Pea Root Rot and Results of Variety Evaluations

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Root rot is an important and widespread disease that often causes significant reduction in the yield and quality of harvested peas throughout the production areas in New York. Pea root rot can be caused by one of several soilborne pathogens or various combinations of root pathogens and also non-pathogens. In recent years, *Fusarium solani* f. sp. *pisi* (causal pathogen of Fusarium - root rot) has been found to be the most prevalent and damaging on peas, which was followed by *F. oxysporum* f. sp. *pis*i (wilt and near wilt diseases). Other known pea pathogens including *Pythium ultimum* (Pythium - root rot), *Thielaviopsis basicola* (black root rot), *Ascochyta* spp. (Ascochyta - root and stem rots), and *Rhizoctonia solani* (Rhizoctonia - root and stem rots) have also been observed on peas grown in New York, but at lower frequency and severity in recent years. Once introduced, all of these fungal root pathogens are capable to surviving in soil for a long time due to their ability to produce thick-walled surviving units and/or their ability to infect and reproduce on a variety of crops and soil organic materials.

Above-ground symptoms on plants infected by root rot pathogens may include poor emergence and stand establishment, damping-off, poor growth, chlorosis of lower leaves, premature defoliation, and lower yield. Symptoms on roots and lower stem tissues are variable and diagnostic of the predominately active pathogen or pathogen combination involved in causing the disease. Description of the symptoms of infection and damage by the various pathogens to peas can be found in the "Compendium of Pea Diseases" (APS Press, 3340 Pilot Knob Rd., St. Paul, MN, 55121). Generally, roots of severely infected plants are discolored, reduced in size, lack the abundance of fine rootlets, and are at different stages of decay. Obviously, such roots are inefficient in absorbing water and nutrient as well as contribute greatly in predisposing plants to various stress factors.

Effective management of root diseases is generally possible only through the use of a combination of control options (cultural, biological and/or chemical) utilizing the principal and strategies of Integrated Pest management (Soil-IPM). A critical first step in the management of root diseases is the use of high quality, pathogen free, and fungicide treated (Apron + Maxim has been highly effective) seeds. Appropriate selection of cropping sequences (rotation and cover crops) based on the prevalent root pathogens in the target fields is critical in controlling root diseases and their damage. Rotation and cover crops directly and/or indirectly affect the soil populations of root pathogens and their potential damage. Also, root diseases are most damaging in poor quality soils, thus improving soil health parameters (reducing compaction, increasing aggregate stability, increasing organic matter content, etc.) will contribute to the production of larger and healthier roots, which indirectly reduce the damage of root pathogens. In addition, planting resistant or tolerant varieties is the most sustainable and highly effective strategy for managing soilborne pathogens and their root diseases. Over the past few years, we have evaluated a large number of commercial pea varieties as well as several promising lines for their reaction and performance in root rot soils under both commercial field and

greenhouse test conditions. Great differences in tolerance to root pathogens were observed among the varieties tested to-date, thus selecting and planting the most tolerant pea varieties will contribute to reducing losses to these pathogens, specially in fields with known history of root rot incidence.

In 2010, the reaction of 37 pea varieties and lines to root rot pathogens was evaluated in replicated greenhouse tests. Seeds of the various materials (kindly provided by Brotherton, Seminis, PLS, Crites, Galetin Valley, and ARS/USDA Res. Station in Pullman, WA) were planted in 4-inch pots (7 seeds/pot, with 5 replications/pea variety) filled with soil collected from a commercial pea field with a history of severe incidence and damage of root rot. Pots wee maintained in the greenhouse for 6 weeks, watered daily and fertilized once a week with a dilute solution of complete fertilizer (15-15-15, NPK). Emergence count was recorded at 2 weeks after planting. At the termination of the test, roots were washed free of soil, plants blotted dry and fresh weight was recorded, and then root rot severity was assessed on a scale of 1 (no visible disease symptoms, healthy) to 9 (>75% of roots and stem tissues affected and at a late stage of decay). Ratings of 1 – 3, >3 – 6, and >6 – 9 are considered as resistant, tolerant/intermediate, and susceptible, respectively. Results obtained are presented in Table 1 and Figures 1 & 2. Root rot development was very severe, undoubtedly due to the heavy infestation of the field soil used and the favorable greenhouse conditions provided throughout the test. Although all the materials included in the test appeared to be susceptible, root rot severity ratings of the varieties varied greatly and significantly (Table 1). The varieties Grundy, Pendleton, Solution, Boogie, Savannah, Bolero, PLS 1051, EX 0899 and Rico exhibited an intermediate (tolerant) disease reaction (root rot severity ratings <6.00). Interestingly, the three breeding lines with resistance to Fusarium-root rot (652444, 652445, and 652446; provided by Dr. Clarice Coyne, ARS/USDA, Pullman, WA) also exhibited a tolerant/intermediate root rot ratings in this test. In contrast, ES 414, June, Ice Breaker, Jumpstart, BSC 5697, Romance, and Marias had among the highest root rot severity ratings in this test (>8.00).

