

ARE MINIMUM STANDARDS ON REDUCING SUGARS MEANINGFUL?

The flue-cured tobacco Regional Testing Program is an immense effort - very time consuming and highly expensive to public agencies and industry alike. It is advantageous to everyone to be certain that we are accomplishing our goals in an efficient manner. I have serious doubts concerning this, because few on our committee are cognizant of the low degree of precision of some of our procedures.

There have been several changes in chemical components used in establishing minimum standards since the inception of the program in 1963. Some of the original components that were considered to be so important to some manufacturers initially, were finally dropped (alpha amino nitrogen, for example, was the basis for the demise of many, many lines) when everyone became convinced that these components only measured environmental, management, or maturity and ripeness effects, and that the variation among tobacco lots for these chemical components was not due to genetic causes. In spite of the confidence that many have in the Regional Program, the precision of estimates of means for leaf chemical components in the Regional Small Plot Test is **not good!** The number of samples, upon which chemical means are estimated is low, $n=6$ - even less in years when locations must be dropped because of environmental problems. The sampling error alone resulting from drawing a composite 50 gram sample of tobacco are from 3 replication at each RSP location is not to be ignored. Nevertheless, few on our committee are even aware of this problem.

In examining the data base on reducing sugars over varieties and years, I believe that we need to consider seriously the value for minimum standards on reducing sugar concentrations. This is not to say that reducing sugars are not important in bright tobacco quality; they obviously are, but variation in reducing sugar concentrations within the American flue-cured germplasm pool are environmental and maturity effects, and not due to genetic (variety) causes. Most breeding lines rejected in the Regional Programs fail because of excessively low nicotine, high sugars, or low nicotine and high sugars. We seldom reject lines because of low or high total nitrogen alone. Reducing sugar data are always erratic and fluctuate widely from location to location and year to year. To support this hypothesis, I have extracted total alkaloids as nicotine and reducing sugar data from the North Carolina Official Variety Test over a 12-year period, 1981-1992. The precision of estimates of mean nicotine and reducing sugar contents for the NC OVT is far superior to Regional Small Plot data because means are based upon chemical analyses of tobacco from three replications per location, and five locations per year (if no tests fail). Hence, the sample size upon which a mean is computed is now $n=15$; or at least $n=12$ if a location must be dropped; contrast this to $n=6$ in RSP.

It is my opinion that cultivars Speight G-28 and K 326 deviate in leaf chemistry the farthest from NC 2326 and NC 95 checks of any varieties that have been released since the inception of the Minimum Standards Program. Nicotine and reducing sugar data from the NC OVT for Spt. G-28 and K 326, along with NC 2326 and NC 95, over the 1981-1993 period are shown in the attached table. K 326 was released in 1981, and was not in the test that year; no chemical analyses were conducted on released varieties in the 1992 NC OVT due to budgetary restraints. Everyone is aware that K 326 and Spt. G-28 produce cured leaf with

a lower nicotine concentration than the checks. Over the 12-year period, K 326 contained 87% and Speight G-28 84% of the mean nicotine concentration of the checks. However, neither K 326 or Spt. G-28 differ greatly in mean reducing sugar concentration (102% and 98%, respectively) of the checks. The data support the hypothesis that the low nicotine - high sugar tobaccos result from environmental or management problems, and do not have a genetic cause. Because of the negative relationship between yield and nicotine concentration, it is not biologically possible to produce varieties that yield at a competitive level of something like K 326, yet have nicotine concentrations higher than the checks. Therefore, all high yielding new breeding lines will have a nicotine concentration less than the mean of NC 2326 and NC 95. If new cultivars do not yield significantly more than the checks, they will not become popular and occupy a significant portion of our acreage. Why do we need to maintain a minimum standard on reducing sugars? In my opinion, if a breeding line is rejected from the program because of a very low nicotine concentration in the cured leaf and the season was a "normal" one, the breeders usually discontinue testing the line. Conversely, if a very good breeding line is rejected because of high reducing sugars alone, the breeder always re-enters the line the following year, and ultimately, has a good chance of getting it approved if this is the only deficiency that it has. Why do we need a standard on reducing sugar concentration if minimum standards on nicotine alone will prevent the release of cultivars which have undesirable chemical composition?

One can argue that we have eliminated all varieties containing high sugar concentrations in cured leaf by the Minimum Standards Program. There is really no way of knowing this, because anything that might have had the capability of producing a high sugar tobacco was always rejected whether the high sugar content was real or environmental.

A large component of our effort is done because it is traditional, and not because it is important. If you agree that a re-examination of sugar standards is in order, how can you convince colleagues of this?

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