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Performance of 'TN 86'

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Performance of 'TN 86' Burley Tobacco

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INTRODUCTION

Tennessee 86 (TN 86) is the first burley tobacco variety having resistance to tobacco etch virus (TEV) and tobacco vein mottling virus (TVMV). It was released by the Tennessee Agricultural Experiment Station as a commercial variety in February 1986. TN 86, which is also resistant to black shank (BS), black root rot (BRR), wildfire (WF), and potato virus Y (PVY), was developed at the Tobacco Experiment Station in Greeneville, Tennessee.

TVMV and TEV, which are transmitted by green peach aphids, have been widespread throughout the burley producing regions of Tennessee, Kentucky, Virginia, and North Carolina in recent years. Virus incidence ratings in burley tobacco in these states have ranged from 30 to 100 %. Although plants infected with TVMV and TEV can be found in almost all fields of tobacco in East Tennessee in most years, many farmers do not recognize the symptoms of these diseases. Initial symptoms may be limited to a slight mottling, yellowing, or other discoloration of the tissue around the veins of the leaves. As the diseases progress, leaf specking and necrosis may result in leaf deterioration. This often

causes tobacco to be harvested prematurely, resulting in reduced yield and quality.

AGRONOMIC CHARACTERISTICS

TN 86 has a more erect leaf habit, a higher leaf number, and a shorter leaf internode than most other burley varieties. The growth habit and plant size of TN 86 are similar to Burley 21. Under normal growing conditions TN 86 has 4 to 7 more leaves than MS KY 14 x L8, but 2 to 4 fewer leaves than Burley 64. The leaf size and shape of TN 86 are similar to those of VA 509 and KY 14. TN 86 has a medium stalk diameter that is larger than MS KY 14 x L8 but is significantly smaller than VA 509.

Because of the upright growth habit of TN 86, breakage and loss of leaves during harvesting is minimized. TN 86 should be topped at about 22 to 26 leaves; higher topping will result in overly large plants that are difficult to manage and harvest. TN 86 is usually ready for harvest approximately ten days to two weeks later than MS KY 14 x L8; however, it matures about seven to ten days earlier than Burley 64. The yield potential of TN 86 is significantly reduced by early harvest.

In comparison to other commercial varieties, TN 86 is lighter green in color while growing in the field. The cured leaf is generally reddish-tan in color and has consistently sold for prices comparable to or higher than those for other varieties.

PERFORMANCE DATA

Variety Trials

When grown under disease-free conditions, TN 86 is competitive with the highest yielding commercial varieties and is significantly higher yielding than are varieties having resistance to Race 1 black shank. TN 86 appears to be widely adapted. It has performed well in yield and quality in advanced breeding line trials and on-farm trials throughout Tennessee. It has performed particularly well in East Tennessee where heavy outbreaks of TVMV and TEV usually occur each year. TN 86 was evaluated in the Regional Variety Test Program during 1984 and 1985. It was the highest yielding line among 22 entries in 1984 and was the second highest yielding line among 19 entries in 1985. It also received the highest ratings in industry evaluations for leaf color, leaf quality, and overall industry usability.

Disease Resistance

TN 86 has high resistance to TVMV, black root rot, and wildfire; medium high resistance to TEV; medium resistance to black shank; and is resistant to most strains of PVY. TN 86 yields were 800 to 2500 pounds per acre higher than those of virus-susceptible varieties when grown in tests artificially inoculated with TVMV or TEV. Yields of TN 86 exceeded those of all other black shank resistant varieties by more than 1000 pounds per acre in these studies. Under moderate to heavy natural infestations of TVMV and/or TEV, yields of TN

86 were 200 to 2000 pounds per acre higher than yields of susceptible varieties.

Several strains of PVY having different levels of virulence have been identified. Although the level of resistance to these strains varies in TN 86, the resistance is similar to that of TI 1406 and is significantly higher than that of other burley varieties.

Recent studies conducted in Mexico and Puerto Rico have demonstrated that TN 86 is somewhat more sensitive to blue mold than are other burley tobacco varieties. TN 86 is susceptible to tobacco mosaic virus. The reaction of TN 86 to alfalfa mosaic virus, tobacco ring spot virus, and tobacco streak virus is similar to that of other burley varieties.

The level of black shank resistance in TN 86 is similar to that of Va 509, which is the variety most commonly used for the control of black shank in Tennessee. TN 86 is not as resistant to black shank as are some other burley varieties. However, it has consistently out-yielded those varieties in tests grown in black shank infested soils. Limited losses due to black shank may occur when TN 86 is grown in heavily infested fields under normal growing conditions. Under extreme drought and black shank pressure, survival of TN 86 may be significantly lower than that of other black shank resistant varieties. However, TN 86 has performed as well or better than VA 509 in test plots, regardless of the severity of black shank conditions. Losses of TN 86 due to black

shank can be decreased by the use of four quarts of Ridomil per acre.

