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New Fusarium Wilt-Resistant Connecticut Broadleaf Tobacco Varieties

BY JAMES A. LaMONDIA
AND GORDON S. TAYLOR

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Two varieties of Connecticut broadleaf tobacco resistant to Fusarium wilt have been developed at the Connecticut Agricultural Experiment Station's Valley Laboratory. These varieties, C8 and C9, allow broadleaf tobacco production in fields heavily infested with the Fusarium wilt fungus *Fusarium oxysporum*. Yields and sorting quality of these varieties are essentially equal to wilt-susceptible broadleaf. Limited quantities of seed are available to growers.

Over the last decade Fusarium wilt has become the most destructive disease of broadleaf tobacco in Connecticut (3), resulting in the removal of a number of infested fields from broadleaf production. The fungi which cause Fusarium wilt, *F. oxysporum* f.sp. *batatas* and *F.o.* f.sp. *vasinfectum*, have been present in Connecticut since 1943 (1), but severe disease was rare until broadleaf tobacco fields became infested with both *F. oxysporum* and the tobacco cyst nematode, *Globodera tabacum tabacum* (3). The tobacco cyst nematode interacts with the wilt fungus to increase the incidence and severity of wilt in a manner similar to previous associations between root-knot nematodes (*Meloidogyne* spp.) and Fusarium wilts of tobacco and other crops (5). However, tobacco resistance to *F. oxysporum* has consistently been the most effective means of control of Fusarium wilt in the presence or absence of parasitic nematodes wherever this disease has been a serious problem in tobacco production (4).

Broadleaf tobacco resistance to Fusarium wilt was identified in C2, a tobacco mosaic virus (TMV)-resistant broadleaf variety released in Connecticut in 1961. Crosses between C2 and horticulturally desirable wilt-susceptible broadleaf were made over several years. Two wilt-resistant lines of acceptable quality, C8 and C9, were derived from crosses between C2 and the wilt-susceptible broadleaf lines 'Winn' and 'Sperry', respectively. Individual plants were selected for Fusarium wilt resistance in greenhouse screens and in *F. oxysporum* infested field plots. Field grown plants were also selected for TMV-resistance and for horticultural characteristics. C8 and C9 have been inbred by self pollination since 1982 and 1984, respectively.

Both C8 and C9 are susceptible to the tobacco cyst nematode. Tobacco cyst and root-knot nematodes have been shown to increase wilt symptom severity in wilt-resistant tobacco, but disease severity was typically mild. Resistance to Fusarium wilt was not overcome by tobacco cyst nematode infection (3,5).

Both C8 and C9 carry resistance to tobacco mosaic virus conferred by the C2 parent. C2 contains a dominant gene for TMV-resistance derived from *Nicotiana glutinosa*. Connecticut pedigrees containing this TMV-resistance trace to W.D. Valleau's cultivar 'Kentucky NN.' C2 was the result of crosses between Kentucky NN, Hartman broadleaf and Kupchunos broadleaf (6). Kupchunos broadleaf is resistant to Fusarium wilt but neither C2 nor Kupchunos are horticulturally acceptable broadleaf types.

C8 and C9 transplants behaved similarly in repeated greenhouse Fusarium wilt screens. Percent wilt incidence in root wounded seedlings infested with *F. oxysporum* was

Table 1. Cured leaf yield and sorting quality of wilt-resistant and susceptible broadleaf tobacco varieties-1988 and 1989.*

variety	leaves per plant	cured wt (g)	wt per leaf (g)	Grades (%) wrapper	other
C8	10.6	628.5	11.9	70.1	29.9
C9	9.7	678.0	14.0	62.3	37.7
wilt-S+	10.9	574.5	10.5	64.3	35.7

* Yields are the average of 20 plants of each variety.
+ Wilt-susceptible broadleaf line 86-4.

29.6, 27.8 and 66.7% for C8, C9 and wilt-susceptible broadleaf, respectively. Wilt-resistant plants were not immune to the disease, and developed mild symptoms (3). Fusarium resistance in tobacco appears to be conditioned by several genes (2) which do not exclude infection by *F. oxysporum*, as the wilt pathogen can be isolated from the stems of asymptomatic plants grown in infested soil (3).

