SUGAR BEET (*Beta vulgaris* ssp. *vulgaris* "Multiple Cultivar")
Rhizoctonia crown and root rot; *Rhizoctonia solani*

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**Kimberly sugar beet germplasm evaluated for Rhizoctonia crown and root rot resistance in Idaho, 2023.**

Twenty-nine sugar beet (*Beta vulgaris* L.) lines from the USDA-ARS Kimberly sugar beet program and three check cultivars were screened for resistance to *Rhizoctonia solani*. The Rhizoctonia crown and root rot evaluation was conducted at the USDA-ARS North Farm in Kimberly, ID which has Portneuf silt loam soil and had been in barley in 2022. The field was fall plowed with a Terrano chisel plow. In the spring, the field was fertilized (115 lb N and 140 lb $P_2O_5$/A), disked, and roller harrowed on 10 Apr 23. The germplasm was planted at the density of 114,048 seeds/A on 2 May. 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. The trial was inoculated with dried barley inoculum (0.02 oz of inoculum/plant of with strain F521 = *R. solani* AG2-2 IIIB) at the 10-leaf growth stage on 30 Jun. The plots were lifted with a single row lifter and rated for rhizoctonia root rot development (percentage of root surface area covered by root rot) on 15 Sept. The percentage root data were also converted to categorical data as suggested by Ruppel et al. (Plant Dis. Reptr. 63:518-522). The percentage of root area data were analyzed in SAS (Ver. 9.4) using the general linear model (Proc GLM) procedure, and Fisher's protected least significant difference ($\alpha = 0.05$) was used for mean comparisons. The categorical root data were analyzed in a nonparametric analysis as described by Shah and Madden (Phytopathology 94:33-43). For transformed data, the non-transformed means have been presented in the table.

Rhizoctonia root rot incidence was uniform and other disease problems were not evident in the plot area. Entry 13 had 56% of its root area covered in rot and only 28% of the roots were considered harvestable. The Rhizoctonia susceptible check had 26% of its root area covered in rot and 72% of its roots were harvestable. In contrast, the resistant check had only 6% rot and 88% of its roots were harvestable. Based on root rot, disease index, and harvestable roots, five entries (2, 3, 7, 12, and 27) were also significantly better than the susceptible check and not different from the resistant check. These resistant entries along with some of the other better performing entries should be evaluated again since they may serve as a starting point for identifying additional sources of resistance to *R. solani*. *Rhizoctonia* resistance in sugar beet is considered a multi-gene trait and thus some of the other lines that performed well may contain a smaller complement of resistance genes.