Yields of TN 86, which is immune to black root rot, have been substantially higher than those of VA 509 in tests grown in black root rot infested fields.

Table 1 . 1985 COMMERCIAL BURLEY VARIETY TEST
Tobacco Experiment Station

Agronomic Characteristics

ENTRY	PLANT HEIGHT (IN)	LEAF LENGTH (IN)	LEAF WIDTH (IN)	LEAF NUMBER	HANG ¹ LENGTH (IN)	HANG ² WEIGHT (LB)	STALK CIRCUM. (IN.)
EARLY MATURITY							
MS KY 14 x L8	47	33	14	17	68	26	4.2
MS BU 21 x L8	49	32	14	18	68	26	4.2
MS BU 37 x L8	48	31	13	17	66	25	4.3
MEDIUM MATURITY							
CO-OP 313	49	31	12	19	68	26	4.3
R 7-11	50	33	13	18	70	28	4.4
KY 14	47	30	12	19	67	24	4.2
KY 17	48	31	14	19	67	25	4.5
CO-OP 543	48	30	13	20	66	25	4.5
CLAY 501	50	31	13	20	68	22	4.3
MS BU 21 X KY 10	50	31	13	19	70	27	4.5
LATE MATURITY							
VA 509	52	31	12	22	73	32	4.9
BU 64	51	29	13	26	74	29	4.6
N 77	54	31	13	23	76	30	4.6
TN 86	54	31	13	24	75	32	4.5

1. Length from butt of stalk to tip of longest leaf when hung on a scaffold.
2. Weight of a 5 stalk stick of tobacco approximately 3 hours after cutting.

Table 2. 1985 COMMERCIAL BURLEY VARIETY TEST

VARIETY	YIELD (LBS/ACRE)		TOBACCO EXPERIMENT STATION			
	HRES ¹	TES ²	DAYS TO BLOOMING	DAYS TO TOPPING	DAYS TO HARVEST	% BLACK SHANK ³ SURVIVAL
EARLY MATURITY						
MS KY 14 x L8	4049	3334	65	65	98	100*
MS BU 21 x L8	3795	3419	65	65	98	100*
MS BU 37 x L8	3614	3213	65	65	98	100*
MEDIUM MATURITY						
CO-OP 313	3960	3704	68	70	102	41
R 7-11	4159	4024	69	70	102	16
KY 14	3820	3488	70	70	102	0
KY 17	3431	3404	69	70	102	97
CO-OP 543	3713	3413	71	70	102	99
CLAY 501	3487	3284	67	70	102	100
MS BU 21 X KY 10	4012	3816	67	70	102	0
LATE MATURITY						
VA 509	3638	4034	71	74	107	96
BU 64	3292	3821	85	74	107	99
N 77	3688	3890	73	74	107	100
TN 86	3939	4107	72	74	107	97

1. HRES = Highland Rim Experiment Station. All varieties were topped and harvested on the same dates at HRES.

2. TES = Tobacco Experiment Station. Varieties were topped and harvested by maturity group at TES.

3. Average survival of four replications in a field having a high level of Race 0 black shank. Yield data and black shank survival data were obtained in separate tests.

* L8 hybrids have high resistance to Race 0 black shank only; THEY HAVE NO RESISTANCE TO RACE 1 BLACK SHANK.

TABLE 3. ADVANCED BURLEY BREEDING LINES TEST
1984 - 1985

ENTRY	YIELD (lbs/acre)		TOBACCO EXPERIMENT STATION		
	HRES ¹	TES ²	GRADE INDEX	CROP INDEX	BLACK SHANK ³ % SURVIVAL
1984					
GR 131	4097	3586	.589	2118	100
GR 132	3715	3699	.531	1972	100
TN 86	4405	4141	.636	2645	100
BU 64	3457	3280	.588	1922	100
R 7-11	--	3660	.635	2329	52
KY 17	3728	3312	.594	1966	100
KY 14	4216	3706	.546	2017	46
VA 509	3946	3432	.592	2030	100
CL 501	--	3708	.641	2372	100
1985					
GR 131	3629	3935	.582	2284	90
GR 132	3518	4009	.648	2599	100
TN 86	4022	4276	.591	2528	97
BU 64	2975	3630	.594	2158	99
R 7-11	----	4484	.662	2949	0
KY 17	3291	3620	.642	2324	97
KY 14	3763	4029	.635	2557	0
VA 509	2925	4100	.667	2730	96
CL 501	3538	3744	.660	2468	100

1. Highland Rim Experiment Station, Springfield, Tennessee.
2. Tobacco Experiment Station, Greeneville, Tennessee.
3. Average survival of three replications grown in a field having a high level of Race 0 black shank. Disease pressure was moderate in 1984 and high in 1985. Yield data and black shank survival data were obtained in separate tests.