Figures 1 and 2 illustrate typical wrapper leaf grades of C8 and C9, respectively. Size and shape of these leaves are similar to wilt-susceptible broadleaf, although C9 is slightly more rounded in the heel and at the tip.

Leaf yield and quality of C8 and C9 were compared with high quality wilt susceptible broadleaf varieties. In 1988 and 1989, small plots of 25 plants each were produced under low disease pressure, and cured weight yields and leaf quality determinations were made. Both yields and leaf quality were comparable to standard wilt susceptible broadleaf tobacco (Table 1).

Cured weight leaf yield and quality of C8 and C9 grown in 1990 and sorted under commercial production conditions was similar to small plot results, with cured weight yields over 2200 lb per acre (2464 kg/ha) and

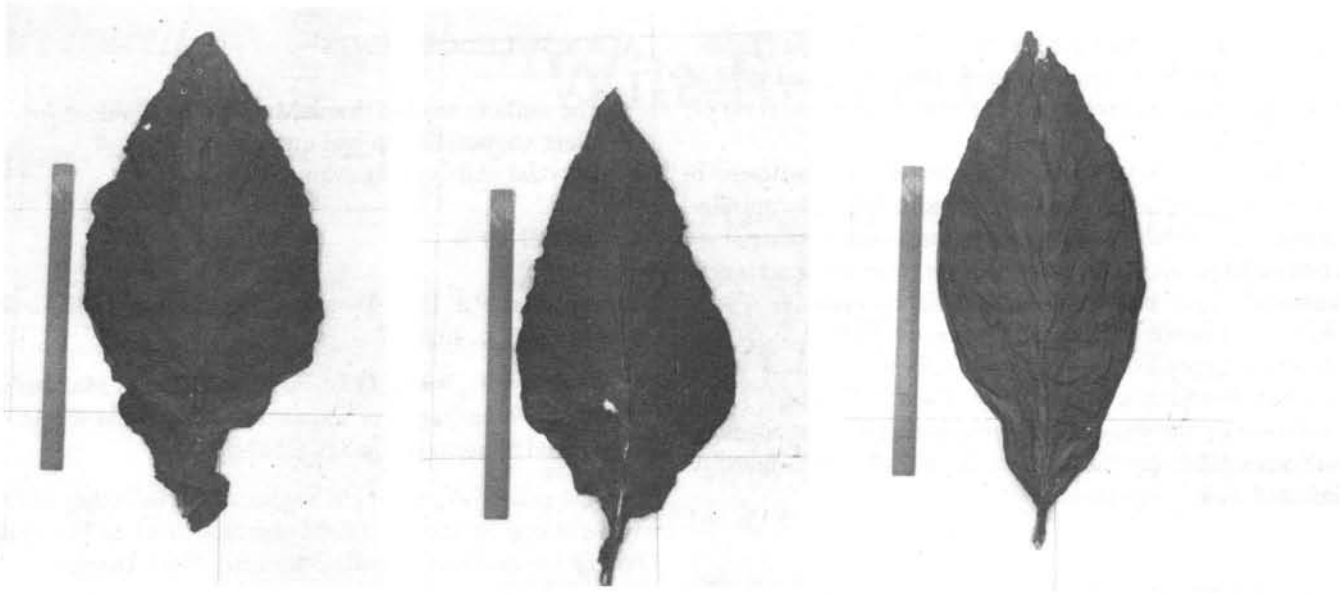

Figure 1. C8 Fusarium wilt-resistant broadleaf tobacco. Typical medium wrapper (MW), dark wrapper (DW) and #1 long second (1LS) leaves. An 18-inch ruler is included for scale.

