

# **FLUE CURED TOBACCO VARIETY EVALUATION IN GEORGIA**

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## **Introduction**

Tobacco varieties play an essential role in yield and quality improvement programs. Moreover, a vital part of any breeding program is the scientific testing and evaluation of new tobacco varieties. In addition to yield, important characteristics of these varieties include disease resistance, curing, leaf chemistry, ease of handling, and market acceptability. For a variety to be recommended it must be superlative in one or more and contain a balance of the remainder of the factors. For a variety to have an excellent yield and poor disease resistance or to yield well and have poor cured leaf quality is unacceptable. In addition, every growing season presents these varieties with new challenges which require documentation so growers can make informed decisions.

As a result, Regional Variety Tests are conducted to obtain data on yield, disease resistance, and quality as judged by physical appearance and chemical analysis. These tests consist of a small plot test and subsequently a farm test where desirable varieties from the small plot test are grown in larger plots and receive additional evaluation. Once this information is analyzed, the desirable varieties and breeding lines from these tests advance to the Official Variety Test for further evaluation under growing and marketing conditions in Georgia.

As a result, we have included data from the Regional Farm Test so when varieties are released from this test the extension service will have an additional data set to use in making recommendations to growers.

## **Materials and Methods**

The 2016 Official Variety Test and Regional Small Plot Test consisted of 36 and 20 entries respectively while the Farm Test had 16 entries. These tests were conducted at the University of Georgia Bowen Farm on Ocilla loamy coarse sand. All transplants were treated in the greenhouse with imidacloprid (0.8 oz Admire Pro/ 1000 plants) for Tomato spotted wilt virus (TSWV). The Regional Farm Test and Regional Small Plot were mechanically transplanted on March 31, followed by the Official Variety Test on April 5. All tests were transplanted with 22-24 plants per field plot and replicated three times. Fertilization consisted of 10 lb/A of 9-45-15 in the transplant water (100gal. /A), 500 lbs/acre of 6-6-18 at first cultivation, 600 lbs/acre 6-6-18 at second cultivation, and an additional 120 lbs/acre of 15.5-0-0 at lay-by for a total of 85 lbs/acre of nitrogen.

Cultural practices, harvesting, and curing procedures were uniformly applied and followed the current University of Georgia recommendations. Data collected included plant stand, yield in lbs/A, value/A in dollars, dollars per hundred weight, grade index, number of leaves per plant, plant height in inches, days to flower, and percent TSWV. In addition, leaf chemistry determinations consisted of total alkaloids, total soluble sugars, and the ratio of sugar to total alkaloids.

## **Results and Discussion**

The 2016 Official Variety Test and Regional Farm Test produced good yields and average quality. All tests benefitted from the application of Telone II, applied at the recommended rate, in November 2015 with good soil conditions which held nematode pressure to a minimum. In addition, the standard tray drench treatment of Admire resulted in a test average of around 7% TSWV symptomatic plants. The 2016 growing season was consistently hot. However, the crop provided average cured leaf quality on the first three harvests. The final harvest could have been delayed slightly for optimum maturity.

In the Official Variety Test, yield ranged from 2275 lbs/A for PVH 2275 to 3377 lbs/A for NC 196. Value of released varieties ranged from 2731 dollars/A for CC 700 to 4771 dollars/A for NC 196. Both price and grade index data were based on 2012 data due to lack of new data for 2016 at the time of publication. Price and grade data were slightly below average for all varieties. As a result, prices ranged from \$117/cwt for a number of varieties while PVH 1920 at \$166 had the best price per cwt for the released varieties. Grade indices mirrored price and ranged from 59 to 82 for PVH 1920. As a whole, later maturing varieties did not grade as well as the earlier maturing ones. Plant heights were normal and averaged around 42 inches while leaf numbers per plant averaged above 21 for the test. The days to flower were shorter for 2016 and averaged less than 70 days for all varieties. Leaf chemistry was average with alkaloids less than 3% and sugars averaging above 12%. The ratio of sugars to alkaloids ranged from 3.9 for PVH 2310 to 9.34 for NC 938. Generally, a value of 10 is desirable for this ratio. The Official Variety Test data are displayed in Table 1. Two and three year averages for selected varieties are found in Table 2.

