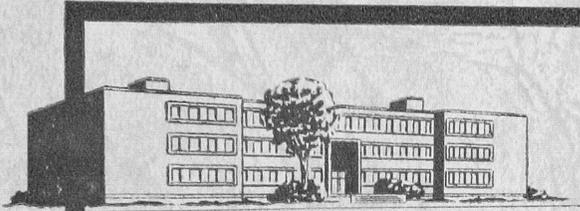


Duplicate

April 1955

Research Report

No. 16



**MEASURED CROP PERFORMANCE
BURLEY TOBACCO**

Luther Shaw

DEPARTMENT OF AGRONOMY
NORTH CAROLINA STATE COLLEGE

DEPARTMENT OF AGRONOMY
NORTH CAROLINA STATE COLLEGE

BURLEY TOBACCO 1/

By

Luther Shaw 2/

58 ?

INTRODUCTION

The Kentucky 16 variety of burley tobacco is currently planted on about 75 per cent of the acreage of this crop in North Carolina. The popularity of this variety is evidence of its ability in past years to produce satisfactory yields of good quality leaf. An increase in the distribution and apparent severity of certain diseases in recent years, combined with a growing interest and demand for better quality leaf, have accelerated the interest of both research personnel and farmers in the development of varieties with multiple disease resistance combined with yield and quality factors at least equal and preferably better than Kentucky 16. Much progress has been made in this direction during the past few years.

A variety evaluation program has been in progress at the Mountain Experiment Station, Waynesville, N. C. and the Upper Mountain Experiment Station, Laurel Springs, N. C. since 1945. Although considerable emphasis in this program has been directed toward evaluating advanced lines not yet released, a number of old as well as new commercial burley varieties were included in the tests for varying periods. It is the purpose of this report to record some of the results obtained to date on the officially named varieties that have appeared in the tests. Data on the advanced lines will be made available as official varieties are released from them.

- 1/. This is a cooperative investigation between the United States Department of Agriculture, the North Carolina Department of Agriculture, and the North Carolina Agricultural Experiment Station.
- 2/. Agronomist, Field Crop Research Branch, Agricultural Research Service, United States Department of Agriculture.

EXPERIMENTAL PROCEDURES

The details of production practices and experimental procedures have varied considerably during the 10-year period of this study. For the purposes of this report it does not seem necessary to record all of these details. Certain of the general methods employed are given in the following paragraphs.

Soil Types: At the Mountain Experiment Station the soil types used were Hiwassee clay loam and Hiwassee gravelly clay loam. These are terrace type soils and are not considered to be quite as good for burley tobacco production as the silt loam soils occurring along streams. At the Upper Mountain Experiment Station the soil types used were Tate silt loam and Watauga silt loam. Both of these soils are considered to have good physical characteristics for burley tobacco production. The soils used in these tests were relatively free of disease producing organisms, including the black root rot parasite.

Rotations: A three-year rotation was used in most of the variety studies at the Mountain Experiment Station: 1st year - tobacco with crimson clover as a winter cover; 2nd year - corn with small grain (usually oats) seeded in fall; 3rd year - small grain (combined for grain) and lespedeza. Most of the variety tests have been grown in continuous tobacco culture at the Upper Mountain Experiment Station with rye planted as a winter cover. The few exceptions involved a two-year rotation with corn as the alternate crop. Rye was used as a winter cover crop following both corn and tobacco.

Fertilization: The base fertilization throughout all tests consisted of about 10 tons of manure per acre. At the Mountain Experiment Station the manure was from the dairy barn and at the Upper Mountain Experiment Station it was from beef cattle feeder pens. In practically all tests the manure was broadcast on the soil before plowing in late

winter or early spring. The time of application of the manure varied from one to several days before plowing. In a given test area it was the general policy to apply the manure as quickly as possible once the operation was started.

The amount of nutrients applied as commercial fertilizer in the row before planting ranged from 30 to 60 pounds of nitrogen, 48 to 90 pounds of P_2O_5 , and 48 to 100 pounds of K_2O . Additional fertilizers were not applied as top-dressers.

