



Control of nematodes that affect potatoes

This feature article firstly directs readers to an informative summary from the University of Nebraska, Lincoln, USA, describing the main nematodes affecting potatoes in North America.



These nematodes fall into three distinct groups – lesion, root-knot and potato cyst nematodes. The publication outlines the occurrence and seriousness of these pests, gives a brief description of the organisms and the damage they cause, and suggests some management options.

Secondly, three research papers are highlighted that present results from investigations into cultural practices to control nematodes. In the first paper (Tobin et al. 2008), a biological control agent, *Pochonia chlamydosporia*, has been successfully tested against potato cyst nematodes. The work was carried out at two field sites in Shropshire, England, and the biological control agent was tested alone or with the nematicide fosthiazate. A decrease of around 50% in the nematode multiplication rate was seen with the *P. chlamydosporia*-only treatment, and this was not significantly different from all plots treated with fosthiazate. This demonstrates that the biological agent gave similar levels of control to the nematicide, and that *P. chlamydosporia* was compatible with fosthiazate.

A different biological control agent, the fungus *Muscodora albus*, has been tested against four plant-parasitic nematodes and the results are described by Riga et al. (2008) in the second paper. The nematodes were exposed in the laboratory for 72 hours to volatiles generated by *M. albus* that had been cultured on rye grain at 24°C. Mortality was over 80% for *Paratrichodorus allius*, *Pratylenchus penetrans* and *Meloidogyne chitwoodi*, but only 22% for *Meloidogyne hapla* and less than 10% for controls. In a greenhouse study, nematodes were inoculated into soil fumigated with *M. albus* and incubated for 7 days, after which host plants were introduced. At a *M. albus* application rate of 1.0% w/w, mortality was very high (>85%) for all four nematode species, both in the soil and in host plant roots. Clearly the fungus has nematicidal properties.

The third paper (Renco 2007) took a different approach, examining the life cycle of potato cyst nematode (*Globodera rostochiensis* pathotype Ro1) on nine potato cultivars in Slovakia during two growing seasons. Second stage juveniles were found earlier on one group of cultivars than the other, but these differences

Spuds in space



Seed potato production was tested in October 1995 aboard the Space Shuttle in its Microgravity Astroculture Laboratory, making potatoes the first veggies to be grown in orbit. The size and shape of the space tubers were similar to the 'ground-control' tubers.

were not apparent with fourth stage juveniles. There was a small difference (3 days) between cultivar groups in the emergence of the first adult males. There was an 8 day difference in the length of the complete life cycle between the two years. These factors need to be considered when designing management strategies for nematode-infested potato fields.

Lesion nematodes: life cycle, effects and management. University of Nebraska, Lincoln, USA (2008) Potato Eyes 20: 1-4.

Effect of the fungus *Pochonia chlamydosporia* and fosthiazate on the multiplication rate of potato cyst nematodes (*Globodera pallida* and *G. rostochiensis*) in potato crops grown under UK field conditions. Tobin et al. (2008) Biological Control 46: 194-201.

***Muscodora albus*, a potential biocontrol agent against plant-parasitic nematodes of economically important vegetable crops in Washington State, USA.** Riga et al. (2008) Biological Control 45: 380-385.

Comparison of the life cycle of potato cyst nematode (*Globodera rostochiensis*) pathotype Ro1 on selected potato cultivars. Renco (2007) Biologia 62: 195-200.



Control of potato diseases without pesticides

► Impact of agronomic strategies (seed tuber pre-sprouting, cultivar choice) to control late blight (*Phytophthora infestans*) on tuber growth and yield in organic potato (*Solanum tuberosum* L.) crops.

