

# Potato tuber resistance to *Phytophthora infestans* – comparison of evaluation methods.

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*Phytophthora infestans* is the most destructive potato pathogen worldwide. Resistance breeding is mainly focused on foliage blight resistance, but tuber blight resistance is becoming more and more important in cultivated potatoes, as an essential component of resistance. The expression of tuber resistance depends to a large extent on testing methods and conditions. To reduce differences between results of assessments performed by various research teams, jointly agreed methods of evaluation were developed in Eucablight project.

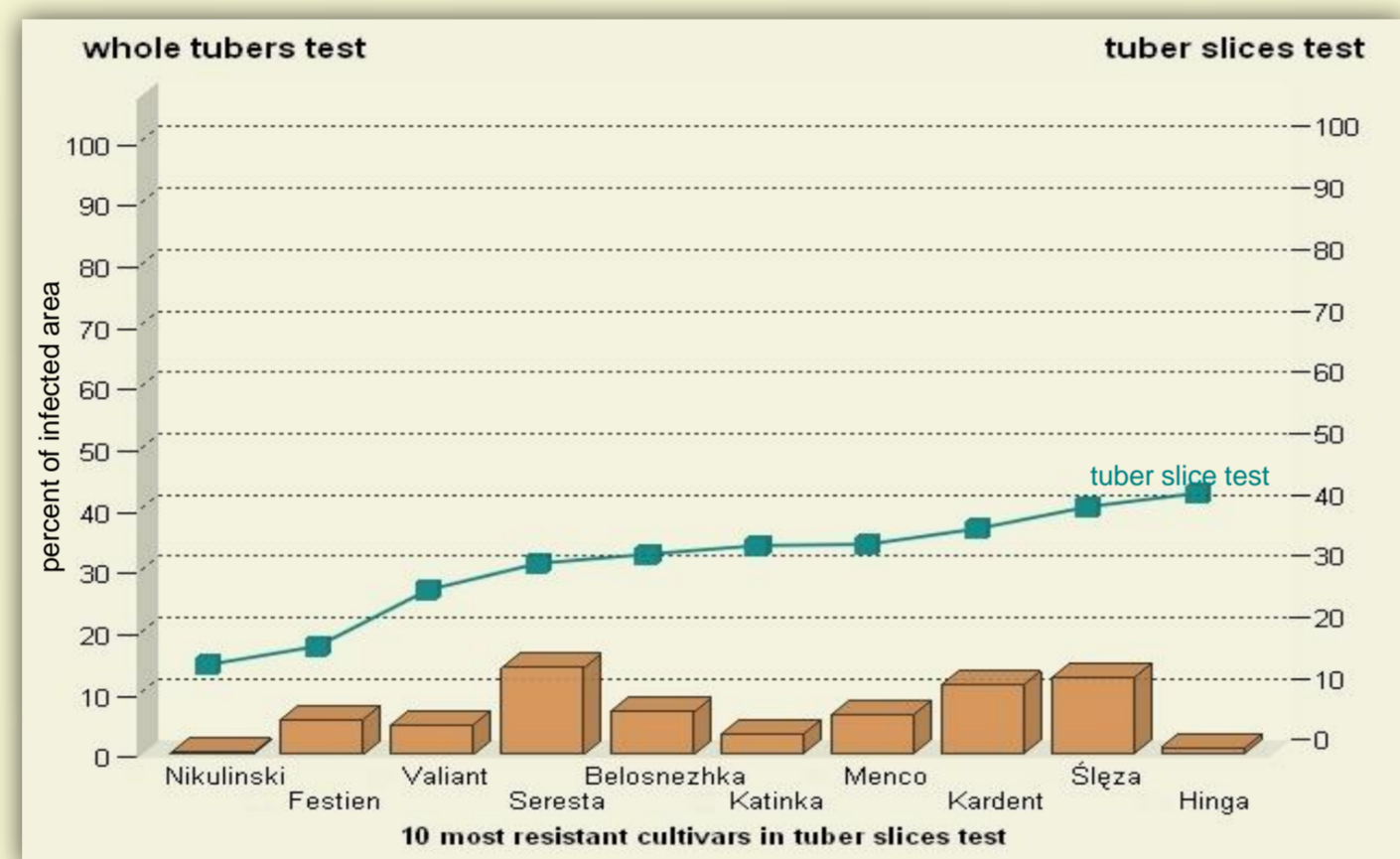
In Plant Breeding and Acclimatization Institute, Młochów Research Center, Poland, phenotypic assessment of potato clones/cultivars with different genetic background for blight resistance is very important. Every year, up to 20 thousand of clones are tested in laboratory tests and up to 1200 breeding clones or cultivars are tested in field conditions. This amount of examined material requires a simple, highly effective and reliable testing methods. All testing methods proposed by Eucablight were accepted and applied, but some of previously developed in Młochów methods are still used.



