chips
a look at what's new in potato information and technology
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Potato viruses

We start this feature with some good news on *Potato Virus Y* (PVY) in New Zealand (*Fomitcheva et al.*). Around the world, PVY causes serious disease in many members of the potato family, including potato, pepper, tomato and tobacco, with impacts such as stand loss, reduced yields and undersized tubers. New strains of the virus that seem to be caused by the recombination of existing strains have been detected in many potato-growing regions, and the researchers wanted to know how this recombination was happening. So they chose New Zealand, an isolated country with good quarantine procedures, for their study.

More than 30 PVY isolates that had been collected in New Zealand over the past 20 years were examined using several different laboratory methods. The results showed that the New Zealand isolates were mainly N- and O-strains, with no recombinants detected. Additional greenhouse experiments could also not measure any recombination, even if tubers infected with different strains were planted in close proximity. So while the researchers couldn't answer their question, New Zealand potato growers can be well pleased that PVY is not actively recombining into new strains.

The next article (*Boiteau et al.*) looks at ways of controlling PVY in seed crops. Over 3 years potato crops were (i) treated with mineral oil sprays to control aphids, (ii) surrounded by a border crop to act as a barrier to aphid-transmitted virus entering the crop, and (iii) grown using both methods (i) and (ii). Both techniques alone gave good reductions in PVY, but the combination treatment was nearly twice as effective as either treatment alone and this effect was more consistent that the single treatments. The mineral oil spray was also tested as whole plot, border-only or centre-only applications. PVY reduction for the border-only spray was similar to the whole plot or centre-only applications and this method is recommended to minimise costs.

The third article (*Davis et al.*) looked at the behaviour of aphid vectors of potato viruses to develop an understanding of the virus infection process. Aphids generally enter a potato crop from the margins, but gaps in the crop canopy can also attract aphids. Thus, experiments were set up to investigate whether localised stand gaps, such as those caused by planter skips, would affect PVY spread. Where stand gaps were less than 0.6 m^2, PVY infection was 13%. In contrast, in gaps greater than 0.6 m^2, PVY infection was 29%. A stand gap of 0.6 m^2 equates to a loss of three or more consecutive plants. This emphasises the importance of good planting technique.

Border treatments to control *Potato Leafroll Virus* (PLRV) were also investigated in the fourth paper (*Carroll et al.*). In the northern Great Plains of the USA, winged aphids disperse into potato crops from field margins during summer, spreading from local crop and weed hosts. Experiments carried out in 23 seed potato crops showed that methamidophos applications targeting crop borders gave excellent control (>94%) of colonising aphids, reduced the treated area by ca 95% and reduced costs from about US$58.91 to $4.22/ha.

Virus infections are notoriously difficult to identify, and the fifth paper (*Mortimer-Jones et al.*) describes a rapid molecular method for simultaneously detecting four viruses, *Potato Leafroll Virus* (PLRV), *Potato Virus X* (PVX), *Potato Virus S* (PVS) and *Tomato Spotted Wilt Virus* (TSWV), in one test-tube. The method, based on the polymerase chain reaction (PCR) technique, was highly reproducible and very sensitive, being able to detect a single infection from a bulked sample of tubers. This will be a very reliable and cost-effective tool for the seed potato industry.

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Carbon dioxide levels

While we hear a lot about the effects of elevated atmospheric CO_2 on climate change, particularly global warming, there is not a lot of media comment about the direct effects of increased CO_2 levels on plant growth, many of which are positive. This short paper describes a study where potatoes were grown under controlled CO_2 atmospheres and the effects on plant growth parameters were measured. Physical properties, except for potato shape, are unlikely to be affected by elevated CO_2, but significant changes are likely in potato composition.

