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

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Beet curly top resistance in USDA-ARS Ft. Collins germplasm, 2018.

Thirty sugar beet (*Beta vulgaris* L.) germplasm lines produced by the USDA-ARS Ft. Collins sugar beet program and four commercial check cultivars [Beta G6040 (resistant), 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 2017. In the spring, the field was plowed and then fertilized (60 lb N and 110 lb P_2O_5/A) and roller harrowed on 5 Apr. The germplasm was planted (density of 142,560 seeds/A) on 29 May. The plots were two rows 10-ft long with 22-in. row spacing and arranged in a randomized complete block design with six replications. The field was sprinkler irrigated, cultivated, and hand weeded as necessary. Plant populations were thinned to about 47,500 plants/A on 22 Jun. Plants were inoculated at the four- to six-leaf growth stage on 25 Jun with approximately six viruliferous (contained the following BCTV strains: California/Logan and Severe) beet leafhoppers per plant. The beet leafhoppers were redistributed three times a day during the first two days and then twice a day for five more days by dragging a tarp through the field. The plants were sprayed with Lorsban 4E (1.5 pints/A) on 9 Jul to kill the beet leafhoppers. Plots were rated for foliar symptom development on 10 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 and analyzed in SAS using the general linear models procedure (Proc GLM), and Fisher's protected least significant difference (LSD; α = 0.05) was used for mean comparisons. The non-transformed means are presented in the table.

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. Based on the visual rating, entry 26 was not significantly different from the two resistant checks, 1 and CH6. Entry 26 will be retested and, if resistance is confirmed, this line will be considered for incorporation into the USDA-ARS germplasm improvement program as a source of resistance to BCTV.

Entry[z]	Source[y]	Description	Curly top rating[x]
1	Beta G6040	Resistant check	4.4 l
CH6	HM PM90	Resistant check	4.5 kl
26	20161028PF	20121014-x; BI of 8 half-sib families (Blk Inc of 05-FC1023m(iso)[2005A020]	4.9 j-l
13	20151020	20101013-xs; BI Roots 20101013-24; 20101013-03; 20101013-71; 20101013-76	5.2 i-k
14	20151016	20111024-x, [(FC907xFC709-2) & 9931 (Salinas)]x[C790-15cmsxFC1036]	5.3 h-j
24	20161026PF	20111019-x; BI LSR - (Z325aa x [20011045MS (WB853 x SucroseMM)])	5.4 i-k
23	20161025PF	20111019-x; B. LSR - (Z325aa x [20011045MS (WB853 x SucroseMM)])	5.4 h-j
25	20161027PF	20101014HO-xs; BI of selfed families from 07-FC124-425	5.5 ij
12	20151019	20141011MS - BI LSR sel SucroseMM x PI 535833 (Saturn) - 20121054	5.5 f-i
30	20171023HO1	20141016HO & 20141016HO1; 20121023HO & HO1; Bulk increase of C812-41 = mm	5.5 h-j
17	20161003PF	20111039MS/PF; BI seed from Z325 (hi sucrose sugarbeet) x BGRC28938	5.6 h-j
5	20101004	FC708 Rhizoctonia Resistant, Leaf Spot Resistant O-type	5.6 g-j
11	20151018	20121056 - Bulk increase of F3 LSRMM x RhzcR/LSR selected for RhzcR - hs 10A-1775	5.6 f-i
3	1997A050	FC607, LSR/CTR, easy bolting, O-type, 2X, mm, self sterile	5.6 d-i
8	20151014HO	20121019HO & HO1 - Increase 03-FC1015HO & HO1	5.7 e-i
20	20161017	20141020; Increase F3 of CN12-446 x FC708 [SBCN x RhzcR/LSR]	5.8 e-i
10	20151017	20121018HO-x - Bulk increase of roots selected for rhizoctonia resistance 2014.	5.8 e-i
21	20161023PF	20111018-x, BI LSR - (Z325 x [LSR Giant Poly (PI535826) x SucroseMM])	5.8 d-i
22	20161024PF	20111019-x; BI LSR - (Z325aa x [20011045MS (WB853 x SucroseMM)])	5.8 d-i
28	20161030PFHO	20121018HO-x & 20121018HO1; 03-FC1014-22 (hs sel FC201)	5.8 d-i
27	20161029PFHO	20121018HO-x & 20121018HO1; 03-FC1014-22 (hs sel FC201)	6.0 c-h
16	20151046PFHO	20101016HO1-xs/20101016HO-x; selfed families (07-FC1015-420) 2007A091	6.0 c-f
9	20151036PF	20131009 BI LSR Bvm (PI540596 biennial - France) x S%MM pop - blkF2 LSR=2.5]	6.0 c-g
18	20161004HO	20121018HO-119pf & 20121018HO-187pf20121018HO-187pf	6.0 c-f
15	20151044PFHO	20101015HO1-x/20131012MS; Selfed families of 20101015HO1-x/20101015HO-xs	6.0 c-f
7	20141035	Increase 2 LSR BVM (biennial - France) x SucroseMM pop - PI 540596	6.0 b-f
19	20161016PF	20141035; 20121055; LSR Bvm (PI540596 biennial - France) x S%MM	6.1 c-f
4	20041010HO	FC712/MonoHy A4	6.1 b-e
2	19951017	FC727	6.2 a-d
6	20141022PF	Bulk 0931 & 9933 x BCN Resistant, Iranian sugar beet landrace	6.2 a-d
RBCH	Detroit Dark Red	Susceptible check	6.6 a-c
CH5	SV2012RR	Susceptible check	6.6 ab
29	2013A081	B.v. vulgaris Poland REKORD POLY 2010i PI 535827 2010I SD	7.5 a
$P > F$[w]			<0.0001

[z] Four entries were commercial check cultivars (bold): 1 (resistant), CH5 (susceptible), CH6 (resistant), and RBCH (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 Fisher's protected least significant difference (LSD; $\alpha = 0.05$) value. The non-transformed mean values are presented.