Impact of different US genotypes of *Phytophthora infestans* on potato seed tuber rot and plant emergence in different cultivars and breeding lines

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Introduction

Globally, *Phytophthora infestans* (Mont.) de Bary remains a threat to the potato crop, causing significant losses annually (Guenther *et al.* 2001). Under favorable conditions, foliar and tuber late blight are the most common symptoms resulting in tuber rotting in the field and storage, and affecting the economic value of the potatoes. Infected volunteer tubers can lead to a late blight epidemic in the following season. The transmission of potato late blight from tuber to sprouts has been confirmed (Berkeley 1846; Appel *et al.* 1998), but the progression mechanism from infected tubers to the plant is not fully understood.

Potato cultivars with higher foliar resistance tend to slow down the epidemics leading to longer periods of vegetative growth of *P. infestans*. As a result, zoospores and mycelia can be washed into the soil (Bain *et al.*, 1997). This fact may provide a high risk of tuber infection. In addition, the populations of *P. infestans* have changed to more aggressive genotypes, like US–8, which is highly aggressive on foliage, and also in tubers and sprouts (Kirk *et al.*, 2001). The changing *P. infestans* population has not been fully understood at in terms of virulence, fitness, aggressiveness and transmission. Also, the dynamics of potato blight development in tubers is highly influenced by temperature (Kirk *et al.*, 2001) resulting in non–emergence of plants due to seed and sprout rot. The objectives of this study were to evaluate the potential of different genotypes of *P. infestans* to impact plant establishment in potato cultivars and advanced breeding lines (ABLs) with different resistance to potato late blight.

Materials and Methods

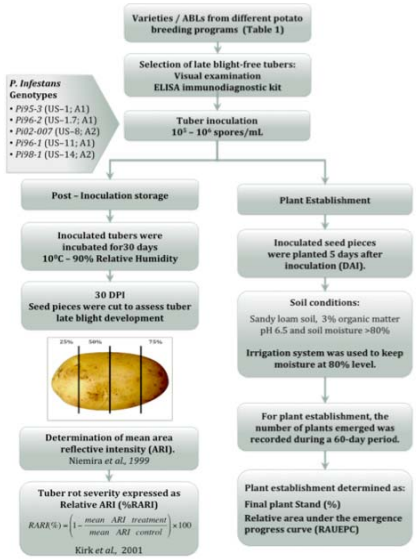

Table 1. Varieties/ABLs challenged during the study including the breeders' estimate for foliar and tuber rating against US-8 (symbols referred to in Fig 2).

Variety / ABLs	Foliar Susceptibility	Tuber Susceptibility	Variety / ABLs	Foliar Susceptibility	Tuber Susceptibility
Atlantic	S	S	MSJ456-2Y	I	S
MSI152-A	I	S	MSJ461-1	R	I
MSJ317-1	R	S	Jacqueline - Lee	R	S
Pike	I	S	Megachip	S	S
Torridon	R	R	FL1833	S	S
FL1879	S	S	FL1867	S	S
MSJ319-7	I	S	MN15620	S	S
MSJ316-A	I	S	MN98642	S	S
MSJ453-4Y	I	S	ND2443	S	S
Snowden	S	S	ND5822C-7	S	S

* S, I, R represent susceptible, intermediate and resistant.

Results and Discussion

- RARI (%) values, for 2003 storage (10ºC) were significantly greater compared to the 2004 experiment (Fig 2).
- Regardless of the variety or ABL inoculated, US–8 genotype caused the most damage, which means a lower RARI (%) value (Fig 1).
- The US–14 genotype was the second most aggressive genotype in tubers in both the years.
- All the cultivars and ABLs demonstrated significant differences in the amount of necrotic tissue (RARI %) after the inoculation with different genotypes of *P. infestans*.
- Figure 2 shows the response of the varieties/ABLs is correlated to the tuber disease.

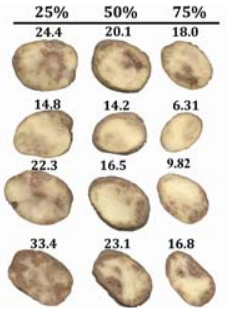

Figure 1. Cross sections of a tuber from the line ND2443 inoculated with *P. infestans* US–8 genotype. Numbers indicate RARI (%) for apical, middle, basal sections.

- The final plant stand of tubers (ratio of plants growing to seeds planted) inoculated with *P. infestans* genotype US-8 and US-14 were significantly lower than the non– inoculated control seed pieces.
- The genotypes US-1 and US-11 also reduced the final plant stand.
- In 2003, cv. Atlantic had the greatest final plant stand among *P. infestans* genotypes; for 2004, cv. Torridon had the highest final plant stand.
- Mean RAUEPC of seed pieces infected with genotypes US-8 and US-14 were significantly lower in 2003 and 2004.
- Final plant stand and RAUEPC were positive correlated for both years' trials (Fig 3). However, RAUEPC and final plant stand values were different for varieties/ ABLs inoculated.
- Foliar symptoms of late blight were absent on plants emerging from the different inoculated seed pieces.
- In fact, the question of the frequency and rate of transmission from infected tubers to foliage is still unresolved.
- The absence of late blight symptoms in the emerged plants from the inoculated seed piece could be affected by different factors.

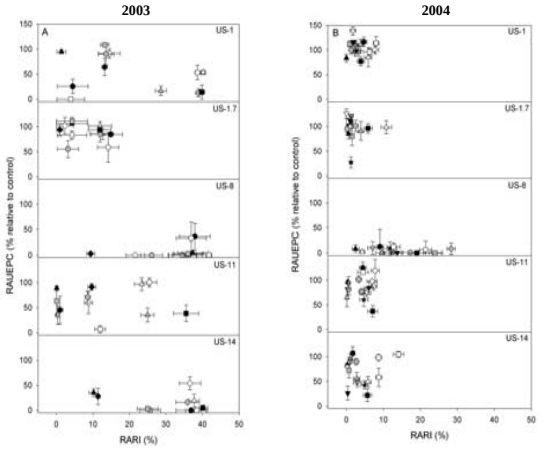

Figure 2. RAUEPC expressed as function of tuber susceptibility (mean RARI %) across varieties/ABLs with different genotypes of *P. infestans* in 2003 and 2004.

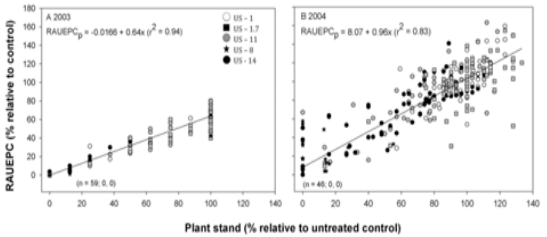

Figure 3. RAUEPC expressed as a functional of final plant stand (%) across varieties/ ABLs with different genotypes *of P. infestans* in 2003 and 2004.

Conclusion

A correlation was observed between tuber susceptibility and plant growth, where tuber pathogenicity lowers the field establishment. As the aggressiveness of *P. infestans* isolates is increasing, more breeding lines on tuber resistance could be helpful. Latent infection of tuber and sprouts could be leading cause for a new epidemic.

References

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