

# Measuring Host Resistance in Potato to *Phytophthora infestans*

## Field, Laboratory and Greenhouse Evaluations



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### Introduction

Late blight (*Phytophthora infestans* Mont de Bary) is one of the major biotic constraints to potato production in Nepal. The disease is primarily controlled with fungicides, although yield loss is common. Host plant resistance could reduce fungicide dependency and increase sustainability of production. The purpose of this investigation was to determine the efficacy of two mono-cyclic screening methods for foliage blight resistance and one method for tuber blight resistance by comparing results from these trials with resistance levels established in the field.

### Materials and Methods

Host plant resistance against *Phytophthora infestans* was evaluated in the field for twenty five potato genotypes in 2010 and 2011 at Khumaltar, Lalitpur, Nepal. This was used as a benchmark to evaluate other assays. A locally isolated strain of *P. infestans* 'LPR-1' was used to measure resistance on whole plants (screen house), detached leaves and tuber slices. The inoculum concentration was  $3 \times 10^3$  sporangia/ml in all the assays. Inoculum was equally distributed over the entire foliage using plastic atomizer in field and screen house assays.



Figure 1. Sporangia production



Figure 2. Sporangia harvesting



Figure 3. Sporangia inoculation

Detached leaves and tuber slices were inoculated with 50  $\mu$ l suspension of inoculum and incubated at  $16.5 \pm 0.5^\circ\text{C}$  for 7 days. Infected foliage area (%) in the field and screen house, lesion size ( $\text{cm}^2$ ) on detached leaves and colony growth (%) on tuber slices were recorded and then all data were individually converted to 0-9 scale for susceptibility, as per Yuen and Forbes (2009)

### Results and Discussion

There was a clear distinction between the most susceptible and most resistant varieties in all assays: field (Fig 4), screen house (Fig 5), detached leaf (Fig 6) and tuber slice (Fig 7). Nonetheless, in the field, many varieties had very little disease (Fig 2) and are suspected to have major resistance (R) genes, which is race specific. This type of resistance has generally been short-lived.



Figure 4. Field assay



Figure 5. Whole-plant inoculation screen house assay



Figure 6. Detached leaf assay



Figure 7. Tuber slice assay

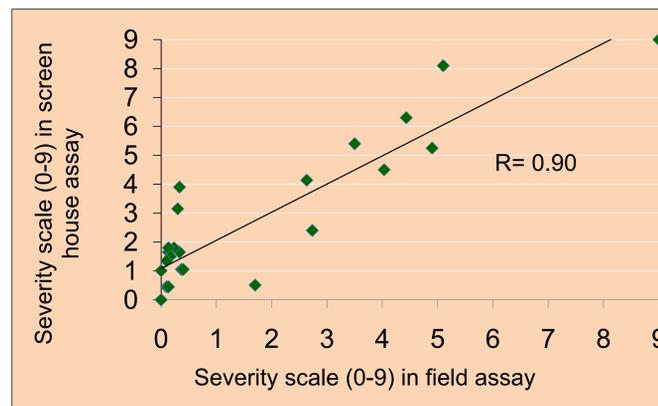


Figure 8. Correlation between field and screen house assay

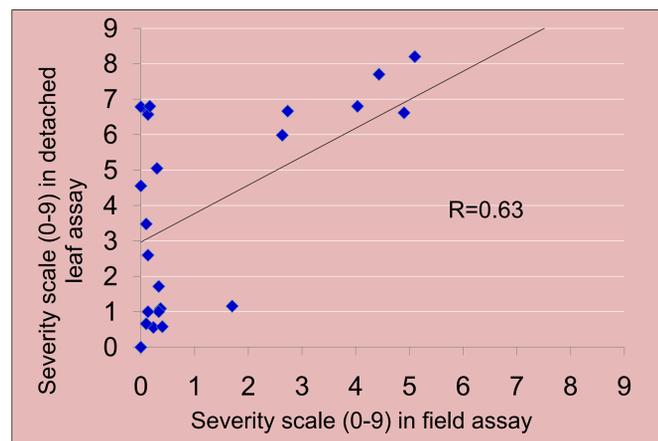


Figure 9. Correlation between field and detached leaf assay

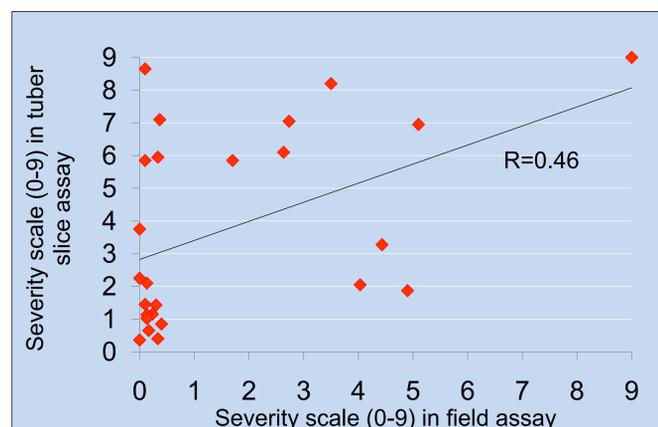


Figure 10. Correlation between field and tuber slice assay

Resistance measured in the field trial was highly correlated ( $R=0.90$ ) with the whole plant assessment in screen house (Fig 8) than with the detached leaf assessment (Fig 9). This appeared to be due to the increased susceptibility of some varieties in the leaf test. The correlation was least ( $R=0.46$ ) with the tuber slice test (Fig 10), but this may reflect genetic differences as different levels of resistance sometimes occur in foliage and tubers.

### Conclusion

More than half of the genotypes had very low incidence (scale value  $<1$ ), indicating that they were probably expressing race specific resistance. Low correlations in the detached leaf assay and tuber slice assay was assumed to represent lower resolution of the single cycle assay. Some genotypes showing high level of resistance under field conditions were found most susceptible in tuber slice assay which also reflected genetic differences as foliage and tuber blight resistance are not always correlated.



### Bibliography

Yuen, J. E., and Forbes, G. A. 2009. Estimating the level of susceptibility to *Phytophthora infestans* in potato genotypes. *Phytopathology* 99:782-786.