PEA (*Pisum sativum*)
Pea stunting; *Rhizoctonia solani* AG 8

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Screening of pea genotypes for resistance to root rot caused by *Rhizoctonia solani* AG 8, 2012.

Rhizoctonia solani AG 8 is one of the major pathogens that causes pea root rot and stunting in the Columbia Basin of Oregon and Washington. The disease is most severe in fields where wheat has been mono-cropped for a number of years or where cereal cover crops are incorporated just before pea seeding. Root rot leads to development of stunted plants in patches, which can range from <1 m to >10 m in diameter and may encompass up to 10% of the field. Pea stunting may cause as much as 75% yield loss in the patches. A total of 81 pea genotypes comprising 78 *Pisum sativum*, 2 *P. sativum* subsp. *sativum* (PI116056 and PI505122), and 1 *P. sativum* var. *arvense* (PI268480) line were screened for resistance to *R. solani* AG 8 by planting the seed in soil infested with isolate Rh070943 in a growth chamber. Pea genotypes were divided into two sets to accommodate the size of the trial. Seeds of each line were disinfested with 0.6% NaOCl in sterilized, distilled water (SDW) with agitation for 2 to 3 min, followed by rinsing three times in SDW. After air drying the seeds overnight at ambient temperature, seeds of each line were planted in plastic cone-tainers (D40 deepots, each 4 cm diameter and 21 cm long, Stuewe and Sons, Inc., Tangent, OR), each filled with 150 g of pasteurized sandy loam soil mixed with ground inoculum of *R. solani* AG 8-colonized oat seed (1% w/w ground inoculum added to the soil). Water (50 ml) was poured over the soil in each cone-tainer just before seeding. A seed was then planted in each cone-tainer and covered with a thin layer of pasteurized soil. Seeds of each line were planted similarly into pasteurized soil in cone-tainers without *R. solani* AG 8 to serve as the non-inoculated control treatment. Each genotype-by-inoculum treatment (81 x 2 factorial treatment combination) was replicated five times, with treatments arranged in a randomized complete block design. The plastic trays holding the cone-tainers were covered with Kraft paper to reduce evaporation, until pea emergence 4 days after planting. Plants were irrigated with 25 ml of water and 25 ml of 1/3-strength Hoagland's solution (macroelements only) every 3 to 4 days until harvest. Seedlings were removed from the cone-tainers 28 days after planting, and the roots rinsed carefully. Plant height and root rot severity were assessed (root rot ratings of 1 to 9, where: 1 = no lesions; 3 = discrete, light- or dark-brown, superficial, necrotic lesions; 5 = adventitious root or taproot necrotic and decayed; 7 = extensive root rot; and 9 = plant dead). The experiment was repeated. The mean plant height and mean root rot of each genotype in infested soil vs. non-infested soil were compared using Student's t-test (P <0.05) in SAS Version 9.3 (SAS Institute, Cary, NC).

R. solani AG 8 did not cause a significant difference in plant height of 27 of the 81 pea genotypes evaluated in both experiments compared to plants of the same genotype growing in non-infested soil, i.e., the following 28 genotypes or cultivars appeared to have some resistance to the pathogen: 90-2079, Bohatur, CDC Striker, Franklin, Marjoret, Marquee, Monarch, PI102888, PI116056, PI163125, PI164612, PI175226, PI180693, PI180695, PI184128, PI197450, PI198735, PI204306, PI219705, PI223527, PI226561, PI226564, PI244121, PI251051, PI272194, PI505122, and Puget. In contrast, *R. solani* AG 8 consistently reduced the plant height of 15 genotypes in both trials. Plant height did not differ significantly for Dark Skin Perfection in the first trial but seed of this cultivar did not germinate in the second trial. Inconsistent results between the two trials were observed for plant height of 38 genotypes. In the first trial, Franklin and PI226564 did not have a significant reduction in plant height when growing in infested soil compared to non-infested soil; whereas the height of Franklin, PI116056, and PI505122 plants were not affected by the pathogen in the second experiment. The range in root rot severity of the 81 pea genotypes was 3 to 8 in the first trial and 4 to 7 in the second trial. PI219705, PI223527, and PI226561 each had mean root rot severity ratings of 3 in the first trial compared to 5, 7, and 4 in the second trial, respectively. In addition, PI198735, PI220189, PI226561, and PI226564 had root rot severity ratings of 6, 4, 3, and 5, respectively, in the first trial compared to a relatively low rating of 4 for all three genotypes in the second trial. Inconsistency in plant height and root rot ratings of the genotypes between the two trials limited the ability to assess genotypes effectively for resistance to stunting caused by *R. solani* AG 8. In general, plant height was greater for many genotypes in the first trial in both non-infested and infested soil compared to the second trial. Seed quality and seed age may have contributed to this difference. Difference in the soil source for the trials possibly contributed to variability between trials. In addition, using a single plant per replicate cone-tainer might have been insufficient to capture potential variation in plant height and root rot severity ratings within and among genotypes. Nonetheless, the few genotypes that showed no significant reduction in plant height and very limited root rot severity ratings in this study might be useful in selecting for resistance to *R. solani* AG 8.