In collaboration with interested growers and industry personnel, the reaction of pea varieties grown in the same field was compared by determining root rot severity ratings of collected plants of each variety in mid to late season. From each variety in a pea field, four composite plant samples (a minimum of 20 plants/sample) were randomly selected, carefully dug-up, and taken to the laboratory. Roots were washed free of soil and then assessed for root rot severity using the above-mentioned scale. Only a few pea fields with previous histories of severe root rot incidence were found planted to more than one pea variety in 2010. Results obtained from varietal comparison in four fields are presented in Table 2 and illustrated in Figures 3 and 4. In field A, Boogie and Tonic exhibited significantly lower root rot severity ratings and more vigorous growth than ES 414 at the flowering stage. In Field C, ES 414 also had a higher root rot severity rating than that of Yuma, although the ratings for both were rather high. However, the stand, growth and color of Yuma were very good (Fig. 3). Both Durango and Grundy showed moderate root rot severity ratings in Field B, whereas both Bolero and EX 0865 looked good and showed low root rot ratings in Field D. Cosima exhibited high root rot severity ratings (average of 8.0) in solid planting in two separate fields.

Table 1. Results of evaluation of pea varieties and lines in a greenhouse test using naturally infested soil collected from a commercial field with a history of severe root rot incidence. NYSAES, 2010.

Variety	RRS	Variety	RRS
ES 414 (std)	8.75	Tonic	7.25
June	8.25	Sweet Savor	7.00
Ice Breaker	8.25	Samish	7.00
Jumpstart	8.00	Portage	7.00
BSC5697	8.00	PLS534	6.75
Romance	8.00	Cabree	6.75
Marias	8.00	Ricco	5.75
Cosima	7.75	EX0899	5.75
BSC3048	7.75	PLS1051	5.50
Ashton	7.75	652446	5.50
Topps	7.75	652445	5.25
Hudson	7.50	652444	5.25
Sienna	7.25	Bolero	5.25
BSC359	7.25	Savannah	5.00
EX0865	7.25	Boogie	5.00
Bistro	7.25	Solution	4.75
Durango	7.25	Pendleton	4.75
Legacy	7.25	Grundy	4.25
Mundial	7.25	*LSD 0.5*	*1.89*

Table 2. Comparing the severity of root rot development on pea varieties grown in the same commercial field in several sites in western New York, 2010.

	Variety	RRR
Farm A	Tonic	2.3
	Boogie	2.0
	ES-414	6.5
	LSD 0.5	*0.7*
Farm B	Durango	4.75
	Grundy	4.75
	LSD 0.5	*0.87*
Farm C	ES-414	7.75
	Yuma	6.75
	LSD 0.5	*0.87*
Farm D	Bolero	2.50
	EX-0865	2.50
	LSD 0.5	*0.99*

Figures 1 – 4. The extremes in reaction of pea varieties to root-rot in the greenhouse (Fig. 1), close-up of roots of four varieties from a greenhouse test (Fig. 2), three varieties in a field in western NY (Fig. 3), and a close-up of roots of three varieties from a field close to LeRoy, NY.

Figure 1:

Figure 2:

Figure 3:

Figure 4: