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

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Rhizomania and storage rot resistance in USDA-ARS Plant Introduction Lines evaluated in Idaho, 2017.

Thirty sugar beet (*Beta vulgaris* L.) Plant Introduction (PI) Lines from the USDA-ARS National Plant Germplasm System (NPGS), and four check cultivars were screened for resistance to *Beet necrotic yellow vein virus* (BNYVV), the causal agent of rhizomania, and to storage rot. 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 2016. In the spring the field was plowed and then fertilized (90 lb N and 110 lb P_2O_5/A) and roller harrowed on 11 Apr 17. The germplasm was planted (density of 142,560 seeds/A) on 4 May. The plots were one row 10-ft long with 22-in. row spacing and arranged in a randomized complete block design with 6 replicates. The crop was managed according to standard cultural practices for southern Idaho. Plant populations were thinned manually to 47,500 plants/A on 3 Jun. The trial relied on endemic field inoculum for rhizomania and storage rot development. The plots were rated for foliar symptom (percentage of plants with yellow, stunted, upright leaves) development on 21 Aug. The plants were mechanically topped and hand-harvested on 10 Oct. At harvest, ten roots per plot 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 10 Oct. On 21 Feb 18, after 133 days in storage, the roots were evaluated for the percentage of root surface area (0 to 100%) covered by fungal growth and rot. Data were analyzed in SAS (Ver. 9.4) 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. Entries 1, 3, 24, and 30 were dropped from the study because of poor stand. The BNYVV susceptible check (Check 1) had 97% foliar symptoms and a high root disease severity rating. The three resistant checks (2, 3, and 4) had 0 to 6% foliar symptoms and the lowest root ratings. Based on root ratings, all PI Line entries were more susceptible than the resistant checks and 14 entries were not different from the susceptible check. However, entry 2 had both the lowest foliar rating of the PI lines and ranked first among all entries for the lowest storage rot. The root rating for entry 2 may have been affected by poor inherent root shape and may not necessarily represent a lack of resistance to BNYVV. The foliar rating and resistance to storage rot both suggest entry 2 should be reevaluated for resistance to BNYVV. Entry 2 may serve as a starting point for identifying additional sources of resistance to BNYVV and storage rots.

Entry[z]	Description	Root rot in storage (%)[y]	RZ foliar rating (% susceptible plants)	Root rating[x]
Check 4	**BTSSALCHK4 (*Rz1Rz1*) = *Rz1* resistant check**	**27 l-n**	**6 d**	**17 o**
Check 3	**BTSSALCHK3 (*Rz1Rz1 Rz2Rz2*) = *Rz1* + *Rz2* resistant check**	**12 mn**	**0 d**	**21 o**
Check 2	**BTSSALCHK2 (*Rz2Rz2*) = *Rz2* resistant check**	**34 j-l**	**3 d**	**23 o**
15	PI 590861; Utah, United States; SLC129 (1523)	36 j-l	100 a	39 n
14	PI 590817; California, United States; C85	42 i-l	92 ab	43 mn
2	PI 518383; Ireland; IDBBNR 5877	10 n	2 d	43 mn
21	PI 564758; California, United States; C790-15	39 i-l	84 b	43 mn
29	PI 266100; Poland; BI IHAR 2N=18	66 c-g	100 a	45 l-n
16	PI 613264; Colorado, United States; GW 035	31 kl	83 b	47 l-n
7	PI 476323; Soviet Union; Ramonskaja odnosemennaja 32	49 g-j	100 a	48 k-m
13	PI 590795; California, United States; WB 51	31 j-l	28 c	49 j-m
8	PI 590666; Maryland, United States; SP70641-0	42 i-l	100 a	50 i-m
22	PI 590743; Utah, United States; SLC 19	30 kl	100 a	50 h-m
28	PI 220645; Afghanistan; IDBBNR 5388	60 e-h	100 a	50 h-m
23	PI 613265; Colorado, United States; GW 066	38 i-l	100 a	53 g-l
20	PI 386205; Soviet Union, former; VNIS F-510	55 f-i	100 a	53 f-l
18	PI 175596; Turkey; IDBBNR 5319	81 a-d	100 a	55 e-k
26	NSL 93285; Chile; A77-17	70 b-f	95 ab	57 d-j
17	Ames 4377; IDBBNR 4836	30 k-m	100 a	57 d-i
11	PI 167374; Turkey; PAUCAR	69 b-f	98 ab	57 d-i
25	NSL 93280; Chile; A76-39	27 l-n	96 ab	58 d-h
5	PI 173642; Turkey; IDBBNR 5304	65 d-g	86 ab	58 d-h
4	PI 120707; Turkey; IDBBNR 5194	83 a-c	90 ab	60 c-g
Check 1	**BTSSALCHK1 (*rzrz*) = susceptible check**	**47 h-k**	**97 ab**	**62 b-f**
27	PI 204678; Turkey; IDBBNR 5375	82 a-d	87 ab	62 a-e
19	PI 176429; Turkey; KOCABAS	82 a-d	100 a	63 a-e
9	PI 140357; Iran; IDBBNR 5207	73 b-e	97 ab	65 a-d
10	PI 142818; Iran; CHOGHONDAR	84 ab	95 ab	67 a-c
12	PI 171513; Turkey; IDBBNR 5284	96 a	100 a	68 ab
6	PI 175600; Turkey; KARACA OREN	92 a	100 a	70 a
P > F[w]		<0.0001	<0.0001	<0.0001
LSD		18	14	8

[z] Four commercial cultivars were included as checks (bold).

[y] Root rot in storage = the percent of root surface area covered by fungal growth and rot. Fungal growth was dominated by an *Athelia*-like basidiomycete (Mycologia 104:70-78), *Botrytis cinerea*, *Penicillium expansum*, and *Penicillium cellarum*.

[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 ($\alpha = 0.05$). Within a column, means followed by the same letter did not differ significantly based on Fisher's protected LSD.