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

I. A. Eujayl and C. A. Strausbaugh, USDA-ARS
NWISRL, Kimberly, ID 83341

Beet curly top resistance in USDA-ARS Kimberly sugar beet germplasm lines, 2016.

Eleven sugar beet (*Beta vulgaris* L.) germplasm lines from the USDA-ARS Kimberly Sugar Beet program and two commercial check cultivars [SV2012RR (susceptible) and HM PM90 (resistant)] 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 2015. The field was plowed in the fall and in the spring, it was fertilized with 90 lb of N and 110 lb of P_2O_5 per acre and roller harrowed on 4 Apr. The germplasm was planted at the rate of 142,560 seeds/A on 16 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 fields were sprinkler irrigated, cultivated, and hand weeded as necessary. Plant populations were thinned to about 47,500 plants/A on 16 Jun. Plants were inoculated at the four- to six-leaf growth stage on 20 Jun with approximately six viruliferous (contained at least the following BCTV strains: CA/Logan, CO, Svr, and Wor) 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 30 Jun to kill the beet leafhoppers. Plots were rated for foliar symptom development on 13 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). During the disease rating, leaf samples were collected and evaluated by enzyme-linked immunosorbent assay (ELISA) as described previously (Plant Dis. 94:972-976). Data were analyzed in SAS using the general linear models procedure (Proc GLM), and Fisher's protected least significant difference (LSD; $\alpha = 0.05$) was used for mean comparisons.

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 both the visual rating and ELISA. KDH13 was significantly more resistant than the resistant check based on the visual rating, but was not different based on ELISA. Line KDH4-9 was significantly better than the resistant check based on ELISA, but was not different based on the visual rating. KDH4-9 will be released because this was the third season that the resistance has been confirmed. Results from the Kd13-19 F_2 subpopulation indicate that resistance can be incorporated from KDH13 into susceptible lines such as K19-19. These segregating populations provide germplasm that can be incorporated into the USDA-ARS germplasm as sources of resistance to BCTV. These results and germplasm will be accessible to interested parties through the USDA-ARS, NPGS GRIN database (http://www.ars-grin.gov/npgs/index.html).

Entry[z]	Description[y]	ELISA[x]	Curly top rating[x]
KDH13	PI 663862, doubled haploid genetic stock (*CtCt*)	1.06 de	2.3 j
KDH4-9	Doubled haploid, originated from C762-17 (*CtCt*)	0.78 e	3.3 i
HM PM90	Resistant check	1.51 b-d	3.6 hi
Kd13-19	KDH13/K19-19, F_2 subpopulation (*CtCtXctct*)	1.43 cd	4.0 g-i
Kd13-09	KDH13/KEMS09 = PI 663862XPI 672569, F_2 subpopulation	1.97 a-c	4.3 f-h
K09-d4-9	KEMS09/KDH4-9= PI 672569 F_2 subpopulation	1.53 b-d	4.4 e-g
K38/944	K038/C5944, F_2 Swiss chard XPI 608798	2.14 a	4.9 d-f
KPS25	KPS25, Selected for high sucrose content	2.23 a	5.2 de
K19-19	K19-19, susceptible breeding line (originated from PI663873)	2.04 ab	5.6 cd
K39/K38	K39-2/K38-17, F_2 subpopulation of PI 608798 X Swiss chard	2.04 ab	6.2 c
SV2012RR	Susceptible check	2.18 a	6.3 bc
K19-17	K19-17, susceptible breeding line (originated from PI663873)	2.44 a	7.0 ab
KEMS6-450	KEMS6-450, EMS treated PI 608798 and Gamma irradiated at 450gy	2.33 a	7.8 a
P > *F*[v]		<0.0001	<0.0001
LSD ($\alpha = 0.05$)		0.58	0.8

[z] Two entries were commercial check cultivars: SV2012RR (susceptible) and HM PM90 (resistant).
[y] All lines were *Beta vulgaris*.
[x] Curly top ratings = curly top was rated using a scale of 0 to 9 (0 = healthy and 9 = dead), with the scale treated as a continuous variable.
[w] ELISA = the enzyme-linked immunosorbent assay (ELISA) values recorded at OD 405 nm. The 12 negative background checks (4 per plate) for the ELISA assay averaged 0.22 ± 0.02.
[v] *P* > F was the probability associated with the F value. 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.