The 2016 Regional Farm Test yielded and graded similar to the other variety tests. In the Farm Test (Table 3), ULT 123 had the lowest yield at 2358 lb/A. CU 206 yielded the highest at 2826 lbs/A, but its price of \$123/cwt was insufficient to give it the highest value. Value differed slightly with ULT 123 bringing in 3086 dollars/A and CU 213 providing 3992 dollars/A. CU 213 graded the best at \$145/cwt and having a grade index of 74. NC EX 79 had the lowest price and grade index of \$121/cwt and 63 respectfully. CU 206 also had a low grade index at 63. Generally, leaf chemistry was similar to the Official Variety Test, with sugars in the mid-teens and alkaloids less than 3%.

## **Acknowledgments**

The authors would like to thank the Georgia Agricultural Commodity Commission for Tobacco for financial support. Also, thanks to Michael Bartenfield, Hunter Brannon,

Charles Conger, Eric Evans, Coby Griffin, Brooke Hester, Catherine Summers, and Molly Stutsman for technical assistance.

Table 1. Yield, Value, Price Index, Grade Index, and Agronomic Characteristics of Released Varieties Evaluated in the 2016 Official Flue-Cured Variety Test at the University of Georgia, Tifton, GA.

Variety	Yield lb/A	Value \$/A	Price Index <sup>1</sup> \$/CWT	Grade Index <sup>2</sup>	Leaves/ Plant (number)	Plant Ht. in	Days to Flower	Total Alkaloids %	Reducing Sugars %	Ratio RS/TA
NC 95	2378	3571	150	77	21	42.1	64	2.53	14.2	5.62
K 326	2327	3462	149	77	22	38.9	65	2.22	15.6	6.99
K 346	2770	3245	117	59	21	40.3	62	2.12	14.8	6.97
K 730	2525	3486	138	70	23	41.4	62	1.96	16.4	8.39
NC 71	2798	3309	117	59	22	39.1	64	2.62	13.6	5.19
NC 72	2584	3214	124	62	23	43.5	64	2.25	15.1	6.70
NC 196	3377	4771	142	71	23	43.9	62	2.00	16.4	8.20
NC 606	2711	3465	128	66	22	41.7	62	2.03	14.2	6.97
NC 925	2822	3409	121	61	22	40.4	62	2.31	16.7	7.26
NC 938	2996	3977	134	68	22	42.3	62	1.86	17.4	9.34
NC 940	3056	3988	130	66	23	39.3	62	2.11	16.2	7.68
CC 13	2806	3685	132	66	22	42.0	62	1.87	16.4	8.77
CC 27	2707	3487	129	65	23	42.2	62	2.02	16.8	8.30
CC 35	3325	3878	117	60	23	48.3	66	2.15	13.8	6.43
CC 37	3155	3852	122	61	23	42.1	63	2.18	15.5	7.14
CC 143	3008	4474	148	76	23	42.2	63	2.11	16.4	7.79
CC 700	2247	2731	122	61	21	37.9	62	2.72	14.0	5.17
CC 1063	2782	3508	126	63	22	41.1	62	2.05	12.6	6.17
PVH 1015	2620	3199	123	63	23	42.9	62	2.12	17.2	8.12
PVH 1118	2806	3658	130	66	22	43.3	62	2.61	14.6	5.59
PVH 1452	3107	3855	124	63	22	43.2	62	2.62	11.9	4.54
PVH 1600	2953	4054	137	70	23	42.5	62	2.60	14.1	5.45
PVH 1920	2584	4288	166	82	23	41.0	62	2.31	13.9	6.03
PVH 2110	3191	4698	145	74	25	44.7	64	1.98	16.8	8.47
PVH 2254	2572	3653	143	73	22	45.0	62	1.90	16.9	8.91
PVH 2275	2081	2910	140	70	23	43.4	64	2.84	12.3	4.33
PVH 2310	2521	3664	145	74	22	42.9	62	2.42	9.4	3.90
SP 225	2588	3139	121	60	21	41.9	62	2.11	13.0	6.17
GF 318	3088	3634	118	60	22	42.9	62	2.20	15.5	7.06
GL 394	2862	3356	117	60	23	44.6	63	2.30	14.1	6.14
GL 395	2973	4338	146	73	21	42.3	62	2.32	12.5	5.39
GL 398	3036	3950	130	66	26	46.5	67	2.13	16.1	7.55
NC 970	3028	4051	133	68	23	41.1	64	2.30	12.9	5.60

Table 1. Yield, Value, Price Index, Grade Index, and Agronomic Characteristics of Released Varieties Evaluated in the 2016 Official Flue-Cured Variety Test at the University of Georgia, Tifton, GA (continued).