Row Widths: Rows were 42 inches apart in the tests from 1945 to 1948, inclusive. Forty-eight inch rows were used thereafter.

Plant Spacing in the Row: The plants were spaced at 15 inch intervals in the row from 1945 to 1948, inclusive. Thereafter, 12, 15, and 18 inch spacings were used with the spacing arrangement uniform within a given test.

General Cultural Practices: Row preparation, transplanting, cultivation, and insect control practices in the field conformed to standard methods.

Topping: The general practice in topping was to break out no more than two leaves below the normal inflorescence. An effort was made to top each variety when the first 20 to 25 per cent of the flowers were pink. This was generally accomplished in most of the lines in two trips through the field; however, in a few cases three trips were necessary.

Suckering: Suckers were removed manually as the need developed.

Harvesting: During the earlier years of these studies the tobacco was all stalk cured. In later years most of the tests were primed once and the remainder cut. Comparisons were made of one-priming vs. all cut at the Upper Mountain Experiment Station in 1948 and at the Mountain Experiment Station in 1952. This was done by dividing each plot into two sub-plots. One sub-plot was then primed once and the other was not

primed. The cut tobacco plants were speared onto sticks with four to six stalks per stick depending upon plant size.

Curing: Curing was done in barns with approximately one-third of the vertical siding hinged permitting opening and closing of this space for ventilation as the need developed. During prolonged periods of high relative humidity artificial heat supplied by a series of oil burners was employed as a means of lowering the relative humidity in the curing barn at the Upper Mountain Experiment Station from 1949 to 1954, inclusive. Gas burners were used for the same purpose in the barns at the Mountain Experiment Station in 1953 and 1954.

Measuring Results: When cured the tobacco from each plot was separated into grades based on position on the stalk, leaf quality, and color. This was done by trained farm labor. Each farm grade from each plot was then weighed. From these plot yields acre yields were calculated. An official U. S. Grade was placed on each farm grade for each plot. Acre values were then calculated by multiplying the acre yield in pounds of a given U. S. grade by the support price established for that grade for the year concerned.

It is obvious that certain objections can be made to the use of support price figures as a basis for calculating acre values, a major one being the fact that the average seasonal price paid for a given grade of tobacco is often higher per hundredweight than the support price. While this and other objections are well grounded, the use of support prices as a basis for calculating acre values and values per hundredweight in this report can be defended on the following points:

- (1) support prices are based on a price history for the grade concerned,
- and (2) they reflect to a relatively high degree of accuracy the demand for specific grades in previous years. Hence, the use of support prices should be effective for calculating relative values for tobacco produced in any given year as well as over a period of years.

Plot Design and Statistical Analyses: Four replications were employed in all tests. Both randomized block and lattice square designs were used at various stages in the study, depending upon the number of entries in a given test. From 1945 to 1948, six row plots were used with the inside four rows harvested for test purposes. In subsequent years plot size was reduced to one 40 ft. row in most of the tests. Most of the yield and value data accumulated in these studies have been analyzed statistically. Although the form in which the yield and value data are given in this report does not readily lend itself to presentation of the statistical data, they were taken into consideration in the discussion of results which follows. It is anticipated that a more complete report on these studies will be prepared for release at a later date at which time the statistical data will be given.

EXPERIMENTAL RESULTS

The yield and value data accumulated on fourteen commercial varieties of burley tobacco during the ten-year period, 1945 to 1954, inclusive, are summarized in Table 1 to 5 3/. Kentucky 16 was used throughout the study as a control black root rot resistant variety. Judys Pride was used as a black root rot susceptible variety through 1953.

The yield of Kentucky 16 ranged from a low of 829 pounds per acre in 1953 to a high of 2645 pounds per acre in 1951 at the Mountain Experiment Station. Acre values form the same pattern (Table 1). Weather conditions, particularly rainfall, were major factors responsible for at least the wider year to year fluctuations in yield and value. Precipitation was relatively low during the growing seasons of 1946 and 1947, and extremely low in 1953 at this Station. Rainfall was about normal during the other years covered in this report.

