BEET (*Beta vulgaris* L.)
SEA BEET (*Beta vulgaris* ssp. *maritima*)
SUGAR BEET (*Beta vulgaris* ssp. *vulgaris*)
Rhizoctonia crown and root rot; *Rhizoctonia solani*

L. Panella, T. Vagher, A. L. Fenwick; USDA-ARS, Sugar Beet Research Unit, Crops Research Lab, 1701 Centre Ave., Fort Collins, CO 80526-2083

Rhizoctonia crown and root rot resistance of *Beta* PIs from the USDA-ARS, NPGS, 2011.

Thirty beet (*Beta vulgaris* subsp. *maritima* (L.) Arcang and *Beta vulgaris* subsp. *vulgaris* L.) plant introduction (PI) accessions from the *Beta* collection of the USDA-ARS National Plant Germplasm System were screened for resistance to Rhizoctonia root and crown rot, at the USDA-ARS Fort Collins, CO Research Farm. The rhizoctonia screening nursery in 2011 was a randomized complete-block design with five replications in one-row plots (76 cm row spacing) 4 m long. The field had been planted to sugar beet in 2007 and summer fallowed since then. The soil (Garrett loam, 0 to 1 % slope, pH 7.8) was fumigated with Telone® II in late Oct 2008, for control of soil borne diseases (esp. rhizomania) and pests. Manure was applied 4 days later and the field was roller harrowed in Nov 2008. Field was land leveled in Mar 2011, and bedded a month before planting. Seed was planted on 17 May to moisture and furrow irrigated as needed. No herbicides were used this year. There was a heavy rain right after planting and the field crusted badly. On 24 Jun the decision to replant this experiment was made. The field was rotary hoed on 3 Jul, roto-bedded on 5 Jul, and replanted on 7 Jul. The field was hand weeded on 30 Jul and thinned on 6 Aug. Inoculation with dry, ground, barley grain inoculum of *Rhizoctonia solani* isolate R-9 (AG-2-2 IIIB) was applied to the crown of the plants on 17 Aug at a rate of 5.3 g m^{-1} row. A Gandy® electrically driven applicator was used to apply the inoculum and the field was cultivated afterwards to place soil onto the plant crowns. Beets were harvested 28 Sep with a single row lifter (pulled and cleaned by hand), and each root was rated for rot on a scale of 0 (no damage) to 7 (dead plant with root completely rotted). Average disease severity per plot was determined to create a disease index (DI) for each entry. Analysis of variance was performed in SAS (Ver. 9.2) using Proc GLIMMIX on disease index and mean DI. Data also are represented as the percentage of sugar beet roots in classes 0 through 1, considered as healthy and in classes 0 through 3, considered harvestable. Because the analysis of variance does not group the entries into discrete classes, Dunnett's one-tailed *t*-test was used to compare entries to the resistant check (FC703) and the highly resistant check (FC709-2).

Spring of 2011 in Fort Collins, CO was cool and wet, and there was a heavy rainfall right after the first planting. Because of heavy crusting, a western beet roller was used on 27 May to break up the crust. However, on 8 Jun it rained heavily again and the field received about 7 cm of rain in less than 3 h. There was extremely thick crusting and the field was western beet rolled again on 13 Jun. Emergence remained so poor that the experiment had to be replanted. Moisture was good at replanting and with the warm soil temperatures; the replanted beet developed quickly and were ready for inoculation 41 days later after planting (17 Aug). Temperatures remained high throughout Sep and there was mild to moderate, uniform disease pressure in the replanted experiments. This experiment had mild disease pressure and the sugar beet susceptible control had a DI of only 3.1 (3.0 ≥ is usually considered the point when the line is considered susceptible). Nonetheless two-thirds of the PI accessions (most of which were wild accessions of sea beet, i.e., *B. v.* subspecies *maritima*) showed less resistance than the susceptible check. PI 552534 and lines listed below it in the table (lower DI) were not significantly different from the best performing highly resistant check (FC709-2, DI 1.3) based on Dunnett's one-tailed *t*-test. These plant introductions were all sugar beet germplasm, although none have been selected for resistance to Rhizoctonia root rot. All the lines listed below and PI 504234 in the table (lower DIs) were not significantly different from the resistant check (FC703, DI 1.9). This included three sea beet accessions from Northern Europe. These accessions will be retested and, if the resistance is confirmed, entered into the USDA-ARS Rhizoctonia root rot-resistance breeding program at Fort Collins, CO. These data will be entered into the USDA-ARS, NPGS GRIN database (http://www.ars-grin.gov/npgs/index.html)

