in 1964 by the USDA (3). Data were turned over to the North Carolina Department of Agriculture and the North Carolina Tobacco Seed Committee for action. Subsequently, this variety was removed from the market. Reams 266 was released as a variety prior to implementation of the program. No variety that has passed the Regional Minimum Standards Program has later been declared a discount variety.

In 1983, the Disease Committee recommended that root-knot nematode resistance determined by the reaction to PVY (potato virus Y) not be used to indicate genetic instability. Also, they discontinued greenhouse testing for Granville wilt resistance.

A news release in the spring of each year was written to inform the public about those varieties that passed the program. This spring news release was suspended in 1985 at the Parent Committee Meeting at the 31st Tobacco Workers' Conference. They felt that this news release confuses growers since all those that passed the program did not necessarily become commercial varieties.

A Changing Scene

Since the inception of the program, breeding agencies have changed. Northrup King bought out McNair Seed Company and later Coker Seed Company so that the two breeding

programs became one. Bell Farms released their last variety in 1970. The University of Georgia released its last variety the same year. Richard Gwynn, the USDA tobacco breeder from Oxford, NC, retired from the USDA and established the RG Seed Company and was approved as a bona fide breeder in December 1987. At the 35th Tobacco Workers' Conference in 1993 Bill Early, who was formerly with McNair Seed Company and Northrup King, was recognized as a bona fide breeder. In 1994 the USDA ended all research programs directly related to tobacco production. By October of 1995 Northrup King had dissolved all of its tobacco seed holdings. Gold Leaf Seed Company was established to handle tobacco seed formerly marketed by Northrup King and was recognized as a bona fide breeder in December 1995.

The list of tobacco companies has changed over the years. Imperial and Liggett-Myers, who were initially with the program, dropped out. Brown and Williamson and Export became one entity and purchased American Tobacco Company in 1994. Dibrell Brothers participated in the earlier years. The Monk Company merged with the Austin Company and subsequently merged with Dibrell Brothers to form one company called DIMON Inc. in 1994. Some companies have changed names. Currently there are seven tobacco companies participating in the program; they are Brown and Williamson/Export, P. Lorillard Tobacco Company, DIMON, Standard Commercial, Philip Morris, R. J. Reynolds, and Universal Leaf Tobacco Company.

SUMMARY

One hundred and thirty-eight entries have passed the program during the 33 years since its inception (Table 1). Similar to the situation in 1954 when over 70 varieties were planted, very few have occupied a significant portion of the flue-cured tobacco acreage. Most notable were 'Coker 258' (1966), 'Speight G-28' (1968), 'Coker 347' (1969), 'McNair 944' (1972), 'NC 82' (1978), 'Speight G-70' (1978), 'K 399' (tested as McNair 3199 in 1979), 'Coker 176' (tested as Coker 79-176 MM in 1981), 'K 326' (tested as McNair 926 in 1981), 'NC 27NF' (tested as NC TG-27 in 1985), 'K 394' (tested as NK3240 in 1985), Coker 371 Gold (tested as Coker 84-371 Y in 1986), 'K 346' (tested as NK 646 in 1988), 'Coker 149' (tested as Coker 86 I-49 in 1988), 'NC 37NF' (tested as NC TG-37 in 1989), and 'K 730' (tested as NK 730 in 1989). This is approximately 12% of the entries that have passed the program. Thus, grower acceptance is the final testing criteria for any potential variety.

The Regional Minimum Standards Program for the release of Flue-Cured Tobacco Varieties is a dynamic program seeking to maintain the superior quality of American flue-cured tobacco on the world market. It has had leaders with vision, excellent cooperation from all aspects of the tobacco industry, and it has fulfilled and will continue to fulfill its purpose. There are movements and shifts in tobacco production that may require refinement and possible overhaul of the program but the overall goal of the program has been a worthy objective.

Table 2. Chronological history of committees associated with the Regional Minimum Standards Program for Flue-Cured Tobacco.