Under high nitrogen conditions, the most effective strategies to combat late blight involve accelerating the early development and tuber initiation of potato crops by (1) seed tuber pre-sprouting (yield increase of ca 18-23%) or (2) selecting cultivars with earlier tuber initiation (yield increase of ca 0-21%). Under conditions of a relatively low N supply, these strategies were not effective, since tuber growth was limited by lack of N before late blight limited yield. In years with an early and strong late blight development, cultivar resistance to late blight did not affect tuber yields. In years with moderate late blight, less susceptible cultivars gave higher tuber yields on fields with a low N availability. However, under high N conditions, these cultivars did not improve tuber yields. *Moller & Reents (2007) Potato Research 50: 15-29.*

► **Selection of isolates of *Trichoderma* spp. with biocontrol activity over *Rhizoctonia solani* in potato.** Ten isolates of *Trichoderma* spp. were assessed for their ability to degrade *Rhizoctonia solani* sclerotia. Five isolates (Th002, Th003, Th007, Th034 and Th181) were selected after they colonised more than 50% of the *R. solani* sclerotia. When the biological control activity of these isolates was evaluated under greenhouse conditions, *T. koningii* Th003 and *Trichoderma* sp. Th034 reduced damping-off in potato plants by 45.5 and 18.7%, respectively. In addition, they significantly increased plant growth. *Beltran Acosta et al. (2007) Bulletin OILB/SROP 30: 55-58.*

► **Reduction of potato tuber diseases with organic soil amendments in two Prince Edward Island fields.** Single applications of liquid swine manure (ca 49 hL/ha), ammonium lignosulfonate (a product derived from the pulp and paper processing industry, 50% solids at ca 10 hL/ha) and Nature Safe (10:2:8 N:P:K; an organic fertiliser made primarily of poultry feathers, ca 8.6 t/ha) were made in two commercial potato fields. Tubers were planted 3 weeks after application of treatments (1999) and again in 2000 and 2001 without further amendments. Potato scab severity was significantly

reduced by both Nature Safe and ammonium lignosulfonate compared with the controls at both sites in the first year. Some effects were seen in the second year, but none in the third year. Liquid swine manure reduced scab severity only at one site in the first year. The severity of black scurf was significantly reduced compared with the control at both sites by liquid swine manure and Nature Safe in the first year only. Verticillium wilt was significantly reduced compared with the control by both Nature Safe and ammonium lignosulfonate at one site and only in the second year. The severity of silver scurf or fusarium dry rot was not affected by any amendment in any year. *Lazarovits et al. (2008) Canadian Journal of Plant Pathology-Revue Canadienne De Phytopathologie 30: 37-45.*

Fertilisers

► **Nitrogen use efficiency characteristics of andigena and diploid potato selections.** In an alternative approach to reducing losses of nitrogen fertiliser through leaching, this paper evaluated the efficiency of use of nitrogen by a number of 16 different potato selection lines grown at two fertiliser nitrogen (0 or 100 kg N/ha) rates over 2 years. There were significant differences between the lines in N use efficiency characteristics, and these were consistent between years, despite drought conditions in the second year. Selections with later onset of senescence and those with greater partitioning of plant N to vines tended to have greater N use efficiency. This work suggests it is practical to screen potato germplasm for N use efficiency. *Zebarth et al. (2008) American Journal of Potato Research 85: 210-218.*

► **Potato yield and tuber set as affected by phosphorus fertilisation.** This 3 year study on a loamy sand soil with medium to high phosphorus levels investigated a number of fertiliser treatments, including P rates of 0, 37, 42 and 74 kg P/ha, two P fertilisers (mono- or di-ammonium phosphate), and P banded at planting or split applications at planting and emergence. Applications of P fertiliser increased total tuber yield and yield of undersized tubers, but decreased the proportion of large-sized tubers. Numbers of tubers in these categories was similarly affected. While the concentration of P in petioles was generally consistent with the rate of P applied, this did vary between seasons. Tuber P concentration (and hence total P uptake) increased as P application rate increased, but differences were quite small. There was no effect of P source or timing on the potato yield parameters measured. *Rosen & Bierman (2008) American Journal of Potato Research 85: 110-120.*