First set of genotypes[z]	Trial 1 Plant height (cm)[y] Non-infested	Trial 1 Plant height (cm)[y] Infested	Trial 1 Root rot[x]	Trial 2 Plant height (cm) Non-infested	Trial 2 Plant height (cm) Infested	Trial 2 Root rot
846-07 PI660729…..	22	15^{**w}	5	14	12^{ns}	6
847-22 PI660731…..	22	9**	7	12	10^{ns}	6
847-28 PI660732…..	21	13**	6	11	11^{ns}	5
847-45 PI660733…..	21	12**	6	12	9*	6
90-2079.....…	22	11^{ns}	6	11	8^{ns}	7
Admiral.....	24	15**	6	14	12^{ns}	6
Alaska 81.....	40	28*	5	21	18^{ns}	6
Aragorn.....	22	17*	4	14	12^{ns}	6
Ariel.....	21	13**	6	14	12**	6
Banner.....	31	18**	5	18	14^{ns}	5
Bohatur.....	21	17^{ns}	6	13	11^{ns}	7
Bohatyr.....	22	18^{ns}	5	14	11*	6
Bonner.....	29	18^{ns}	6	16	13*	5
Carousel.....	22	17**	6	15	13*	5
Columbian.....	40	27*	4	21	18^{ns}	6
Cruiser……..	20	12^{ns}	5	14	13*	7
Dark Skin Perfection	17	16^{ns}	6	-[v]	-	-
Delta.....	23	12**	5	12	10*	5
Franklin.....	13	13^{ns}	4	9	9^{ns}	5
Granger.....	37	26**	5	19	14*	6
Guido.....	22	11*	7	13	9^{ns}	6
Lifter.....	24	16**	6	14	13^{ns}	6
Marjoret.....	21	16^{ns}	6	16	14^{ns}	6
Medora.....	19	11*	8	13	11^{ns}	6
Melrose.....	25	16**	4	16	11*	7
Midas.....	18	7**	5	13	12^{ns}	6
Monarch.....	20	13^{ns}	6	11	8^{ns}	6
Prodigy.....	21	11**	7	13	12^{ns}	5
Puget.....	19	12^{ns}	6	13	9^{ns}	7
Spectes.....	29	23^{ns}	5	26	17**	6
Spector.....	37	16*	7	22	17^{ns}	6
Stirling.....	16	11**	5	9	9^{ns}	5
Toledo.....	20	15^{ns}	5	14	10*	6
Universal.....	25	19*	5	12	11^{ns}	6
Windham.....	19	11**	6	12	8**	6
Second set of genotypes						
CDC Striker…….....	15	12^{ns}	6	11	9^{ns}	7
Marquee…….....…	14	9^{ns}	6	10	9^{ns}	6
Nitouche……........	17	14**	7	11	9*	6
PI102888……..	23	16^{ns}	7	9	7^{ns}	7
PI116056……..	30	26^{ns}	4	16	16^{ns}	5

Second set of genotypes (continued)	Trial 1 Plant height (cm) Non-infested	Trial 1 Plant height (cm) Infested	Trial 1 Root rot	Trial 2 Plant height (cm) Non-infested	Trial 2 Plant height (cm) Infested	Trial 2 Root rot
PI116944……	30	20**	6	13	8*	6
PI121976……	33	23**	7	15	13^{ns}	6
PI125839……	24	20*	5	11	8*	5
PI125840……	24	17^{ns}	5	9	7*	6
PI138945……	33	26*	6	16	13^{ns}	6
PI163125……	38	13^{ns}	8	17	16^{ns}	5
PI164612……	33	26^{ns}	6	15	14^{ns}	5
PI166084……	27	22**	5	10	8*	6
PI175226……	31	19^{ns}	7	14	12^{ns}	7
PI180693……	33	29^{ns}	6	16	14^{ns}	6
PI180695……	28	16^{ns}	6	11	10^{ns}	6
PI180702……	31	25^{ns}	5	14	10*	6
PI184128……	26	18^{ns}	5	12	10^{ns}	6
PI195020……	30	27^{ns}	5	14	11*	5
PI197450……	33	28^{ns}	5	16	14^{ns}	5
PI197990……	36	23*	6	15	15^{ns}	5
PI198735……	23	16^{ns}	6	11	9^{ns}	4
PI203064……	28	17*	5	13	9*	5
PI204306……	30	22^{ns}	4	15	13^{ns}	5
PI207508……	33	12*	8	12	9^{ns}	5
PI219705……	25	21^{ns}	3	10	9^{ns}	5
PI220174……	30	24^{ns}	4	13	10**	5
PI220189……	34	24*	4	14	9**	4
PI222071……	30	21**	3	12	10^{ns}	5
PI222117……	33	19**	4	11	8^{ns}	6
PI223526……	26	18^{ns}	3	11	8*	5
PI223527……	23	18^{ns}	3	10	9^{ns}	7
PI226561……	29	23^{ns}	3	11	9^{ns}	4
PI226564……	31	31^{ns}	5	14	12^{ns}	4
PI227258……	33	22**	4	10	7*	6
PI227457……	28	17**	5	9	7^{ns}	6
PI244121……	11	9^{ns}	5	7	6^{ns}	6
PI249645……	27	17*	6	13	9^{ns}	5
PI251051……	27	15^{ns}	6	11	9^{ns}	6
PI253968……	27	20*	4	9	7^{ns}	6
PI257592……	28	23^{ns}	4	15	9*	6
PI268480……	27	20^{ns}	5	9	6*	5
PI271119……	25	19**	6	9	6^{ns}	5
PI272194……	31	26^{ns}	6	16	15^{ns}	5
PI413686……	34	30*	4	18	14*	5
PI505122……	19	16^{ns}	5	9	9^{ns}	5

[z] Pea genotypes evaluated in two sets to fit in the growth chamber. [y] Mean pea plant height in non-infested soil or in soil infested with *Rhizoctonia solani* AG 8. [x] Mean root rot severity (1 to 9 scale). [w] * and ** = Significant difference plant in in infested vs. non-infested soils based on Student's t-test at $P = 0.01$ and 0.05, respectively. ^{ns} = no significant difference in plant height in infested vs. non-infested soils based on Student's t-test at $P > 0.05$. [v] '-' = Seed did not germinate in the repeat trial.