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

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Experimental sugar beet cultivars evaluated for rhizomania resistance and storability in Idaho, 2013.

Twenty-four experimental sugar beet cultivars and five commercial check cultivars were evaluated in a sprinkler-irrigated sugar beet field near Kimberly, ID where barley was grown in 2012. 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 19 Apr 13. The plots were planted on 23 Apr to a density of 142,560 seeds/A, and thinned to 47,520 plants/A on 15 May. Plots were four rows (22-in. row spacing) and 24 ft long. The experimental design was a randomized complete block design with four replications. The crop was managed according to standard cultural practices. The plot was rated for the percentage of plants with foliar rhizomania symptoms on 22 Jul. The plants were mechanically topped and the center two rows were dug with a mechanical harvester on 11 Oct. 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 11 Oct set to hold 34°F. On 10 Feb 14, roots were retrieved after 123 days in storage and evaluated for surface root rot (% of root surface area), weight, and percent sucrose (via gas chromatography). 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), 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. There were significant differences among cultivars for all variables. Rhizomania was uniform based on foliar symptoms (98% susceptible) in the susceptible check, B-103. All cultivars exhibited good rhizomania resistance based on both foliar and root ratings. Root yield averaged 41.3 t/A, which was similar to Idaho's average of 36.2 t/A (USDA-National Ag. Stat. Service) and also indicates rhizomania resistance was adequate. The primary fungal growth was an *Athelia*-like Basidiomycete (Mycologia 104:70-78), but *Botrytis cinerea*, *Penicillium* sp., and *Phoma betae* were also frequently present. After 123 days in storage, surface root rot ranged from 7 to 76%, weight loss ranged from 6.6 to 11.6%, sucrose losses ranged from 32 to 66%, and estimated recoverable sucrose (ERS) ranged from 1,643 to 8,308 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. A number of entries performed better than some of the commercial checks indicating the seed companies are making progress in developing better cultivars.

Cultivar[y]	Rhizomania rating[z]		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						
12SYN003	0 f	2.1 f-i	23 e-i	8.0 c-h	46.1 ab	12,597 a-e	34 ef	8,308 a
SX026	2 d-f	2.2 c-i	18 e-i	8.7 b-h	44.7 a-e	13,401 ab	39 d-f	8,208 ab
SX025	0 f	2.0 hi	11 g-i	7.8 f-h	46.9 a	13,378 ab	39 d-f	8,175 ab
C-37	0 f	2.2 e-i	20 e-i	6.8 gh	46.3 ab	13,579 a	41 d-f	8,044 a-c
B-55	0 f	2.4 b-e	16 e-i	6.6 h	42.4 c-g	12,217 c-h	36 ef	7,876 a-d
B-56	0 f	2.4 b-g	31 c-h	6.6 h	41.5 e-h	12,108 c-i	36 ef	7,743 a-e
SYN 13069253	0 f	2.4 b-f	18 e-i	8.6 b-h	39.2 g-i	11,387 f-l	32 f	7,722 a-e
C-29	0 f	2.2 d-i	22 e-i	10.2 a-f	42.0 c-g	11,997 d-i	36 ef	7,663 a-e
SYN 13069251	0 f	2.1 f-i	10 hi	8.3 b-h	45.4 a-c	13,205 a-c	42 d-f	7,594 a-e
SYN 13069255	0 f	2.4 b-g	14 f-i	8.5 b-h	37.1 i	10,626 kl	35 ef	6,938 a-f
SYN 13069256	0 f	2.2 d-i	10 hi	10.6 a-d	41.8 d-g	11,274 g-l	40 d-f	6,778 b-f
SYN 13069257	2 b-e	2.5 b-d	30 c-h	9.6 a-g	40.5 f-i	11,087 h-l	39 d-f	6,766 b-f
SX027	0 f	2.4 b-f	13 f-i	7.8 e-h	40.7 f-h	12,283 b-g	45 c-e	6,724 b-g
B-7	3 b-d	2.5 bc	7 i	9.0 a-h	39.3 g-i	11,049 i-l	40 d-f	6,666 c-g
M 13069301	0 f	2.3 b-i	27 d-i	9.0 a-g	41.0 f-h	10,551 l	39 d-f	6,429 d-h
C-38	0 f	2.4 b-e	25 e-i	7.9 d-h	39.1 g-i	11,598 e-l	45 c-e	6,311 e-i
SV020	0 f	2.2 d-i	37 c-e	7.4 f-h	40.6 f-i	10,588 l	45 c-e	5,860 f-j
HH016	1 d-f	2.3 b-h	33 c-f	10.6 a-e	43.0 b-f	11,362 g-l	50 b-d	5,655 f-k
SV021	1 ef	2.2 c-i	32 c-f	8.4 b-h	41.9 c-g	12,533 a-f	56 a-c	5,621 f-i
HM 118711	1 ef	2.4 b-e	51 bc	10.8 a-c	38.2 hi	10,497 l	50 b-d	5,236 g-l
SYN 13069252	0 f	2.0 i	32 c-g	7.6 f-h	46.9 a	12,299 b-g	59 ab	5,066 h-l
M 125594	0 f	2.6 b	17 e-i	8.9 a-h	40.5 f-i	11,793 d-j	58 ab	4,909 i-l
C-39	4 b	2.1 f-i	34 c-f	9.1 a-h	45.1 a-d	12,856 a-d	63 a	4,771 j-l
SV019	0 f	2.2 d-i	65 ab	9.9 a-f	40.9 f-h	11,152 g-l	60 ab	4,429 j-l
SV018	2 b-e	2.1 g-i	74 a	9.1 a-h	45.1 a-d	12,066 c-i	64 a	4,373 j-l
HM 124268	4 bc	2.4 b-e	50 bc	7.7 f-h	38.1 hi	10,807 k-l	60 ab	4,281 kl
M 13069302	0 f	2.2 c-i	76 a	11.6 a	39.9 f-i	10,846 j-l	63 a	4,042 l
SX024	2 c-f	2.2 d-i	62 ab	8.9 a-h	43.1 b-f	11,738 d-k	66 a	4,017 l
B-103	98 a	3.85 a	47 b-d	11.0 ab	19.2 j	4,802 m	66 a	1,643 m
Overall mean	4	2.3	31	8.8	41.3	11,575	47	6,133
$P > F$[t]	<0.0001	<0.0001	<0.0001	0.0233	<0.0001	<0.0001	<0.0001	<0.0001
LSD	2	0.3	21	2.8	3.5	1,148	12	1,501

[z] Foliar = percentage of foliage in plot with rhizomania symptoms on 22 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.

[y] For more information on coded cultivars, contact the following companies: B = Betaseed Inc., C = ACH Seeds Inc., HH = Holly Hybrids, HM = Hilleshog, M = Maribo, SV = SESVanderHave, SX = Seedex, and SYN = Syngenta. The commercial checks (B-7, C-29, HH016, and HM 118711) and the rhizomania susceptible check cultivar (B-103) are in bold print.

[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; $\alpha = 0.05$).