► **Influence of source and time of potassium application on potato growth, yield, economics and crisp quality.** In a similar manner to the previous paper, this research investigated nine combinations of potassium source (potassium chloride, potassium sulphate and potassium nitrate) and time of potassium application (basal dressing, split application, and split application + foliar spray) over two seasons with two processing cultivars in India. Plant growth characteristics, such as stem number, plant height and compound leaf number, were not influenced by sources of potassium fertiliser or application time. However, there were differences between potassium sources for processing-grade tuber yield, total tuber yield, biomass yield, specific gravity, tuber dry-matter percentage, crisp yields and oil percentage of the crisps. Application time had little effect on these characteristics. When all parameters were taken into account, it was suggested that potassium sulphate was the most suitable potassium source for crisping potatoes. *Parveen et al. (2007) Potato Research 50: 1-13.*

Cultivars

► **Premier Russet: A dual-purpose, potato cultivar with significant resistance to low temperature sweetening during long-term storage.** The primary benefit of this new cultivar is its resistance to the accumulation of reducing sugars, which allows tubers to be stored at temperatures as low as 5.6°C for 250 days without the need for reconditioning prior to processing. This means that there is an associated reduction in the incidence and severity of storage diseases associated with higher storage temperatures used for industry-standard cultivars. Tuber yields and specific gravity tend to be higher than other standard processing cultivars. Although it is resistant to a wide range of diseases, it does have a higher incidence of hollow heart than Ranger Russet or Russet Burbank, and cultural recommendations to manage this condition are provided. *Novy et al. (2008) American Journal of Potato Research 85: 198-209.*

► **Dakota Diamond: An exceptionally high yielding, cold chipping potato cultivar with long-term storage potential.** This cultivar includes approximately 23% germplasm from several wild potato species. It has smooth round tubers, with bright white skin and white flesh. The plant is very vigorous and yield potential is high. The cultivar's name suggests its beautiful appearance and excellent chip quality particularly from late season storage, as well as honouring the Diamond Jubilee of the North Dakota State University potato breeding programme. *Thompson et al. (2008) American Journal of Potato Research 85: 171-182.*



New Scientist

► **Let them eat spuds.** Potatoes were recently featured in the cover article of this widely-read science magazine. The article described the huge increases in potato consumption in developing countries, explaining that they now grow and eat more potatoes than traditional potato-eating countries. For example, China is the biggest potato producer in the world, and India produces twice the weight of potatoes that the USA does. Potatoes can be complementary to grain crops in a rotation and have nutritional advantages over grain. However, there are disadvantages to potatoes, such as being more perishable and expensive to transport than grain ... and then there are the diseases. The article concluded by investigating disease problems in potatoes using late blight as an example, looking at the alternatives for control, such as cultivar resistance, fungicides and genetic modification. If this disease can be adequately controlled around the world, then potatoes will have a major place in feeding the world's population. *2 August 2008, p. 30.*

Potato Country

Research report: Cutting back in-season nitrogen on eight potato cultivars. This interesting article summarises a 3-year programme by researchers at Washington State University addressing a number of objectives. The first task was to develop a research method to apply treatments using fertigation techniques, which was achieved using a pull-type sprayer that applied urea through adjustable nozzles. The trials showed that some new cultivars responded differently to N fertiliser than Russet Burbank and that care must be taken with fertigation practices with new cultivars. However, petiole N concentrations appeared to be similar over time for all cultivars, despite variations between seasons. The main finding was that maximum total yield was not equivalent to maximum economic yield and there were considerable advantages in cutting back in-season N applications. *July/August 2008, p. 4.*



► **Aphid pest gets “egged”.** This article describes a new method of marking aphids so that their movements between fields can be tracked. A mixture of egg-white proteins and water is sprayed onto host plants, aphids crawling over the plants become marked with the egg proteins and they then fly off to a new location. At this location the aphids are trapped on mesh-screens with a special adhesive. The aphids are removed, and the presence of egg proteins can be detected in the laboratory using antibodies. The technique will be used in studies to monitor aphid populations and modify IPM programmes. *July/August 2008.*

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 that are indicated.

