RESEARCH CIRCULAR 145 FEBRUARY 1966

Corn Virus Research In Ohio In 1965

L. E. WILLIAMS, W. R. FINDLEY, E. J. DOLLINGER,
B. D. BLAIR, AND O. W. SPILKER

OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER
WOOSTER, OHIO

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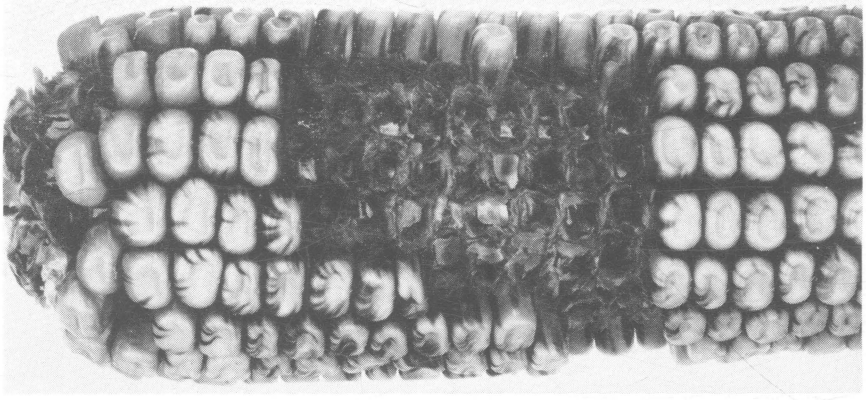

Fig. 1.—Yellow dent corn hybrid showing red streaking of kernels.

ON THE COVER: Many studies of corn viruses are made in the greenhouse. Dr. W. R. Findley, standing, and Dr. L. E. Williams examine the effects of MDM virus plus a root rot fungus on corn plants.

AGDEX 111/632

2-66-10M

Corn Virus Research in Ohio in 1965

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B. D. BLAIR, AND O. W. SPILKER[1]

HISTORY

Maize dwarf mosaic was first noted in a few scattered corn plants in one or two fields along the Ohio River in 1962. Significance of the disease was not realized until 1963, when it had spread to an estimated 15,000 acres in 12 counties along the Ohio and Scioto rivers. Yield losses in diseased fields in 1963 were estimated from a trace to 90 percent.

Further spread of the disease was indicated in 1964, with corn losses in Ohio estimated at 5 million bushels. Losses varied by counties from a trace to 30 percent of the harvested crop and again were most severe in southern Ohio along rivers and their tributaries.

Another virus, in addition to the MDM virus, has been found in Ohio corn. This virus (called 3A temporarily) was first isolated from red-streaked corn kernels in the fall of 1964 by research personnel at the Ohio Agricultural Research and Development Center.

As far as is known, the red streaking of corn kernels first appeared in northwestern Ohio, northeastern Indiana, and southern Michigan in 1963. In the following year, 1964, it was reported in several additional states and Canada. It was observed in every Ohio county in 1965.

Red streaking has been observed on many types of corn, including flint, dent, sweet, and popcorn. It has been most common on yellow dents (Figure 1).

The 3A virus has not been definitely established as the cause of red streak. However, it is suspect because it has been transmitted from red-streaked kernels in the field and is capable of reproducing a similar symptom in greenhouse corn.

The 3A virus also was found to be pathogenic on small grains and was transmitted from wheat in several Ohio fields in the spring of 1965. This virus is believed to be related to or the same as the wheat streak mosaic virus which has been a problem in wheat in the Great Plains states for many years.

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DISTRIBUTION AND SEVERITY OF CORN VIRUSES IN 1965

A survey of the location and severity of corn virus diseases in 1965 was sponsored jointly by the Ohio Department of Agriculture, Ohio Agricultural Research and Development Center, and Ohio Cooperative Extension Service. Suspected virus-infected plants were assayed for viruses by mechanical transmission in the greenhouse.

The MDM virus was found in 38 Ohio counties and the 3A virus in 44 counties (Figure 2). Losses due to the MDM virus were estimated to be 2.6 million bushels and losses due to the 3A virus, 900,000 bushels.

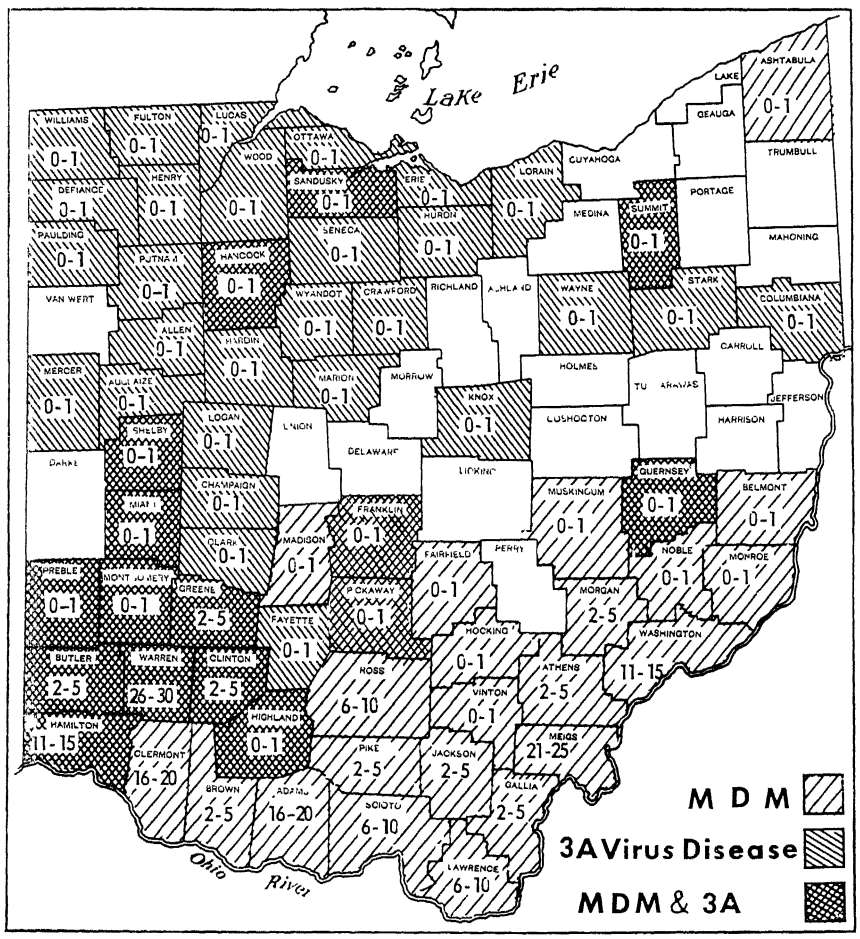

Fig. 2.—Ohio counties in which corn viruses were found in 1965 survey. Figures indicate estimated percentage yield loss.