Table 4. 1985 BURLEY TOBACCO ON-FARM VARIETY TRIALS

COUNTY	AVERAGE YIELD IN POUNDS/ACRE					
	TN 86	VA 509	CL 501	KY 17	KY 14	MS KY 14 X L8
MACON	2771	3072	2620	2610	2419 ¹	3085
TROUSDALE	2743	2776	2624	2620	3029	2797
SUMNER	2867	2750	2517	2100	2428	3133
ROBERTSON	2260	2428	2226	2057	2428	2496
MONROE	3929	4098	2823	3642	3963	4131
CLAIBORNE ²	4040	3259	3072	3378	3276	3513
JOHNSON ²	3019	1636	1973	2049	1788	2631
HANCOCK	3143	3022	2554	2744	2880	2758
HAWKINS	2725	2616	2827	2604	3055	2612
GREENE	4480	4294	4014	3827	4014	3827
ROBERTSON	4022	2925 ³	3538	3291	3763	4049
MEAN	3273	2989	2800	2811	3004	3185

1. Approximately 10 % loss due to black shank.

2. Heavy incidence of tobacco vein mottling and tobacco etch viruses.

3. Moderately stunted by black root rot.

Table 5. REGIONAL BURLEY SMALL PLOT TESTS

YIELD and QUALITY

ENTRY	STATE					AVG.	RANK
	KY	TN	VA	NC	OH		
1984 YIELD (LBS/A)							
VA 509	2952	2934	2997	2095	3130	2822	15
TN 86	3280	3491	3171	2714	3619	3255	1
KY 14	3233	3574	3011	2301	3305	3085	2
1985 YIELD (LBS/A)							
VA 509	3079	4325	3222	3037	2788	3290	10
TN 86	3211	4574	3699	3455	2873	3562	2
KY 14	3418	4248	3402	3412	3004	3497	3
1985 LEAF COLOR							
VA 509	2.07	1.95	1.80	1.47	1.73	1.80	3
TN 86	1.60	2.25	1.95	1.40	1.60	1.76	1
KY 14	1.33	2.25	2.20	3.53	2.20	2.30	15
1985 LEAF QUALITY							
VA 509	2.87	3.05	3.10	2.33	2.40	2.75	2
TN 86	2.67	3.00	3.10	2.47	2.20	2.69	1
KY 14	2.80	3.90	3.15	4.73	3.13	3.54	17
1985 PERCENT USABLE LEAF							
VA 509	46	31	30	55	58	44	2
TN 86	52	33	33	51	67	47	1
KY 14	49	15	22	0	44	26	14

1. Rank among the total number of entries in the Regional Small Plot Tests. Twenty-two entries were in the 1984 test and 19 were in the 1985 test.

LEAF COLOR: 1=Tan or Brown; 2=Red; 3=Variegated; 4=Greenish, Piebald, or Motley.

LEAF QUALITY: 1=Good; 2=Fair; 3=Poor; 4=Very Poor.

PERCENT USABILITY: Average overall industry usability as judged by the six tobacco companies participating in warehouse evaluations.

Table 6. 1985 REGIONAL BURLEY FARM TEST

YIELD and QUALITY

ENTRY	STATE					AVG.	RANK
	KY	TN	VA	NC	OH		
YIELD (LBS/ACRE)							
VA 509	2953	3308	3081	2834	2850	3054	3
TN 86	3048	3511	3496	3316	2870	3274	2
KY 14	3080	3482	3187	3508	3160	3277	1
GR 131	2947	3046	3226	3270	2784	3044	4
NC 127	2858	2924	2942	3382	2888	2957	5
LEAF COLOR							
VA 509	2.09	2.26	1.81	1.74	1.96	2.02	1
TN 86	1.93	2.36	2.08	1.60	2.04	2.04	2
KY 14	1.83	2.26	2.37	2.66	2.70	2.25	5
GR 131	1.89	2.43	2.38	1.60	2.46	2.15	4
NC 127	1.95	2.45	2.01	2.00	2.20	2.12	3
LEAF QUALITY							
VA 509	3.33	3.30	3.17	2.63	2.86	3.15	2
TN 86	3.08	3.46	3.19	2.70	2.74	3.11	1
KY 14	3.12	3.54	3.31	3.93	3.53	3.41	5
GR 131	3.16	3.60	3.54	2.90	3.30	3.33	4
NC 127	3.13	3.53	3.24	3.14	3.06	3.24	3
PERCENT LEAF USABILITY							
VA 509	34	25	30	45	47	34	2
TN 86	40	21	29	43	50	35	1
KY 14	40	19	24	14	26	27	5
GR 131	41	18	19	37	36	30	4
NC 127	40	18	27	30	40	31	3