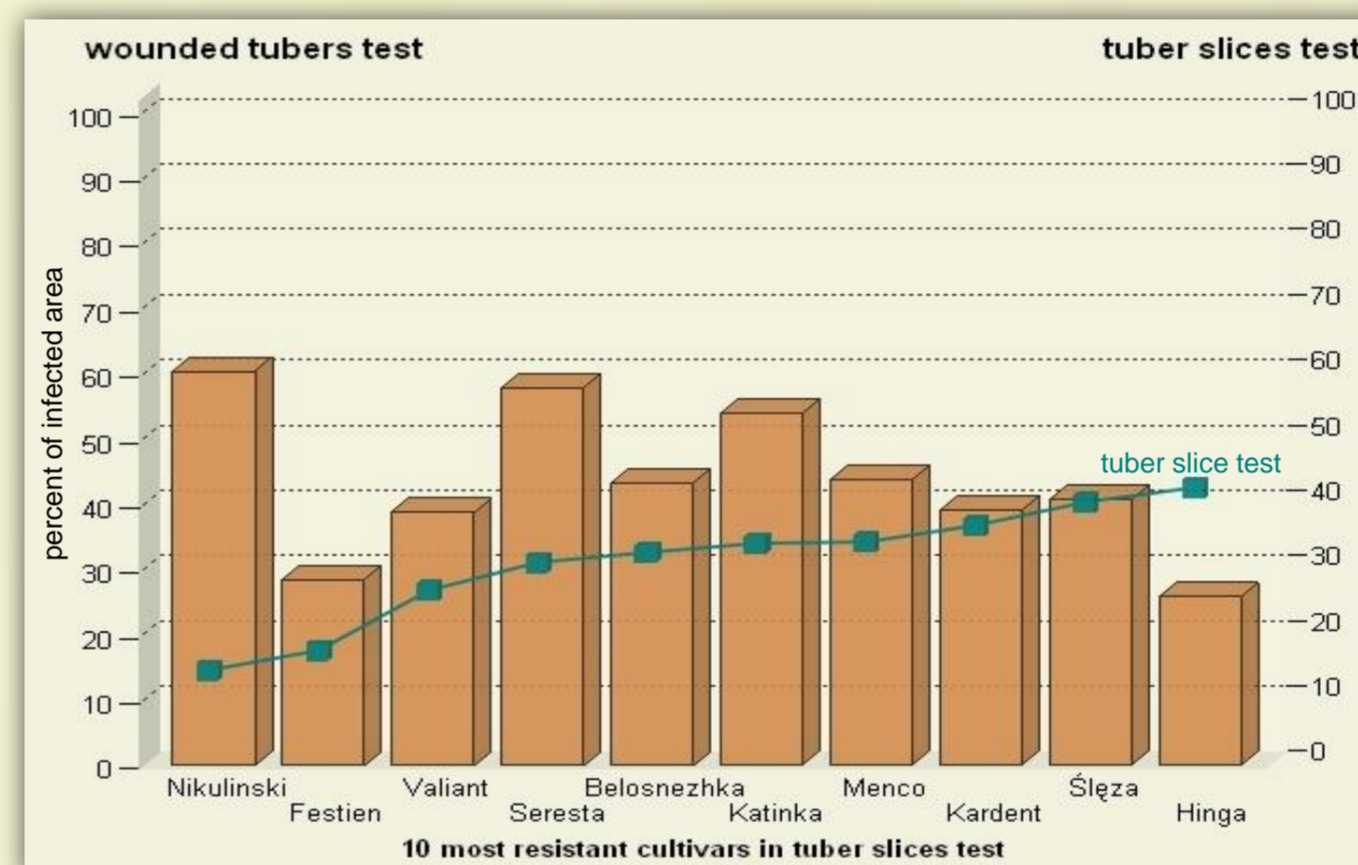
In 2006 – 2008, tuber resistance was assessed by: tuber slice test, whole tuber test proposed by Eucablight and whole tuber test with wounded tubers. For both whole tuber tests conditions were the same (described in Eucablight protocol) and the only difference between them is puncturing tubers before inoculation in the second test. 14 days after inoculations tubers from both tests were cut in half and all inoculated tubers were scored for percentage of infected area. Every year, 20 tubers per clone/cultivar were assessed (5 tubers x 2 reps x 2 dates). To demonstrate differences between these two testing methods results of inoculation of **10 most resistant and 10 most susceptible cultivars in tuber slice test** are presented.



