chips
a look at what's new in potato information and technology
Horticulture™ New Zealand
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Late blight

Funding for research into late blight disease, caused by *Phytophthora infestans*, has been rather limited recently, with investments being focused on other potato crop diseases. However, research is still being carried out as the disease continues to affect potato production. Below, four papers published over the last year are reviewed.

In the first paper (Dowley et al. 2008) field experiments carried out over 25 years (1983 to 2007) at Oak Park, Carlow, in Ireland investigated the loss in potato production caused by crop infection with *Phytophthora infestans*. In each year, untreated potato crops were compared with those under protectant and with systemic fungicide programmes. For over half of the years, blight was first recorded in crops between 17 July and 13 August, and reached epidemic status in all but 4 of the 25 years. In every year, yield losses from not using fungicides were significant, with a mean yield loss of 10.1 t/ha. There appeared to be no change in the aggressiveness of the pathogen throughout the trial period.

The trials described in the next paper (Bouws & Finckh 2008) were carried out in Germany and investigated an organic approach to control of late blight disease. This involved strip cropping of potatoes with cereals or a grass-clover mix, with some treatments being planted perpendicular to the main wind direction. In the first year (2000), plots were 3 m x 10 m and no disease reductions were observed, apparently due to interplot interference. Plot sizes were increased in 2001 and 2002 (to 6 x 18 and 6 x 36 m respectively), and reduction in disease ranged from 4 to 20%. Greatest reductions in disease were seen in plots planted perpendicular to the wind and neighboured by grass-clover. The main reason for disease reduction was a loss of inoculum to the neighbouring non-potato crops. There were significant yield reductions in the potato rows bordering cereals, but this did not affect the disease-yield-loss relationship. Strip intercropping may be a useful strategy in integrated management of late blight disease of organic potatoes.

The third paper (Hospers-Brands et al. 2008) also studied disease management strategies for organic potato production, with experiments being carried out in the UK and The Netherlands. The agronomic treatments included presprouting (chitting) and early planting of seed tubers, which should encourage early bulking and evasion of the disease. In addition, different plant populations and spacings were tested to see if they altered the microclimate of the crop, making it less favourable for infection. Early planting and presprouting strategies were most effective in years with a short growing season, while the population and spacing treatments affected canopy architecture but not late blight infection.

At high altitudes, the pre-Inca cultures, and later the Incas, bred special frost-tolerant potato plants with high glycoalkaloid (anti-freeze!) content. They dehydrated and freeze-dried the potatoes, using the freezing night temperatures and the hot sunshine of the daylight hours. The potatoes were then stored for use by their armies and to guard against famine. These potatoes, called chuño, are still processed in the same way and eaten today.

[from "Fifty potato facts" – www.cipotato.org/publications/pdf/004495.pdf]

The final paper (Mayton et al. 2008) focused on strategies for suppressing tuber late blight infections. In 3 field trials over 2 years, phosphonate biopesticides were applied at weekly intervals to the foliage, and tuber disease was assessed at harvest and after 2 months in storage. In general, tubers from plots treated with phosphonates had less tuber blight than tubers from plots treated with a conventional fungicide. All phosphonate treatments suppressed foliar late blight disease.

Yield losses caused by late blight (*Phytophthora infestans* (Mont.) de Bary) in potato crops in Ireland. Dowley et al. (2008) Irish Journal of Agricultural and Food Research 47: 69-78.

Effects of strip intercropping of potatoes with non-hosts on late blight severity and tuber yield in organic production. Bouws & Finckh (2008) Plant Pathology 57: 916-927.

Effects of presprouting, planting date, plant population and configuration on late blight and yield of organic potato crops grown with different cultivars. Hospers-Brands et al. (2008) Potato Research 51: 131-150.

Potato late blight in tubers – The role of foliar phosphonate applications in suppressing pre-harvest tuber infections. Mayton et al. (2008) Crop Protection 27: 943-950.