Variety	Yield lb/A	Value \$/A	Price Index <sup>1</sup> \$/CWT	Grade Index <sup>2</sup>	Leaves/ Plant (number)	Plant Ht. in	Days to Flower	Total Alkaloids %	Reducing Sugars %	Ratio RS/TA
XHN 60	3008	3714	124	61	22	44.1	63	2.57	14.7	5.71
GL 976	3111	4356	141	71	25	40.7	63	2.01	16.1	8.04
CU 201	3084	3565	117	59	23	46.5	66	2.29	14.2	6.21
NC 971	2996	3599	120	61	24	43.2	62	1.97	14.0	7.12
NC 972	3325	4128	124	64	23	41.7	66	2.42	15.5	6.43
LSD - 0.05	635.9	1153.6	27.2	14.3						

<sup>1</sup>Price Index based on two year average (2011-2012) prices for U.S. government grades.

<sup>2</sup>Numerical values ranging from 1-99 for flue-cured tobacco based on equivalent government grades - higher the number, higher the grade.

Table 2. Comparison of Certain Characteristics for Released Varieties Evaluated in the 2016 Official Flue-Cured Tobacco Variety Test at the University of Georgia, Tifton, GA.

Variety	Yield lb/A	Value \$/A	Price Index <sup>1</sup> \$/CWT	Grade Index <sup>2</sup>	Leaves/ Plant (number)	Plant Ht. in	Days to Flower	Total Alkaloids %	Reducing Sugars %	Ratio RS/TA
3 Year Average 2014, 2015 and 2016										
NC 95	2367	3472	146	75	22	46.7	74	2.19	16.9	7.90
K 326	2500	3848	154	78	22	42.2	74	2.10	16.7	8.14
K 346	2737	3762	140	69	20	40.7	67	2.09	17.1	8.24
NC 71	2684	3730	139	70	22	41.7	76	2.27	16.9	7.68
NC 72	2767	3696	135	67	23	46.2	74	2.02	16.6	8.34
NC 196	3126	4386	143	71	23	47.3	73	1.99	17.5	8.80
NC 925	2813	3545	126	64	22	42.9	72	2.16	17.2	8.05
NC 938	3118	4222	137	69	22	45.3	75	1.89	17.1	9.07
CC 13	2936	4214	145	73	22	44.4	69	2.01	17.0	8.57
CC 27	2925	4205	145	73	22	43.7	68	2.15	17.7	8.30
CC 35	2843	3753	135	67	22	49.4	71	2.13	15.8	7.51
CC 37	2836	3925	139	68	22	44.3	73	1.94	17.5	9.35
CC 143	3019	4694	154	78	23	46.1	72	1.83	17.6	9.73
CC 700	2620	3714	143	71	21	41.5	69	2.30	15.4	6.87
CC 1063	2978	4550	153	75	22	45.3	71	2.12	15.4	7.32
PVH 1452	2921	4297	149	74	22	45.2	70	2.18	15.4	7.37
PVH 2110	3004	4602	154	77	24	46.7	73	2.05	17.7	8.63
PVH 2254	2853	4205	147	74	22	47.9	73	1.77	18.6	10.57
PVH 2275	2678	4139	154	76	22	45.6	70	2.77	14.1	5.14

Table 2. Comparison of Certain Characteristics for Released Varieties Evaluated in the 2016 Official Flue-Cured Tobacco Variety Test at the University of Georgia, Tifton, GA (*continued*).

