

Potato under pressure: exploring plant protection measures for a changing future

Potato is the third most important staple crop in the world. It is an irreplaceable part of the Swedish diet and has been the focus of my research during my whole time at SLU. Potato is threatened by numerous pathogens, and current methods of pathogen control rely heavily on spraying with fungicides and other pesticides. In Sweden, potato is grown on approximately 1 % of the farmland, but requires 20 % of the fungicides used annually. Currently, the plant protection methods used for potato cultivations are being challenged in a number of ways. Several fungicides that have previously been mainstays of plant protection strategies against late and early blight have already been banned in Denmark and will probably be banned in the EU within a few years. Furthermore, the late blight pathogen has recently started to develop resistance against other commonly used pesticides. In addition, viruses such as potato virus Y also cause yield losses in potato cultivation. This is a potential problem for potato growers in general and for growers of seed potato in particular.

It is obvious that there is a need for novel plant protection strategies for potato. One goal should be to reduce the need for chemical pesticides and to provide alternative strategies that can be used against fungal and oomycete pathogens. Cultivars with complete or partial disease resistance are likely to be an important component of such strategies, either alone or in combination with other cultural practices in an IPM-based approach. For this purpose, many different sources of disease resistance will be needed. Resistant cultivars can be developed by using new genomic techniques, but to achieve this we need an improved understanding of resistance mechanisms in plants and more targets for genetic modification. Proteomics is a set of techniques that analyze the abundance of thousands of proteins simultaneously. This can be used to discover genes that can be modified for increased resistance to fungi and oomycetes.

The problem of viral infection of potato will require a different set of plant protection strategies, and an important goal is to find alternative methods against viral infection. Mulching is a promising method to reduce viral infection by reducing the number of aphids that transmit the virus. A crucial part of all strategies will likely be the combination of basic science and field trials.

In this lecture I will discuss the use of new combinations of plant protection methods to meet emerging challenges for potato cultivation. I intend to describe how I have used basic science to explore the role of proteins in infection and resistance in potato and other systems and combined this with field trials. I will also discuss how to continue integrating these approaches. Our previous results indicate that there is great potential in using proteomics to reveal interesting targets for resistance. In view of the changing regulatory situation and novel challenges brought on by climate change, the search for such targets needs to be intensified. In parallel, I will describe my work on mulching and aphids and discuss how to continue it, for example by investigating the effects of various genetic modifications on the sensitivity of potato to viral infection.