Seed Source		Subspecies[z]	Donor's ID	DI[y]		% 0-1	% 0-3
PI	546381	*maritima*	Spain, IDBBNR 5659	5.2	a[x]	0	12
PI	504240	*maritima*	Italy, sea beet	4.7	ab	2	34
PI	546397	*maritima*	Denmark, IDBBNR5596	4.7	ab	0	21
PI	504208	*maritima*	Italy, sea beet	4.5	ab	10	31
PI	504209	*maritima*	Italy, sea beet	4.3	ab	5	24
PI	518352	*maritima*	England UK, IDBBNR 5846	4.3	ab	5	19
PI	546412	*maritima*	Denmark, IDBBNR 5607	4.2	ab	4	20
PI	540583	*maritima*	France, WB 837	4.0	ab	5	33
PI	518301	*maritima*	England UK, IDBBNR 5795	4.0	abc	2	38
PI	540677	*maritima*	Denmark, WB 931	4.0	abc	10	34
PI	504259	*maritima*	Italy, sea beet	3.9	abc	0	21
PI	504261	*maritima*	Italy, sea beet	3.8	abcd	10	35
PI	540674	*maritima*	Denmark, WB 928	3.8	abcd	3	40
PI	546426	*maritima*	Italy, IDBBNR 5642	3.8	abcde	12	37
PI	540648	*maritima*	France, WB 902	3.8	abcde	2	28
PI	604509	*maritima*	Sicily Italy, IDBBNR	3.7	abcde	11	31
PI	546401	*maritima*	Italy, IDBBNR 5634	3.7	aabcdef	11	35
PI	540691	*maritima*	France, WB 945	3.6	abcdefg	10	42
PI	540679	*maritima*	Denmark, WB 933	3.5	abcdefgh	14	40
PI	540634	*maritima*	United Kingdom, WB 888	3.5	abcdefgh	12	52
PI	599350	*maritima*	N. Atlantic Coast of Europe mixed.	3.5	abcdefgh	7	40
PI	546420	*maritima*	Greece, IDBBNR 5614	3.4	abcdefgh	13	46
PI	540621	*maritima*	France, WB 875	3.3	abcdefgh	12	45
PI	504234	*maritima*	Italy, sea beet	3.3	abcdefghi	0	50
19941025		***vulgaris***	**FC901/C817- Susceptible Check**	**3.1**	bcdefghi	**8**	**61**
PI	540675	*maritima*	Denmark, WB 929	3.1	bcdefghi	16	51
PI	546411	*maritima*	England UK, IDBBNR 5605	2.9	bcdefghi	26	61
PI	552534	*vulgaris*	F1014 – released germplasm	2.1	cdefghi	46	89
PI	232888	*vulgaris*	Hungary, IDBBNR 5404	2.0	defghi	49	87
PI	***590656***	***vulgaris***	***FC703 - Resistant Check***	**1.9**	**efghi**	**59**	**84**
PI	552533	*vulgaris*	F1013 – released germplasm	1.9	fghi	49	95
PI	612768	*vulgaris*	AT3993-5 United States, Utah	1.8	ghi	52	93
PI	***590754***	***vulgaris***	***FC705/1- Highly Resistant Check.***	**1.7**	**hi**	**61**	**90**
			FC709-2 - Highly Resistant	**1.3**	**i**	**75**	**100**
PI	***599668***	***vulgaris***	***Check***				
			Trial Mean	3.4		18	48

[z] All entries that are *Beta vulgaris* subspecies *vulgaris* are cultivated, those of *B. v.* ssp. *maritima* (sea beet) are wild.

[y] DI = Disease index on a scale of 0 (no damage) to 7 (plant death), % 0-1= the percentage of roots in class 0 and 1 combined, % 0-3 = the percentage of roots in class 0 to 3 combined.

[x] Means with the same letter are not significantly different based on the least squared means statement (P = 0.05) in the Proc GLIMMIX analysis.

Mention of trade names or commercial products in this article is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.