In whole tuber test recommended by Eucablight, tubers are infected mostly via eyes and lenticels so only very few tubers are infected.



Three years means of percentage of infected area are much lower than means from tuber slice test.



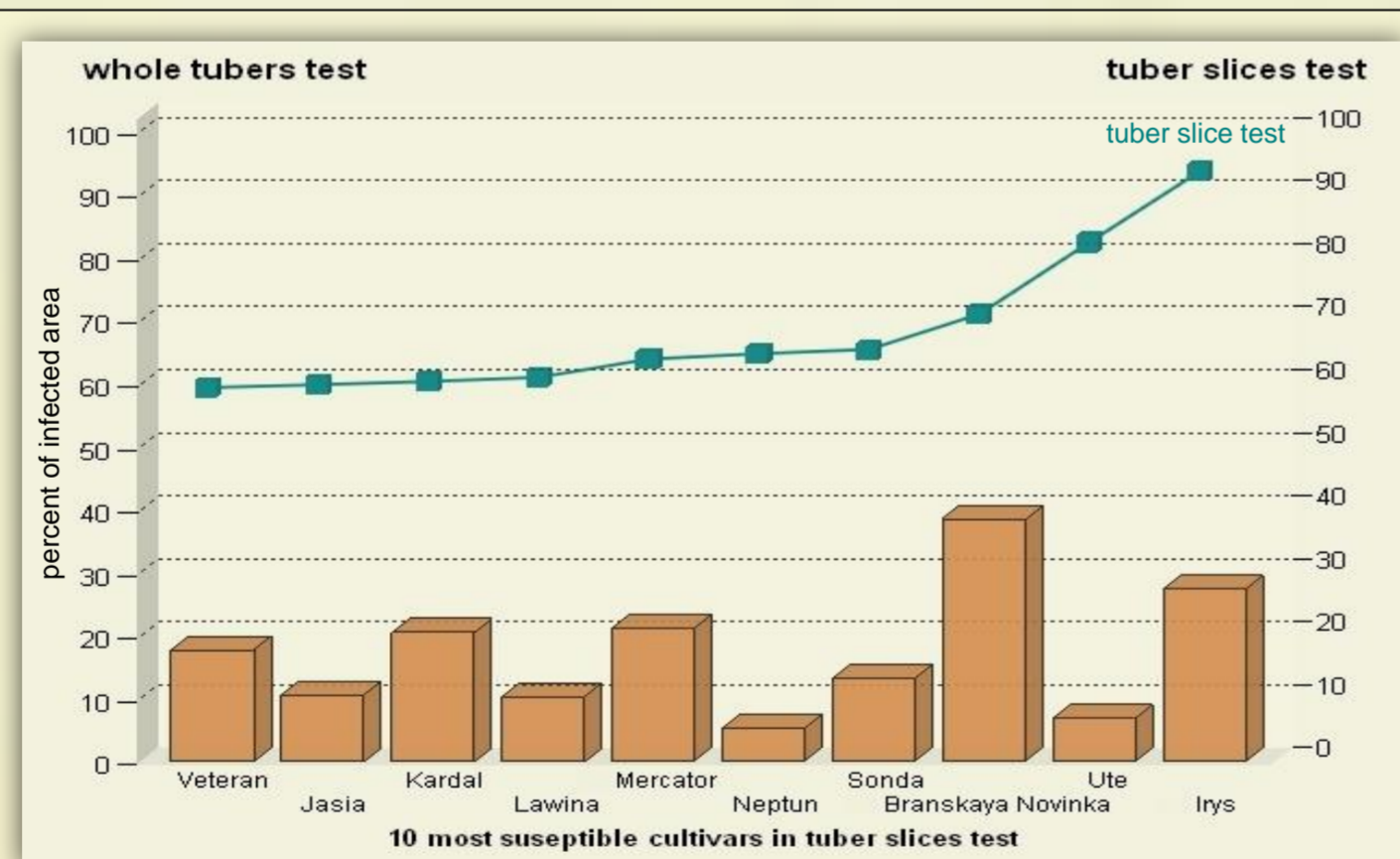
Percentages of infected area for resistant cultivars are even higher than in tuber slice test.



