

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

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Beet curly top resistance in USDA-ARS Fort Collins Germplasm, 2011.

Twenty-two sugar beet (*Beta vulgaris* L.) lines from the USDA-ARS Ft. Collins sugar beet program were screened for resistance to *Beet severe curly top virus* (BSCTV) and other closely related *Curtovirus* species in 2011. Commercial cultivars Monohikari and HM PM90 were included as susceptible and resistant checks, respectively. 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 2010. The field was plowed both in the fall and the spring, fertilized (80 lb N and 120 lb P₂O₅/A) on 20 Apr 11, sprayed with Ethotron (2 pt/A), and roller harrowed. The germplasm was planted (density of 142,560 seeds/A) on 16 May. The plots consisted of two rows 10 ft long with 22-in row spacing, arranged in a randomized complete block design with three replications. The field was sprinkler irrigated and hand-weeded as necessary. Plant populations were thinned to about 47,500 plants/A on 19 Jun. Plants were inoculated at the four to six leaf growth stage on 27 Jun with approximately six viruliferous beet leafhoppers per plant. The leafhoppers had been reared in the greenhouse on viruliferous sugar beet plants. The beet leafhoppers were moved twice a day (right after sunrise and just before sunset) for 1 week by dragging a tarp through the field. The plants were sprayed with Lorsban 4E (1.5 pints/A) on 11 Jul to kill the beet leafhoppers. The plots were rated for foliar symptom development on 18 Jul using a scale of 0-9 (0 = healthy and 9 = dead; Mumford 1974), with disease index (DI) treated as a continuous variable. Data were analyzed using the general linear models procedure (Proc GLM-SAS), and Fisher's protected least significant difference was used for mean comparisons. Yield data were not collected.

Curly Top development was uniform and no other disease problems were evident in the plot area. The test was evaluated while disease pressure was moderate and good symptom development occurred in the more susceptible lines. The experiment was rated only 3 weeks after inoculation, because of the severity of the epidemic; some of the more susceptible entries had died by 4 weeks and thus some of the differences among entries were no longer apparent. Only three experimental germplasms and the susceptible check were significantly different from the resistant controls. However, the three most resistant germplasm tested were not significantly different from the most resistant control (HM PM90, rated 3.1). All three also have increased tolerance of leaf spot caused by *Cercospora beticola* Sacc. (data not shown). The combination of resistance to both diseases gives this germplasm potential for use in development of hybrid parents in the Great Plains (Colorado, Wyoming, Western Nebraska, and Montana) because both of these diseases can severely limit yield. These lines also may be of use in the Red River Valley of North Dakota and Minnesota, as well as Michigan, two growing areas with severe leaf spot pressure.

Entry ^z	Seed source	Description	CT rating ^y
16	20091030PF	Best CLR family (1999 10A-1788) EL 2008.	6.5 a
6	20041010HO	FC712/MonoHy A4.....	6.2 ab
20	20101011	C790-15cms x 05-FC1019 - CTR.....	6.0 a-c
23 .....	.....	<i>Monohikari (susceptible check)</i>	5.8 a-d
3	19771082	LSR CTR population	5.6 a-e
2	1997A050	FC607 (PI 590837)	5.4 a-f
5	20011007	F ₃ LSR MM x RhzcR/LSR (907 x 709-2)	5.2 b-f
21	20101012	C790-15cms x RZM-ER-% (FC712 x 9931)F ₃	4.9 b-f
9	20061007	FC220-1 sel - inc. 20051030.....	4.9 b-f
18	20101009	C790-15cms x 05-FC1018 - CTR.....	4.9 c-f
17	20101008	FC1018, 05-FC1018 (PI 658059)	4.8 c-f
19	20101010	FC1019, 05-FC1019 (PI 658060)	4.8 c-f
1	19741026H	<i>Beta vulgaris</i> ssp. <i>maritima</i> backcross.....	4.8 c-f
12	20071011H	Inc. (FC907 x FC709-2) x 9931.....	4.8 c-g
10	20061010HO	03-FC1015 FC201 sib.....	4.7 d-g
13	20091011PF	FC221-1	4.7 d-g
7	20041010HO1	FC712/MonoHy A4 - CMS equivalent	4.7 d-g
11	20061010HO1	03-FC1015 FC201 sib - CMS equivalent	4.6 d-g
8	20061005HO1	03-124 CMS equivalent	4.3 e-h
4	1978A044	FC606 (PI 590843)	4.3 e-h
15	20091029PF	CLR family (BGRC 45511 X High Sucrose) ..	4.3 f-h
22	1996A008	<i>Beta G6040 - Resistant Check</i>	4.2 f-h
14	20071015	Half sibs of FC123mm (FC301); monogerm	3.5 gh
24 .....	.....	<i>HM PM90 (resistant check)</i>	3.1 h
Overall mean .	.....	.....	4.9
$P > F^x$ .....	.....	.....	0.0007
LSD ($P \leq 0.05$) .....	.....	.....	1.3

^z All lines were *Beta vulgaris*. Three entries were check cultivars: Monohikari, Beta G6040, and HM PM90.

^y CT rating = curly top was rated using a scale of 0-9 (0 = healthy and 9 = dead), with disease index (DI) treated as a continuous variable.

^x $P > F$ was the probability associated with the F value. LSD = Fisher's protected least significant difference value. Within a column, means followed by the same letter did not differ significantly based on Fisher's protected LSD.

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