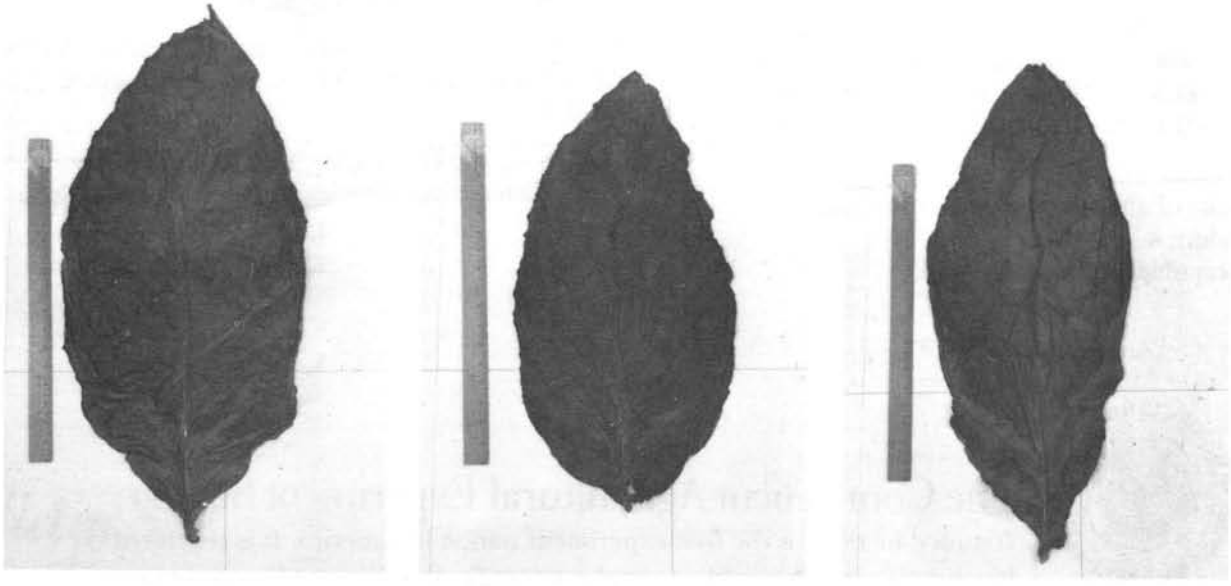

Figure 2. C9 Fusarium wilt-resistant broadleaf tobacco. Typical medium wrapper (MW), dark wrapper (DW) and #1 long second (1LS) leaves. An 18-inch ruler is included for scale.

Table 2. Cured leaf yield and sorting quality-1990 in percent grades by weight.

variety	med	dark	1 sec.	2 sec.	43	stemming
C8*	36.2	4.1	24.3	18.7	4.5	11.7
C9	35.9	5.1	20.5	23.1	5.1	10.3

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* C8 average of over 60,000 plants, C9 average of over 100 plants grown under commercial conditions.
+ Cigar wrapper grades: med, dark, 1 second; binder grades: 2 second, 43.

percent cigar wrapper grades over 60% by weight (Table 2). Yields of C9 are results of over 100 plants, and yield of C8 represents an average of over 9 acres (3.6 hectares) of production.

The benefit of wilt resistance was also demonstrated in the presence of tobacco cyst nematodes. Wilt-susceptible broadleaf and wilt-resistant C8 plants grown in paired rows of 10 plants each in 24 replicate plots in tobacco cyst nematode and Fusarium-infested soil had great differences in wilt incidence and severity (Table 3). Resulting green weight leaf yields reflect both the decreased incidence and severity of wilt in C8 and demonstrate the dramatic differences between producing wilt-susceptible or wilt-resistant broadleaf in soils heavily infested with *F. oxysporum*.

Table 3. Fusarium wilt incidence, severity and green weight leaf yield of wilt-resistant and susceptible broadleaf in *Fusarium oxysporum* infested soil-1989.

variety	percent wilt	wilt severity*	yield/ 100 plants
C8	11.2	2.3	117.1 kg
wilt-S+	77.1	3.6	14.2 kg

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* Wilt severity of affected plants on a 0-4 scale; 0 = healthy, 4 = dead.
+ Wilt-susceptible broadleaf line 86-4.

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