LEAF COLOR: 1=Tan or Buff; 2=Red; 3=Variegated; 4=Greenish, Piebald or Motley.

LEAF QUALITY: 1=Good; 2=Fair; 3=Poor; 4=Very Poor.

PERCENT USABILITY: Average overall industry usability as judged by the six tobacco companies participating in warehouse evaluations.

Table 7. DISEASE RESISTANCE RATINGS OF SELECTED BURLEY VARIETIES

ENTRY	BLACK SHANK	BLACK ROOT ROT	WILDFIRE	VIRUS DISEASES			
				TMV	TEV	TVMV	PVY
KY 14	NONE	MED-HIGH	HIGH	HIGH	NONE	NONE	NONE
MS BU 21 X KY 10	NONE	LOW	HIGH	HIGH	NONE	NONE	NONE
R 7-11	NONE	MEDIUM	HIGH	HIGH	NONE	NONE	NONE
CO-OP 313	LOW	MED-HIGH	HIGH	HIGH	NONE	NONE	NONE
CO-OP 543	MED-HIGH	MEDIUM	HIGH	HIGH	NONE	NONE	NONE
TN 86	MEDIUM	HIGH	HIGH	NONE	MED-HIGH	HIGH	*
VA 509	MEDIUM	LOW	HIGH	NONE	NONE	NONE	NONE
KY 17	MED-HIGH	HIGH	HIGH	HIGH	NONE	NONE	NONE
CL 501	MED-HIGH	MEDIUM	HIGH	HIGH	NONE	NONE	NONE
N 77	MED-HIGH	MEDIUM	HIGH	MEDIUM	NONE	NONE	NONE
MS KY 14 X L8	**	MEDIUM	HIGH	HIGH	NONE	NONE	NONE
MS BU 37 X L8	**	LOW	HIGH	HIGH	NONE	NONE	NONE
MS BU 21 X L8	**	LOW	HIGH	HIGH	NONE	NONE	NONE

* TN 86 is resistant to most strains of PVY.

** High resistance to Race 0, no resistance to Race 1 black shank

Table 8. TOBACCO ETCH AND TOBACCO VEIN MOTTLING VIRUS
INOCULATION STUDIES

VARIETY	YIELD lbs/acre		VALUE/ACRE \$/acre		YIELD lbs/acre		VALUE/ACRE \$/acre	
	TEV ¹	CHECK	TEV	CHECK	TVMV ²	CHECK	TVMV	CHECK
BLACK SHANK SUSCEPTIBLE								
KY 10	2975	3600	5373	6490	2824	3175	5095	5818
KY 14	2724	3674	4906	6682	2604	2704	4742	4949
KY 15	2936	3585	5308	6488	2365	2313	4140	4157
BU 21	2662	3845	4886	6964	1763	2478	3104	4492
CO-OP 313	2930	3507	5284	6435	2470	2763	4508	5018
MS BU 21 X KY 10	2958	3336	5366	6030	1685	1964	2974	3585
R 7-11	2986	3422	5394	6189	1919	2161	759	1158
BLACK SHANK RESISTANT (RACE 0)								
MS KY 14 X L8	2535	3301	4532	6021	2511	2927	4582	5372
MS BU 21 X L8	2683	2957	4817	5332	1685	1964	2974	3585
MS BU 37 X L8	1900	3156	3375	5789	966	1894	1550	3425
BLACK SHANK RESISTANT (RACE 0 AND RACE 1)								
KY 17	2611	3317	4770	5983	1830	1979	3255	3513
BU 37	2048	2943	3698	5327	244	1194	336	2173
BU 49	1968	2864	3568	5163	0	1009	0	1641
CL 501	2530	3037	4582	5539	1968	2360	3589	4376
VA 509	2739	3399	5011	6155	1667	2028	2871	3667
VA 528	2686	3452	4885	6223	2380	2363	4309	4295
VIRUS RESISTANT								
TN 86	3932	3721	7156	6704	3643	3173	6830	5972
MEAN	2675	3240	4736	5787	2306	2622	3983	4590

1. Plots were inoculated three weeks after transplanting. Check plots were not inoculated and expressed little or no virus symptoms.
2. Plots were inoculated three weeks after transplanting. Check plots were not inoculated but expressed moderate to heavy virus symptoms due to infestation from native virus sources.