Climate change and increasing atmospheric CO_2. Consequences for potato yields and quality? *Hoegy & Fangmeier (2009) Kartoffelbau 60: 30-33.*

Potatoes NEW ZEALAND Growing together

Tomato-potato psyllid, Candidatus Liberibacter solanacearum and zebra chip disease

Fifteen years ago few people had heard of the tomato-potato psyllid, and zebra chip disease was unknown. However, the rapid spread of the pest and the associated bacterial pathogen throughout the south-western United States, Mexico, Central America and New Zealand has led to a significant investment in research to understand the pest and the disease and identify control measures for both. This information is just beginning to be published in the scientific literature – so the information below is literally hot-off-the-press!

▶ **Seasonality of *Bactericera cockerelli* in potatoes (*Solanum tuberosum*) in South Auckland, New Zealand.** Psyllids collected from yellow sticky traps showed that adult activity began in October and remained low (ca 2/trap per week) until mid December. Plant sampling was also carried out at this time, but results were less sensitive than sticky traps. Crops harvested at this time had no detectable reductions in yield and quality. From late December trap catches increased rapidly, exceeding 100/trap per week in February. During this period, psyllid nymph numbers measured from plant sampling were positively correlated with trap catches, Liberibacter was detected and unacceptable levels of zebra chip disease were recorded. *Cameron et al. (2009) New Zealand Journal of Crop and Horticultural Science 37: 295-301*.

▶ **Insecticidal activity of entomopathogenic fungi (Hypocreales) for potato psyllid, *Bactericera cockerelli* (Hemiptera: Triozidae): development of bioassay techniques, effect of fungal species and stage of the psyllid.** This paper examined five fungal isolates (one *Beauveria bassiana,* two *Metarhizium anisopliae* and two *Isaria fumosorosea*) that were potential biocontrol agents for the potato psyllid. Fungal suspensions (2 ml of 107 conidia/ml aqueous suspensions) were applied to psyllids on potato leaves and kept under conditions that were optimal for the fungi. All isolates (except *B. bassiana*), produced 91–99% mortality in adults and nymphs, 2–4 days after application. *B. bassiana* mortality was 53 and 78% for adults and nymphs, respectively, 4 days after application. Thus, there is potential to apply biocontrol measures to manage the potato psyllid. *Lacey et al. (2009) Biocontrol Science and Technology 19: 957-970.*

▶ **Zebra chip disease incidence on potato is influenced by timing of potato psyllid infestation, but not by the host plants on which they were reared.** This study investigated the relationship between potato psyllid infestation and the expression of zebra chip disease. Potato psyllids were reared separately on four solanaceous hosts plants (potato, tomato, eggplant or capsicum) for more than 1 year. These psyllids were transferred to healthy potato plants 4, 6 or 10 weeks after germination. Zebra chip symptoms were seen in all potato leaves and tubers, regardless of the host that the psyllids had been reared on. Uninfested control plants had no zebra chip symptoms. Damage to leaves and expression of zebra chip symptoms were more severe on potato plants that had been exposed to potato psyllids 4 weeks after germination than on plants that had been exposed at later growth stages. Tubers from psyllid-infested plants had higher levels of reducing sugars (glucose) and lower levels of starch than uninfested plants. *Gao et al. (2009) Insect Science 16: 399-408.*

▶ **Impact of zebra chip disease on the mineral content of potato tubers.** This paper investigated physiological responses of potato plants infected with zebra chip disease, focusing particularly on concentrations of the following minerals: P, K, S, Ca, Mg, Na, Fe, Al, Mn, Cu, Zn and B. Measurements were made in tuber flesh and peel for 'Atlantic' potatoes grown at two sites (Washington and Texas states, USA). At both locations, infected tuber flesh had higher concentrations of P, K and Ca than uninfected tissue; peel from infected tubers had higher levels of Zn. Mg was significantly higher in uninfected than in infected tubers from both locations. For some minerals there were differences between sites. *Miles et al. (2009) American Journal of Potato Research 86: 481-489.*

