

BEET (*Beta vulgaris*)  
Beet curly top; *Beet curly top virus*

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### **Beet curly top resistance in USDA-ARS Plant Introduction lines, 2022.**

Thirty beet (*Beta vulgaris* L.) USDA-ARS Plant Introduction (PI) lines and three commercial check cultivars [Detroit Dark Red (susceptible), HM PM90 (resistant), and SV2012RR (susceptible)] were screened for resistance to *Beet curly top virus* (BCTV). This panel of germplasm represents a continuing effort to systematically screen U.S. National Plant Germplasm System Beta germplasm for resistance to multiple sugar beet diseases and pests to aid germplasm improvement activities. The curly top evaluation was conducted at the USDA-ARS North Farm in Kimberly, ID which has Portneuf silt loam soil and had been in barley in 2021. The field was plowed and then fertilized (110 lb N and 160 lb P<sub>2</sub>O<sub>5</sub>/A) and roller harrowed on 6 Apr. The germplasm was planted (density of 114,048 seeds/A) on 3 May. The plots were two rows 10-ft long with 22-in. row spacing and treatments were arranged in a randomized complete block design with six replications. The field was sprinkler irrigated, cultivated, and hand weeded as necessary. Plants were inoculated at the four- to six-leaf growth stage on 15 Jun with approximately six viruliferous (containing the following BCTV strains: California/Logan and Severe) beet leafhoppers (*Circulifer tenellus* Baker) per plant. The beet leafhoppers were redistributed two times a day during the first seven days by dragging a tarp through the field. The plants were sprayed with Admire Pro (3.5 fl oz/A) on 27 Jun to kill the beet leafhoppers. Plots were rated for foliar symptom development on 6 Jul using a scale of 0 to 9 (0 = healthy and 9 = dead), with the scale treated as a continuous variable (Plant Dis. 90:1539-1544). Data were rank transformed prior to analysis in SAS (Ver. 9.4) with mixed linear models (Proc MIXED), but the non-transformed means have been presented in the table. Mean separation was based on a PDIFF comparison with a probability cutoff of 0.05.

Curly top symptom development was uniform and no other disease problems were evident in the plot area. The resistant and susceptible checks performed as expected for the visual ratings. Statistically, 12 of the entries contain at least some minor resistance since their visual ratings were significantly lower than those for both susceptible checks. Nine entries from the USDA-ARS Utah sugar beet program that were donated to the NPGS in 1983 (3, 4, 5, 6, 7, 8, 9, 10, and 14) were not significantly different from the resistant check. All nine of these entries were statistically more resistant than both susceptible check lines. An additional two entries from the USDA-ARS Utah sugar beet program (NSL 183366 and NSL 183511) and one *Beta vulgaris* spp. *maritima* accession collected by USDA-ARS researchers in Morocco (W6 44508) were statistically more resistant than the susceptible sugar beet check SV2012RR, but had statistically higher curly top ratings than the resistant check. These entries along with entries with similar levels of resistance from prior years evaluations will be retested and, if resistance is confirmed, these lines will be considered for incorporation into the USDA-ARS germplasm improvement program as a source of resistance to BCTV.

Entry <sup>z</sup>	Source	Description	Curly top rating <sup>y</sup>
CH6	HM PM90	Resistant check, sugar beet cultivar	4.4 i
7	NSL 183473	9401; United States, Utah (Donated 1983, J.C. Theurer, Sugarbeet Investigations)	4.6 hi
5	NSL 183419	2529-2 C; United States, Utah	4.6 hi
8	NSL 183478	46143; United States, Utah	4.7 hi
6	NSL 183438	3585; United States, Utah	4.8 hi
3	NSL 183370	223; United States, Utah	4.9 g-i
4	NSL 183418	2526 C; United States, Utah	5.0 g-i
14	NSL 183514	211H3; United States, Utah	5.1 g-i
9	NSL 183482	46183; United States, Utah	5.1 g-i
10	NSL 183487	96344; United States, Utah	5.3 g-i
26	W6 44508	MAR10-015; Morocco	5.3 gh
2	NSL 183366	127; United States, Utah	5.5 gh
13	NSL 183511	90.105; United States, Utah	5.7 fg
12	NSL 183509	90.101; United States, Utah	6.0 ef
29	W6 45822	MAR12-002; Morocco, Rabat-Salé-Kénitra, Kénitra	6.1 d-f
11	NSL 183508	90.99; United States, Utah	6.2 de
25	PI 527307	F1009; United States, North Dakota	6.2 de
1	Ames 4377	IDBBNR 4836	6.3 de
30	W6 45823	MAR12-003; Morocco, Rabat-Salé-Kénitra, Kénitra	6.3 de
24	PI 518166	Monogerm (No. 1); China	6.3 de
CH5	SV2012RR	Susceptible check, sugar beet cultivar	6.5 c-e
23	PI 221436	Lablaboo; Afghanistan	6.5 c-e
15	PI 120706	No. 3238; Turkey	6.6 cd
28	W6 45821	MAR12-001; Morocco, Rabat-Salé	6.6 cd
27	W6 44518	MAR10-025; Morocco	6.6 cd
19	PI 175599	Kocabas; Turkey	6.9 bc
21	PI 176875	No. 9335; Turkey	7.0 bc
22	PI 177269	Kocabas; Turkey	7.1 bc
20	PI 176427	Kocabas; Turkey	7.2 ab
18	PI 167374	Paucar; Turkey	7.2 ab
RB	Detroit Dark Red	Susceptible check, red beet cultivar	7.2 ab
16	PI 140351	No. 6052; Iran	7.4 ab
17	PI 163182	Choghundur; India	7.7 a
$P > F^x$			<0.0001

<sup>z</sup> Three entries were commercial check cultivars: CH5 (susceptible), CH6 (resistant), and RB (susceptible).

<sup>y</sup> Curly top ratings = curly top was rated using a scale of 0 to 9 (0 = healthy and 9 = dead), with this rating treated as a continuous variable.

<sup>x</sup>  $P > F$  was the probability associated with the F value when using rank transformed data. Within a column, means followed by the same letter did not differ significantly based on PDIFF with a probability cutoff of 0.05. The non-transformed mean values are presented.