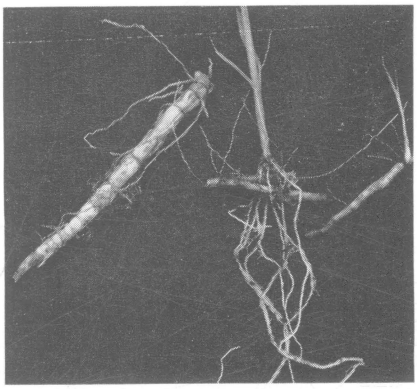

Fig. 3.—Fleshy, underground root-like rhizomes of Johnson grass in which the MDM virus overwinters.

INSECT VECTOR STUDIES

Several species of aphids have been proven vectors of the MDM virus under greenhouse conditions. Four of these species were found in Ohio corn fields in 1965. Root-feeding aphids, including corn root aphids, were found feeding on Johnson grass in late April and on corn roots in mid-May. Present indications are that these root-feeding forms may be responsible for MDM spread in early spring. Corn leaf

Fig.4.—Warren Stoner, USDA entomologist, using suction apparatus to collect insects from corn plants. Note different reactions of corn strains to the MDM virus.

aphids and a less commonly known aphid species were collected from corn leaves as early as June 16, 1965.

All transmission studies with flea beetles, thrips, leafhoppers, and garden centipedes indicate that these are not MDM vectors. Additional studies are required to confirm these findings.

Control studies in 1965 included aerial applications of malathion to areas bordering corn fields, aldrin and dieldrin applications to control root aphids in corn fields, and systemic insecticides (Di-Syston and Thimet) applied in the row at corn planting time to reduce aphid populations. Results from greenhouse studies indicate that Di-Syston and Thimet gave equal aphid control on corn when corn leaf aphids were introduced at weekly intervals.

Results from all studies show that insecticides applied in research fields did not give satisfactory MDM vector control. Additional research, including studies of placement and timing of application, may result in vector control programs which are feasible. However, use of an insecticide to obtain MDM vector control appears unjustified in 1966.

REACTION OF CORN HYBRIDS TO MDM

Corn hybrids tested for MDM reaction along the Ohio River near Portsmouth in 1965 included open-pedigree single and double cross dents, and dent, sweet, and popcorn hybrids from commercial interests (Tables 1-4).

Johnson grass showing virus symptoms became abundant among the young corn seedlings. It was hoed out between June 1 and June 15 and kept under control for the remainder of the season.

Disease development depended on natural infection. Symptoms of maize dwarf mosaic were first noted on corn in the plots June 8 and a high incidence of the disease developed rapidly and uniformly over the test area.

Hybrids were rated both for degree of stunting and chlorosis. Early ratings were made July 7 to 14 and final ratings August 23 to 27. Ratings reported are two plot averages. August stunt ratings were made in about three-fourths of the dent hybrid entries and were made in only one replication in most of these. The sweet corns were dead in August and could not be rated.

The rating scale contained the six classes: 1.0, 1.1, 1.5, 2.0, 2.5, and 3.0. These ranged from 1.0, no visible virus symptoms, to 3.0 complete susceptibility.

Hybrids which scored 1.5 or less for stunt or chlorosis are considered sufficiently tolerant or resistant to MDM so yield reduction

Fig. 5.—Mature single-cross hybrids. Right, resistant to MDM virus; left, moderately susceptible. Note slight stunting and poor seed set in moderately susceptible hybrid.

should not be significant. An MDM epidemic will reduce yield an estimated 15 to 25 percent in hybrids which scored 2.0 for stunt or chlorosis. Correspondingly greater yield reductions may be expected in a virus epidemic in hybrids rated more susceptible.

Chlorosis ratings are more reliable than stunt ratings because of the observers' unfamiliarity with most of the hybrid entries. Frequently, normal appearing plants in the plots served as references.

In general, available MDM-resistant hybrids are less acceptable for some agronomic characteristics than are other normally recommended combinations. At present, there is little MDM resistance in hybrids with maturity ratings earlier than 800 (hybrids U. S. 13 maturity). There has not been time enough to combine, through breeding, MDM resistance with other desirable attributes.

Unless MDM has been found in an area and an overwintering reservoir of Johnson grass is present, a switch of hybrids on the basis of resistance alone may not be wise.

TABLE 1.—Maize Dwarf Mosaic Virus Ratings of Open-pedigree Single Crosses.

Single Cross	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
C103 x Oh07	25	1.0	1.0	1.3	1.3
C103Rf x Oh07Rf	41	1.0	1.0	1.0	1.1
C103 x Cl.187-2	43	3.0	2.5	2.8	2.8
C107 x Va31	36	2.0	2.0	2.0	2.0
C153 x NY821	41	3.0	2.5	3.0	3.0
A x WF9	56	2.0	1.5	1.5	2.5
A x W23	29	1.3	1.3	1.0	2.0
M14 x Cl.187-2	41	3.0	2.5	3.0	3.0
R181 x Pa32	34	2.0	1.8	2.0	1.8
WF9T x C103Rf	42	2.5	2.0	1.5	3.0
WF9 x P8	29	2.0	1.5	1.5	2.5
WF9 x Oh07	29	2.0	1.0	1.0	1.0
WF9 x Oh33	31	1.8	1.3	1.8	2.3
P8 x H55	24	2.5	1.5	1.8	1.8
B8 x MS142	31	2.0	3.0		D†
B8 x A401	39	1.0	1.3	1.3	1.5
B8 x ND376	37	1.0	1.0	1.5	1.0
B8 x ND405	32	2.5	2.5	3.0	2.5
B8 x ND407	24	2.5	2.5	2.5	2.5
B8 x ND408	23	2.5	2.5		D
B8 x ND480	25	2.5	2.5		D
B8 x W64A	35	3.0	2.5	3.0	2.8
B37 x Pa32	35	1.0	1.0	2.0	2.5
MS142 x ND405	20	3.0	3.0		D
MS142 x ND407	26	2.5	2.0		D
MS142 x ND408	28	3.0	3.0		D
MS142 x ND480	21	3.0	2.5		D
A73 x Oh43	48	3.0	2.5	2.5	2.0
NY3 x D50	36	2.5	2.0		D
NYN40 x Pa54	46	3.0	2.0	2.5	2.5
NY821 x NY511Rf	19	2.5	1.5	2.0	1.8
NY821 x Pa83Rf	30	3.0	3.0	2.5	3.0
Oh05 x Oh7K	33	1.5	1.3	1.5	1.8
Oh05 x Oh32	36	2.5	2.0	1.5	2.5
Oh05 x Oh45B	37	3.0	3.0		D
Oh05 x W23	23	3.0	1.8	2.5	2.3
Oh07 x Oh43	38	1.0	1.3	1.0	1.5
Oh07 x Oh51A	13	2.0	1.0	1.3	1.5
Oh7A x 38-11	34	1.5	1.0	1.0	1.0
Oh7A x Oh43	40	2.0	1.8	1.3	2.3
Oh7B x Hy	26	1.0	1.0	1.0	1.3
Oh7K x W22	45	3.0	3.0	2.5	2.8
Oh7N x H60	30	3.0	1.3	2.0	2.0
Oh7N x HD2187	36	2.0	1.3	1.5	2.0
Oh26 x Hy	43	2.3	1.5	1.5	2.0