3/. Thanks are due Dr. H. E. Heggstad, Agronomist, U.S.D.A., Tobacco Experiment Station, Greeneville, Tennessee for supplying seed of the breeding lines from which Burley 1, 2, 11A, 11B, and 21 were developed.

At the Upper Mountain Experiment Station the same degree of extremes in weather conditions did not occur. The lowest yield for Kentucky 16 was 1640 pounds per acre in 1950 and the highest 2787 pounds per acre in 1951 (Table 3). Throughout the ten-year period rainfall appeared to be more nearly adequate for satisfactory vegetative growth of tobacco at the Upper Mountain Experiment Station than it was at the Mountain Experiment Station.

A total of eight varieties developed and released by the Kentucky Agricultural Experiment Station and five (Burley 1, 2, 11A, 11B, and 21) developed and released by the Tennessee Agricultural Experiment Station in cooperation with the U. S. Department of Agriculture were included in the tests for varying periods at both Stations (Tables 1 to 5, inclusive).

The data in the accompanying tables show that among the Kentucky varieties considerable fluctuation occurred from year to year in yields and values in relation to Kentucky 16. Of particular interest is the fact that none of the Kentucky entries was consistently better in any one or all factors measured than Kentucky 16. On the other hand, Kentucky 56 was consistently poorer in all respects than Kentucky 16 each year it was tested.

The varieties developed at the Greeneville Cooperative Station were generally equal to or somewhat better than Kentucky 16. Burley 1 failed to measure up to Kentucky 16 more frequently than did the other varieties, particularly at the Mountain Experiment Station. Better performance of Burley 1 probably would have been obtained had it been topped lower and earlier than was done in these tests.

Judys Pride, the only black root rot susceptible variety included in the study, gave yields and values remarkably close to Kentucky 16 in a high percentage of the tests. The performance of this variety indicated that the soils involved had a very low population of the black root rot

parasite. Hence, black root rot had, at most, only a minor influence on variety performance in these studies.

The black shank parasite was not present in the soils where these studies were made. Wildfire and mosaic did not develop to any appreciable extent. Since these studies were conducted under relatively disease-free conditions it is especially significant that for the most part neither consistent or outstanding differences in performance were found among the variety entries. Thus, it is evident that much emphasis should be placed on resistance to specific diseases in the selection of a variety or varieties for planting (Table 6).

CONCLUSIONS

The yield, value, and disease resistant characteristics (Tables 1 to 6, inclusive) of the burley tobacco varieties included in these studies indicate that the best adapted ones for general uses under Western North Carolina conditions are Kentucky 16, Kentucky 41A, Kentucky 26, Burley 2, and Burley 21. Burley 21, which was officially released in December 1954, is of special interest in this area because of its multiple disease resistance, especially its resistance to wildfire. On soils contaminated by the black shank parasite or where there is immediate danger of such contamination, Burley 11A or 11B should be planted. Burley 11A and 11B are resistant to Fusarium wilt, and could be planted to advantage on soils contaminated by this parasite.

It should not be inferred from the above that the other varieties tested, namely Kentucky 19, 21, 35, 56, and 57, and Burley 1 are unacceptable. Under some conditions these varieties may give entirely satisfactory performances. However, certain weaknesses, such as the low yield of Kentucky 56 and 57, the low quality of Kentucky 19, and the moderate Fusarium wilt resistance of Kentucky 35, places this group of varieties second in the order of preference.