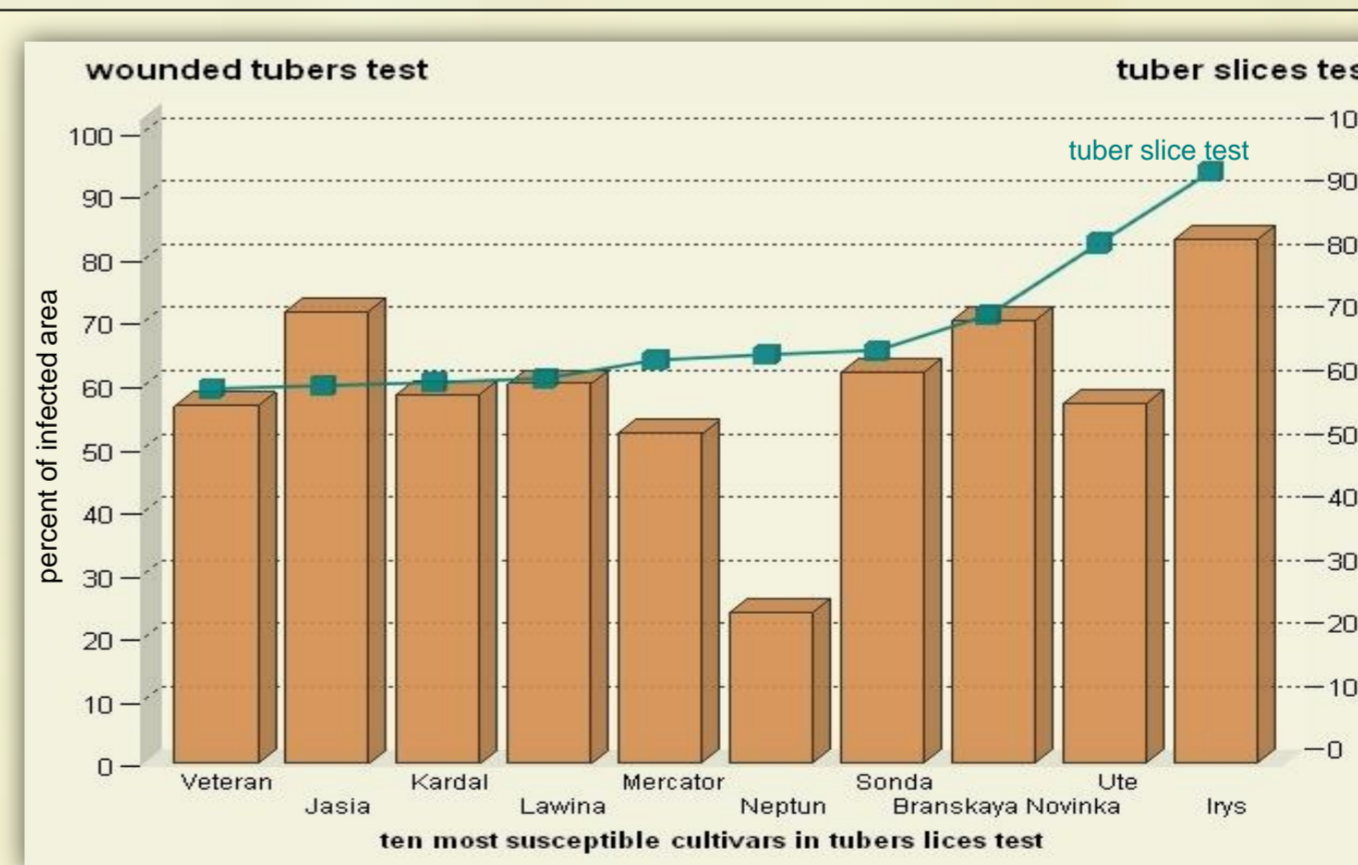
Wounds are ideal 'gates' for pathogen. Tuber infections are more severe and much more frequent than in unwounded tuber test.