*1 = No virus symptoms; 2 = Intermediate; 3 = Completely susceptible

†D = All plants dead at rating time

TABLE 1. (Continued)—Maize Dwarf Mosaic Virus Ratings of Open-pedigree Single Crosses.

Single Cross	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
Oh26 x Oh501	36	1.5	1 3	1.3	1.8
Oh26F x A619	36	3.0	2.5	3.0	3.0
Oh26F x Oh43	43	3.0	2.0	3.0	3.0
Oh26F x Oh502	31	3.0	2.5	3.0	3.0
Oh26F x Pa11	16	1.0	1.0	1.8	2.0
Oh32 x Oh43	33	3.0	2.5	2.5	2.8
Oh33 x Oh40B	26	3.0	3.0		D†
Oh43 x Pa32	30	2.0	2.0	2.3	3.0
Oh43 x CI.21E	9	2.5	1.8	2.5	2.5
Oh45B x HD2187	32	2.0	1.5	2.0	2.5
Oh45B x Va35	44	2.0	1.8	2.0	1.8
Oh45C x CI.187-2	35	3.0	3.0	3.0	3.0
Oh51A x Pa11	30	1.0	1.0		D
Oh65 x W23	37	1.3	1.3	1.3	2.0
Oh502 x CI.187-2	40	3.0	2.0	2.8	2.5
Pa32 x Pa33	24	3.0	2.5		D
Pa32 x Pa33A	37	3.0	3.0		D
Pa41 x WI44	23	3.0	3.0		D
Pa405 x W64A	35	2.0	1.0	1.0	1.0
CI.21E x CI.38B	46	1.5	1.3	1.5	1.8
Va35 x CI.38B	39	1.0	1.0	1.0	1.3

*1.0 = No virus symptoms; 2.0 = Intermediate; 3.0 = Completely susceptible

†D = All plants dead at rating time

TABLE 2.—Maize Dwarf Mosaic Virus Ratings of Dent Corn Hybrids from Commercial Interests and Open-pedigree Combinations.

Hybrid	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
Canada Hybrid 1	30	1.8	2.0		D†
Foliant O.P.	16	2.0	2.0		D
Gelber Burgenlander O.P.	20	2.3	2.8		D
Prior O.P.	16	2.3	2.8		D
Ky 105	40	1.0	1.0	1.0	1.2
Ky5921W	35	1.5	1.5	1.5	1.4
(Pa41 x C153) (NY821 x NY511)	33	2.0	2.3	3.0	2.9
(W144 x Pa41) (NY821 x NY511)	33	2.3	2.5	3.0	2.6
(Pa405 x W64A) (NY821 x NY511)	33	1.8	1.8	1.5	2.2
(B8 x W64A) (NY821 x NY511)	28	2.0	2.3	3.0	3.0
(B8 x A401) (NY821 x NY511)	25	1.8	1.8	3.0	2.7
(B8 x Pa405) (NY821 x NY511)	24	1.8	1.8	2.0	2.3
Cornell M3	26	2.3	2.0	3.0	2.9
Cornell M4	35	1.8	1.8	2.5	2.5
Cornell M9	34	2.0	2.0	3.0	3.0
Cornell M10	31	2.0	1.8	3.0	2.6
Mo. 542	36	2.0	1.8		1.6
Mo. 881	44	1.5	1.5		1.4
Mo. 904-1	40	2.3	2.0		2.8
Mo. 916	41	1.8	1.5		1.4
AES904AW	41	1.5	1.5		1.7
U.S.523WC	42	2.0	1.8		2.2
Agrico H50	37	2.0	2.0	3.0	2.3
Agrico H59	33	2.3	2.0	2.5	2.5
Agrico H66	38	2.3	2.0	3.0	2.8
Agrico H70	35	2.0	2.0	3.0	2.9
Agrico H72	33	2.0	2.0	2.0	2.3
Agrico H76	34	2.0	2.0	2.0	2.2
Agrico H80	33	2.5	2.0	2.0	2.4
Agrico H85	23	2.0	2.0	2.0	2.2
Agrico K12	21	2.0	2.0	2.0	2.6
Agrico P99	33	2.0	2.0	2.0	2.4
Agsco H75	24	2.3	2.3		D
Agsco H82	20	1.8	1.8		D
Agsco H83	26	2.0	2.3		D
Agsco H85	28	1.8	2.3		D
Agsco H88	30	2.0	2.5		D
Agsco H90	36	1.8	2.0		2.8
Agsco H95	36	2.0	2.3	2.0	3.0
Agsco H100	29	2.5	2.8	3.0	3.0
Agsco 3X33	30	2.3	2.3	3.0	3.0
Agsco Exp2XH1	28	2.3	2.5	3.0	3.0
Ainsworth EX6903	39	1.5	1.5	1.5	1.9
Ainsworth EX9570	30	2.0	1.8	2.0	2.2
Ainsworth EX9600	35	1.8	2.0	2.0	2.8

*1.0 = No virus symptoms; 2.0 = Intermediate; 3.0 = Completely susceptible

†D = All plants dead at rating time

TABLE 2. (Continued)—Maize Dwarf Mosaic Virus Ratings of Dent Corn Hybrids from Commercial Interests and Open-pedigree Combinations.

