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

C. A. Strausbaugh, USDA-ARS NWISRL, 3793 N. 3600 E., Kimberly, ID 83341

Commercial sugar beet cultivars evaluated for rhizomania resistance and storability in Idaho, 2017.

Twenty-six 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 2016. The trial was conducted in a field that contained Portneuf silt loam soil and relied on natural infection for rhizomania development. In the spring the field was plowed and fertilized (90 lb N and 110 lb P_2O_5/A) and roller harrowed on 11 Apr 17. The plots were planted on 4 May to a density of 142,560 seeds/A, and thinned to 47,520 plants/A on 3 Jun. 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 21 Aug. The plants were mechanically topped and the center two rows were dug with a mechanical harvester on 2-3 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 (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 3 Oct set to hold 34°F. On 26 Feb 18, roots were retrieved after 147 days in storage and evaluated for the percentage of rotted 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. 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 data were arc-sine square root transformed and the root rating was rank transformed prior to analysis, but the non-transformed means are presented in the table.

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. The cultivars exhibited rhizomania resistance based on foliar symptoms, although entries B-7 and SV012 would be questionable for production with 6% of the plants exhibiting foliar symptoms. All cultivars were also rhizomania resistant based on root rating of 3.0 or lower. The highest average root yield for any cultivar was 42.4 t/A, which was similar to Idaho's average of 39.2 t/A (USDA-National Ag. Stat. Service). The primary fungal growth was an *Athelia*-like basidiomycete (Mycologia 104:70-78), but *Botrytis cinerea* Pers. and *Penicillium* spp. (*P. expansum* Link and *P. cellarum* C.A. Strausb. & Dugan) were also frequently present. After 147 days in storage, surface root rot ranged from 10 to 85%, weight loss ranged from 14 to 28%, sucrose reduction ranged from 25 to 87%, and estimated recoverable sucrose (ERS) after storage ranged from 596 to 9,111 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 losses.

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						
B-71	0 f	2.2 k-n	18 j-m	14.7 ij	40.8 a-f	12,523 a-c	27 k	9,111 a
B-69	0 f	2.2 i-n	17 k-m	14.4 j	40.5 a-g	11,868 c-f	25 k	8,897 a
B-66	0 f	2.1 l-n	16 lm	16.4 d-j	42.0 ab	12,794 a	33 i-k	8,595 ab
C-49	0 f	2.2 j-n	20 i-m	17.2 d-j	40.7 a-f	12,260 a-d	32 jk	8,402 a-c
SV028	0 f	2.2 f-l	30 f-j	16.6 d-j	39.5 b-h	12,125 a-e	31 jk	8,359 a-c
B-46	0 f	2.2 f-l	17 k-m	18.8 c-g	39.0 c-i	11,942 c-f	31 jk	8,204 a-c
B-7	6 b	2.4 b-e	15 lm	17.6 d-j	36.6 ij	10,991 g-i	30 jk	7,659 b-d
C-36	0 f	2.3 c-f	10 m	15.7 g-j	37.7 hi	10,898 h-j	31 jk	7,504 c-e
C-48	0 f	2.2 g-m	18 j-m	16.0 e-j	40.5 a-g	11,922 c-f	37 h-j	7,483 c-e
SV026	1 ef	2.3 e-h	32 d-i	14.9 h-j	39.2 c-h	12,150 a-e	40 f-i	7,228 d-f
SX026	0 f	2.3 e-k	37 d-g	15.6 g-j	38.6 d-i	11,972 b-f	42 f-h	6,909 d-g
HM 118711	3 b-d	2.3 e-i	42 c-e	18.2 c-i	38.2 f-i	10,810 ij	36 h-j	6,877 d-g
SX021	0 f	2.1 mn	35 d-g	16.8 d-j	41.2 a-d	12,721 ab	46 ef	6,840 d-h
SV025	0 f	2.3 c-f	18 k-m	16.3 d-j	38.0 g-i	11,818 c-f	43 f-h	6,771 d-h
C-34	0 f	2.3 e-j	21 h-m	18.3 c-i	38.5 e-i	11,529 d-i	42 f-h	6,689 e-h
SV012	6 bc	2.3 e-j	28 f-k	15.9 f-j	38.5 e-i	11,302 f-i	44 f-h	6,367 f-i
B-48	2 b-d	2.3 d-g	18 j-m	16.7 d-j	37.7 hi	11,450 e-i	45 e-g	6,271 g-i
HM 12SYN003	0 f	2.6 a-d	26 g-l	21.4 bc	34.8 j	9,538 kl	38 g-j	5,927 hi
SX030	0 f	2.2 l-n	32 d-h	17.7 d-j	41.2 a-d	12,529 a-c	53 de	5,891 hi
C-204	0 f	2.1 l-n	39 c-f	19.2 c-g	41.5 a-c	12,062 a-f	53 de	5,659 ij
B-65	0 f	2.1 n	31 e-i	19.8 cd	42.4 a	12,528 a-c	61 bc	4,853 jk
C-47	2 cd	2.2 j-n	44 cd	19.1 c-g	40.6 a-g	11,717 d-g	60 b-d	4,750 jk
HM 125891	0 f	2.3 e-j	58 b	18.5 c-h	38.2 f-i	10,190 jk	57 cd	4,384 kl
C-39	2 de	2.2 h-m	58 b	19.6 c-e	40.9 a-e	11,628 d-h	66 b	4,055 kl
HM 126457	3 b-d	2.8 ab	61 b	18.3 c-i	30.6 k	9,258 l	56 cd	4,044 kl
HM 103425	3 b-d	2.6 a-c	50 bc	19.5 c-f	34.0 j	9,632 kl	61 b-d	3,782 l
BTS4D20	100 a	4.3 a	85 a	23.6 b	21.4 l	5,035 m	87 a	744 m
C-209	100 a	4.9 a	82 a	27.7 a	13.0 m	3,020 n	81 a	596 m
$P > F$[t]	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
LSD (α = 0.05)	Trans	Trans	12	3.6	2.7	768	8	951

[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 (Bold).

[y] Foliar = percentage of foliage in plot with rhizomania symptoms on 21 Aug. 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). Trans = the foliar data were arc-sine square root transformed and root rating was rank transformed prior to analysis, but the non-transformed means are presented in the table.