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, 2017.

Forty-two sugar beet (*Beta vulgaris* L.) lines from the USDA-ARS Ft. Collins sugar beet program and five 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 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 11 Oct. At harvest, eight roots per plots 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 11 Oct. On 18 Feb 18, after 132 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.

Rhizomania symptom development was uniform and other disease problems were not evident in the plot area. The BNYVV susceptible check plots (Check 1 and RB) had 97 to 100% foliar symptoms and high root disease severity ratings. The three resistant checks (2, 3, and 4) had 0 to 6% foliar symptoms and low root ratings. Based on root ratings, all entries except entry 20151043PF had some level of resistance since they were all better than the susceptible checks. However, 20141018 was the only entry that performed well for all variables. 20161023PF also had a good root rating, but had considerable foliar symptoms. 20151044PFHO and 20151046PFHO had no foliar symptoms and very little storage rot, so the poor root rating may be related to inherently poor root shape and not a lack of BNYVV resistance. Twenty-six of the entries had resistance to fungal rots in storage, because they were not different from 20161014HO and Check 3. Some entries may serve as a starting point for identifying additional sources of resistance to BNYVV and storage rots.

Patrix				RZ foliar rating	
Check 4 BTSSALCHK3 (R:RE) = R:2 resistant check 27 g.j 6 q.s 17 t Check 3 BTSSALCHK3 (R:RE) = R:2 resistant check 12 lo 0 s 21 st Check 2 BTSSALCHK3 (R:RE) = R:2 resistant check 12 lo 0 s 21 st 20141018 201210361 (IPC907 × IC709-2) & 9931 x (C790-15mx × IC706) 16 jo 12 o-8 26 st 20161029EP 20111018x, (2325 LISR Giant Poly (PISSSE6) × SucroseMMJ) 41 be 49 e-8 27 q.s 20161029EP 20111019x; (2325 ax [20011035M) (WB8S3 × SucroseMMJ) 12 lo 9 p.s 30 p.r 20161029EP 20111019x; (2325 ax [20011035M) (WB8S3 × SucroseMMJ) 12 lo 9 p.s 30 p.r 20161019PF FC220-2; 20121037PF&MS (FC220-1 - inc. 20051030 RbcR 11 lo 20 n.s 32 p.r 20151010 20121018B10-x - Bulk increase of roots selected for RbcR 13 lo 20 n.s 33 lo 20151014H01 20061005H0 & 20061005H01; 03-124 PC123 derivative and CMS 11 lo 38 g.o 33 l-q 20151014H01 20061005H0 & 20061005H01; 03-124 PC123 derivative and CMS 11 lo 38 g.o 33 l-q			Root rot in	(% susceptible	RZ root
Check 3	Entry ^z	Description	storage (%) ^y	plants)	rating ^x
Check 3 BTSSALCHK3 (RR2R) = R21 = R21 + R22 resistant check 34 e-g 3 rs 23 st 20141018 20121036; [FC907 × FC709-2) & 9931] x [C790-15cm x FC1036] 16 jo 12 e-s 26 rs 20141018 20121036; [FC907 × FC709-2) & 9931] x [C790-15cm x FC1036] 16 jo 12 e-s 26 rs 201610220FF 20111019-x; (Z325a x [20011045MS (WB833 × SucroseMMJ)) 12 lo 9 p-s 30 p-r 201610192FF 2011019-x; (Z325a x [20011045MS (WB833 × SucroseMMJ)) 12 lo 9 p-s 30 p-r 201610192FF PC220-2; 20121037FF8kmS; (C220-1 in 2.0051030) RhzcR 11 lo 20 n-s 32 n-r 20151020 20101013-xx; B.I. Roots selected at El. in 2010 & 2011 16 jo 22 n-s 32 n-r 20151020 20121018HO-x Bulk increase of roots selected for RhzcR 13 lo 20 n-s 33 l-q 2016101410 20121018HO-x Bulk increase of roots selected for RhzcR 13 lo 20 n-s 33 l-q 2016101410 20101013-xx; B.I. Zd5x6x (S611 x SucroseMM) 25 g-k 29 l-q 33 l-q 2016101410 20101018HO-1877021018HO 9 n-o 18 n-s 34 l-p <t< th=""><th>Check 4</th><th>BTSSALCHK4 $(Rz1Rz1) = Rz1$ resistant check</th><th>27 g-j</th><th>6 q-s</th><th>17 t</th></t<>	Check 4	BTSSALCHK4 $(Rz1Rz1) = Rz1$ resistant check	27 g-j	6 q-s	17 t
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20161026PF 20111019-x; (7225an x 20011045MS (WBRS3 x SucroseMM)	20141018	20121036; [(FC907 × FC709-2) & 9931] x [C790-15cms × FC1036]	16 j-o	12 o-s	26 rs
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20141019PF FC220-2; 20121037PF&MS FC220-1 - inc. 20051030) RhzcR	20161026PF	20111019-x; (Z325aa x [20011045MS (WB853 × SucroseMM)])	12 l-o	9 p-s	
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^z All lines were *Beta vulgaris* subsp. *vulgaris*. Five 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), *Botrytis cinerea*, *Penicillium expansum*, and *Penicillium cellarum*.

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. ND = no data.