Hybrid	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
Ainsworth EX9604	35	2.3	2.3	3.0	3.0
Ainsworth EX9670	42	2.3	1.8	2.3	2.5
Ainsworth EX274603	34	1.3	1.3	1.0	1.1
Ainsworth EX572571	37	2.0	2.5	2.5	2.5
Ainsworth EX573575	20	2.8	2.8	3.0	3.0
Ainsworth EX587370	35	2.5	2.0	3.0	3.0
Ainsworth EX590603	40	1.8	1.5	1.5	1.7
Appl's B37 x B55	41	3.0	2.5	2.0	3.0
Appl's (WF9TMS x H50) (B14 x CI.31ARf)	40	2.3	2.0	2.0	2.7
Appl's (WF9 x B41) (C103Rf x C103D)	39	2.0	1.8	3.0	3.0
Appl's (H49 x B37TMS) (H60 x C103Rf)	37	2.3	2.0	3.0	2.4
Appl's (H49 x B37) (H60 x C103)	38	2.3	2.3	3.0	2.5
Bear 637	45	1.8	1.5	2.0	2.0
Bear 710	36	1.1	1.3	1.5	1.3
Bear 800	39	2.0	2.3	2.5	2.9
Bear 869	41	1.8	1.5	1.5	1.9
Bear 873	33	2.0	1.5	2.0	1.9
Bear 889	38	2.0	2.0	1.5	2.8
Bear 890	34	2.0	2.0	2.0	1.9
Burgdorf B99W	30	2.0	2.0	2.0	2.1
Burgdorf 814	24	2.0	1.8	2.0	1.9
Burgdorf 837	36	2.0	1.8	2.0	1.8
Burgdorf Imp.909-4B	30	2.0	1.8	1.5	1.8
Cornelius X36	42	2.0	2.0	2.3	2.4
Cornelius X39	40	2.0	2.0	2.0	2.3
Cornelius X41	44	2.0	2.5	3.0	3.0
Cornelius X45	36	2.0	2.0	2.0	2.7
Cornelius X46	33	2.0	2.0	2.0	2.1
Cornelius X50	35	2.0	2.3	3.0	2.9
Cornelius X57	40	2.0	2.0	2.3	2.2
Cornelius X62	36	2.0	2.3	2.5	2.8
Cornelius X76	36	2.0	2.0	2.0	2.3
Cornelius 404B	29	2.3	2.3	3.0	3.0
Crow 722	41	1.6	1.5		1.7
Crow 825	36	1.0	1.0	1.0	1.0
Crow XP-2X-3	42	1.6	1.5		1.5
Dekalb 640	42	2.0	2.0	2.0	2.5
Dekalb 1006	24	1.8	1.8	1.5	2.0
Dekalb XL385	38	2.3	2.0	2.0	2.1
Dekalb Exp.6151	42	2.0	1.8	2.0	3.0
Dekalb Exp.6153	28	2.8	2.8	3.0	3.0
Dekalb Exp.6154	29	2.8	2.8	3.0	3.0
Dekalb Exp.8125	41	1.8	1.5	2.0	2.3
Dekalb Exp.9120	39	1.8	1.5	1.5	1.7
Dekalb Exp.9131	40	1.1	1.1	1.0	1.1

*1.0 = No virus symptoms; 2.0 = Intermediate; 3.0 = Completely susceptible

TABLE 2. (Continued)—Maize Dwarf Mosaic Virus Ratings of Dent Corn Hybrids from Commercial Interests and Open-pedigree Combinations.

Hybrid	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
Dekalb Exp.9132	36	1.8	1.6	1.5	1.4
Funk G146	43	2.0	2.0		2.6
Funk G4656	30	2.3	2.0	3.0	3.0
Funk G4703	33	2.0	2.0		2.6
Funk G4831W	35	1.5	1.5	1.0	1.5
Funk 16787	40	1.5	1.1		1.3
Funk 17014	39	1.5	1.3		1.2
Funk 17550	38	1.3	1.3		1.3
Funk 17552	34	1.5	1.5		1.6
Funk 17555	44	1.8	1.5		1.4
Funk 18024	41	2.3	2.0		2.8
Edw. J. Funk S7	30	2.3	2.3	2.0	3.0
Edw. J. Funk S55	22	2.8	2.5	3.0	3.0
Edw. J. Funk S66	36	2.3	2.3	3.0	2.9
Edw. J. Funk 890	34	2.0	2.0	2.0	2.3
Edw. J. Funk 891	31	2.0	1.8	2.0	2.2
Edw. J. Funk 5900	38	2.0	2.0	3.0	3.0
Edw. J. Funk S6360	31	1.8	1.5	2.5	3.0
Edw. J. Funk S7100	36	2.3	2.0	3.0	2.9
Edw. J. Funk 8300	32	2.0	1.8	2.0	2.2
Edw. J. Funk S8648	38	1.8	1.5	3.0	2.8
Gildersleeve GSC-7	20	2.3	2.0	3.0	3.0
Gildersleeve GSC-10	10	2.5	2.0	3.0	3.0
Gildersleeve GSC-30	25	2.3	2.0	3.0	3.0
Gildersleeve GSC-50	27	1.6	1.5	1.8	1.7
Gildersleeve GSC-52	28	2.8	2.0	3.0	2.3
Gildersleeve GSC-120	30	2.0	2.0	2.0	1.4
Gildersleeve GSC-150	34	2.5	2.0	2.0	2.9
Gildersleeve GSC-420	29	2.0	2.0	2.0	2.2
Gildersleeve GSC-450	34	1.8	1.8	2.0	1.8
Gildersleeve GSC-M130	37	2.3	2.3	3.0	3.0
Haapala HFW1	21	3.0	2.8	3.0	3.0
Haapala HFW2	16	3.0	3.0		D†
Haapala HFW4	28	2.8	3.0		D
Haapala HA4	15	3.0	2.5	3.0	2.5
Haapala Ho25	39	2.5	2.5	2.5	2.3
Haapala Ho35	8	2.3	2.3	3.0	2.5
Haapala HM72B	28	3.0	2.5	3.0	2.3
Haapala HM85	25	2.8	2.8	3.0	2.5
Haapala H2722	18	3.0	3.0		D
Haapala H2933	16	3.0	2.8		D
Hiser VRD875	24	1.8	1.5		1.6
Hiser VRD994	33	2.0	1.5		1.4
Hiser VRD995	43	2.0	2.0		2.1
Hiser VRD996	48	1.8	1.5		1.8

*1.0 = No virus symptoms; 2.0 = Intermediate; 3.0 = Completely susceptible

†D = All plants dead at rating time

TABLE 2. (Continued)—Maize Dwarf Mosaic Virus Ratings of Dent Corn Hybrids from Commercial Interests and Open-pedigree Combinations.

