

BEET (*Beta vulgaris*)
 BEET, WILD (*Beta vulgaris* ssp. *maritima*)
 Rhizoctonia root rot; *Rhizoctonia solani*

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Rhizoctonia root rot resistance of *Beta* PIs from the USDA-ARS NPGS, 2006.

Thirty plant introductions (PI) from the USDA-ARS National Plant Germplasm System (NPGS) (including garden beet, sugar beet, leaf beet, fodder beet, and wild beet) were evaluated for resistance to Rhizoctonia root rot. The trial was a randomized complete block design with five replications in one-row plots (56 cm row spacing) 4 m long at the ARS Fort Collins Research Farm, CO. The field had been summer-fallowed in 2004 and 2005, and planted to barley in 2003. The soil (Garrett loam, 0 to 1 % slope, pH 7.8) was deep ripped and plowed in Nov 2005, and disked, roller-harrowed and landplane-leveled in Apr prior to bedding and planting. The field was fumigated with Telone II 11 Apr for control of potentially confounding soilborne diseases and insects. Seed was planted on 24 May to moisture, and furrow-irrigated as needed. The plant population was thinned to 20-25 cm spacing by hand. Inoculation with dry, ground, barley grain inoculum of *Rhizoctonia solani* isolate R-9 (AG-2-2) was performed on 13 Jul at a rate of 2.2 g/m row with inoculum applied on the crown of the plant. Immediately after inoculation, plots were cultivated (using an in-row duck-foot cultivator) to place soil onto the plant crowns. Beets were harvested 8 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 was determined to create a disease index for each PI. Analyses of variance (PROC ANOVA) were performed on disease indices (DI), % healthy roots (classes 0 and 1 combined) and % roots in classes 0 through 3 (harvestable roots). Data in classes 0-1 and 0-3 were transformed using arcsine square root to normalize the data for analyses (AP 0-1 and AP 0-3, respectively).

The PI were tested in a disease nursery that included eight additional tests, involving experimental breeding material and commercial cultivated varieties. Controls were included in all nine tests. Rhizoctonia root rot reached moderate severity levels in early Sep for the entire nursery. Average DI across all nine tests in the 2006 nursery for highly resistant FC705-1, resistant FC703, and susceptible FC901/C817 controls were 1.7, 1.8, and 3.5, respectively. Percentages of healthy roots (those in disease classes 0 to 1) were 51.5, 43.7, and 21.3% for these controls, respectively. The percentages of harvestable roots (those in disease classes 0 through 3) were 97.4, 91.5, and 50.9% for these controls, respectively. The greatest and least DI for all of the lines evaluated in the nursery, including materials not in the PI tests, were 5.8 and 1.0, respectively. For the PI, DI differences among entries were significant ($P < 0.001$). Three PI (#518377, #540574, and #540633) had DI and AP 0-3 (harvestable roots) that were not significantly different from either the resistant or the highly resistant controls (#991017 or #831083, respectively). One PI (#546388) had a DI and AP 0-3 that were not significantly different from the resistant control, although it was significantly different from the highly resistant control. All of the PI had significantly lower percentages of healthy roots than the resistant and highly resistant control, but one additional PI (#546387) was not significantly different from the resistant and highly resistant controls for AP 0-3 (harvestable roots).