TABLE 1. Percentage Comparisons of Acre Yields and Values with the Yearly Means of Kentucky 16 of Certain Burley Tobacco Varieties for the Ten Year Period 1945 to 1954, inclusive. Mountain Experiment Station, Waynesville, N. C. 1/

Variety	2/ Avg. 1945-48		3/ 1949		3/ 1950		3/ 1951		2/ 1952	3/ 1952	2/ 1953		3/ 1954	
	Yield	Value	Yield	Value	Yield	Value	Yield	Value	Yield	Yield	Yield	Value	Yield	Value
Kentucky 16	lbs. 1597	\$ 616	lbs. 1979	\$ 441	lbs. 1658	\$ 516	lbs. 2645	\$ 1312	lbs. 1705	lbs. 1925	lbs. 829	\$ 298	lbs. 2391	\$ 1093
Kentucky 19	% 112	% 113	% 104	% 74	% 94	% 84	% 98	% 96	%	%	%	%	%	%
Kentucky 21	102	97	107	126										
Kentucky 26							94	93	107	99	103	107		
Kentucky 35			102	96	85	86	105	103			88	83	118	107
Kentucky 41A	97	103					100	100						
Kentucky 56			96	92	77	74	87	86						
Kentucky 57							97	94	97	100			92	93
Burley 1					101	108	94	89	100	96	94	95		
Burley 2									115	108	104	110	97	112
Burley 11A									116		97	111	106	111
Burley 11B											111	113	101	110
Burley 21									104	104	94	105	100	106
Judys Pride	95	93	99	110	93	80	91	90	91	88	89	91		

1/ Freezing injury to the tobacco while curing in the barn prevented calculating accurate acre values for the 1952 crop.

2/ All stalk cured.

3/ Primed once, balance stalk cured.

TABLE 2. Percentage Comparisons of the Value per Hundredweight with the Yearly Means of Kentucky 16 of Certain Burley Tobacco Varieties for the Ten Year Period 1945 to 1954, except for 1952. 1/ Mountain Experiment Station Waynesville, N. C.

Variety	2/ 1945	2/ 1946	2/ 1947	2/ 1948	2/ 1949	3/ 1950	3/ 1951	2/ 1953	3/ 1954
Kentucky 16	\$33.98	\$37.95	\$43.06	\$39.47	\$22.28	\$31.12	\$52.25	\$36.06	\$45.89
Kentucky 19	% 90	% 109	% 95	% 106	% 71	% 89	% 98	%	%
Kentucky 21	98	105	89	91	118				
Kentucky 26							99	103	
Kentucky 35					94	101	98	94	99
Kentucky 41A	97	110	100	111			100		
Kentucky 56					95	96	99		
Kentucky 57							97		100
Burley 1						107	95	101	
Burley 2								102	115
Burley 11A								114	104
Burley 11B								102	108
Burley 21								109	104
Judys Pride	93	103	94	99	110	110	99	102	

1/ Freezing injury to the tobacco while curing in the barn prevented calculating accurate hundredweight values for the 1952 crop.

2/ All stalk cured.

3/ Primed once, balance stalk cured.

TABLE 3. Percentage Comparisons of Acre Yields and Values with the Yearly Means of Kentucky 16 of Certain Burley Tobacco Varieties for the Ten Year Period 1945 to 1954, except for 1949 1/. Upper Mountain Experiment Station, Laurel Springs, N. C.

Variety	2/ Avg. 1945-48		3/ 1948		3/ 1950		3/ 1951		2/ 1952	2/ 1953		3/ 1954	
	Yield	Value	Yield	Value	Yield	Value	Yield	Value	Yield	Yield	Value	Yield	Value
Kentucky 16	lbs. 1817	\$ 661	lbs. 1988	\$ 815	lbs. 1640	\$ 732	lbs. 2787	\$ 1226	lbs. 2316	lbs. 2286	\$ 1200	lbs. 2404	\$ 1217
Kentucky 19 ^{4/}	% 94	% 87	% 90	% 88	% 87	% 74	% 103	% 90	% 93	% 93	% 93	% 94	% 94
Kentucky 21 ^{4/}	93	91	97	98									
Kentucky 26							97	102	121	107	113		
Kentucky 35					92	82	104	89		102	109	107	113
Kentucky 41A	94	93	98	97	102	99	103	100					
Kentucky 56							88	82					
Kentucky 57							101	95	110			104	107
Burley 1					99	103	112	107	112	98	100		
Burley 2									127	107	111	116	127
Burley 11A										103	107	112	118
Burley 11B										115	119	102	106
Burley 21									129	115	121	129	135
Judys Pride	92	93	104	109	86	78	97	92	113	103	111		

1/ The 1949 crop at this Station was so irregular as a result of an inadequate plant supply that it was not harvested for test purposes. Freezing injury to the tobacco while curing in the barn prevented calculating accurate acre values for the 1952 crop.