Disease control

▶ **Rhizoctonia disease.** The fungal pathogen *Rhizoctonia solani* causes stem canker and black scurf diseases on potatoes and can cause large reductions in yield. Disease inoculum found on seed tubers can be effectively controlled by seed treatment with fungicides, but soil-borne inoculum is much harder to control. The four papers below look at various aspects of the biology of the pathogen and strategies to manage the disease.

▶ **Infection of potato by *Rhizoctonia solani:* effect of anastomosis group.** The species *Rhizoctonia solani* is actually made up of various anastomosis groups (AGs), and these differ in their pathogenicity and the type of disease they cause. In both glasshouse and field experiments AG3PT and AG5 have been shown to cause severe stem and stolon disease, while AG8, and to a lesser extent AG3PT, have been associated with severe root disease. Even within AGs there is large variation, with the AG2-1 isolate (X81) producing only small lesions (<5 mm), while in a glasshouse trial another AG2-1 isolate caused more severe stem and stolon infection than AG3PT. In the field, tuber yields from seed potatoes inoculated with various isolates were all reduced compared with uninoculated (control) plants. The majority (84%) of tubers inoculated with AG3PT developed black scurf, while very few tubers inoculated with AG2-1 or AG5 showed these symptoms. *Woodhall et al. (2008) Plant Pathology 57: 897-905.*

▶ **Infection with *Rhizoctonia solani* induces defense genes and systemic resistance in potato sprouts grown without light.** An interesting phenomenon observed with *Rhizoctonia solani* is that, while initial shoots that are infected prior to emergence may die, subsequent compensatory new sprouts are not damaged and emerge successfully. The mechanism behind this recovery response is not known, and the research described in this paper was carried out to test the hypothesis that infection may induce pathogen defence in sprouts. Tubers were sprouted in cool, moist conditions in darkness and the basal part of the sprout was inoculated with a highly virulent *Rhizoctonia solani* strain. The genes activated in the apical part of the sprout were monitored and compared with uninoculated sprouts. Differential expression of a large number of genes was observed, indicating that infection with the pathogen at one site activated resistance at other sites in the sprout. This information can be used to develop control strategies. *Lehtonen et al. (2008) Phytopathology 98: 1190-1198.*

▶ **Biological and chemical control and their combined use to control different stages of the Rhizoctonia disease complex on potato through the growing season.** This study investigated the ability of commercially available biocontrol fungi and bacteria, along with the flutolanil seed dressing, to control soil-borne infection of *Rhizoctonia solani* in the field. Interestingly flutolanil did not affect the biocontrol agent *Trichoderma harzianum* but significantly inhibited the growth of *Rhizoctonia solani*. This combination treatment (flutolanil + *Trichoderma harzianum*) reduced sprout damage and severity of stem canker during early growth, increased the proportion of marketable-sized tubers and decreased the incidence of black scurf on progeny tubers. The two other antagonist micro-organisms tested, *Streptomyces griseoviridis* and *Gliocladium catenulatum*, did not affect *Rhizoctonia solani. Wilson et al. (2008) Annals of Applied Biology 153: 307-320.*

▶ **Antagonistic activities of potato associated bacteria via their production of hydrolytic enzymes with special reference to pectinases.** The research described in this paper isolated 52 strains of bacteria that were associated with potatoes, and examined their ability to control two plant pathogens, *Phoma betae* and *Rhizoctonia solani*. There was high antagonistic activity in 46 of the strains, and so the mechanisms behind this effect were investigated, in particular their ability to produce hydrolytic enzymes. The highest pectinolytic activity was recorded from a *Paenibacillus polymyxa* strain, and the enzyme responsible for this activity was active over a wide pH range, with maximal activity at 60–70°C. It was concluded that the bacterium has potential as a biocontrol agent, and that the enzyme may be useful in industrial applications. *Mahmoud et al. (2008) Research Journal of Agriculture and Biological Sciences 4: 575-584.*