▶ **First report of '*Candidatus* Phytoplasma australiense' in potato.** If *Candidatus* Liberibacter solanacearum wasn't enough – now there is *Candidatus* Phytoplasma australiense! This organism was isolated in January 2009 from potato plants in the Waikato region, New Zealand, that had upward rolling and purple-tinged leaves – similar to zebra chip disease. An additional 14 plants were collected from 7 different potato fields: seven of these tested positive only for phytoplasma, three tested positive for only liberibacter, while the remaining four tested positive for both pathogens. The implications of these mixed infections have yet to be investigated. *Liefting et al. (2009) Plant Disease 93: 969.*

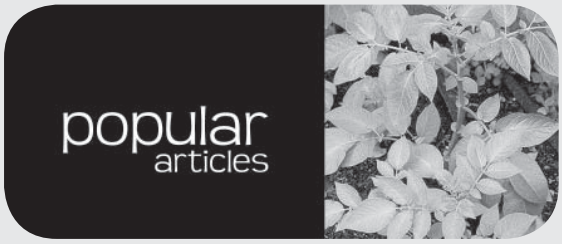
Nitrogen fertiliser

▶ **Nitrogen management for irrigated potato production under conventional and reduced tillage.** Field experiments were carried out under centre pivot irrigation for 4 years using reduced or conventional

tillage and different N management practices (56+280, 112+224, 112+336 or 112+112 (preplant+in-season) kg N/ha). Total yields were high in all treatments, and potato size distribution and tuber specific gravity were not greatly affected by any of these treatments. However, the energy and labour inputs to the system were significantly decreased by reduced tillage compared with conventional cultivation. *Alva et al. (2009) Soil Science Society of America Journal 73: 1496-1503*.

▶ **Surfactant impact on nitrogen utilization and leaching in potatoes.** Dry zones can develop in the potato hill on sandy soils. This research investigated the effect of surfactant on water surface tension in the dry zone and on water and nutrient uptake by potatoes. The non-ionic surfactant was applied at 9.35 L/ha as a band in the seed furrow at planting. Samplers were installed to measure nitrate leaching at a depth of 1 m. Over 3 years, changes in nitrate leaching were measured, but statistical differences could not be detected because of high variability in the data. Residual soil nitrate and ammonium concentrations were reduced by the surfactant treatment. Tuber N content, but not total yield, increased with surfactant use. *Arriaga et al. (2009) American Journal of Potato Research 86: 383-390*.

▶ **Nitrate–nitrogen rates in petiole sap of potato crop (*Solanum tuberosum* L.).** This study investigated using a meter to measure the concentration of nitrogen in leaf petiole sap as a tool to determine whether nitrogen fertiliser should be applied. Three potato cultivars were grown at three nitrogen fertiliser rates (0, 100 and 200 kg N/ha). Measurements were made of petiole sap nitrogen and nitrogen percentage in potato leaves 65, 75, 85 and 95 days after sowing. Petiole sap nitrogen measurements were more responsive to changes in N fertiliser than were leaf nitrogen percentages. In addition, petiole sap nitrogen levels were higher in dry than wet periods. Petiole sap nitrogen levels were related to total nitrogen accumulation in the potato tubers. *Majic et al. (2009) Acta Horticulturae 846: 333-338*.



Potato Processing

▶**News Feature: Global food security – potatoes play their part.** In 2008 there were three summits heavily focused on food as we plan for the world population to rise to 9.1 billion by mid century. It was also the international year of the potato, and the UN has set numerous potato initiatives into motion in many developing countries. Potatoes, being the fourth most important staple food in the world after rice, wheat and corn, are poised to help fill the gaps in food supply. Significant development in potato production is occurring in non-traditional potato-growing countries, such as Nepal, with assistance from developed countries that already consume large volumes of potatoes. *May/June 2009, p. 26.*

▶**Washing, destining and grading: cutting costs.** Potato processors are constantly looking for ways to improve the cost structure of their businesses, which are traditionally high maintenance operations. The US-based company Heat and Control is developing high tech potato washing systems that clean and re-use wash water and dramatically reduce freshwater consumption and effluent emissions. Even small things make a difference, like blow drying potato slices to remove surface water and increase the efficiency of the fryer. *March/April 209, p.18.*