► **Australia: Giant sculpted potatoes to mark Year of the Potato in Western Australia.** In recognition of the importance of Victoria's potato industry, five giant potatoes with forks, measuring up to 4.5 m and weighing up to 2.5 tonnes each, will be displayed in Federation Square. The sculpture has taken 6 months and is made from 20 million year-old volcanic rock found in the Gippsland area, a key Victorian potato growing area. In Victoria the potato industry is worth more than A\$380 million annually. The sculptor, John Mutsaers, said the forked potatoes symbolised the human talent to farm and cultivate but also the ability to share food with each other. After being displayed in Federation Square, the sculpture will be permanently located outside the “Spud Shed” in Trafalgar on a 6 m concrete plate. *May 2008: News Headlines.*

► **United Kingdom: More aphids threaten virus spread in British seed potatoes.** Entomologist Andy Evans says that up to 15 aphid species are involved in transmitting potato viruses in the UK, and in susceptible varieties, such as Estima, Desirée, Kerr's Pink, Marfona and Russet Burbank, aphids should be controlled as soon as the crop emerges. In recent years there has been an increase in Potato Virus A (PVA), which is typically transmitted early in the season. Aphid species not normally associated with potatoes may actually cause more damage than normal aphids because they probe the plant and then quickly move on to other plants, spreading the infection rapidly across the field. Dr Evans outlined spray recommendations for aphid control. *May 2008: News Headlines.*

► **China, New Zealand: University of Canterbury scientists researching superior potatoes with China.** Scientists from Crop & Food Research at Lincoln are cooperating with research organisations in Christchurch's Friendship city of Wuhan, China, to develop potato cultivars with disease resistance and desirable processing traits. Senior scientist Professor Tony Conner is collaborating with the Wuhan scientists on the international potato genome sequencing project, and spoke at the China-New Zealand Science to Market conference in Beijing. Of particular interest is co-operative work on resistance to cold-induced sweetening, for which Crop & Food Research has elite breeding material. *May 2008: News Headlines.*

► **United States: Innovations needed to boost spud sales, says new chief of US Potato Board.** Many of today's consumers are not interested in a 10-pound bag of russet spuds and are looking for something more convenient, such as a small package of red, yellow or purple potatoes or a poly-wrapped microwaveable baker. It is important that growers and retailers work together to provide potatoes in the form that consumers want them, along with continuing to promote the nutritional benefits of potatoes. *May 2008: News Headlines.*

► **Novel coloured spuds rich in antioxidants to grab consumer interest.** Recent research from Agriculture and Agri-Food Canada has shown that blue and purple flesh potatoes are rich in flavonoids, especially the flavonoids containing cancer-fighting antioxidants. *May 2008: Potato Trends.*

► **United Kingdom: Climate change responsible for earlier aphid flights.** In the UK, the peach-potato aphid has been found to be flying 2 weeks earlier for every 1°C rise in mean temperature for January and February combined. In 2008, the first aphid was caught on 25 April, which is almost 4 weeks ahead of the 42-year average. This appears to be due to an increased frequency of mild winters allowing overwinter survival of higher numbers of aphids. *August 2008: News Headline.*

► **Australia: Australian potato chip maker win ‘Best of Show’ award.** The winner of the Snack Foods category went on to be judged “Best in Show” at the 2008 Australian FOOD Challenge Awards. This was a brand new entrant to the market, PotatoMagic's Sultry Sally Potato Chips, which are baked, 97% fat free and made from Australian potatoes. The chips were developed as a low fat alternative and have no direct competitor that has a potato chip's mouth-feel, taste and texture. *August 2008: News Headline.*



Mana Kai Rangahau