Hybrid	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
Hiser VRS21	27	1.1	1.1		1.2
Hiser VRT855	29	1.5	1.3		2.0
Hoegemyer 61	29	2.0	2.0	2.0	1.6
Hoegemyer 66	40	2.0	2.0		2.2
Hoegemyer 81	41	1.8	2.0		2.0
Hoegemyer 102	36	2.0	2.0		2.4
Hoegemyer 105	36	2.0	2.0		2.4
Hoegemyer SX639	44	1.5	1.8		2.1
Hoegemyer X703	37	2.0	2.0		2.5
Hoegemyer X802	38	1.5	2.0		2.0
Hoegemyer X902	31	2.0	2.0		2.5
Hoegemyer X937	29	2.0	2.0		2.2
Hofmeyer Early Harvest	38	2.0	1.8		2.7
Hofmeyer Bin Buster	44	1.8	1.5		2.3
Hofmeyer H55	40	2.3	2.0		2.9
Hofmeyer H404	35	2.5	2.3		2.8
Hofmeyer H505	40	2.0	2.3		2.9
Hofmeyer 600W	44	2.0	2.3		2.5
Hofmeyer H601	29	1.8	1.8		1.7
Hunerkoch H-16	37	2.0	2.0		2.8
Hunerkoch H-21	46	1.5	1.5		1.8
Hunerkoch H-31	37	2.0	2.0		2.5
Hunerkoch H-37	33	1.8	1.5		1.8
Hunerkoch H-50	41	1.8	1.5		1.7
Hunerkoch H-51	32	2.0	1.5		1.3
Hunerkoch H-95W	42	2.0	2.0		2.5
Kenworthy S.C.1	31	2.5	2.3	3.0	3.0
Kenworthy S.C.2	35	2.3	2.5	3.0	2.9
Kenworthy 48	41	2.0	2.0	2.0	2.9
Kenworthy 49	35	2.0	1.8	3.0	2.5
Kenworthy 50	37	2.0	2.0	3.0	2.8
Kenworthy 436	28	2.3	2.0	3.0	2.7
Kenworthy 437	27	2.0	1.8	3.0	3.0
Kenworthy 454	25	1.8	1.8	2.0	2.8
Kenworthy 455	34	2.0	1.8	3.0	2.7
Kenworthy 465	38	2.0	1.8	2.0	1.2
Knisley X52	34	2.0	2.0	2.5	2.9
Knisley 166	29	2.0	2.0	3.0	2.4
Knisley 232	40	2.0	2.0	2.5	3.0
Knisley 242	42	2.0	2.0	2.5	2.5
Knisley 302	30	2.0	2.0	2.5	2.3
Knisley 402	31	2.0	2.0	2.0	2.1
Knisley 414	24	2.0	1.8	2.0	2.9
Knisley 444	43	2.0	2.0	2.0	2.5
Knisley 602	45	2.0	2.0	2.0	2.5

*1.0 = No virus symptoms; 2.0 = Intermediate; 3.0 = Completely susceptible

TABLE 2. (Continued)—Maize Dwarf Mosaic Virus Ratings of Dent Corn Hybrids from Commercial Interests and Open-pedigree Combinations.

Hybrid	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
Knisley 622	44	2.0	2.0	2.3	2.5
Mangelsdorf Embro X4	37	2.0	1.5		1.9
Embro Plowboy	37	2.0	2.0		2.4
Embro Compact 11	31	2.5	2.3	3.0	2.8
Embro 44XE	34	2.3	2.5	3.0	3.0
Mangelsdorf Embro X3BR	25	2.0	2.0		2.9
Embro 38	29	2.3	2.3	3.0	2.8
Embro 222TA	34	1.8	1.8		1.7
Embro Departure VI	35	2.0	2.0		2.1
Embro X5	29	2.0	2.0		2.5
Mangelsdorf Embro Jarvis E	29	2.0	2.0		2.3
Mark M20WA	39	2.0	2.0		2.0
Mark M22W	38	2.0	2.0		1.6
Mark M100B	29	2.3	2.0	3.0	3.0
Mark M217	30	2.3	2.0	3.0	2.8
Mark M218	40	2.0	2.0		2.6
Mark 219	37	2.3	2.0		2.5
Mark M227	39	2.5	2.0	3.0	2.9
Mark M314A	37	2.3	2.0		2.8
Mark M314	39	2.0	2.0		2.5
Mark M397	36	2.0	2.0		2.6
Martin 95A	25	2.0	2.3	3.0	3.0
Martin 100A	35	2.0	2.0	3.0	2.8
Martin 105A	24	2.0	2.0	3.0	3.0
Martin 115A	34	2.0	2.0		2.7
Earl May 1	29	2.3	2.0	3.0	2.9
Earl May 2	38	2.0	2.0	2.0	2.2
Earl May 3	38	1.8	1.8	2.0	2.7
Earl May 4	37	2.3	2.3	3.0	2.8
Earl May 5	44	1.8	1.8	2.0	2.6
Earl May 6	32	2.3	2.0	3.0	2.8
Earl May 7	35	2.0	2.0	3.0	2.9
Earl May 8	29	2.0	2.0	3.0	2.7
Earl May 9	31	2.0	2.3	3.0	2.9
Earl May 10	38	2.0	2.5	3.0	2.9
Earl May 11	39	2.0	2.0	3.0	2.9
McCurdy 3X5	47	2.5	2.3	3.0	3.0
McCurdy 7X11	34	2.0	1.8		2.2
McCurdy 6X7	42	1.5	1.5		1.5
McCurdy 119	43	2.0	2.0		2.2
McCurdy 112M	42	2.0	2.0		2.8
McCurdy 113B	40	2.0	2.0		2.5
McCurdy M97	37	2.0	2.3		2.6
McCurdy M13-22	34	2.0	2.0		2.6
McCurdy 900	38	2.3	2.0		2.9

*1.0 = No virus symptoms; 2.0 = Intermediate; 3.0 = Completely susceptible

TABLE 2. (Continued)—Maize Dwarf Mosaic Virus Ratings of Dent Corn Hybrids from Commercial Interests and Open-pedigree Combinations.

