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

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Ft. Collins sugar beet germplasm evaluated for rhizomania and storage rot resistance in Idaho, 2018.

Thirty 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 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 2017. In the spring the field was plowed and fertilized (60 lb N and 110 lb P_2O_5/A) and roller harrowed on 5 Apr 18. The germplasm was planted (density of 142,560 seeds/A) on 25 Apr. The plots were one row 10-ft long with 22-in. between-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 26 May. The trial relied on endemic field inoculum for rhizomania and storage rot development. The plots were rated for rhizomania foliar symptom (percentage of plants with yellow, stunted, upright leaves) development on 7 Aug. The plants were mechanically topped and hand harvested on 15 Oct. At harvest, ten roots per plot were rated for rhizomania 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 16 Oct. On 11 Feb 19, after 119 days in storage, the roots were evaluated for the percentage of root surface area covered by fungal growth or 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. The root ratings were rank transformed prior to analysis, but the non-transformed means have been presented in the table.

Rhizomania symptom development was uniform and other disease problems were not evident in the plot area. The BNYVV susceptible check plots (Check 1) had 97% foliar symptoms and high root disease ratings. The three resistant checks (2, 3, and 4) had 0 to 6% foliar symptoms and low root ratings. Entries 4, 13, and 14 had a level of resistance similar to the resistant checks based on root ratings. Based on foliar ratings, entries 10, 11, 13, 15, 16, 22, and 23 were similar to the resistant checks. A number of the entries had resistance to fungal rots in storage, but only entry 13 performed well for all three variables. Some entries 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)	RZ root rating[x]
Check 4	**BTSSALCHK4 (*Rz1Rz1*) = *Rz1* resistant check**	**10 d-h**	**6 kl**	**20 o**
Check 3	**BTSSALCHK3 (*Rz1Rz1 Rz2Rz2*) = *Rz1* + *Rz2* resistant check**	**6 f-i**	**0 l**	**22 no**
Check 2	**BTSSALCHK2 (*Rz2Rz2*) = *Rz2* resistant check**	**9 d-i**	**3 l**	**26 m-o**
13	20121018HO-119pf & 20121018HO-187pf20121018HO-187pf	8 d-i	0 l	34 l-o
14	20121018HO1	2 hi	20 jk	36 k-m
4	20111024-x, 20071011-[(FC907xFC709-2)&9931]x[C790xFC1036]	3 g-i	40 hi	37 k-n
15	20061005HO & 20061005HO1; 03-124 FC123 derivative and CMS	2 i	8 kl	38 j-l
27	20121018HO-x & 20121018HO1; 03-FC1014-22 (hs sel FC201)	3 g-i	48 e-h	40 h-l
16	20061005HO & 20061005HO1; 03-124 FC123 derivative and CMS	2 i	9 kl	40 i-l
22	20111019-x; BI of best performing sel families from Inc 20071009H2	1 i	12 kl	40 j-l
8	20101013-xs; (Z325aa x {BGRC45511 x SucroseMM pop})	3 g-i	63 c-e	42 i-l
19	20111018-x, BI of Inc 20071006H2 (Iso 3)	15 c-e	60 c-g	43 h-k
1	FC607, LSR/CTR, easy bolting, O-type, 2X, mm, self sterile	2 i	92 a	43 h-j
3	20121019HO & HO1 - Increase 03-FC1015HO & HO1 derivatives	2 i	31 ij	44 h-j
29	20151033, B.I. of 20131002pfHO, T2	4 f-i	59 c-g	46 h-j
18	20141020; Increase F3 of CN12-446 x FC708 [SBCN x RhzcR/LSR]	3 g-i	56 d-g	47 f-i
30	B.v. vulgaris Poland REKORD POLY 2010i PI 535827 2010I SD	41 ab	97 a	47 g-i
6	20101013-xs; selected at EL in 2010 & 2011 for LSR	2 hi	63 c-e	47 e-i
5	20121018HO-x - Bulk increase for Rhizoctonia resistance 2014	5 f-i	36 hi	48 d-h
20	20111019-x; BI of 20071009H2 (Iso 6)	8 e-i	45 g-i	51 c-g
25	20121018HO-x & 20121018HO1; 03-FC1014-22 (hs sel FC201)	2 i	58 c-g	52 b-f
7	20071005H2 - Z325CMS (Salinas % sucrose) x 20011037	2 i	73 bc	52 c-g
23	20101014HO-xs; BI of selfed families from 07-FC124-425	4 f-i	0 l	53 b-e
2	Bulk 0931 & 9933 x BCN resistant, Iranian sugar beet landrace	2 hi	62 c-f	53 b-d
28	20121018HO-x & 20121018HO1; 03-FC1014-22 (hs sel FC201)	10 d-g	82 ab	54 b-d
21	20111019-x; BI of worst performing families from 20071009H2	7 f-i	72 bc	54 b-d
26	20121018HO-x & 20121018HO1; 03-FC1014-22 (hs sel FC201)	20 c	86 ab	55 a-c
12	20111039MS/PF; BI seed from Z325 x BGRC28938	16 cd	72 bc	56 a-d
10	20101015HO1-x/20131012MS	2 i	0 l	57 a-c
Check 1	**BTSSALCHK1 (*rzrz*) = susceptible check**	12 d-f	97 a	57 a-c
9	20101013-xs; (Z325aa x {BGRC45511 x SucroseMM pop})	34 b	95 a	58 a-c
17	20141035; 20121055; 20081012PF-23, -29	44 a	65 cd	60 ab
24	20121014-x; B.I. 8 half-sib families (05-FC1023m(iso)[2005A020])	12 d-f	47 f-h	60 a-c
11	20101016HO1-xs/20101016HO-x; selfed families (07-FC1015-420)	1 i	0 l	61 a
P > F[w]		<0.0001	<0.0001	<0.0001
LSD		8	16	Trans

[z] All lines were *Beta vulgaris* subsp. *vulgaris*. Four commercial cultivars were included as checks (bold).

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

[x] Ten roots per plot were evaluated for rhizomania symptoms 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. Trans = the root ratings were rank transformed prior to analysis, but the non-transformed means have been presented in the table.

[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.