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

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Evaluation of sugar beet germplasm for rhizomania and storage rot resistance in Idaho, 2012.

Nine sugar beet (*Beta vulgaris* subsp. *vulgaris* L.) lines from the USDA-ARS Kimberly 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 root 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 plowed in the fall 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, 3 Aug, and 17 Sep. The plants were mechanically topped and hand harvested with the aid of a single-row lifter on 3 Oct. At harvest, roots in the plots were rated for symptoms 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 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 rot as the percentage of root surface area covered by fungal growth. Data were analyzed using SAS (Ver. 9.2) with 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 there were no other disease symptoms evident in the plots. The BNYVV susceptible check (Roberta) had 95 to 100% foliar symptoms and a high root disease severity rating. The three BNYVV resistant check entries (2, 4, and 5) with different genetic sources of resistance, had no foliar symptoms early in the season, but entry 2 showed a moderate level of yellowing on 3 Aug which would suggest that it is the optimum date for foliar evaluation. Most experimental entries were different from the susceptible check for both rhizomania variables. Based on both foliar and root ratings, the most BNYVV resistant entry, K944-EMS-9, was not significantly difference from the commercial resistant checks. When the germplasm were evaluated for rot in storage, 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. All Kimberly germplasm performed significantly better than the BNYVV resistant and susceptible checks in storage. However, entries 7, 8, 10, 11, and 12 had the best storage ratings, but were weak for BNYVV resistance. These preliminary data suggest that resistance to BNYVV is different from resistance to storage rot since there were no significant differences among commercial checks for root rot in storage. These results with some of the Kimberly germplasm may help identify additional sources of genetic resistance to both BNYVV and storage rots.

Entry[w]	Description	Fungal growth in storage (%)[x]	Rhizomania			
			Foliar rating (% susceptible plants)			Root rating[y]
			13 Jul	3 Aug	17 Sep	
1	K944-EMS-9	21 bc	0 c	2 c	0 d	16 f
2	**Beta 4430R (*Rz1Rz1*)**	48 a	0 c	17 bc	0 d	17 ef
3	K944-62	53 a	8 c	32 b	6 cd	18 d-f
4	**Beta G017R (*Rz2Rz2*)**	59 a	0 c	0 c	0 d	18 d-f
5	**Angelina (*Rz1Rz1Rz2Rz2*)**	52 a	0 c	2 c	0 d	19 d-f
6	K944-6-91	29 b	8 c	88 a	20 c	22 c-e
7	K944-19-19	12 bc	0 c	18 bc	12 cd	22 c-e
8	K944-EMS-6	11 bc	5 c	13 bc	0 d	22 c-e
9	K944-19-9	29 b	15 c	80 a	58 b	23 b-d
10	K39-16	14 bc	3 c	33 b	0 d	25 bc
11	K944-EMS-12	15 bc	0 c	10 c	0 d	26 bc
12	K39-33	10 c	39 b	87 a	51 b	27 b
13	**Roberta (*rzrz*)**	52 a	95 a	83 a	100 a	35 a
P > F[z]		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
LSD		19	16	21	18	5

[w] All entries are *Beta vulgaris*. Four entries were rhizomania 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 an *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 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.

[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.