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

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Commercial sugar beet cultivars evaluated for rhizomania resistance and storability in Idaho, 2022.

Twenty-five commercial sugar beet (*Beta vulgaris* L.) cultivars and two rhizomania susceptible check cultivars were evaluated in a sprinkler-irrigated sugar beet field near Kimberly, ID where barley was grown in 2021. The trial was conducted in a field that contained Portneuf silt loam soil and relied on natural infection for rhizomania development. The field was plowed and fertilized (110 lb N and 160 lb P_2O_5/A) and roller harrowed on 6 Apr 22. The plots were planted on 2 May to a density of 51,840 seeds/A. Plots were four rows (22-in. between-row spacing) and 24-ft long. The experimental design was a randomized complete block design with six replications. The crop was managed according to standard cultural practices in southern Idaho. The plots were rated for rhizomania foliar symptom (percentage of plants with yellow, stunted, upright leaves) development on 15 Aug. The plants were mechanically topped to remove foliage and the center two rows were dug with a mechanical harvester on 3-4 Oct. At harvest, the roots were evaluated for rhizomania symptoms using a scale of 0 to 9 (0 = healthy and 9 = dead; Plant Dis. 93:632-638). The percent sucrose at harvest was established based on two eight-root samples from each plot. The samples were submitted to The Amalgamated Sugar Co. Tare Lab (determined percent sucrose, conductivity, nitrates, and tare). At harvest, eight roots per plot were also placed in a mesh onion bag, weighed, and placed in an indoor commercial sugar beet storage facility in Paul, ID on 5 Oct set to hold 34°F. On 14 Mar 23, roots were retrieved after 152 days in storage and evaluated for surface root rot (% of root surface area), weight, and percent sucrose using high performance liquid chromatography (Plant Dis. 92:581-587). Only samples from the same plot were compared when establishing percent reduction in sucrose at harvest versus storage. Except for the root ratings, data were analyzed using the general linear models procedure (Proc GLM-SAS 9.4), and Fisher's protected least significant difference (LSD; $\alpha = 0.05$) was used for mean comparisons. The foliar rating data were arc sine square root transformed prior to analysis. The root ratings were analyzed in a nonparametric analysis as described by Shah and Madden (Phytopathology 94:33-43).

Root rots and other disease problems other than rhizomania were not evident in the plot area. There were significant differences among cultivars for all variables. Rhizomania was uniform based on foliar symptoms (100%) in the susceptible checks, BTS4D20 and C-209. Most cultivars exhibited some rhizomania resistance based on foliar symptoms, since they had 0 to 7% susceptible plants. However, entries C-59, HIL2384, and HM126457 had root ratings that were not significantly different from at least one of the susceptible checks. The highest average root yield for any cultivar was 43.31 t/A, which was similar to Idaho's average of 38.1 t/A (USDA-National Ag. Stat. Service). The primary fungal growth in storage were an *Athelia*-like basidiomycete (Mycologia 104:70-78), *Botrytis cinerea* Pers., and *Penicillium* spp. (*P. expansum* Link and *P. cellarum* C.A. Strausb. & Dugan). After 152 days in storage, surface root rot ranged from 11 to 87%, weight loss ranged from 11.8 to 23.5%, sucrose reduction ranged from 28 to 87%, and estimated recoverable sucrose (ERS) after storage ranged from 376 to 8,159 lb/A. Given these response ranges, selecting cultivars for rhizomania resistance and combining this resistance with storability will lead to considerable economic benefit for the sugar beet industry. If cultivars with the highest sucrose reduction are considered for production in the future, they should only be directly processed (early harvest cultivars) and not stored based on data for root rot and sucrose reduction.

