

Fire Blight Susceptibility of Dwarfing Apple Rootstocks

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Abstract

Fire blight susceptibility data for Malling and Malling-Merton apple dwarfing rootstocks are summarized. Clonal rootstocks showed about the same degree of fire blight susceptibility at all test locations. Of 28 rootstocks classified, 9 were slightly, 12 moderately, 5 severely, and 2 very severely susceptible. The degree of blight susceptibility of the scion cultivar may or may not be influenced by the degree of susceptibility of the clonal rootstock. The scion-rootstock interaction should be considered before new apple orchards are planned in areas where fire blight is a problem.

During the past decade, the use of clonal rootstocks to control the size of apple trees has increased extensively. In some areas, a large portion of the trees in newly established orchards is on dwarfing rootstocks. In the warm, humid climate of the Mid-Atlantic region, fire blight (*Erwinia amylovora* (Burrill) Winsl. et al.) causes severe damage, and resistance of the various dwarfing stocks is of utmost importance.

Several investigators have reported on blight susceptibility of Malling rootstocks inoculated naturally and artificially (1, 3, 5, 7, 8). Others determined the relative susceptibility of cultivars grafted on a series of dwarfing rootstocks (2, 6, 9). In assessing the fire blight susceptibility of various rootstocks, one must distinguish between the direct damage of fire blight to the rootstock itself and the indirect effect of the rootstock in increasing susceptibility ("sensitizing") in the grafted scion cultivar.

Fire Blight Susceptibility of Ungrafted Clonal Rootstocks

The fire blight susceptibility data for Malling and Malling-Merton rootstocks evaluated by other investigators was summarized by assigning scores of 0 (no blight), 1 (light), 2 (moderate), 3 (severe), and 4 (very severe) arbitrarily to each rootstock in each test. With few exceptions, the degree of susceptibility of a given rootstock was about the same in tests conducted by different investigators (Table 1). Ungrafted 'M.2' and 'M.7' with natural or artificial inoculation showed severe blight in one test, compared to light to moderate blight in four other tests. 'M.106' showed light to moderate blight in three tests and very severe blight in one test. 'M.8' and 'M.109' showed severe or very severe blight in one test site and light blight in one other. Besides the rootstocks mentioned above, Doll (5) also observed more severe blight in 'M.6', 'M.12', 'M.13', and 'M.16' than reported by other investigators. Most other rootstocks, agreed fairly well among tests.

To further classify the rootstocks in Table 1, the mean blight ratings for natural plus artificial infection were placed in four general categories and grouped as ungrafted rootstocks (Table 2). Thus, of the clonal rootstocks, 9 appeared in the light susceptibility class, 12 in the moderate, 5 in the severe, and 2 in the very severe class.

Sensitivity of Cultivars to Fire Blight When Grafted on Various Clonal Rootstocks

Some cultivars such as 'Jonathan' or 'Lodi' are susceptible to fire blight, whereas others such as 'McIntosh' or

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'Delicious' are resistant to the disease. The literature on fire blight susceptibility has developed on seedling rootstocks. Any comparison with clonal rootstocks, therefore, can be only relative by use of the susceptibility of the cultivar on seedling rootstocks as a base.

In the experiments of Boyce (2), 'M.26', 'M.106', and 'M.111' increased the susceptibility of 'Mutsu', whereas there was hardly any increase in 'Ver-

mont Delicious', 'Richared Delicious', and 'McIntosh'. Mowry (6) observed more blight in 'Jonathan' on 'M.7', 'M.25', 'M.106', and 'M.109' than on 'M.2', 'M.104', or 'M.111'. Whereas 'Jonathan' was strongly sensitized to fire blight by several rootstocks, the effect on 'Golden Delicious' and 'Red Prince Delicious' was almost insignificant. In Thompson's experiments (9), 'Tydeman's Red' and 'Raritan' were very sensitive on 'M.7', 'M.104', and 'M.106' but had only slight to moder-

Table 1. Fire Blight Susceptibility of Various Ungrafted Dwarfing Apple Rootstocks in Several Geographic Areas

Rootstock	Natural Infection*			Arkansas (Rom-Slack)	Artificial Infection*		Mean rating (Natural and artificial infection)
	Pennsylvania (Anthony- Clarke)	New York (Cummins- Aldwinckle)	Iowa (Doll)		New York (Parker- Luepschen- Jones)	Arkansas (Rom- Slack)	
M.1	2.5	1.5	3.0	2.5	3.0		2.5
M.2	1.0	1.0	3.0	2.0	1.0	1.0	1.5
M.3	4.0		4.0				4.0
M.4		2.0	3.0		2.0		2.3
M.6		2.0	4.0				3.0
M.7	1.0	1.0	3.0	1.5	1.0	1.0	1.4
M.8		1.0	4.0				2.5
M.9	2.5	3.0	4.0	2.5	3.0	2.5	2.9
M.10	2.0		2.5				2.3
M.12	1.0	2.0	4.0		2.0		2.2
M.13	1.0		4.0		2.0		2.2
M.15	0.0	1.0					0.5
M.16	2.0	2.0	4.0		3.0		2.8
M.25		2.5					2.5
M.26		4.0		4.0		4.0	4.0
M.27		2.0					2.0
M.102			1.0				1.0
M.103			1.0				1.0
M.104		2.0	1.0	1.0	1.0	1.0	1.2
M.105			1.0				1.0
M.106			2.0	1.5	4.0	2.5	2.5
M.107			2.0				2.0
M.109			3.0		1.0		2.0
M.110			1.0				1.0
M.111			2.0	1.0	1.0	0.0	1.0
M.112			2.5				2.5
M.113			3.5				3.5
M.114			3.0				3.0

* = Blight rating; 0 = no blight; 1 = light; 2 = moderate; 3 = severe; 4 = very severe.

