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

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

Thirty-two experimental 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, Paul, IDto determine 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; $\alpha = 0.05$) was used for mean comparisons.

Root rots and other disease problems other than rhizomania were not evident in the plot area based on visual observations. There were significant differences among cultivars for all variables. Rhizomania was uniform based on foliar symptoms (100% susceptible) 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. SYN15704 was the highest ranking cultivar for rhizomania root rating, but was still significantly better than the susceptible checks. The highest average root yield for any cultivar was 39.14 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 on sugar beet 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 8 to 81%, weight loss ranged from 8 to 21%, sucrose losses ranged from 25 to 89%, and estimated recoverable sucrose (ERS) after storage ranged from 439 to 8,261 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 (%)	Rhizomania rating[y] 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)
SX030	0 e	2.0 k-m	20 g-i	8.0 j	37.32 a-d	11,948 a-d	31 j-n	8,261 a
B-71	0 e	2.1 i-m	20 g-i	8.8 h-j	36.23 c-f	11,822 a-d	31 k-n	8,198 a
C-49	0 e	2.1 h-m	12 hi	9.9 f-j	36.86 b-e	11,982 a-d	33 i-n	7,975 ab
B-70	0 e	2.2 f-m	14 hi	8.9 h-j	34.71 f-i	11,268 d-f	30 l-n	7,918 ab
SX032	3 b	2.4 de	15 hi	11.1 d-i	31.61 k-o	10,513 g-i	27 mn	7,715 a-c
SYN15702	1 d	2.4 d	8 i	8.4 ij	31.50 l-o	10,161 g-j	25 n	7,602 a-c
B-72	0 e	2.2 f-l	15 hi	10.3 e-j	34.65 f-j	11,456 b-e	36 h-n	7,324 a-d
B-69	0 e	2.1 j-m	26 f-h	12.3 c-g	37.05 a-e	11,794 a-d	38 h-m	7,319 a-d
C-51	0 e	2.1 h-m	20 g-i	11.1 d-i	35.54 d-g	11,314 c-f	36 h-n	7,270 a-e
SV028	0 e	2.2 e-k	24 f-h	13.4 cd	35.62 d-g	11,476 b-e	39 g-m	7,009 a-f
SV029	0 e	2.3 d-h	20 g-i	13.0 c-e	35.17 e-h	11,396 c-e	39 h-m	7,001 a-f
C-50	0 e	2.0 m	34 d-g	10.3 e-j	39.14 a	12,322 a	44 c-j	6,940 a-g
SX031	0 e	2.0 k-m	19 g-i	12.2 c-g	36.97 b-e	12,127 ab	45 c-i	6,686 b-h
SV030	0 e	2.3 d-h	26 f-h	11.0 d-i	33.59 g-l	10,790 e-g	39 f-m	6,564 b-h
SYN15503	2 c	2.3 d-i	45 c-e	12.9 c-e	33.54 g-m	10,802 e-g	41 e-l	6,439 c-h
B-66	0 e	2.2 h-m	26 f-h	12.4 c-f	36.24 c-f	11,994 a-c	46 c-h	6,439 c-h
SYN15705	2 c	2.3 d-g	22 f-i	11.1 d-i	33.17 h-n	9,999 h-j	36 h-n	6,411 c-h
SYN15502	0 e	2.3 d-i	23 f-i	13.6 cd	33.61 g-k	10,050 h-j	37 h-n	6,342 c-i
SYN15706	0 e	2.3 d-g	28 f-h	9.5 g-j	31.92 k-o	10,100 g-j	39 f-m	6,143 d-j
SYN15704	0 e	2.6 c	16 hi	12.5 c-f	28.99 p	8,633 l	32 j-n	5,899 d-j
SYN15703	3 b	2.4 d	16 hi	11.6 c-h	31.27 no	9,652 jk	39 f-m	5,878 e-j
SYN15501	1 d	2.3 d-g	21 g-i	11.6 c-h	32.78 i-m	9,887 i-k	42 e-l	5,731 f-j
SYN15505	0 e	2.4 d	23 f-i	12.0 c-g	30.36 op	9,224 kl	38 h-m	5,663 f-j
SYN15709	1 d	2.4 d-f	17 g-i	14.2 c	31.48 m-o	9,737 jk	43 d-k	5,532 g-k
SYN15707	2 c	2.0 m	50 b-d	11.3 c-i	37.16 a-e	11,375 c-e	52 b-f	5,516 g-k
SYN15710	1 d	2.0 k-m	57 bc	13.3 cd	37.75 a-c	11,350 c-e	53 b-e	5,385 h-k
B-67	0 e	2.0 lm	40 c-f	12.2 c-f	38.51 ab	11,908 a-d	56 bc	5,331 h-k
B-65	0 e	2.1 j-m	56 bc	11.6 c-h	36.75 b-f	11,871 a-d	56 bc	5,261 h-k
SYN15504	0 e	2.3 d-i	29 e-h	13.3 cd	33.02 i-n	10,146 g-j	51 b-g	4,954 i-k
SYN15708	0 e	2.4 d-f	34 d-g	11.5 c-h	32.59 j-m	9,990 h-j	52 b-e	4,881 jk
SYN15701	1 d	2.2 g-m	28 e-h	17.7 b	36.06 c-f	10,606 f-h	54 b-d	4,859 jk
B-68	2 c	2.2 d-j	51 b-d	11.3 c-i	33.39 h-m	10,220 g-j	60 b	4,136 k
BTS4D20	100 a	4.2 b	64 ab	19.0 a	21.66 q	6,133 m	80 a	1,272 l
C-209	100 a	4.8 a	81 a	21.0 a	14.61 r	3,867 n	89 a	438 l
Overall mean	6	2.4	29	12.1	33.55	10,527	44	6,068
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	2.9	2.11	719	13	1,440

[z] For more information on coded cultivars, contact the following companies: B = Betaseed Inc., C = ACH Seeds Inc., SYN = Syngenta, SV = SESVanderHave, and SX = Seedex. Rhizomania susceptible check cultivars were B-54 and C-209.

[y] Foliar = percentage of foliage in plot with rhizomania symptoms on 23 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-(((% $\text{Sucrose}_{\text{storage sample}}$ – 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, means followed by the same letter did not differ significantly based on Fisher's protected least significant difference (LSD; α = 0.05).