Late Blight Resistance

Isolation and cloning of several late blight resistance genes from wild potato species

Genes conferring resistance to the devastating late blight disease, *Phytophthora infestans*

Evaluation and Licensing Opportunities

For further information on this technology and evaluation / licensing opportunities please contact:

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Patent Literature

US Patent 8,367,893

European Patent EP2179042

Also granted in South Africa, Russian Federation, China, Ukraine and Canada.

Late blight (caused by *Phytophthora infestans*) is the world's most devastating crop disease and leads to major crop losses world-wide. Overall the annual financial impact of late blight disease in potato farming in developing countries is $3.25bn and if the disease could be controlled effectively, yields would increase by up to 50%. In the developed world late blight is controlled through extensive fungicide spraying regimes. In the original 12 countries of the EU, for example, up to fourteen fungicide sprays are applied to each crop of potatoes during the growing season, at a cost of over €300 per ha (total use of 7.5m kg of fungicide at a total value of over €400m per annum). In addition late blight is also a serious problem in other crops including tomatoes.

Professor Jonathan Jones and co-workers at the Sainsbury Laboratory have now isolated and cloned a range of late blight resistance genes. The genes were identified by classical genetic and physical mapping approach. *Rpi-mcq1* (formerly *Rpi-moc1*) and *Rpi-mcq2* were isolated from *S. mochiquense*, *Rpi-nrs1* from *S. neorossii* and *Rpi-vnt1*, a previously uncharacterized late-blight resistance gene, from *Solanum venturii*, Additional alleles of *Rpi-vnt1.1* (*Rpi-vnt1.2* and *Rpivnt1.3*) were found in another late-blight-resistant wild potato species (*S. okadae* in the CGN database, although recently reclassified). The *Rpi-vnt* genes were cloned in collaboration with Wageningen University.

The Rpi genes confer resistance to *Phytophthora infestans* upon transformation into susceptible potato and tomato cultivars. In the picture on the left detached leaves from plants of *Solanum tuberosum* cv. Desiree containing (top row) or lacking (bottom row) *Rpi-vnt1.1* and infected with the late blight fungal pathogen.

Potato (cv. Desiree) was transformed with the *Rpi-vnt1.1* gene under the control of its native promoter and terminator. From 29 transformed lines, 24 lines were resistant to both *P. infestans* isolates 90128 and BPC2006 3928A (superblight, blue 13) and did not show any signs of blight infection.

In total, in further tests 11 *P. infestans* isolates were tested and only isolate EC1 from Ecuador was able to overcome *Rpi-vnt1.1* and cause disease on the inoculated plants

Strategies to develop late blight resistant potatoes ideally involve the use of multiple resistant genes, as isolated here. While the above study using *Rpi-vnt1.1* demonstrates good resistance, the combination with the other isolated resistance genes will both improve the spectrum of resistance as well as making such resistance more durable.

The technology offered here, consisting of multiple late blight resistance genes, therefore offers the opportunity to protect potatoes and tomatoes against late blight infections with the potential of substantially reducing the use of fungicide applications and increasing potato yields in developing country agriculture.

References:

Foster SJ *et al* (2009). *Rpi-vnt1.1*, a *Tm-2*^{2} Homolog from *Solanum venturii*, Confers Resistance to Potato Late Blight *MPMI* **22:** 589-600.