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

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Commercial sugar beet cultivars evaluated for rhizomania resistance and storability in Idaho, 2015.

Twenty-eight commercial sugar beet cultivars and two rhizomania susceptible check cultivars were evaluated in a sprinkler-irrigated sugar beet field near Kimberly, ID where barley was grown in 2014. The trial was conducted in a field that contained Portneuf silt loam soil and relied on natural infection for rhizomania development. The field was fall plowed and in the spring, fertilized (90 lb N and 110 lb P_2O_5/A) and roller harrowed on 9 Apr 15. The plots were planted on 20 Apr to a density of 142,560 seeds/A, and thinned to 47,520 plants/A on 30 May. Plots were four rows (22-in. 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 20 Jul. The plants were mechanically topped and the center two rows were dug with a mechanical harvester on 28-29 Sep. At harvest, the roots were evaluated for rhizomania using a scale of 0 to 9 (0 = healthy and 9 = dead) in a continuous manner. 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 29 Sep set to hold 34°F. On 12 Feb 16, roots were retrieved after 136 days in storage and evaluated for surface root rot (% of root surface area), weight, and percent sucrose using gas chromatography (Plant Dis. 92:581-587). Only samples from the same plot were compared when establishing percent reduction in sucrose at harvest versus storage. Data were analyzed using the general linear models procedure (Proc GLM-SAS 9.4), and Fisher's protected least significant difference (LSD; α = 0.05) was used for mean comparisons.

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 rhizomania resistance similar to the resistant checks, with the worst foliar rating being only 3% susceptible plants. HM-126457 and HM-13038121were the highest ranking cultivars for rhizomania root rating, but were still significantly better than the susceptible checks. The highest average root yield for any cultivar was 38.1 t/A, which was the same as Idaho's average of 38.1 t/A (USDA-National Ag. Stat. Service). The primary fungal growth was an *Athelia*-like basidiomycete (Mycologia 104:70-78), but *Botrytis cinerea* and *Penicillium* spp. were also frequently present. After 136 days in storage, surface root rot ranged from 13 to 81%, weight loss ranged from 9.2 to 21.0%, sucrose losses ranged from 24 to 89%, and estimated recoverable sucrose (ERS) after storage ranged from 439 to 8,057 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 observations for root rot and sucrose losses.

Cultivar [z]	Rhizomania rating [y] Foliar (%)	Root	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)
C-36	0 e	2.2 h-k	13 k	10.5 h-k	35.67 b-e	11,147 b-e	28 lm	8,057 a
SV025	1 d	2.3 d-i	14 jk	9.2 k	33.76 e-j	11,090 b-f	31 k-m	7,610 ab
SV026	0 e	2.1 j-l	18 jk	9.7 jk	37.42 ab	12,234 a	39 h-k	7,538 a-c
B-46	0 e	2.3 d-h	17 jk	9.9 i-k	30.36 l	9,840 h-j	24 m	7,443 a-c
SV016	1 d	2.2 e-j	26 g-k	10.9 f-k	34.54 d-i	11,203 b-e	40 h-k	6,739 b-d
SX021	0 e	2.2 g-k	21 h-k	13.7 b-f	35.24 b-f	11,410 bc	41 g-k	6,710 b-d
B-56	2 c	2.2 d-j	19 i-k	10.8 g-k	33.13 f-k	10,484 e-h	36 j-l	6,674 b-e
SV010	2 c	2.2 d-i	21 h-k	13.3 b-h	32.80 h-k	10,409 f-h	37 i-k	6,562 b-e
B-110	1 d	2.3 d-g	26 g-k	11.0 f-k	31.81 j-l	9,992 g-i	35 j-m	6,472 b-e
C-29	0 e	2.3 d-i	36 d-g	10.6 h-k	33.67 e-j	10,926 c-f	41 g-k	6,471 b-e
SX028	2 c	2.2 f-j	36 e-i	10.7 h-k	34.86 d-i	11,358 b-d	44 g-j	6,370 b-f
SX026	1 d	2.2 f-j	30 g-j	12.7 c-i	34.71 d-i	11,088 b-f	43 g-k	6,310 c-f
B-7	0 e	2.2 e-j	26 g-k	14.7 bc	32.98 g-k	10,388 f-h	40 h-l	6,292 c-f
HM-12SYN003	1 d	2.2 g-k	21 h-k	13.3 b-h	36.30 a-d	10,421 f-h	40 h-k	6,281 c-f
C-34	0 e	2.2 e-j	28 g-k	11.5 d-k	33.22 f-k	10,505 e-h	42 g-k	6,037 d-g
C-48	0 e	2.2 e-j	35 f-i	13.9 b-e	34.52 d-i	10,950 c-f	46 f-j	5,970 d-g
HM-125891	1 d	2.0 l	42 c-g	13.5 b-g	38.09 a	10,854 c-f	47 f-j	5,757 d-h
SV012	2 c	2.3 d-h	22 h-k	13.6 b-g	32.85 h-k	10,490 e-h	46 f-j	5,652 d-h
SX027	1 d	2.4 d	24 h-k	11.2 e-k	31.26 kl	9,806 h-j	43 g-k	5,631 d-i
B-48	2 c	2.3 d-h	22 h-k	12.5 c-j	32.78 i-k	10,677 d-g	49 e-h	5,431 e-j
HM-118711	3 b	2.3 d-h	30 g-j	14.7 bc	35.11 c-g	10,742 c-f	52 d-g	5,141 f-k
C-204	0 e	2.0 kl	40 c-g	14.4 bc	37.14 a-c	11,696 ab	57 d-f	5,002 g-l
HM-126457	1 d	2.6 c	55 bc	14.9 bc	27.99 m	8,886 kl	48 f-i	4,684 h-l
HM-13038121	1 d	2.6 c	52 b-e	15.8 b	27.23 m	8,565 l	49 e-h	4,380 i-l
C-47	2 c	2.1 i-l	55 bc	14.4 bc	34.99 c-h	10,842 c-f	61 c-e	4,254 j-l
HM-103425	3 b	2.4 de	53 b-d	14.0 b-d	32.66 i-k	9,521 i-k	57 d-f	4,103 kl
C-39	1 d	2.3 d-h	47 c-e	14.1 b-d	31.93 j-l	9,907 hi	62 cd	3,765 lm
B-43	2 c	2.3 d-f	66 ab	15.7 b	31.16 kl	9,157 j-l	70 bc	2,710 m
BTS4D20	100 a	4.2 b	64 b	19.0 a	21.66 n	6,133 m	80 ab	1,272 n
C-209	100 a	4.8 a	81 a	21.0 a	14.61 o	3,867 n	89 a	439 n
Overall mean	8	2.4	35	13.2	32.48	10,153	47	5,525
P > F [t]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
LSD (α = 0.05)	1	0.2	17	2.8	2.21	722	12	1,271

[z] For more information on coded cultivars, contact the following companies: B = Betaseed Inc., C = ACH Seeds Inc., HM = 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 20 Jul. Root = roots were evaluated for rhizomania using a scale of 0 to 9 (0 = healthy, 9 = dead; Plant Dis. 93:632-638) in a continuous manner 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-(((% Sucrose$_{storage\ sample}$ – 1.395) x Weight$_{storage\ sample}$)/(% Sucrose$_{harvest\ sample}$ x Weight$_{harvest\ sample}$))) x 100.

[t] P > F was the probability associated with the F value. Within each variable, means followed by the same letter did not differ significantly based on Fisher's protected least significant difference (LSD; α = 0.05).