Hybrid	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
McCurdy 85	30	2.0	2.3		2.8
Mitchell Farms C/F17	48	2.3	2.3	3.0	2.9
Mitchell Farms C/F29	42	1.8	1.5		2.2
Mitchell Farms C/F55	38	2.0	2.0		2.3
Mitchell Farms C/F58	37	2.0	2.0		2.0
Mitchell Farms C/F66	41	2.3	2.0		2.6
Mitchell Farms C/F70	44	2.3	2.0		2.7
Mitchell Farms C/F75	44	1.8	2.0		2.2
Mitchell Farms C/F116	41	1.8	1.5		1.7
Mitchell Farms C/F131	36	2.0	2.0		2.3
Mitchell Farms C/F183W	37	1.8	1.8		1.8
Meows 1	25	2.5	2.0	2.0	2.8
Meows 2	39	2.0	1.8	2.0	2.0
Meows 3	41	1 5	1.5	2.0	1.7
Meows 4	33	2.8	2.8	3.0	2.9
Meows 5	37	2.3	1.8	2.0	1.9
Meows 6	41	1.8	1.8	1.5	1.6
Meows 7	41	1.8	2.0	2.0	2.3
Meows 8	42	1.8	2.3	3.0	3.0
Meows 9	41	1.8	1.8	2.0	2.3
Meows 10	32	2.0	2.0	3.0	2.8
Northrup King 10256	42	1.8	1.3	1.3	1.3
Northrup King 12035	23	2.0	1.5	2.0	1.8
Northrup King 15429	27	2.5	2.0	2.5	2.5
Northrup King 15436	27	2.0	1.0	1.8	1.5
Northrup King 18011	43	2.0	1.5	2.0	2.8
Northrup King 18235	29	2.5	1.3	1.8	1.3
Northrup King 20823	37	2.0	1.5	2.0	2.3
Northrup King 21063	35	2.0	1.8	2.0	2.5
Northrup King 21080	41	1.0	1.0	1.3	1.3
Northrup King 21115	37	2.0	1.5	2.0	1.7
Park 4TW	32	2.3	2.0	3.0	2.9
Park X11	37	2.0	2.0	3.0	3.0
Park X44	40	2.0	2.0	3.0	2.8
Park 100A	38	1.5	1.8	2.0	1.8
Park 200	37	2.3	2.5	3.0	2.9
Park 250	39	2.0	2.0	3.0	2.9
Park 610	37	2.0	2.0	3.0	3.0
Park 800	40	2.0	2.0	2.5	2.1
Pfister PAG SX19	29	1.1	1.3	1.5	1.3
Pfister PAG SX29	20	2.0	1.8	2.0	1.6
Pfister PAG 434	41	1.8	1.8	2.0	1.9
Pfister PAG 444	33	2.0	1.8	2.0	1.8
Pfister Exp.15020	34	1.1	1.1	1.5	1.4
Pfister Exp.15053	18	1.8	1.8	2.0	1.7

*1 0 = No virus symptoms; 2.0 = Intermediate; 3.0 = Completely susceptible

TABLE 2. (Continued)—Maize Dwarf Mosaic Virus Ratings of Dent Corn Hybrids from Commercial Interests and Open-pedigree Combinations.

Hybrid	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
Pfister Exp.15444W	38	1.8	1.5	1.5	1.5
Pfister Exp.16494	34	1.5	1.5	2.0	1.6
Pfister Exp.17219W	32	1.8	1.8	2.0	1.6
Pioneer 31806	37	2.0	1.8	2.0	1.9
Pioneer 44182	47	1.1	1.3	1.0	1.4
Pioneer 44183	42	1.5	1.5	1.0	1.4
Pioneer 44184	41	1.8	1.5	1.0	1.4
Pioneer 44185	36	1.6	1.5	1.5	1.2
Pioneer 44187	40	2.0	2.0	1.5	1.7
Pioneer 44189	39	1.8	1.3	1.5	1.3
Pioneer 44190	40	1.8	1.5	1.0	1.4
Pioneer 44199	45	1.8	1.5	1.5	1.6
Pioneer 44203	36	1.8	1.5	1.0	1.1
Princeton P9W	27	2.5	2.3	3.0	2.3
Princeton SX-804	36	1.5	1.3	2.0	2.2
Princeton SX-806	44	2.0	1.5	1.5	2.1
Princeton 790AA	23	2.0	1.5		2.0
Princeton 888A	38	2.5	2.5	3.0	2.9
Princeton 890AA	33	2.0	1.8	2.0	2.1
Princeton 920A	36	2.0	1.5	1.5	1.7
Princeton 990A	38	1.5	1.3		2.1
Producers 1	40	1.1	1.1	1.0	1.9
Producers 2	44	2.0	1.8	1.5	1.8
Producers 3	40	1.1	1.1	1.0	1.3
Producers 4	24	1.8	1.5	1.5	1.4
Producers 5	47	1.5	1.5	1.5	1.4
Producers 6	44	1.5	1.5	1.5	1.3
Producers 7	33	1.0	1.0	1.0	1.0
Producers 8	41	1.5	1.5	2.0	1.6
Producers 9	34	1.5	1.5	2.0	1.9
Producers 10	37	1.8	1.5	2.0	1.7
Robson Seneca 155	43	1.6	1.6	2.0	2.4
Robson Seneca 285	36	2.0	2.3	3.0	2.8
Robson Seneca 315	37	1.6	1.6	1.5	1.9
Robson Seneca 318	34	2.0	2.0	3.0	2.9
Robson Seneca 320	32	1.8	1.8	2.0	2.7
Robson Seneca 350	35	2.0	2.0	3.0	2.8
Robson Seneca 690	32	2.0	2.0	3.0	2.7
Ruff RW22	38	2.0	1.8		2.0
Ruff REW24	20	2.0	1.5		1.6
Ruff REW25	35	1.8	1.5		1.8
Ruff RES8	34	1.5	1.3		1.1
Ruff RT1223	42	1.8	1.5		2.2
Ruff REX1314	43	1.8	1.8		2.6
Ruff RExp5691	38	1.8	2.0		2.8

*1.0 = No virus symptoms; 2.0 = Intermediate; 3.0 = Completely susceptible

TABLE 2. (Continued)—Maize Dwarf Mosaic Virus Ratings of Dent Corn Hybrids from Commercial Interests and Open-pedigree Combinations.