Variety	Yield lb/A	Value \$/A	Price Index <sup>1</sup> \$/CWT	Grade Index <sup>2</sup>	Leaves/ Plant (number)	Plant Ht. in	Days to Flower	Total Alkaloids %	Reducing Sugars %	Ratio RS/TA
3 Year Average 2014, 2015, and 2016( <i>continued</i> )										
PVH 2310	2640	4384	166	82	22	47.1	73	2.23	12.2	5.54
SP 225	2733	3849	141	70	21	45.6	71	2.10	15.8	7.61
GF 318	3086	4051	134	67	22	43.6	70	2.16	17.7	8.23
GL 395	2871	4239	150	75	21	44.8	69	2.31	15.2	6.70
GL 398	3000	3954	133	67	23	46.4	72	2.06	17.7	8.68
2 Year Average 2015-2016										
NC 95	2327	3198	137	71	22	47.3	69	2.26	16.5	7.50
K 326	2410	3536	147	75	22	43.4	69	1.97	16.4	8.55
K 346	2561	3723	148	73	20	41.6	63	2.05	17.1	8.39
K 730	2335	3440	148	75	23	43.7	65	2.15	16.0	7.51
NC 71	2662	3318	125	63	23	42.9	70	2.25	15.8	7.39
NC 72	2572	3746	145	73	23	47.5	69	1.95	15.6	8.24
NC 196	2994	4501	153	77	23	47.4	68	2.00	17.2	8.61
NC 606	2517	3759	151	76	22	47.6	67	1.94	17.0	8.85
NC 925	2666	3443	129	65	23	45.7	67	2.10	17.2	8.28
NC 938	2925	4199	144	73	23	47.9	69	1.83	17.1	9.33
CC 13	2715	4046	150	75	23	45.3	65	1.86	17.0	9.12
CC 27	2701	4100	152	76	22	45.0	64	1.98	17.2	8.71
CC 35	2745	3641	138	70	23	52.1	71	2.03	15.4	7.66
CC 37	2793	3855	140	70	23	46.6	69	1.84	17.0	9.67
CC 143	2763	4513	158	80	24	47.2	68	1.92	17.1	9.05
CC 700	2286	3401	149	73	21	42.5	64	2.32	15.2	6.85
CC 1063	2735	4069	149	73	23	46.3	68	1.99	15.0	7.59
PVH 1452	2823	4201	151	75	23	46.0	65	2.23	14.5	6.92
PVH 2110	2746	4292	157	79	25	48.6	68	1.98	17.7	8.94
PVH 2254	2605	3723	144	74	23	49.9	68	1.72	17.9	10.54
PVH 2275	2307	3665	157	78	22	46.7	66	2.84	13.0	4.59
PVH 2310	2377	3877	164	82	22	47.5	69	2.31	10.3	4.47
SP 225	2552	3570	141	71	22	46.6	67	1.99	15.5	7.89
GF 318	2794	3896	142	71	23	45.9	64	2.13	16.8	7.95
GL 395	2607	4026	156	78	22	46.3	65	2.14	14.8	7.05
GL 398	2777	3805	139	70	25	49.0	72	2.16	16.7	7.75

<sup>1</sup>Price Index based on two year average prices for U.S. government grades.

<sup>2</sup>Numerical values ranging from 1-99 for flue-cured tobacco based on equivalent government grades - higher the number, higher the grade.

Table 3. Yield, Value, Price Index, Grade Index and Agronomic Characteristics of Varieties Evaluated in the 2016 Regional Farm Test at the University of Georgia, Tifton, GA.

Variety	Yield lb/A	Value \$/A	Price Index <sup>1</sup> \$/CWT	Grade Index <sup>2</sup>	Leaves/ Plant (number)	Plant Ht. in	Days	Total Alkaloids %	Reducing Sugars %	Ratio RS/TA
							to Flower			
NC 95	2432	3313	136	70	18	41.4	65	3.10	13.6	4.38
K 326	2493	3241	130	67	21	39.6	71	1.90	14.4	7.58
ULT 115	2642	3753	142	73	24	45.4	77	1.92	14.5	7.54
NC EX 78	2707	3761	139	72	21	44.3	74	1.83	12.7	6.95
CU 218	2776	3827	139	71	21	41.1	78	1.88	16.4	8.72
NC EX 79	2691	3222	121	63	22	39.8	67	2.46	12.9	5.22
XHN 65	2552	3651	144	73	21	41.6	74	1.94	17.0	8.79
CU 206	2826	3466	123	63	20	42.3	64	2.12	16.9	7.99
ULT 123	2358	3086	130	68	23	43.3	78	1.36	14.4	10.59
XHN 58	2445	3283	135	69	21	39.8	78	1.69	17.4	10.26
CU 220	2786	3925	141	73	22	40.7	66	2.03	14.6	7.19
CU 213	2743	3992	145	74	22	43.7	67	2.47	13.4	5.42
GL EX 365	2757	3735	136	70	25	44.3	77	2.19	15.4	7.05
NC EX 73	2782	3828	137	71	24	45.4	73	1.91	12.1	6.32
CU 219	2402	3485	144	73	22	42.3	78	2.46	13.3	5.40
CU 214	2564	3296	128	67	22	44.9	68	2.11	15.2	7.20
LSD -0.05	406.9	724.3	16.1	7.3						

<sup>1</sup>Price Index based on two year average (2011-2012) prices for U.S. government grades.

<sup>2</sup>Numerical values ranging from 1-99 for flue-cured tobacco based on equivalent government grades - higher the number, higher the grade.