Processing

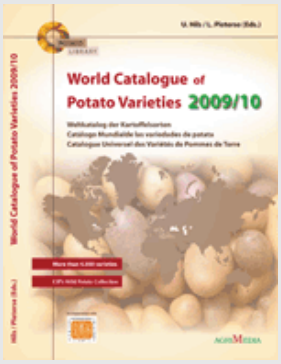
▶ **Nitrogen management for potatoes by using rapid test methods.** Nitrogen concentrations in the sap and chlorophyll content were measured in leaves from a trial that had been given one of five nitrogen fertiliser treatments. Both sap nitrogen and chlorophyll content increased with increasing nitrogen fertiliser and decreased during the growing season. However, tuber yield was not correlated with either sap nitrogen or chlorophyll content. *Poljak et al. (2008) Cereal Research Communications 36: 1795-1798.*

▶ **Organic amendment history and crop rotation effects on soil nitrogen mineralization potential and soil nitrogen supply in a potato cropping system.** This field trial was carried out over 2 years in Maine, USA, and was based on three crop rotations with and without a history of organic amendment (cow manure). Soil samples were collected from the top 15 cm of soil before planting and the amount of potentially mineralisable nitrogen was measured. On average, historically amended soil had 35% greater levels of potentially mineralisable nitrogen than non-amended soil. There were higher levels of potentially mineralisable nitrogen in the potato-barley and potato-soybean-potato-barley rotations than in the potato-soybean-barley-alfalfa/timothy rotation. Other measurements of soil nitrogen availability were also made (e.g. mineralisable nitrogen pools) and these also detected management-induced changes. *Sharifi et al. (2008) Agronomy Journal 100: 1562-1572.*

▶ **Opportunities for improved fertilizer nitrogen management in production of arable crops in eastern Canada: A review.** This paper reviews the tools and strategies that arable crop growers can use to minimise losses of nitrogen to air or water, yet still optimise crop yield and quality. These include measurements of crop nitrogen status during the growing season, soil nitrogen tests and new nitrogen fertiliser products. The advantages and limitations of these tests are discussed, and areas for future research are identified. *Zebarth et al. (2009) Canadian Journal of Soil Science 89: 113-132.*

▶ **Slow- or controlled-release fertilisers. Slow-release nitrogen fertilizers in vegetable production: a review.** Slow-release nitrogen fertilisers that have a release pattern matching crop needs can improve the efficiency of nitrogen use and decrease application costs. There are two main groups of synthetic slow-release fertilisers. The first group releases the nitrogen as a byproduct of a chemical reaction (such as urea-formaldehyde), while the second group has a sulphur, wax or resin coating around the fertiliser prill. Most studies have shown that slow-release nitrogen fertilisers neither increase nor decrease crop yields relative to conventional fertiliser treatments, with the main advantages coming from reduced environmental risk and savings in production costs. *Guertal (2009) Horttechnology 19: 16-19.*

▶ **Recent book – World Catalogue of Potato Varieties 2009/10.** The latest edition of this book, co-edited by Lukie Pieterse and Uwe Hils, describes more than 4500 different potato varieties from over 100 countries around the world. In addition, 1900 wild potato varieties and species from the International Potato Center Wild Potato collection, Lima, Peru, are described.



Essential information about every variety is provided, including name and synonym(s), contact details for the breeder, the year of release, countries where cultivated, tuber characteristics (shape, flesh and skin colour, depth of eyes) and agronomic information (maturity, usage, disease resistance). The catalogue contains detailed cross-references, and lists some of the major potato breeding/research institutes around the world.

This book will be of great practical value to commercial potato farmers, retailers, processors, packers, private breeders of potato seed and others in the industry, as well as being an excellent reference manual to researchers and breeders at universities, colleges and institutes.

Published by Agrimedia GmbH and available at the very reasonable price of USD$125.00, the book can be purchased directly from Global Potato News website (www.potatonews.com/knowledgecenter/books/wkk.asp).

