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 resistance to rhizomania and fungal growth in storage in Idaho, 2011.

    Twenty-one sugar beet (*Beta vulgaris vulgaris* L.) germplasm accessions from the USDA-ARS Kimberly sugar beet program and four check cultivars were screened for resistance to *Beet necrotic yellow vein virus* (BNYVV) during the 2011 growing season. During the 2011/2012 storage period, fungal growth in an indoor storage was also evaluated. The rhizomania evaluation was conducted at rhizomania nursery in 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, ten roots per plot were rated for symptom development using a scale of 0-9 (0 = healthy and 9 = dead; Plant Disease 92:581-587). These root ratings were then used to establish a disease severity index value for each plot 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 plants in categories 0-9, respectively. At harvest, eight roots per plot were also placed in a mesh onion bag and placed in an indoor commercial storage facility in Paul, ID on 29 Sep. On 13 Feb12, 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 mixed models procedure (Proc GLIMMIX) and mean comparisons were conducted using the least squared means (LSMEANS) statement ($\alpha = 0.05$).

    Rhizomania symptom development was uniform and other disease problems were not evident in the plot area. The susceptible check (entry 24) had 98 to 99% foliar symptoms and a high root rating. The three BNYVV resistant checks entries (1, 2, and 4) had few to no foliar symptoms and a low root rating. These checks had a high percentage of fungal growth in storage (67 to 91%) indicating resistance to BNYVV does not preclude roots from storage rot. The BNYVV susceptible check also had considerable fungal growth in storage as expected. Based on previous research, if roots are compromised by BNYVV or lack storability, they will rot in storage as indicated by fungal growth on the root surface. Entry 3 (K944-62) had BNYVV resistance similar to the resistant checks and also had very little rot in storage. Entries 5 (K944-191) and 7 (K39-16) also performed well with a good level of resistance to both BNYVV and storage rots. This germplasm will be used in the breeding program to identify additional sources of resistance to both BNYVV and storage fungal rot.

			Rhizomania		
		Fungal growth in storage (%)[y]	Root DSI[x]	Foliar rating (% susceptible plants)	
Entry[z]	Germplasm description			26 Jul	26 Aug
1	**Beta 4430R (*Rz1Rz1*)**	**67 bc**	**14 f**	**0 f**	**0 d**
2	**Angelina (*Rz1Rz1Rz2Rz2*)**...............................	**78 ab**	**16 f**	**4 ef**	**3 d**
3	K944-62	18 f	17 ef	4 ef	4 d
4	**Beta G017R (*Rz2Rz2*)**	**91 ab**	**20 d-f**	**5 ef**	**4 d**
5	K944-191	29 ef	21 b-f	11 ef	11 cd
6	K39-32	42 c-f	23 a-d	15 ef	20 cd
7	K39-16	16 f	22 b-f	0 f	25 cd
8	K39-7	67 b-d	28 ab	22 ef	39 bc
9	K39-10	25 f	23 a-e	39 de	49 bc
10	K39-23	54 b-e	24 a-d	29 ef	51 a-c
11	K39-34	15 f	27 ab	34 e	51 a-c
12	K39-2	21 f	21 b-f	74 a-c	52 a-c
13	K39-64	39 d-f	25 a-d	17 ef	54 a-c
14	K39-14	22 f	24 a-d	46 c-e	55 a-c
15	K39-28	61 b-d	22 b-f	46 c-e	62 a-c
16	K39-40	19 f	25 a-d	50 b-e	64 ab
17	K39-33	14 f	23 a-e	60 b-e	67 ab
18	K39-19	58 b-d	20 c-f	74 a-c	71 ab
19	K39-62	57 b-d	29 a	70 a-e	73 ab
20	K39-25	45 c-f	24 a-d	73 a-d	73 ab
21	K39-67	13 f	26 a-c	82 ab	76 ab
22	K39-26	45 c-f	26 a-d	70 a-e	79 a
23	K944-192	64 b-d	23 a-d	46 c-e	96 a
24	**Roberta (*rzrz*)**	**100 a**	**23 a-e**	**99 a**	**98 a**
25	K39-47	51 b-f	22 b-f	100 a	100 a
P > *F*[w]		<0.0001	0.0019	<0.0001	<0.0001

[z] All germplasm were *Beta vulgaris* var. *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), but *Botrytis* sp. and *Penicillium* sp. were also present.

[x] Ten roots (if available) per plot were evaluated using a scale of 0-9 (0 = healthy and 9 = dead; Plant Disease 92:581-587). Root DSI = a disease severity index value for each plot was 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 plants in categories 0-9, respectively.

[w] *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 least squared means ($\alpha = 0.05$).

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