2/ All stalk cured.

3/ Primed once, balance cut.

4/ Average 1946-48

TABLE 4. Percentage Comparisons of the Value per Hundredweight with the Yearly Means of Kentucky 16 of Certain Burley Tobacco Varieties for the Ten Year Period 1945 to 1954, except for 1949 and 1952 ^{1/}. Upper Mountain Experiment Station, Laurel Springs, N. C.

Variety	^{2/} 1945	^{2/} 1946	^{2/} 1947	^{2/} 1948	^{3/} 1948	^{3/} 1950	^{3/} 1951	^{2/} 1953	^{3/} 1954
Kentucky 16	\$31.89	\$39.45	\$39.28	\$34.97	\$42.00	\$44.63	\$43.99	\$52.45	\$50.63
Kentucky 19	%	39	92	98	98	85	87	%	%
Kentucky 21		91	95	108	101				
Kentucky 26							105	106	
Kentucky 35						89	85	107	98
Kentucky 41A	109	88	88	114	99	97	97		
Kentucky 56								93	
Kentucky 57								94	103
Burley 1						105	95	102	
Burley 2								104	110
Burley 11A								104	105
Burley 11B								104	103
Burley 21								106	104
Judys Pride	96	97	86	135	110	91	95	108	

^{1/} The 1949 crop at this Station was so irregular as a result of an inadequate supply of plants that it was not harvested for test purposes. Freezing injury to the tobacco while curing in the barn prevented calculating accurate hundred-weight values for the 1952 crop.

^{2/} All stalk cured.

^{3/} Primed once, balance stalk cured.

TABLE 5. Percentage Comparisons with the Mean of Kentucky 16 with Certain Burley Tobacco Varieties, 1945-1954. Combined Results of the Waynesville and Laurel Springs Tests.

Variety	Numbers of Comparisons	Acre Yield	Acre Value	Value Per 100 Pounds
Kentucky 16	18	1903 lbs.	\$775	\$40.05
		Per Cent	Per Cent	Per Cent
Judys Pride	16	94.7	95.0	96.1
Kentucky 19	13	100.6	93.9	92.8
Kentucky 41A	12	97.2	98.4	100.8
Kentucky 21	9	98.9	99.2	99.6
Kentucky 35	9	100.3	96.4	96.1
Burley 1	6	99.7	100.3	100.8
Kentucky 26	4	100.3	104.0	103.3
Kentucky 56	4	87.0	83.5	96.0
Kentucky 57	4	98.5	97.3	98.5
Burley 2	4	106.0	115.0	107.8
Burley 11A	4	104.5	111.8	106.8
Burley 11B	4	110.3	112.0	104.3
Burley 21	4	112.3	116.8	105.8

TABLE 6. Diseases to Which Certain Burley Tobacco Varieties are Resistant.

Variety	Black Root Rot	Fusarium Wilt	Mosaic	Black Shank	Wildfire
Kentucky 16	+				
Kentucky 19	+				
Kentucky 21	+				
Kentucky 26	+				
Kentucky 35	+	+	+		
Kentucky 41A	+				
Kentucky 56	+		+		
Kentucky 57	+		+		
Burley 1	+				
Burley 2	+				
Burley 11A ^{1/}	+	+		+	
Burley 11B ^{1/}	+	+		+	
Burley 21	+		+		+

^{1/} Classification of these varieties as Fusarium Wilt resistant is based on unpublished data obtained by Dr. H. E. Heggstad, Tobacco Experiment Station, Greeneville, Tennessee.