▶ **Potato processing. Guest column: sustainability is not just environment. March/April 2009, p. 34.** This interesting perspective from Terry Olsen, Chairman of Potatoes New Zealand, emphasises that the industry must invest in one of its most important resources – people. Young growers may face different challenges than their predecessors, but they still need to be trained, mentored and supported as they take over the reins. And to keep them in the industry, they need to be given fair returns or they will go elsewhere, which is not good for anyone in the industry.

Snippets from www.potatonews.com

Listed below is a small selection of the articles that are posted on the Global Potato News website. Please visit the site for further details or follow the links indicated.

▶ **United Kingdom: Potato growers set sprayer booms too high.** At the Scottish Agricultural College/ Association of Potato Growers conference, spray application specialist Paul Miller said that most potato growers set their sprayer booms too high. Although this is done to prevent damage to the boom, this practice may reduce spray coverage. Another factor affecting coverage is spray volume, and at least 150 to 200 L/ha was recommended for blight sprays. *February 2009 – News Headline.*

▶ **China: China turning to the humble potato to feed the poor.** The Chinese government is aiming to increase their annual potato production from 70 to 120 million tonnes over the next 5 years in an effort to feed their population. *February 2009 – News Headline.*

▶ **Australia: Victoria's potato growers spitting chips.** After over 280,000 negative soil samples, countless meetings, hours of inspections and reams of paperwork, the ban on movement of potatoes from Thorpdale, Victoria, Australia, has been lifted. Although only about 19 cysts were found during three routine tests across one 4 ha paddock on one farm, the industry was shut down within a 20 km radius. No more cysts have been found since and the affected paddock will be taken out of production for a very long time. While the ban was very costly to growers, they are pleased to have market access back. *February 2009 – News Headline.*

▶ **Scottish and US scientists developing purple potato chips.** The new potato variety, based on `Purple Majesty', has purple skins and purple flesh, and is high in anthocyanin pigments that have strong antioxidant properties. In addition, purple foods like these potatoes are thought to have anti-ageing properties, such as slowing the breakdown of skin collagen and wasting of muscles. It appears that neither frying nor microwaving destroy these properties, so healthy chips really can be on the menu. *February 2009 – News Headline.*

▶ **United Kingdom: New tuber treatment developed for seed potatoes in the UK.** Based on the chemical fludioxonil, Syngenta is developing a seed potato treatment to control a range of tuber diseases, such as *Rhizoctonia solani* (responsible for stem canker and black scurf), silver scurf and black dot. In addition, field trials in 2005 on `Maris Piper' gave good reductions in common scab disease, for which there is currently no chemical control. *March 2009 – News Headline.*

▶ **Storage disease prediction system validated in commercial fields**. A system for measuring disease levels in soil using molecular techniques (real-time Polymerase Chain Reaction; RT-PCR) and assessing disease risk was developed by scientists at the University of Wisconsin-Madison, USA, and in 2008 was applied to 42 commercial potato fields by Pest Pros Inc., an independent crop consulting and disease diagnostic laboratory. The diseases included in the assessment were soft rot, pink rot and Pythium leak, and the varieties being grown were `Russet Burbank', `Norkota', `Gold Rush', `FL 1879', `FL 1867', `White Pearl', `Snowden' and `Dakota Pearl'. Fields were given a disease risk of 1–5 (very low–high risk) and storage bins were monitored for disease and rated from 1 to 5 (very low rot–high rot). Results have shown that 74% of disease predications were either in complete agreement or very close to the final disease outcome. False positives occurred in 25% of fields because slightly less rot developed than was predicted, which is thought to be due to a seasonal effect. In future, other diseases that are thought to be a potential problem, such as late blight or Fusarium, can be included in the risk assessment. *March 2009 – Feature Article.*

▶ **Radiation cameras focus on crop pests, disease.** Radiation cameras, which detect electromagnetic radiation outside the visible spectrum and have been used in satellites for decades, are being developed for recognising infection of crops by pests and diseases. Although very costly, at about $10,000 each, scientists from Australia's premier national technology incubator, NICTA, say that the cameras could give growers a competitive advantage by enabling more rapid detection than traditional techniques. *18 March 2009, Potato News Today – News Headline.*

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