Seed Source	Subspecies	Donor's ID	DI*	% 0-1	% 0-3	AP 0-1	AP 0-3
PI 518355	<i>maritima</i>	IDBBNR 5849, UK	4.0	0.0	60.5	0.0	51.7
PI 540577	<i>maritima</i>	WB 831, France	4.1	4.0	41.4	5.3	39.8
PI 546416	<i>maritima</i>	IDBBNR 5610, Greece.....	5.2	0.0	31.7	0.0	31.1
PI 562585	<i>maritima</i>	IDBBNR 9796, Egypt.....	4.8	6.7	43.3	7.1	38.0
PI 504204	<i>maritima</i>	Wild beet, Italy	4.5	17.4	32.1	19.3	31.0
PI 518377	<i>maritima</i>	IDBBNR 5871, Ireland.....	2.8	12.4	68.4	13.5	62.0
PI 518426	<i>maritima</i>	IDBBNR 5920, UK	3.8	6.0	51.8	11.1	46.1
PI 540563	<i>maritima</i>	WB 814, France	3.7	17.0	49.3	18.9	46.4
PI 540565	<i>maritima</i>	WB 816, France	4.4	6.7	42.4	7.1	40.5
PI 540567	<i>maritima</i>	WB 818, France	4.1	5.0	47.2	8.3	43.3
PI 540573	<i>maritima</i>	WB 827, France	5.6	5.7	20.9	6.5	21.0
PI 540574	<i>maritima</i>	WB 828, France	3.0	20.0	71.7	18.0	67.1
PI 540633	<i>maritima</i>	WB 887, UK.....	2.3	15.0	90.0	15.9	80.2
PI 540666	<i>maritima</i>	WB 920, France	3.7	8.7	57.4	13.4	49.5
PI 546379	<i>maritima</i>	IDBBNR 5657, Spain.....	3.9	2.2	60.0	3.9	54.0
PI 546387	<i>maritima</i>	IDBBNR 5631, USA	3.8	5.7	70.5	6.5	60.5
PI 546388	<i>maritima</i>	IDBBNR 5656, USA	3.3	10.0	70.0	11.9	59.8
PI 546389	<i>maritima</i>	IDBBNR 5632, USA	4.2	0.0	44.4	0.0	41.7
PI 546393	<i>maritima</i>	IDBBNR 5593, USA	4.5	2.5	43.8	4.1	38.2
PI 546426	<i>maritima</i>	IDBBNR 5642, Italy.....	4.1	3.1	46.7	6.5	40.8
PI 546437	<i>maritima</i>	IDBBNR 5650, Greece.....	6.3	0.0	12.5	0.0	14.8
PI 546509	<i>maritima</i>	IDBBNR 9676, Greece.....	5.2	6.7	26.2	7.1	24.7
PI 546517	<i>maritima</i>	IDBBNR 9684, Greece.....	3.6	7.3	64.6	7.4	56.9
PI 546519	<i>maritima</i>	IDBBNR 9686, Greece.....	3.6	0.0	63.3	0.0	56.0

Seed Source	Subspecies	Donor's ID	DI*	% 0-1	% 0-3	AP 0-1	AP 0-3
PI 546520	<i>maritima</i>	IDBBNR 9687, Greece.....	5.8	0.0	20.0	0.0	18.0
PI 546528	<i>maritima</i>	IDBBNR 9695, Italy.....	5.2	6.7	35.0	7.1	33.0
PI 546529	<i>maritima</i>	IDBBNR 9696, Italy.....	4.2	6.9	45.3	9.8	42.1
PI 562587	<i>maritima</i>	IDBBNR 9738, Egypt.....	4.7	0.0	26.5	0.0	30.2
PI 562588	<i>maritima</i>	IDBBNR 9739, Egypt.....	5.7	2.9	7.9	4.4	10.4
PI 562589	<i>maritima</i>	IDBBNR 9740, Egypt.....	4.0	4.0	46.8	5.3	40.3
941025	<i>vulgaris</i>	(FC901/C817)//413 - 'Susceptible' Check..	3.2	17.4	54.5	22.1	47.6
831083	<i>vulgaris</i>	FC705/1 - 'Highly Resistant' Check.....	1.6	52.1	100	46.2	90.0
991017	<i>vulgaris</i>	FC703 - 'Resistant' Check.....	1.7	40.3	98.5	39.1	86.8
		LSD (P=0.05)	1.6			16.8	33.3
		Trial Mean	4.1	8.9	49.8	9.9	45.2

* DI = Disease index on a scale of 0 (no damage) to 7 (plant death), % 0-1= % roots in class 0 and 1 combined, % 0-3 = % roots in class 0 to 3 combined, AP is the arcsine-square root transformation of percentages of roots in classes 0-1 and 0-3 to normalize the data for analyses.