Table 9 . REACTION OF SELECTED BURLEY VARIETIES
TO FOUR STRAINS OF POTATO VIRUS Y

VARIETY	PERCENT NECROTIC TISSUE ¹			
	NC 78	NC 171	NC 187	NC 189
Burley 21	0	20	20	25
Burley 37	100	30	-- ²	30
Burley 49	100	50	--	30
Greeneville 115	0	0	0	15
TN 86	0	0	0	15
Virgin A Mutant	0	0	0	15

The test was conducted in a greenhouse at $26 \pm 5^{\circ}\text{C}$ on plants produced in 2.5 in. diameter clay pots. Plants were inoculated at the 3-4 leaf stage of growth. Symptoms were recorded 4 weeks after inoculation. Three plants were inoculated in each treatment and the experiment was repeated 2 times with essentially identical results; only the results of one trial are reported.

1. Visual estimate of percentage of necrotic tissue on the plant.
2. -- = no data recorded.

POTATO VIRUS Y STRAINS

<u>Designation</u>	<u>Source</u>
NC 78	MN strain from tobacco
NC 171	Necrotic strain from West Germany
NC 187	Necrotic strain from South Africa
NC 189	Necrotic strain from Hungary

Table 10. REACTION OF SELECTED BURLEY VARIETIES TO ALFALFA MOSAIC, TOBACCO RINGSPOT, AND TOBACCO STREAK VIRUSES.

VARIETY	REACTION					
	AMV		TRSV		TSV	
	M ¹	S	M	S	M	S
Burley 21	3	30	3	50	4	60
Burley 49	3	30	3	50	4	60
Kentucky 14	3	30	3	50	4	60
TN 86	3	30	3	50	4	60
Virgin A Mutant	2	20	2	30	2	40

The test was conducted in a greenhouse at 26 5 C on plants produced in 2.5 in. diameter clay pots. Plants were inoculated at the 3-4 leaf stage of growth. Symptoms were recorded four weeks after inoculation. Three plants were inoculated in each treatment and the experiment was repeated two times with essentially identical results; only the results of one trial are reported.

1. M=mottling (1=mild, 3=severe); S=stunting (visual estimate of percent reduction in growth compared with non-inoculated check). Number represents mean of the reaction on three plants.

Table 11. BURLEY VARIETY PERFORMANCE TRIALS UNDER BLACK SHANK CONDITIONS WITH THREE RATES OF RIDOMIL

VARIETY	RESISTANCE LEVEL	SUMNER COUNTY			TOBACCO EXPERIMENT STATION		
		RIDOMIL RATE/ACRE ¹			RIDOMIL RATE/ACRE		
		2 QUARTS	4 QUARTS	6 QUARTS	2 QUARTS	4 QUARTS	6 QUARTS
TN 86	MEDIUM						
YIELD ²		3170	3504	3576	3501	4004	3912
% SURVIVAL		97	100	100	99	100	100
VA 509	MEDIUM						
YIELD		2824	2905	2865	3410	3176	3673
% SURVIVAL		96	99	100	100	100	100
CL 501	MED-HIGH						
YIELD		2965	2934	3264	3260	3138	2976
% SURVIVAL		100	100	100	100	100	100
BU 64	MED-HIGH						
YIELD		2676	3054	2938	2746	2810	2491
% SURVIVAL		98	100	100	100	98	96
CO-OP 313	LOW						
YIELD		1072	1168	1800	1626	2498	2009
% SURVIVAL		28	32	64	49	72	64
KY 14	SUSCEPTIBLE						
YIELD		56	35	382	0	101	1202
% SURVIVAL		2	2	8	0	3	34

1. All Ridomil treatments were pre-plant incorporated.

2. Yields and percent survivals are average values for four replications. Yields are in pounds per acre.

Table 12. BURLEY VARIETY PERFORMANCE TRIALS
UNDER BLACK ROOT ROT CONDITIONS

VARIETY	RESISTANCE LEVEL	YIELD IN POUNDS PER ACRE	
		HAMBLEN CO. ¹	ROBERTSON CO. ²
VA 509	LOW	2230	2925
KY 14	MEDIUM	3694	3763
CL 501	MEDIUM	3635	3538
BU 64	HIGH	3281	2975
TN 86	HIGH	4194	4022

1. Heavy black root rot infestation.
2. Moderate black root rot infestation.