Cultivar [z]	Rhizomania rating[y]		Surface root rot (%)[x]	Weight reduction (%)[w]	Root yield (t/A)	ERS at harvest (lb/A)[v]	Sucrose reduction (%)[u]	ERS after storage (lb/A)
	Foliar (%)	Root						
HIL2357NT	1 c	2.3 f	12 mn	12.3 hi	38.62 b-f	11,416 b-d	28 m	8,159 a
HIL2356NT	1 c	2.5 de	11 n	11.8 i	36.81 e-h	10,670 d-h	29 lm	7,609 ab
SX036	0 c	2.2 fg	18 j-n	16.3 c-g	39.70 b-d	11,571 b	35 k-m	7,507 ab
B-66	0 c	2.3 f	14 k-n	13.6 e-i	38.26 c-f	11,278 b-d	34 k-m	7,424 a-c
C-49	0 c	2.2 fg	23 i-m	16.1 c-h	38.54 b-f	11,292 b-d	35 k-m	7,366 a-c
B-74	0 c	2.3 f	36 f-h	13.6 e-i	38.24 c-f	11,171 b-d	36 k-m	7,195 a-d
SV039	0 c	2.3 f	24 i-k	13.5 e-i	38.71 b-e	11,609 b	38 i-k	7,159 b-d
SV038	0 c	1.8 h	21 j-n	12.6 g-i	43.31 a	12,742 a	46 g-i	6,894 b-e
B-69	0 c	2.2 fg	24 i-k	13.1 f-i	39.83 bc	11,486 bc	41 h-k	6,807 b-e
SX040	7 b	2.4 ef	12 l-n	13.0 f-i	37.22 e-g	10,682 d-h	37 j-l	6,670 b-f
SV036	0 c	2.1 gh	21 j-n	15.0 c-i	40.60 b	12,391 a	46 g-i	6,642 b-f
C-56	0 c	2.5 de	33 f-i	18.7 bc	36.91 e-h	10,957 b-f	40 h-k	6,519 c-f
C-58	0 c	2.4 ef	28 g-j	17.9 b-d	37.50 d-g	11,081 b-e	41 h-k	6,518 d-f
C-61	0 c	2.5 de	24 i-l	16.9 c-f	36.50 f-h	10,754 c-g	40 h-k	6,444 d-g
SX037	0 c	2.8 b-d	19 j-n	13.0 f-i	34.14 i-k	9,941 h-j	36 k-m	6,382 d-h
HIL2355NT	1 c	2.2 fg	16 k-n	13.9 e-i	38.39 c-f	11,190 b-d	45 g-j	6,086 e-h
C-62	0 c	2.4 ef	26 h-k	16.3 c-g	37.35 e-g	10,958 b-f	48 f-h	5,694 f-h
B-81	0 c	2.6 cd	41 ef	14.7 d-i	34.22 ij	10,280 f-i	46 g-i	5,509 gh
B-78	0 c	2.4 ef	37 fg	15.1 c-i	37.23 e-g	10,983 b-f	51 e-g	5,433 h
HIL2384	5 b	2.8 b-d	37 f-h	17.1 b-e	33.33 jk	9,626 ij	56 d-f	4,203 i
HIL9916	3 b	2.6 cd	33 f-i	15.4 c-i	34.97 h-j	10,003 g-j	57 de	4,179 i
C-59	0 c	2.9 a-c	50 de	14.7 d-i	32.00 k	9,409 j	62 cd	3,576 ij
B-80	0 c	2.5 de	34 f-i	13.4 e-i	35.60 g-i	10,345 e-i	72 b	2,878 jk
HM125891	0 c	2.4 ef	55 cd	17.1 b-e	37.85 c-f	9,483 j	70 bc	2,792 jk
HM126457	7 b	3.2 ab	64 bc	23.5 a	27.85 l	8,032 k	72 b	2,282 k
BTS4D20	100 a	4.0 ab	75 b	20.8 ab	24.51 m	6,065 l	82 a	1,067 l
C-209	100 a	5.0 a	87 a	18.8 bc	13.29 n	3,006 m	87 a	376 l
$P > F$[t]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
LSD (α = 0.05)	Trans	Trans	12	3.9	2.20	755	8	981

[z] For more information on coded cultivars, contact the following companies: B = Betaseed Inc., C = ACH Seeds Inc., HM and HIL = Hilleshog, SV = SESVanderHave, and SX = Seedex. Rhizomania susceptible check cultivars were BTS4D20 and C-209.

[y] Foliar = percentage of foliage in plot with rhizomania symptoms on 15 Aug. Root = roots were evaluated for rhizomania using a scale of 0 to 9 (0 = healthy, 9 = dead; Plant Dis. 93:632-638) at harvest.

[x] Surface root rot = percentage of root surface area discolored in storage.

[w] Weight reduction = difference in weight from harvest to the end of storage.

[v] ERS = estimated recoverable sucrose was calculated as extraction x 0.01 x gross sucrose and extraction = 250 + [1255.2 x (conductivity -15000) x (percent sucrose - 6185)]/(percent sucrose x [98.66 - (7.845 x conductivity)]).

[u] Sucrose reduction (%) = (1-(((% $\text{Sucrose}_{\text{storage sample}}$ − 1.395) x $\text{Weight}_{\text{storage sample}}$)/(% $\text{Sucrose}_{\text{harvest sample}}$ x $\text{Weight}_{\text{harvest sample}}$))) x 100.

[t] $P > F$ was the probability associated with the F value. Within each variable (except for root ratings), means followed by the same letter did not differ significantly based on Fisher's protected least significant difference (LSD; α = 0.05). Mean separation for the root ratings was based on PDIFF (α = 0.05). Trans = the foliar data were arc sine square root transformed and the root rating data were rank transformed prior to analysis, but the non-transformed means are presented in the table.