SUGAR BEET (*Beta vulgaris*)
Rhizomania; *Beet necrotic yellow vein virus*
Storage rot; *Athelia* sp., *Botrytis* sp., *Penicillium* sp., and *Phoma* sp.

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Ft. Collins sugar beet germplasm evaluated for rhizomania and storage rot resistance in Idaho, 2012.

Eighteen sugar beet (*Beta vulgaris* L.) lines from the USDA-ARS Ft. Collins sugar beet program and four check cultivars were screened for resistance to *Beet necrotic yellow vein virus* (BNYVV), the causal agent of rhizomania, and storage rot in 2012. The rhizomania evaluation was conducted at the USDA-ARS North Farm in Kimberly, ID which has Portneuf silt loam soil and had been in barley in 2011. The field was fall plowed and in the spring, fertilized (90 lb N and 110 lb P_2O_5/A) on 16 Apr 12, sprayed with the herbicide Ethotron (2 pt/A), and roller harrowed. The germplasm was planted (density of 142,560 seeds/A) on 23 Apr. The plots were one row 10 ft long with 22-in row spacing and arranged in a randomized complete block design with 6 replications. The crop was managed according to standard cultural practices. Plant populations were thinned to 47,500 plants/A on 4 Jun. The trial relied on natural infection for rhizomania and storage rot development. The plots were rated for foliar symptom (percentage of plants with yellow, stunted, upright leaves) development on 13 Jul and 17 Sep. The plants were mechanically topped and hand harvested with the aid of a single-row lifter on 3 Oct. At harvest, ten roots in the plots were rated for symptom development using a scale of 0 to 9 (0 = healthy and 9 = dead; Plant Disease 93:632-638), with disease index (DI) treated as a continuous variable. At harvest, eight roots per plot were also placed in a mesh-onion bag and placed in an indoor commercial storage facility (temperature set point 34°F) in Paul, ID on 4 Oct. On 7 Feb13 after 127 days in storage, the roots were evaluated for the percentage of root surface area covered by fungal growth. Data were analyzed in SAS (Ver. 9.2) using the general linear models procedure (Proc GLM), and Fisher's protected least significant difference ($\alpha = 0.05$) was used for mean comparisons.

Rhizomania symptom development was uniform and other disease problems were not evident in the plot area. The susceptible check (entry 19) had 75 to 95% foliar symptoms and a high root disease severity rating. The three check entries (20, 21, and 22) with resistance to BNYVV, had few to no foliar symptoms and low root ratings. Entries 2, 3, and 5 had both high foliar and root ratings which were similar to the susceptible check (entry 19). Most other entries had fewer foliar symptoms and a better root rating than the susceptible check (entry 19). Based on both BNYVV foliar ratings and the root rating, entries 4, 11, 12, 15, and 16 had resistance that was similar to the resistant checks. If roots are compromised by BNYVV or lack storability, they will rot in storage as indicated by fungal growth on the root surface. The primary fungal growth was an *Athelia*-like Basidiomycete (Mycologia 104:70-78), but *Botrytis* sp., *Penicillium* sp., and *Phoma* sp. were also frequently present. Entries 11, 12, and 15 performed well for all variables. Some of these entries may serve as a starting point for identifying additional sources of resistance to both BNYVV and storage rots.

Entry[w]	Description	Fungal growth in storage (%)[x]	Rhizomania		
			Foliar rating (% susceptible plants)		
			13 Jul	17 Sep	Root rating[y]
2	FC712/MonoHy A4	12 f	83 ab	79 bc	32 a
3	FC712/MonoHy A4 - CMS equivalent	14 ef	81 ab	86 ab	31 a
19	**Roberta (*rzrz*)**	71 a	95 a	75 b-d	31 ab
5	Rhzc sel FC221 RhzmR, MM, CTR, LSR	22 d-f	68 bc	62 d	27 bc
6	Bulk 5 LSR ½ sib families BGRC 45511 (LSR) x $Sucrose_{MM}$	60 ab	58 c	68 cd	27 c
1	PI 590845 - FC708 Rhizoctonia Resistant, LSR O-type	16 d-f	82 ab	91 ab	27 c
18	Bulk 5 highest LSR families 20071004HO-xs; LSR_{MM} w/Fargo	61 ab	84 ab	97 a	25 cd
10	C790-15cms x RZM-CR-% (FC712 x 9931)F_3	31 c-f	48 cd	41 e	25 c-e
7	(Best FC LSR x Best EL LSR) - mm seedballs	25 d-f	25 e	40 e	25 c-f
8	PI 658059 - FC1018 - 05-FC1018 = RZM-CR-% (C931 x FC709-2)F_3	12 f	28 de	11 f	24 c-f
13	[{SP85657-01 x FC709-2} X EL51]}aa x FC220-sel Rhzc	25 d-f	12 e-g	0 f	24 c-f
9	C790-15cms x 05-FC1018 [RZM-CR-% (C931 x FC709-2)F_3]	25 d-f	18 e-g	6 f	23 c-f
14	({SP85657-01 x FC709-2} X FC708)aa x FC220-sel Rhzc	25 d-f	22 ef	7 f	23 c-f
12	({SP85657-01 x FC709-2} X EL53)aa x FC220-sel Rhzc	17 d-f	11 e-g	0 f	23 c-f
16	PI 665053 - Blk Inc FC1028 (04-FC1028 = 9933rr x FC709-2)blk	35 cd	8 e-g	2 f	22 d-g
11	(FC708CMS X EL 51)aa x FC220-sel Rhzc	17 d-f	19 e-g	9 f	22 d-g
17	20071003H-74 - Lowest performing CLR family (BGRC 45511 X $Sucrose_{MM}$)	31 c-f	26 e	12 f	22 d-g
4	PI 665054 - FC1036 = RZM [(FC709-2 x 9933) & (LSR FC x EL x CR11) & (LSR FC x EL x CR10)]	31 c-f	3 fg	1 f	22 d-g
22	**Angelina (*Rz1Rz1Rz2Rz2*)**	32 c-e	0 g	0 f	22 d-g
21	**Beta G017R (*Rz2Rz2*)**	46 bc	3 fg	0 f	21 e-g
15	PI 665055 - Increase FC1037 (04-FC1037)	17 d-f	9 e-g	0 f	21 fg
20	**Beta 4430R (*Rz1Rz1*)**	46 bc	0 g	0 f	19 g
Overall mean		30	36	31	24
P > F[z]		<0.0001	<0.0001	<0.0001	<0.0001
LSD		20	20	17	4

[w] All lines were *Beta vulgaris*. Four entries were check cultivars (bold): Roberta, Beta 4430R, Beta G017R, and Angelina.

[x] Fungal growth in storage = the percent of root surface area covered by fungal growth. Most of the fungal growth was by a recently described *Athelia*-like Basidiomycete (Mycologia 104:70-78).

[y] Ten roots per plot were evaluated using a scale of 0-9 (0 = healthy and 9 = dead; Plant Disease 93:632-638). Root rating = a disease severity index value for each plot established using the following formula: [((A)0+(B)1+(C)2+(D)3+(E)4+(F)5+(G)6+(H)7+(I)8+(J)9)/90]100, where A-J are the number of plants in categories 0-9, respectively.

[z] *P* > F was the probability associated with the F value. LSD = Fisher's protected least significant difference value ($\alpha = 0.05$). Within a column, means followed by the same letter did not differ significantly based on Fisher's protected LSD.