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

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Sugar beet germplasm evaluated for rhizomania and storage rot resistance in Idaho, 2011.

Fourteen 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 2011. 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 2010. The field was fall plowed and in the spring, fertilized (80 lb N and 120 lb P_2O_5/A) on 20 Apr 11, sprayed with the herbicide Ethotron (2 pt/A), and roller harrowed. The germplasm was planted (density of 142,560 seeds/A) on 3 May. The plots were one row 10 ft long with 22-in row spacing and arranged in a randomized complete block design with 5 replications. The crop was managed according to standard cultural practices. Plant populations were thinned to 47,500 plants/A on 20 Jun. The trial relied on natural infection for rhizomania and storage rot development. The plots were rated for foliar symptom (% of plants with yellow, stunted, upright leaves) development on 26 Jul and 26 Aug. The plants were mechanically topped and hand harvested with the aid of a single-row lifter on 28 Sep. At harvest, roots in the plots were rated for symptom development using a scale of 0-9 (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 29 Sep. On 13 Feb12 after 137 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 42, had 98 to 99% foliar symptoms and a high root disease severity rating. The three check entries (39, 40, and 41) with resistance to BNYVV, had few to no foliar symptoms. However, based on root symptoms, the *Rz2* source of resistance in entry 41 was more susceptible than entry 40, which contains the *Rz1* source of resistance. Entry 1 had both high foliar and root ratings similar to the susceptible check (entry 42). Other entries had fewer foliar symptoms than the susceptible check (entry 40), but based on root symptoms they were not different from the susceptible check. 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. and *Penicillium* sp. were also frequently present. Although entries 4, 5, 7, 8, 9, 11, 13, and 14 did not perform well based on the root rating, both the foliar and storage ratings indicate they must contain some level of resistance to BNYVV and storage rots. Entry 6 did well in all ratings, indicating it may have the best combination of both BNYVV and storage resistance. Some of these entries may serve as a starting point for identifying additional sources of resistance to both BNYVV and storage rots.

Entry[z]	Description	Fungal growth in storage (%)[y]	Rhizomania		
			Foliar rating (% susceptible plants)		
			26 Jul	26 Aug	Root rating[x]
1	FC716	76 a-c	96 a	96 a	25 a
9	Inc. 2005A020 - half sibs of FC123mm (FC301); monogerm	21 f	30 cd	9 g	24 ab
42	**Roberta (*rzrz*)**	100 a	99 a	98 a	23 a-c
7	FC220	35 ef	64 b	41 cd	23 a-c
5	CMS equivalent	36 ef	5 d	18 e-g	21 a-d
12	05-FC1019 (FC1019)	55 c-e	14 cd	21 d-g	21 b-d
4	03-FC1015 FC201 sib - sel R	37 ef	19 cd	36 c-e	20 b-e
2	03-124 CMS equivalent	55 c-e	9 cd	8 g	20 b-e
13	C790-15cms x 05-FC1019 - CTR	27 f	23 cd	15 e-g	20 b-e
10	05-FC1018 (FC1018)	59 c-e	62 b	70 b	20 b-e
3	FC220-1 sel - inc. 20051030	35 ef	29 cd	7 g	20 b-e
41	**Beta G017R (*Rz2Rz2*)**	91ab	5 d	4 g	20 b-e
14	C790-15cms x RZM-CR-% (FC712 x 9931)F3	47 d-f	25 cd	35 c-f	19 c-e
8	FC221-1 RhzcR(sel), RhzmR, MM, CTR, LSR ({4918, 2915aa} x {FC902, 607, 709-2})-hs	44 d-f	38 bc	53 bc	18 de
11	C790-15cms x 05-FC1018 - CTR	40 ef	39 bc	14 fg	18 de
6	Inc. 20051027 - RhzcR/RhzmR - ((FC907 x FC709-2) x 9931 (Salinas))	28 f	30 cd	13 g	17 ef
39	**Angelina (*Rz1Rz1Rz2Rz2*)**	78 a-c	4 d	3 g	16 ef
40	**Beta 4430R (*Rz1Rz1*)**	67 b-d	0 d	0 g	14 f
Overall mean		52	33	30	20
$P > F^w$		<0.0001	<0.0001	<0.0001	<0.0001
LSD ($P \leq 0.05$)		27	32	22	4

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

[y] 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).

[x] Ten roots per plot were evaluated using a scale of 0-9 (0 = healthy and 9 = dead; Plant Disease 92:581-587). 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.

[w] $P > F$ 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.