| Entry[z] | Line | Description | Disease index (0-7)[y] | Healthy (% in 0-1) | Harvestable (% in 0-3) | Root rot (%) |
|---|---|---|---|---|---|---|
| NIC | B-74 | non-inoculated susceptible sugar beet check | 0.0 i | 100 a | 100 a | 0 k |
| 2 | K23Rcs2 | EL57_2022 field selected_2 | 0.4 hi | 86 a-c | 98 ab | 3 jk |
| 12 | K23Rcs12 | Maritima/KEMS08_3 | 0.4 hi | 86 a-c | 96 ab | 3 jk |
| 3 | K23Rcs3 | EL57_2022 field selected_3 | 0.9 g-i | 66 b-i | 96 ab | 4 jk |
| 7 | K23Rcs7 | EL57_2022 field selected_7 | 0.6 g-i | 84 a-c | 94 a-c | 5 i-k |
| 10 | K23Rcs10 | Maritima/KEMS08_1 | 0.7 g-i | 78 a-f | 92 a-d | 5 i-k |
| 27 | K23Rcs27 | Maritima/KEMS08_18 | 0.6 g-i | 85 a-c | 94 a-c | 6 i-k |
| R3 | B-80 | resistant sugar beet check | 0.7 g-i | 82 a-e | 88 a-e | 6 i-k |
| 16 | K23Rcs16 | Maritima/KEMS08_7 | 0.6 g-i | 83 a-d | 92 a-d | 7 i-k |
| 11 | K23Rcs11 | Maritima/KEMS08_2 | 0.6 g-i | 87 ab | 89 a-e | 7 h-k |
| 20 | K23Rcs20 | Maritima/KEMS08_11 | 0.9 f-h | 77 a-f | 89 a-e | 8 h-k |
| 4 | K23Rcs4 | EL57_2022 field selected_4 | 0.9 f-h | 75 b-g | 88 a-e | 8 h-k |
| 14 | K23Rcs14 | Maritima/KEMS08_5 | 1.4 e-h | 61 c-k | 88 a-e | 11 g-k |
| 17 | K23Rcs17 | Maritima/KEMS08_8 | 1.4 e-h | 59 d-k | 88 a-e | 13 f-k |
| 24 | K23Rcs24 | Maritima/KEMS08_15 | 1.7 e-h | 57 e-l | 83 a-f | 15 f-k |
| 8 | K23Rcs8 | EL57_2022 field selected_8 | 1.3 e-h | 70 b-h | 80 a-f | 15 f-k |
| 6 | K23Rcs6 | EL57_2022 field selected_6 | 1.4 e-h | 73 b-g | 78 b-f | 19 e-j |
| 26 | K23Rcs26 | Maritima/KEMS08_17 | 1.7 d-g | 62 c-j | 73 c-f | 20 e-j |
| 19 | K23Rcs19 | Maritima/KEMS08_10 | 1.9 c-f | 56 f-l | 70 e-h | 20 e-j |
| 25 | K23Rcs25 | Maritima/KEMS08_16 | 1.9 c-f | 54 f-m | 73 c-f | 21 e-i |
| 28 | K23Rcs28 | Maritima/KEMS08_19 | 1.9 c-f | 63 b-j | 70 e-h | 25 d-h |
| R2 | Crystal 539R | susceptible sugar beet check | 2.3 b-e | 51 g-m | 72 d-g | 26 d-g |
| 22 | K23Rcs22 | Maritima/KEMS08_13 | 2.2 b-e | 55 f-m | 68 e-h | 29 c-f |
| 29 | K23Rcs29 | Maritima/KEMS08_20 | 2.6 a-d | 42 i-o | 62 f-i | 30 b-f |
| 23 | K23Rcs23 | Maritima/KEMS08_14 | 2.6 a-d | 47 h-n | 63 f-i | 33 b-e |
| 1 | K23Rcs1 | EL57_2022 field selected_1 | 3.2 a-c | 30 m-p | 50 h-j | 40 a-d |
| 21 | K23Rcs21 | Maritima/KEMS08_12 | 3.4 a-c | 25 n-p | 51 g-j | 41 a-d |
| 15 | K23Rcs15 | Maritima/KEMS08_6 | 3.5 a-c | 32 l-p | 52 g-j | 45 a-c |
| 5 | K23Rcs5 | EL57_2022 field selected_5 | 3.4 a-c | 37 k-p | 50 h-j | 45 a-c |
| 18 | K23Rcs18 | Maritima/KEMS08_9 | 3.3 a-c | 39 j-p | 46 i-k | 47 ab |
| 9 | K23Rcs9 | EL57_2022 field selected_9 | 4.4 ab | 20 op | 38 jk | 56 a |
| 13 | K23Rcs13 | Maritima/KEMS08_4 | 4.3 a | 14 p | 28 k | 56 a |
| $P > F$[x] | | | <0.0001 | <0.0001 | <0.0001 | <0.0001 |
| LSD | | | Trans | 25 | 22 | 18 |

[z]All lines were *Beta vulgaris* subsp. *vulgaris*. Two commercial cultivars (R2 and R3) were included as checks. B-74 was included as a non-inoculated check (NIC).

[y]Root rot = the percent of root surface area covered by fungal growth or rot was determined on 10 roots per plot. Percentage root rot was also converted to a categorical scale of 0-7 (0 = healthy and 7 = dead) as suggested by Ruppel et al. (Plant Dis. Reptr. 63:518-522). The percentage of healthy (0-1 categories) and harvestable (0-3 categories) roots were determined as well.

[x]*P* > F was the probability associated with the F value. Except for the categorical root ratings, data were analyzed in SAS (Ver. 9.4) using the general linear model (Proc GLM) procedure, and Fisher's protected least significant difference (LSD; $\alpha = 0.05$) was used for mean comparisons. The categorical root ratings were rank transformed (Trans) prior to analysis with mixed linear models (Proc MIXED) and mean separation was based on PDIFF ($\alpha = 0.05$). For transformed data, the non-transformed means have been presented in the table.