

# Relative Curly-Top Resistance of Sugar Beet Varieties in the Seedling Stage

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It has long been recognized that early planted sugar beets were less likely to suffer serious injury from curly top than later plantings. The reason is that the older plants are much more resistant at the time of leafhopper invasion (1, 6, 7)<sup>2</sup> Also, it often has been assumed and stated that curly top-resistant varieties of sugar beet were "susceptible" when young, thus implying that the resistant beets are injured as much as susceptible varieties if the young plants are infected.

Seedling plants of resistant varieties do show much greater resistance to both infection and injury than comparable plants of susceptible varieties. Evidence published in 1937 (2) showed that seedlings of U. S. 1, a beet of relatively low resistance, were more resistant to infection, slower in developing symptoms and less severely injured than comparable plants of the commonly used commercial beet varieties. These tests included data from several experiments and more than 2,300 plants. All plants were in the cotyledon or very young two-leaf stage when inoculated and one viruliferous leafhopper was used on each plant. These plants were grown under environmental conditions which were as nearly comparable as anyone might reasonably wish and the results showed the same trend in every experiment. The same publication gave similar, but less voluminous, evidence concerning some other curly top-resistant beets, including selections from U. S. 1.

Some detailed evidence concerning resistance to infection and to injury in the cotyledon or young two-leaf stage was published in 1938 (3). Data from field experiments of 1939 and 1941 were published in 1942 (4). This dealt with young plants of the beet varieties Old Type, U. S. 22 and Improved U. S. 22. The plants were inoculated immediately after thinning. The results were similar to those reported earlier but much more pronounced in the case of Improved U. S. 22. Some additional evidence from greenhouse experiments was published in 1944 (5).

The data used in all the above mentioned work were checked statistically and found to be highly significant.

The author believes that there has been some misunderstanding concerning the use of the word "susceptible." Young plants of any sugar beet variety which has been tested may be infected with curly top virus by the use of sufficient numbers of leafhoppers carrying the proper strain or strains of virus, but that is relatively unimportant if the plant is not seriously injured, recovers and continues to make good growth. The important factor is susceptibility or resistance to injury by the curly top virus rather than susceptibility to infection.

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<sup>2</sup> Numbers in parentheses refer to literature cited.

During the last few years we have had to deal with newly discovered and more highly virulent strains of the curly top virus. Some data from recent experiments are given in Tables 1 and 2.

Table 1.—Curly Top Resistance of Sugar Beet Varieties Infected in Cotyledon or Very Young Two-Leaf Stage. Results 6 Weeks After Inoculation.

Beet Variety	A. Plants Infected with Virus Strains 1 or 11 <sup>1</sup>				B. Data for 4 Groups of Plants Inoculated with Virus Strains 1, 3, 11 or 12 <sup>2</sup>	
	Strain 1		Strain 11		Average Severity	Plants Dead
	Average Severity	Plants Dead	Average Severity	Plants Dead		
	Grade	%	Grade	%	Grade	%
SL 842	4.8	42	4.7	89		
SL 1-300 (OT)	3.8	25	4.8	70	3.4	30
SL 175	1.8	4	4.3	54	2.6	12
SL 824	1.7	2	4.4	16	2.7	6
SL 96(22/3)	1.6	0	4.2	27	2.6	10
SL 92M1	1.3	0	3.6	7	2.5	10
SL 92	1.4	0	3.5	6	2.3	6

<sup>1</sup>Data included in Part A covers three experiments with approximately 100 plants for each beet variety and each virus strain.

<sup>2</sup>Data in Part B includes approximately 80 plants of each beet variety. Except SL 92M1, which had only 28 plants. Averages include the 4 virus strains for each beet variety.

The extreme virulence of virus strain 11 is clearly evidenced in Section A of Table 1 by the severity of symptoms and the percent of plants killed within 6 weeks after inoculation. Cotyledon and very young two-leaf stage plants of beet varieties S. L. 92M1 and 92, curly top-resistant selections from 22/3, are outstanding in resistance to injury from virus strain 11. This fact is more evident in the percent of plants killed than in the degree of severity.

Figure 1 shows typical results obtained on plants of beet varieties S. L. 1-300 (Old Type), and S. L. 92 infected by curly top virus strains 11, 1 and 3 respectively.

It is fortunate that a sugar beet field is very rarely apt to have widespread infection by curly top virus strain 11, or one of similar virulence, while the plants are young. This is because such highly virulent strains are likely to cause extreme dwarfing or death of wild hosts and so become somewhat self-limiting in winter and spring plant host areas. The data given under Section A Virus Strain 1 or under Section B of Table 1 are more likely to be what one might expect under field conditions than that given under Virus Strain 11 of Section A.

Table 2 gives evidence of the increased resistance of young plants during an 8-day period of growth. Only approximately 20 plants were included in the test of each beet variety with each virus strain on each inoculation date but the tendency toward increased resistance is shown in the resistant varieties, particularly in S. L. 92M1 and S. L. 82.

Resistance to curly top infection and resistance to injury increases with age in all sugar beet varieties which have been tested. The increase in resistance is generally more rapid in varieties which are listed as resistant than

Table 2.—Increase in Curly Top Resistance of Young Sugar Beet Seedlings During an 8-Day Period of Growth in Greenhouse.<sup>1</sup>

Beet Variety	Curly Top Virus Strain I				Curly Top Virus Strain II			
	Average Severity Inoculated October		Plants Dead Inoculated October		Average Severity Inoculated October		Plants Dead Inoculated October	
	5th	13th	5th	13th	5th	13th	5th	13th
SL 842	4.7	5.0	50	27	4.7	4.6	84	87
SL 1-300 (OT)	4.4	4.4	47	13	4.8	4.9	82	65
SL 175	2.0	2.1	12	0	4.6	4.1	71	50
SL 824	1.8	1.2	0	0	4.7	4.2	24	13
SL 95 (22/3)	1.6	1.3	0	0	4.6	4.5	32	36
SL 92M1	1.3	1.1	0	0	4.1	3.2	5	0
SL 92	1.5	1.2	0	0	3.9	3.5	0	0

<sup>1</sup> Plants inoculated October 5 were strictly in cotyledon stage and those inoculated October 13 were in very young two-leaf stage.



Figure 1. Sugar beet plants six weeks after inoculation with curly top virus strains. Top row is variety S. L. 1-300 (Old Type). Bottom row is S. L. 92. Plants in pots at left infected by virus strain 11, in middle pots by strain 1 and in pots at right by strain 3.

in those more susceptible. There is abundant evidence that resistant sugar beet varieties possess a great measure of that quality of resistance to both infection and to injury while the seedlings are still in the cotyledon and very young two-leaf stage. Comments concerning curly top-resistant varieties should avoid the implication that they are in the same class as the susceptible varieties during their early growth.

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