Tubers are infected more 'by chance' and the mean percentage of infected area does not reflect level of tuber tissue resistance.



Even for 'susceptible' cultivars percentages of infected area are very low as compared with tuber slice test.

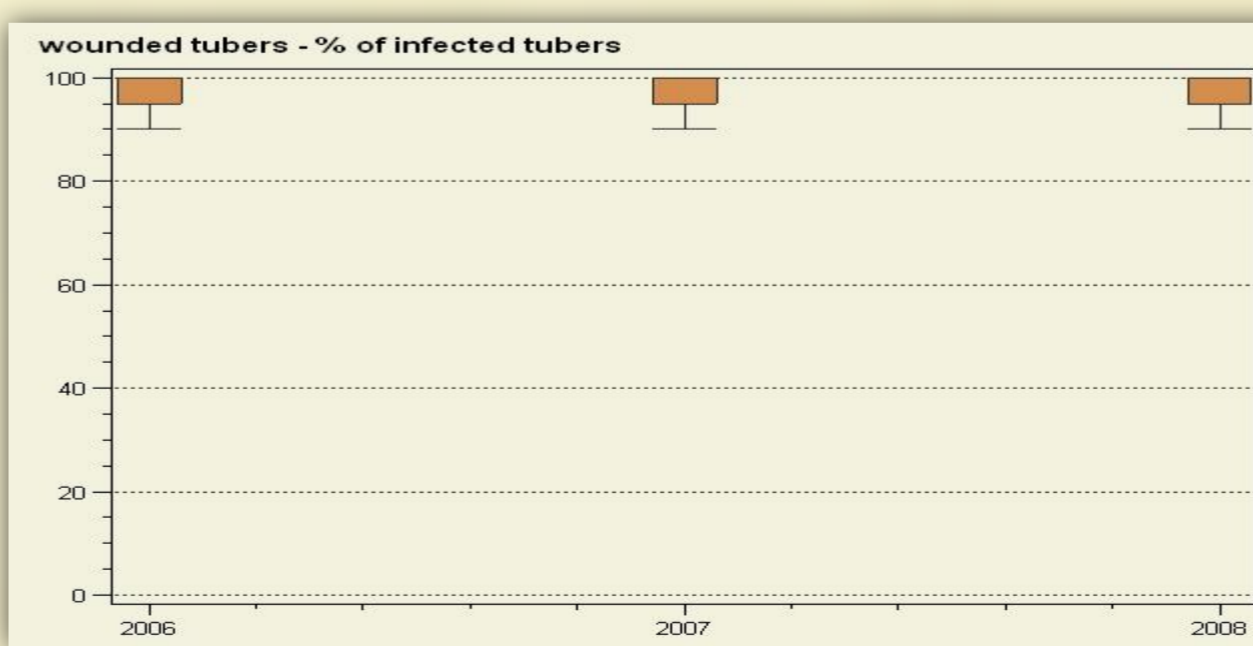
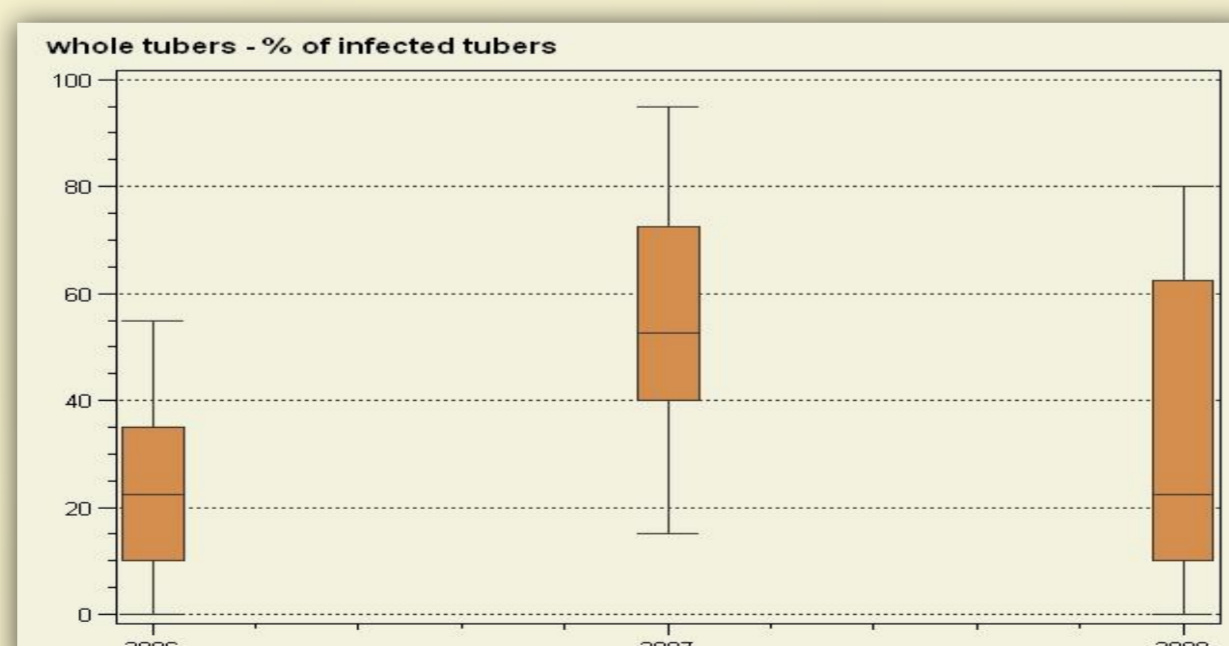


