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

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**Kimberly sugar beet germplasm evaluated for rhizomania and storage rot resistance in Idaho, 2017.**

Fourteen sugar beet (*Beta vulgaris* L.) lines and populations 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 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 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 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 (Check 1) had 98% foliar symptoms and a high root disease severity rating. The three resistant checks (Check 2, 3, and 4) had 0 to 12% foliar symptoms and low root ratings. Based on root ratings, all entries had a level of resistance better than the susceptible check. However, KEMS43 and KD13/19-19 were the only entries with both root and foliar ratings not different from the resistant checks. Four additional entries (KEMS09-600, KEMS12/KPS24, KEMS06-600, and KEMS06) with both good foliar and storage ratings should be reevaluated for BNYVV resistance. These six entries just mentioned should also be considered as sources of storage rot resistance. These entries with superior performance will be released to the public and utilized in backcrossing breeding.

| Entry[z] | Description | Root rot in storage (%)[y] | RZ foliar rating (% susceptible plants) | Root rating[x] |
|---|---|---|---|---|
| **Check 4** | **BTSSALCHK4 (*Rz1Rz1*) = *Rz1* resistant check** | **27 b-e** | **0 e** | **22 i** |
| **Check 3** | **BTSSALCHK3 (*Rz1Rz1 Rz2Rz2*) = *Rz1+Rz2* resistant check** | **12 e-h** | **0 e** | **20 i** |
| **Check 2** | **BTSSALCHK2 (*Rz2Rz2*) = *Rz2* resistant check** | **34 a-c** | **12 d** | **20 i** |
| KD13/19-19 | Population (KDH13- PI663862/K19-19 | 13 e-h | 5 de | 25 hi |
| KEMS43 | C5944-EMS treated. Pool mutant populations | 14 e-h | 0 e | 28 g-i |
| KEMS09-600 | Gamma-ray (600gy) of EMS mutant PI672569 | 9 f-h | 0 e | 33 f-h |
| KEMS12/KPS24 | Hybrid (F1) of PI672570 (mutant)/ and high sugar accession | 1 h | 5 de | 34 e-g |
| KEMS08 | PI683516 | 37 ab | 8 de | 35 e-g |
| KEMS06-600 | PI683515 | 8 f-h | 0 e | 38 d-f |
| KDH39-33 | Doubled haploid selected from PI608798 | 22 c-f | 100 a | 39 c-f |
| KEMS06 | PI683514 | 6 gh | 0 e | 40 b-f |
| KDH13/K39 | Population of PI663862/PI608798 | 34 a-c | 97 a | 42 b-f |
| KPS25 | High sugar – parental line | 31 b-d | 25 c | 43 b-e |
| K19-17 | Breeding line selected from C5944 | 11 f-h | 57 b | 44 b-d |
| KDH13/EMS09 | Population PI663862/PI672569 | 18 d-g | 95 a | 46 b-d |
| KDHEMS09 | Doubled haploid from PI672569 | 22 b-f | 100 a | 48 bc |
| KDH4-9 | PI683513, full-sib doubled haploid of KDH13 | 46 a | 100 a | 48 b |
| **Check 1** | **BTSSALCHK1 (*rzrz*) = susceptible check** | **47 a** | **98 a** | **69 a** |
| *P* > F[w] | | <0.0001 | <0.0001 | <0.0001 |
| LSD | | 15 | 11 | 9 |

[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 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.