Hybrid	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
Schenk S56	37	1.8	2.0	3.0	2.8
Schenk S73	40	2.5	2.0	2.0	2.4
Schenk S73A	35	2.0	2.0	3.0	2.8
Schenk S77	39	2.3	2.3	2.0	2.8
Schenk S87A	37	2.0	1.8	1.5	2.3
Schenk S88	37	2.0	2.0	3.0	2.9
Schenk S96W	37	1.5	1.5	2.0	1.9
Scroggin Bo-Jac 550	41	2.0	2.3	3.0	2.8
Scroggin Bo-Jac MP174	38	2.0	2.0	3.0	2.6
Scroggin Bo-Jac 13AX	41	1.8	1.8	2.0	2.7
Scroggin Bo-Jac MP730	37	1.8	2.0	2.0	2.7
Scroggin Bo-Jac S-3X	36	2.3	1.8	3.0	2.8
Scroggin Bo-Jac 379	32	2.3	2.3	2.5	2.8
Scroggin Bo-Jac 11-2	38	2.0	2.3	3.0	2.9
Scroggin Bo-Jac 33A	47	2.0	1.8	2.0	2.7
Scroggin Bo-Jac MP462	36	2.0	2.0	3.0	2.8
Scroggin Bo-Jac MP546	37	1.8	2.0	2.0	2.7
Tenney 1	28	2.0	1.3	2.0	2.8
Tenney 2	39	2.0	2.0	1.8	2.8
Trojan 1	45	2.3	2.3	3.0	2.9
Trojan 2	42	1.1	1.1	1.0	1.6
Trojan 3	41	2.0	2.0	3.0	2.9
Trojan 4	39	1.5	1.5	1.3	1.4
Trojan 5	41	2.3	2.5	3.0	3.0
Trojan 6	40	2.0	2.0	3.0	2.8
Trojan 7	36	2.0	2.0	2.5	2.4
Trojan 8	43	2.0	2.0	2.0	2.2
Trojan 9	34	2.0	2.0	2.0	2.7
Trojan 10	35	2.3	2.0	3.0	2.8
United-Hagie UHX3D2	32	3.0	1.5	2.8	2.5
United-Hagie UHX10D1	37	3.0	2.0	2.0	2.0
United-Hagie UH130	38	2.0	2.3	2.0	2.5
United-Hagie UH138B	38	2.0	1.5	1.8	2.3
United-Hagie UH146C	38	2.5	2.3	2.0	2.8
United-Hagie UH146A	34	2.0	2.0	2.5	2.8
United-Hagie UH152A	25	3.0	1.8	3.0	2.5
United-Hagie UH158	27	2.5	2.5	3.0	3.0
United-Hagie UH160	27	3.0	3.0	3.0	3.0
United-Hagie UH1500	22	3.0	3.0	3.0	3.0
Van Horn C.A.P.1	35	2.0	2.0	3.0	3.0
Van Horn C.A.P.4	30	2.0	1.8		1.8
Van Horn C.A.P.6	12	1.5	1.5		1.4
Van Horn C.A.P.7	37	1.8	1.5	1.0	1.2
Van Horn C.A.P.8	31	1.3	1.3	1.0	1.1
Van Horn 109	40	2.0	2.0		2.8

*1 = No virus symptoms; 2 = Intermediate; 3 = Completely susceptible

TABLE 2. (Continued)—Maize Dwarf Mosaic Virus Ratings of Dent Corn Hybrids from Commercial Interests and Open-pedigree Combinations.

Hybrid	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
Van Horn 624	38	2.0	2.0		2.7
Van Horn 628	41	2.0	1.8		2.1
Van Horn 649	41	2.0	2.0		2.8
Whisnand SX7073	43	1.8	2.0		2.2
Whisnand 814(406E)	41	1.8	1.8		2.4
Whisnand 814(807G)	44	1.3	1.3		2.1
Whisnand 830	45	1.5	1.3		2.1
Whisnand 851	42	1.8	1.8		2.8
Whisnand 851M	42	1.5	1.5		1.8
Whisnand 852	43	1.8	1.3		2.0
Whisnand 874	42	1.8	1.5		2.6
Wyckoff W-10X	33	2.0	1.5	2.5	2.1
Wyckoff W-5X	42	2.0	2.0	2.5	2.4
Wyckoff SX3540	44	2.5	2.0	3.0	3.0
Wyckoff W-24	35	1.8	1.8	2.0	2.3

*1 = No virus symptoms; 2 = Intermediate; 3 = Completely susceptible

TABLE 3.—Maize Dwarf Mosaic Virus Ratings of Popcorn Hybrids.

Hybrid	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
Purdue P-202	36	2.5	2.0		D†
Purdue P-410	40	2.0	1.8	1.8	1.8
Purdue P-213	32	2.3	2.0	2.0	2.0
Purdue P-406A	41	2.0	1.8	1.8	2.0
Purdue P-605	45	2.0	1.5	1.5	1.5
Purdue P-632	38	2.0	2.0	2.0	1.5
Purdue 2275	29	2.3	2.3		D
Purdue 3355	34	2.3	2.0	2.0	2.0
Purdue 23688	28	2.5	2.0		D
Purdue 3302	39	2.0	2.0	2.5	2.8
Purdue 2301	42	2.0	1.5	2.0	2.0
Purdue 4378	29	2.3	2.0	2.1	2.3
Purdue 3425	23	1.8	1.5	1.5	1.5
Purdue 43209	42	2.0	1.5	1.8	2.0
Purdue 43210	39	2.0	1.8	1.8	2.0
Purdue 3385-R	42	1.8	1.5	1.5	1.5
Purdue P-303	23	2.3	2.0	1.8	1.8
Purdue 0320W	31	2.5	2.0		D
Purdue 0357W	37	2.0	1.8		D
Ag. Alumni AP-903	37	2.0	1.8	2.5	2.5
Ames 39 x 66	38	2.0	1.5	1.5	1.5
Ames 37 x 56	41	2.0	1.5	1.8	1.8
Ames 37 x 66	40	2.0	1.8	1.8	1.8
Ames 39 x 31A	43	1.8	1.5	1.3	1.5
Ames 56 x 68	36	2.0	1.8	1.8	1.8
Ames 43 x 88G	33	2.3	2.5		D
Ames 31A x 88G	50	2.0	1.8	2.3	2.5
Ames 43 x 40	31	2.3	2.0		D
Ames G67 x 68	31	1.8	1.8	1.8	2.0
Ames 28E x G-67	30	2.0	2.0	2.5	2.8
Ames 44 x G-69	32	2.0	2.0	2.0	2.8
Ames 44 x 51A	33	2.5	2.5	2.5	2.5
Ames 51A x G-69	18	2.5	2.3	2.5	3.0
Ames A-2 x 40	35	2.5	2.3		D
Ames 1 x 4	34	2.8	2.8		D
Ames 1A5 x 1	25	2.5	2.0		D
Ames 1A5 x 4	53	2.0	2.0	2.5	2.5
Ames 313	40	2.0	2.5	2.5	2.8
Ames 328	40	2.0	2.0	1.8	2.3
Ames 332	39	2.0	2.0	1.8	2.0
Ames Iopop-5	34	2.0	2.0		D
Ames Iopop-6	40	2.0	2.3	2.3	2.8
Ames Iopop-7	38	2.3	2.0	2.5	2.5
Ag. Alumni EP-138	36	2.5	2.3	2.5	2.5
Ag. Alumni EP-139	45	2.0	1.8	2.0	2.0