Table 2. General Classification of Blight Susceptibility for the Most Common Malling Apple Dwarfing Rootstocks

Mean infection rating	Susceptibility class	Clonal rootstock ('M.' no.)	
		'East Malling'	'Malling Merton'
0.1 - 1.5	Light	2, 7, 15	102, 103, 104, 105, 110, 111
1.6 - 2.5	Moderate	1, 4, 8, 10, 12, 13, 25, 27	106, 107, 109, 112
2.6 - 3.5	Severe	6, 9, 16	113, 114,
3.6 - 4.0	Very severe	3, 26	

ate infection on seedlings. In contrast, 'N.J.32' and 'Lodi' were susceptible on seedlings, but were not further sensitized by the Malling clonal rootstocks. 'Mutsu' in these experiments was most susceptible on 'M.7'. 'Mariborka' and 'Greendale' increased in susceptibility as a result of all three rootstocks 'M.7', 'M.104', and 'M.106'.

Observations from a planting of 'York Imperial', 'Red Yorking', and 'Triple Red Delicious' established at Beltsville in 1965 report the presence of fire blight inoculum. The warm, humid weather prevailing between 1967 and 1970 led to blight infections during these years. Each year control of the disease was attempted by pruning out blighted limbs and by applying four to five applications of streptomycin. In 1970, fire blight was very severe, and in August the trees were rated on a simple scale from 0 (no blight) to 3 (severe blight). 'York Imperial' was more severely infected on 'M.26' rootstock than on 'M.111' and seedling rootstocks (Table 3). The amount of blight on 'M.111' rootstock was about one-third of that on 'M.26'

and the amount on seedling rootstock was about one-fifth of that on 'M.26'. 'Red Yorking' on 'M.9' showed about half the blight shown by 'York Imperial' on 'M.26', and 'Triple Red Delicious' on 'M.9' had the least infection.

In addition to the Beltsville results, where 'M.26' apparently increased the susceptibility of the scion cultivars to fire blight, a similar effect was reported in 1970 on 'Mutsu' in Vermont (2) and was observed in 1972 on 'Golden Delicious' in New York (personal observation). Mowry also reported that in Illinois he observed more severe blight in apple cultivars on 'M.26' than on any other rootstocks.

In contrast to the above observations, is the fact that 'M.26' has had no effect on the susceptibility of 'Golden Delicious' in large orchard plantings in Pennsylvania. Also, in the Beltsville orchard, two or three trees of 'Golden Delicious', 'Rome', 'Stayman', 'Beacon', and several others on 'M.26' showed, at the most, only light fire blight infection. Even though the

Table 3. Incidence of Fire Blight in Some Apple Cultivars, as Influenced by Seedling and Dwarfing Rootstock at Beltsville, Maryland (Aug. 1970)

Scion	Rootstock	Trees (no.)	Trees blighted (%)	Mean blight rating*	Calculated blight rating†
York Imperial	M.26	62	95	2.5	238
" "	M.111	90	77	1.1	85
" "	Seedling	96	60	0.8	48
Red Yorking	M.9	71	66	1.7	112
Triple Red Delicious	M.9	86	24	0.3	7

*Blight rating: 0 = no blight; 1 = light; 2 = moderate; 3 = severe.

†Percentage of trees blighted × mean blight rating; the highest possible blight score is 300.

28 apple rootstocks in Table 1 are classified into four blight susceptibility classes (Table 2), important differences in degree of susceptibility may occur from one site to another. Soil conditions, weather factors, and physiology of the tree may account for these differences.

The increased sensitivity of the scion cultivar on several clonal rootstocks is well established. Mowry (6) and Cummins and Norton (4) attributed this increase to an earlier flower production induced by the rootstock that provides more infection courts for fire blight. In Thompson's experiments (9) and in the observations at Beltsville, however, infection on the grafted scion cultivars occurred in August and apparently had no relation to the number of flowers produced by the tree. It is concluded that the rootstock may have altered certain physiological processes in the tree, thus producing more flowers and also rendering the scion variety more susceptible to fire blight. Therefore, the two processes are concomitant rather than causal. Whatever the reason for increased susceptibility of certain cultivars to fire blight induced by the clonal rootstock, this conjoining effect has to be taken into consideration when new plantings

are designed. In areas where fire blight infection is likely, either the susceptible rootstock has to be avoided or scion cultivars have to be used that are most resistant to the disease.

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Book Review

National Apple Register of the United Kingdom.

An authoritative register of all apple varieties, grown in Britain since 1853, is contained in the book "National Apple Register of the United Kingdom" by Muriel W. G. Smith. The register lists approximately 6000 distinct apple varieties, both native and foreign. It records the accepted name, all synonyms, a brief history and description, and references. In the ap-

pendix, the progeny of each variety is given.

The book, of 652 pages, is published by the Ministry of Agriculture, Fisheries and Food, Tolcarne Drive, Pinner, Middlesex HA5 2DT, England. The overseas price in Pounds Sterling is 12.50, and includes postage and handling. The register will be of interest to fruit breeders, amateurs and all others interested in old and new apple varieties.

—L. D. Tukey