SUGAR BEET (*Beta vulgaris* ssp. *vulgaris*)
Beet curly top; *Beet curly top virus*

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Beet curly top resistance in USDA-ARS pre-breeding germplasm, 2021.

Thirty sugar beet (*Beta vulgaris* L.) germplasm lines produced by USDA-ARS pre-breeding programs 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). 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 2020. The field was plowed and then fertilized (120 lb N and 120 lb P_2O_5/A) and roller harrowed on 26 Mar. The germplasm was planted (density of 114,048 seeds/A) on 17 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 22 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 Lorsban 4E (1.5 pints/A) on 6 Jul to kill the beet leafhoppers. Plots were rated for foliar symptom development on 12 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, 17 of the entries had visual ratings significantly lower than those for both susceptible checks, indicating these genotypes had at least minor levels of resistance. However, eight entries (FC220xF1024, C869, EL44, C842, FC607, FC1019, CS42, and EL54) had resistance levels that were not significantly different than the commercial resistant check. A majority (22 of 30) of the entries in this panel are a part of a USDA-ARS whole genome resequencing project. These eight entries along with entries with similar levels of resistance will be retested and, if resistance is confirmed, these lines will be used to map BCTV resistance gene(s) present in these genotypes and used as sources of BCTV resistance in USDA-ARS germplasm improvement programs.

Entry[z]	Source[y]	Description	Curly top rating[x]
CH6	HM PM90	Resistant check, sugar beet cultivar	4.7 l
15	2011A012	FC220xF1024	5.0 l
16	2020A023	C869[v]	5.2 l
5	2005A001	EL44[v]	5.2 kl
3	20041022	C842[v]	5.6 j-l
9	1997A050	FC607[v]	5.6 i-l
14	20101011	FC1019[v]	5.6 i-l
24	2013A031	CS42 (NSL 141986)	5.8 h-l
30	2009A004	EL54[v]	5.9 h-l
26	2011A011	FC712xF1024	6.0 g-k
4	20071001	Z325 Salinas	6.1 f-j
6	20161004HO	CT CLS	6.1 f-j
1	20111027	FC1028[v]	6.2 f-j
11	20121010	FC1020[v]	6.2 e-j
18	2009A046	FC1036[v]	6.2 e-j
17	20161019PF	CR933[v]	6.2 e-i
29	2020A024	SR98/2[v]	6.3 d-h
8	20131006	FC305[v]	6.3 d-h
2	2013A006	C931[v]	6.4 c-h
23	2013A033	NSL80221	6.4 c-h
25	2011A009	EL53[v]	6.4 b-g
7	20161004HO1	CT CLS	6.5 b-g
22	2020A019	F1024[v]	6.6 b-f
13	20101009	FC1018[v]	6.6 b-f
19	20141018	C890[v]	6.6 b-f
20	2020A020	F1043[v]	6.6 b-f
28	2001A021	SR from E Lansing	6.6 b-e
12	20091009	FC1022[v]	6.7 b-d
CH5	SV2012RR	Susceptible check, sugar beet cultivar	6.8 a-c
10	20071013	FC220[v]	6.9 a-c
27	2020A017	F1002[v]	7.0 a-c
21	19951017	FC727[v]	7.0 ab
RB	Detroit Dark Red	Susceptible check, red beet cultivar	8.2 a
$P > F$[w]			<0.0001

[z] Three entries were commercial check cultivars: CH5 (susceptible), CH6 (resistant), and RB (susceptible).

[y] All lines were *Beta vulgaris* subspecies *vulgaris* (cultivated beet).

[x] Curly top ratings = curly top was rated using a scale of 0 to 9 (0 = healthy and 9 = dead), with disease index (DI) treated as a continuous variable.

[w] $P > F$ 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.

[v] Entry is a part of whole genome resequencing panel available on NCBI SRA under BioProject PRJNA563463