*1 = No virus symptoms; 2 = Intermediate; 3 = Completely susceptible

†D = All plants dead at rating time

TABLE 3. (Continued)—Maize Dwarf Mosaic Virus Ratings of Popcorn Hybrids.

Hybrid	Stand	July Ratings*		August Ratings*	
		Stunt	Chlorosis	Stunt	Chlorosis
Ag. Alumni EP-142	34	2.3	2.0	2.3	2.5
Ag. Alumni EP-144	42	2.0	2.0	2.0	2.5
Ag. Alumni EP-147	38	2.3	2.0	2.0	3.0
Ag. Alumni E-8318	32	2.5	2.5		D†
Chester Hybrid 1	42	2.0	2.0	2.0	2.0
Chester Hybrid 2	39	2.0	2.0	2.0	2.0
Chester Hybrid 3	26	2.5	2.5	2.5	2.8
Chester Hybrid 4	40	2.3	2.0	2.0	2.3
Chester Hybrid 5	43	2.0	2.0	2.0	2.0
Chester Hybrid 6	45	2.0	2.0	2.0	2.0
Chester Hybrid 7	41	2.5	2.5	2.5	2.5
Chester Hybrid 8	46	2.0	2.0	2.0	2.3
Chester Hybrid 9	36	2.3	2.0	2.0	2.5
Chester Hybrid 10	17	2.3	2.0	2.0	2.3
Crookham P-1	33	2.0	2.0	2.3	2.3
Crookham P-2	28	2.5	2.3		D
Crookham P-3	9	3.0	3.0		D
Crookham P-4	22	3.0	2.8		D
Crookham P-5	26	2.0	1.8	2.8	2.8
Crookham P-6	21	2.0	1.8	2.8	2.8
Crookham P-7	17	2.0	2.0	2.8	2.8
Crookham P-8	25	2.3	2.0	2.8	3.0
Crookham P-9	20	2.5	2.0	3.0	3.0
Crookham P-10	9	2.3	1.8	2.5	2.8
Crookham P-11	29	2.5	2.5		D

*1.0 = No virus symptoms; 2.0 = Intermediate; 3.0 = Completely susceptible
†D = All plants dead at rating time

TABLE 4—Maize Dwarf Mosaic Virus Ratings of Sweet Corn Hybrids.

Hybrid	Stand	July Ratings* Stunt	Chlorosis
Stokely-Van Camp 106	37	2.0	2.0
Stokely-Van Camp 107	32	2.0	2.0
Stokely-Van Camp 952	23	2.3	2.0
Stokely-Van Camp 960	26	2.0	1.8
Asgrow Seed Co. O.S.V.G.	36	1.8	1.5
Asgrow Seed Co. O.S.D.G.	39	1.8	1.8
Asgrow Seed Co. A.S.G.F.	24	2.0	2.0
Asgrow Seed Co. A.S.M.Y.	41	2.0	2.0
Ferry-Morse Seed Co. M1	33	2.3	2.3
Ferry-Morse Seed Co. M2	21	2.3	2.3
Ferry-Morse Seed Co. M3	30	2.0	2.0
Ferry-Morse Seed Co M4	34	2.0	2.0
Seed Research Specialist, Inc. SRSTC	30	2.5	2.5
Seed Research Specialits, Inc. SRSVG	29	2.0	1.8
Seed Research Specialist, Inc. SRSET	36	2.3	2.5
Seed Research Specialist, Inc. SRSGS	21	2.8	2.8
Crookham Company MDV-C1	36	2.0	2.0
Crookham Company MDV-C2	36	1.8	1.8
Roger Brothers A 48014	42	2.0	2.0
Roger Brothers B 48017	29	2.0	2.0
Roger Brothers C48021	31	2.0	2.0
Roger Brothers D48016	26	3.0	3.0
Robson Seed Farms Corp. RSF-4341	29	2.5	2.5
Robson Seed Farms Corp. RSF-5901	30	1.5	1.8
Robson Seed Farms Corp. RSF-5761	36	2.0	2.0
Robson Seed Farms Corp. RSF-5111	39	1.8	1.8
Libby, McNeil & Libby JY333	38	2.0	2.0
Libby, McNeil & Libby JY481	20	2.0	2.0
Libby, McNeil & Libby JY393	32	2.0	1.8
Libby, McNeil & Libby JY245	26	2.5	2.5
Green Giant Co. L2	32	2 0	2.3
Green Giant Co. L4	27	2.5	2.5
Green Giant Co. L5	24	2.3	2.5
Green Giant Co. L9	31	2.0	2.3
Northrup King Co. 3014/B1	27	2 3	2.0
Northrup King Co. 5317	38	2.5	2.0
Northrup King Co. 3052/B14	36	2 5	2.5
Northrup King Co. 3027/B55	35	2.5	2.5
California Packing Corp. SC106	45	2.0	2.0
California Packing Corp. SC110	16	3.0	3.0
California Packing Corp. SC130	23	3.0	3.0
California Packing Corp. SC200	44	2 3	2.3
Agway, Inc. 475	36	2.0	2.3
Agway, Inc. 863	38	1.8	1.5
Agway, Inc. 869	37	2.3	2.3
Agway, Inc. 908	46	2.0	1.8
Joseph Harris Co., Inc. 137/2086F	28	2.5	2.5
Joseph Harris Co., Inc. 116/3001-19F	31	2.0	2.3
Joseph Harris Co., Inc. 136/2049F	37	1.5	1.5
Joseph Harris Co., Inc. 118/2095-19F	17	2.0	2.0
Cornelli Seed Co. K.V.F.4L-001	28	1.5	1.5

*1.0 = No virus symptoms; 2.0 = Intermediate; 3.0 = Completely susceptible