Percentages of infected area for most of 'susceptible' cultivars are similar to those obtained in tuber slices test.



Almost all tubers are infected and the results of testing reflect a real level of tuber flesh resistance.

In whole tuber test recommended by Eucablight, percentage of infected tubers is rather low and very variable in years. In inoculation of unwounded tubers, infection is restricted to eyes, lenticels, periderm natural wounds and pathogen is forced to get through physical barriers. Results of this test are much more depending on resistance factors operating on surface of tuber than inside tuber tissue. Whole tuber test recommended by Eucablight describes resistance to infection of whole tuber rather than other resistance factors.



Inoculation of wounded tubers is highly effective. Percentage of infected tubers in all years is very high and range between 95 and 100 % of inoculated tubers for both 'resistant' and 'susceptible' group of cultivars. Wounding of tubers provides direct access to tuber flesh tissue for a pathogen. Therefore, tuber response in this test demonstrates factors of resistance operating in tuber flesh.

Potato tuber resistance to *P. infestans* is a very complex trait depending on many factors. Probably different resistance factors operate in the reaction of intact tuber and in the reaction of tuber flesh. In fact, this two compared tests reflect various resistance mechanisms. Results of unwounded tuber test mainly demonstrate resistance of whole tuber to infection while wounded tuber test demonstrates acting of resistance factors operating in tuber flesh. These factors are crucial for tuber resistance, which makes wounded tuber test more reliable for proper evaluation or comparison of blight resistant clones with different genetic background. This test is commonly used in routine tests in Research Center Młochów. Whole tuber test is performed only additionally to supplement characterization of resistance.