Year	Committee
1958	Regional Flue-Cured Tobacco Quality Evaluation Committee later changed to Regional Flue-Cured Tobacco Quality Committee-Varieties alias Parent Committee of the Regional Minimum Standards Program
1958	Tobacco Varietal Release Standards Sub-Committee No. 1
1962	Tobacco Varietal Release Standards Sub-Committee No. 2
1962	Termination of Tobacco Varietal Release Standards Sub-Committee No. 1
1963	Termination of Tobacco Varietal Release Standards Sub-Committee No. 2
1963	Flue-Cured Tobacco Advisory Sub-Committee: This committee came to be known as the Flue-Cured Tobacco Variety Evaluation Sub-Committee in 1968.
1963?	Genetics Stability Sub-Committee
1963?	Standards Sub-Committee
1968	Disease Evaluation Sub-Committee
1971	New Procedures Sub-Committee
1973	Termination of New Procedures Sub-Committee
1987	Termination of Genetics Stability Sub-Committee
1991	Combined Flue-Cured Tobacco Variety Evaluation Sub-Committee and Standards Sub-Committee

ACKNOWLEDGMENTS

The author acknowledges the assistance of Drs. Guy L. Jones and J. F. Chaplin in reviewing the history of the program and Dr. G. Miner and the anonymous reviewers in editing the manuscript. Jane Dove Corl prepared the manuscript.

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APPENDIX

The Current Program

Current committee structure consists of the Parent Committee (Regional Flue-Cured Tobacco Quality Committee-Varieties) with two standing subcommittees—the Disease Evaluation Sub-Committee and the Flue-Cured Tobacco Variety Evaluation Sub-Committee. A brief outline of committee origins is found in **Table 2**. The Parent Committee meets at each Tobacco Workers' Conference and as needed. The two standing subcommittees meet annually and as needed. All standing committees are composed of tobacco company representatives (both domestic manufacturers and export leaf dealers), university research and extension personnel, and tobacco breeders and seed producers.

The structure of the current field program is outlined in **Table 3**. The chemical standards are as follows:

- Total nitrogen $\pm 10\%$ of average of the 2 check varieties
- Nicotine $+15\%$ to -20% of average of the 2 check varieties
- Reducing Sugars $\pm 15\%$ of the average of the 2 check varieties
- Total secondary alkaloids—not more than 13% of the total alkaloids

Disease evaluation on resistance to Granville wilt (*Pseudomonas solanaceorum* E.F. Smith) and black shank are conducted in the field. Root-knot nematode (*Meloidogyne incognita*

Table 3. Current (1996) structure of the regional small plot and regional farm tests for flue-cured tobacco.

Parameter	Regional Small Plot	Regional Farm Test
Plot size	22 plants	1/4 acre or larger
Replicates	3 per location	1 per farm
Locations	6 research stations GA, SC, VA, and 3 in NC	13 farms 2 in GA, 2 in SC, 3 in VA, and 6 in NC
Entry Number	Maximum 40 including the 2 checks	Maximum 14 including the 2 checks
Entry Number/Sponsor Data	Maximum 5	Maximum 2 unless all 12 spaces are not taken
Plant Height	Yes	No
Leaves/Plant	Yes	No
Days to 50% flower	Yes	No
Yield	Yes	Yes
Physical Evaluation	1 replicate/location evaluated for usability	All plots evaluated for usability, body, texture, and color
Chemical Evaluation	100 grams/plot—all reps	500 grams/plot
Smoke Taste Evaluation	None	15 pounds/plot from all farms in GA, SC, and 3 farms in NC

(Kofoid & White) Chitwood) and tobacco mosaic virus resistance evaluations are conducted in the greenhouse. Only tobacco mosaic virus ratings are used to detect genetic stability.

Physical evaluations are conducted at tobacco warehouses in each state at the end of the season; two evaluations are conducted in North Carolina.

Flue-Cured Tobacco Variety Evaluation Subcommittee deliberations take place the first to the middle of December each year in Raleigh, NC. All entries except the check varieties are under code during deliberations. K326 has been added as a check variety in the regional small plot test so extension agronomists may use the data for comparisons to the most popular variety.

Updated information regarding the program may be obtained from the following address: Official Variety Testing Program, Crop Science Dep., Box 8604, North Carolina State University, Raleigh, NC 27695-8604.