

**THE LATE BLIGHT FUNGUS IN WESTERN WASHINGTON, 1990-1998:  
WHY SCREENING POTATO GERMPLASM FOR RESISTANCE HAS BEEN  
EFFECTIVE HERE**

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Renewed interest in developing resistance to *Phytophthora infestans* is centered on the development of potato cultivars which have a durable or long-lasting type of resistance. Stability of such resistance depends, in part, on the buffering effect of multiple host genes which help counteract the variability in pathogenicity of the fungus. Recently, WSU-Mount Vernon has been used as a field site for screening potato germplasm for resistance to *P. infestans*. To better insure that our evaluation efforts will help select germplasm more likely to have durable resistance to late blight, we have been studying characteristics of the population of *P. infestans* in western Washington since the early 1990s.

Certain features of our pathogen population are important in Pacific Northwest breeding efforts because of lessons learned at other locations. Historically, the search for late blight resistance in potatoes began in the 1840s when late blight epidemics became widespread in Europe and North America, but breeding efforts resulted in many failures. Although potato scientists were able to identify specific R-genes (resistance genes) and introduce them into commercial cultivars, R-gene specific races of *P. infestans* soon appeared (by convention, races of *P. infestans* are named by the host gene which they overcome). By the 1950s and 1960s there were many examples of failure by R-gene resistant cultivars. In 1952 it was discovered that most of the *Solanum* species utilized as sources of R-gene resistance were susceptible to several races of *P. infestans* occurring naturally in central Mexico. Dutch workers also showed during the late 1960s that the new races of *P. infestans* which developed on R-gene cultivars could survive from one season to start a new epidemic the next season.

Presently, most potato geneticists primarily breed for durable resistance with a secondary interest in R-gene resistance. The expression of durable resistance in the potato plant is a function of different components, each probably dependent on several genes. Many mechanisms may be operative affecting entrance and growth of the pathogen into the plant thereby influencing the number of lesions formed, the rate of lesion development, and/or the degree of sporulation within the lesions. Unfortunately, multi-genic inheritance makes breeding difficult, and also creates problems in selection and evaluation work.

Nevertheless, it is essential that germplasm is evaluated in diverse settings and against complex populations of the pathogen so that the final selection of breeding material is not inadvertently based on simple R-gene resistances.

Exposing a breeding population to a variety of complex races at several locations over time is necessary. Our results in the two tables below indicate important features of western Washington's *P. infestans* population during the 1990s which validate the complexity of the pathogen population in the area.

Characteristics of the <i>P. infestans</i> population in western Washington, 1990-1998				
Year	Genotype	Mating type	Metalaxyl response	Number of potato differentials infected*
Prior to 1989	US-1 (presumed)	A-1	Sensitive	Unknown
1990-1991	US-6	A-1	Insensitive	6+
1992-1993	US-6	A-1	Insensitive	3-7
1994-1995	US-11	A-1	Insensitive	Not tested
1996	US-11	A-1	Insensitive	1-7
1997	US-11	A-1	Insensitive	2-7
	US-8	A-2		8-10
1998**	US-8	A-2	Insensitive	8+
	US-11	A-1		3-6

\*Summarized from Deahl, et al., 1993; Goodwin, Sujkowski, and Fry, 199\_; Dorrance et al., 1999; and Derie and Inglis, 1999. \*\*As of 2/99; confirmation in progress.

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 Complexity of *P. infestans* isolates collected in western Washington, 1996-1998
 

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Year	Genotype	Percent isolates with five or more virulence factors
1996	US-11	70
1997	US-11	63
	US-8	100
1998	US-8	100
	US-11	In progress

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*From Derie and Inglis, unpublished data.*

From our experience, several factors contribute to the value of the WSU-Mount Vernon field site for evaluating potato germplasm for resistance to late blight. These include 1) a favorable environment for disease development, particularly if potatoes are planted late in the growing season (early June) so as to be exposed to naturally-occurring inoculum during August, when typically, there are low cloud ceilings and foggy days which contribute to prolonged leaf wetness, 2) the existence of both US-8 and US-11 genotypes of the fungus, each which have been shown by Miller and Johnson (1998) to be aggressive on potato, and 3) a high percentage of complex races in the area having five or more virulence factors which reduces the possibility of selecting breeding materials with only simple R-gene inheritance.