Winter Survival of Kidney Bean Root Rot Pathogens in Various Crop Residues.

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A fungal root rot complex of dry beans is a major problem in Minnesota and consists of a complex of three pathogenic fungal organisms (*Fusarium oxysporum, F. solani* f. sp. *phaseoli*, and *Rhizoctonia solani*). *Fusarium solani* is the primary organism involved in the disease complex. *Aphanomyces, Pythium* and *Phytophthora* species were not found associated with the bean root rot complex. Achieving satisfactory root rot control has been difficult because of the involvement of multiple pathogens each with their own biology, disease causing abilities and host range. The aim of this study was to determine the role of crop residue in pathogen survival.

Corn, canola, dry bean, soybean, pea, sunflower and potato residues were each assessed as possible sites for pathogen (s) survival over-winter. The crops were grown in a root rot infested soil at Staples, MN in 1998. At physiological maturity each crop was harvested, their residues were placed in a fiberglass mesh bags, either buried at 15 cm or left on the soil surface to over-winter. In the Spring of 1999 the residue was collected and 10 g of each was dispensed separately in 1 kg. pots filled with pasteurized soil and 1 g used for pathogen isolation on potato dextrose agar (PDA) and Water Agar (WA). Ten Montcalm seeds were sowed in each of four replicated pots. Soybean and peas were sown in the bean pots after their harvest. Corn and canola were sown in separate pots. Plants were evaluated for emergence (%) and disease severity (DS) (scale1-9). Root and hypocotyls of diseased and healthy plants were cultured on PDA and WA to determine pathogen identification. Pathogenicity was assessed by sowing susceptible Montcalm beans into pasteurized soil amended with each of the isolated fungi.

F. solani was recovered from the residues of bean, soybean, pea and canola. *F. oxysporum* was recovered from the residue of all hosts. *R. solani* was only recovered from bean, potato and soybean residue. Pathogenicity was confirmed for *F. solani*, *F oxysporum* and *R. solani* isolated from the residue of beans, soybeans, corn, peas and potatoes. Pathogens were also recovered from infested tissue of the root and hypocotyl of the different hosts when they were grown in soil amended with the residues (Table 1). When bean was used as a host (trap plant) *F. solani* was recovered from the residue of bean, soybean, pea and canola, further pathogenicity tests confirmed their ability to cause disease on Montcalm beans. Beans grown in soil containing corn and sunflower residue were not infected with *F. solani* or *R. solani* but were infected with pathogenic isolates of *F. oxysporum*. Other *Fusarium* species were also found. *Rhizoctonia solani* was not isolated from beans grown in soil containing pea residue but it was found in beans grown in soil containing soybean and canola residues (Table 1). These data suggest that soybean and bean residue can sustain all bean root rot pathogens over one winter and should not be recommended as a rotation alternative in a field following dry beans with history of root rot. *F. solani* and *R. solani* could not be recovered from beans grown on soil amended with corn residues, but was recovered from soil containing canola residue. Generally residue left on the soil surface was more conducive for the survival of the pathogens than buried. The lack of residue decomposition probably plays a role in maintaining the pathogens. Germination decreased for all hosts planted in soil mixed with bean residue (Table 2). Soybeans had a 30 and 25% germination when planted in soil amended with bean residue left on the soil surface and buried respectively. The control had a 90% germination. The effect of the different residues on germination was the lowest on corn (Table 2).

Table 1. Fungi isolated from beans, canola, corn, peas, potatoes and soybeans grown in pasteurized soil amended with crop residues left over-winter

RESIDUE	Location	HOST				
		Bean	Canola	Corn	Pea	Soybean
Bean	Surface	**Fs**	Fs	Fo, F	Fo	Fs, Fo, Rs
	15 cm.	**Fo**		Fo, F		Fo
Canola	Surface	**Fs**		F	Fs, Fo, F	Fs
	15 cm.	**Rs, Fs**		F	Fs	Fo, Fs
Corn	Surface	**Fo**	Rs	Fo, F	Fo	Fo
	15 cm.	Fo		Fo, F		
Pea	Surface	**Fo**		Fo	Fo, Fs	Fo
	15 cm.	**Fs, Fo**		F	Fo	Fs, F
Soybean	Surface	Fo, **Rs**	Fs	F	Fs, Fo	Fs, Rs, F
	15 cm.	**Fs**	Fs		Fo	Fs, Fo, Rs
Potato	Surface	**Rs**	Rs	F	Fo, F	Rs
	15 cm.	Fo			Fo	Fo
Sunflower	Surface	**Fo**		F	Fo	Fo
	15 cm.	**Fo**			Fo	Fo

- Bold letters indicate that pathogenicity on Kidney beans was confirmed

Table 2. Germination (%) of beans, canola, corn, peas and soybeans, in pasteurized soil amended with different crop residues from a root rot infested area.

RESIDUE		HOST				
		Bean	Canola	Corn	Pea	Soybean
Bean	Surface	70	66	75	26	30
	15 cm.	70	79	70	55	25
Canola	Surface	68	63	82	33	33
	15 cm.	60	72	85	50	28
Corn	Surface	75	52	88	43	38
	15 cm.	80	92	80	43	38
Pea	Surface	78	78	85	50	60
	15 cm.	75	58	88	40	70
Soybean	Surface	53	73	75	55	58
	15 cm.	73	72	75	35	48
Potato	Surface	60	71	80	20	43
	15 cm.	93	81	85	35	28
Sunflower	Surface	68	50	88	28	38
	15 cm.	80	72	90	43	35
Control		**95**	**96**	**95**	**88**	**90**