Potato Storage

▶**News Feature: Pests – more ways than one.** The potato cyst nematode (PCN) can reduce yields by up to 60% where population densities of the pest are high. The research described in this article is testing the effectiveness of a natural gaseous compound produced by mustard plants on reducing PCN populations. The process, known as bio-fumigation, involves growing mustard plants in PCN-infested soil and then chopping the crop up and ploughing it into the soil during summer. Under the ground, enzymes act on plant compounds to release a fumigating gas, which diffuses through the soil. While the method is not expected to kill all PCN in a particular field, it is one more weapon in the arsenal against this devastating pest. *Spring 2009, p. 12.*

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▶**Keeping it clean.** This article looks at some refinements in washing and handling potatoes from key players in the vegetable washing industry. One of the most successful of these is an upgrade of the Wyma Vege-Polisher™, first developed in Christchurch in 2001. Key features include ease of maintenance, water recycling, flexibility of adding different cleaning modules for different markets and compact design. Wyma also produces machines that are adapted for lighter washes (Wyma Barrel Waher) or for brushing soil from vegetables (Wyma Flat Bed Brusher). *Spring 2009, p. 14.*

▶**Europe: Organic approval for Restrain.** A new anti-sprouting storage system recently approved in the UK will allow organic growers to access the late season, high-value market. Restrain is a patented system that uses ethylene gas, and has been used commercially in Europe for the last 5 years. The system has now obtained organic status throughout Europe and works for both onions and potatoes. Restrain is robust, flexible and user-friendly and there is no need to modify the store. *Spring 2009, p. 18.*

Snippets from www.potatonews.com

Listed below is an article that was posted on the Global Potato News website. Please visit the site for further details.

▶**Topcon introduces CropSpec™ Integrated, on-the-Go Plant Nutrition Sensor.** CropSpec™ is a real-time, integrated plant nutrient monitoring and application system that has been introduced by Topcon Precision Agriculture, a business unit of the California-based Topcon Positioning Systems that is a worldwide developer and manufacturer of precision positioning equipment. CropSpec™ is a powerful crop canopy sensor that is mounted on both the left and right sides of the cabin and allows a farm operator to monitor plant conditions and apply fertiliser and other inputs only as needed. It has been developed in co-operation with Yara International, a manufacturer of nitrogen-based fertilisers. The sensors measure spectral reflectance using light from pulsing laser diodes focused on the plants, and the readings are translated into chlorophyll content, which is closely linked to plant nitrogen levels and relative canopy vigour. The sensor information can be linked to a variable rate control program for liquid sprayers or granular spreaders and the required application of fertiliser can be delivered immediately. The precision application can significantly reduce costs and waste compared with traditional fertiliser application methods. *November 2009, Feature Article.*

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The final paper (*van Toor et al.*) compared the effectiveness of a calendar-based insecticide regime (methamidophos fortnightly) with various targeted insecticide control treatments for reducing aphid populations and an potato virus infection. Targeted treatments involved applying lambda-cyhalothrin or pymetrozine when an aphid threshold of 10 per 150 potato leaves was exceeded. Experiments were carried out over 2 years in Pukekohe, North Island, and over 3 years at Lincoln in the South Island of New Zealand. At Pukekohe in both years aphids were not found on potato foliage until late January, making 3–4 of the calendar-based sprays unnecessary. In autumn, plots treated on a calendar basis had higher levels of aphids than untreated plots, probably because spraying on this basis suppressed aphid predators (e.g. syrphids and lacewings). At Lincoln, only one insecticide application or imidacloprid seed treatment alone was needed to keep populations below the threshold for 2 of the 3 years, with no treatment required in the third year. Insecticide treatments did not reduce PLRV or PVY infection of tubers at either site in any year compared to the untreated control. Controlling aphids using a threshold population approach will reduce insecticide application costs.

▶ **Potato virus Y strain spectrum in New Zealand – absence of recombinant N:O strains.** *Fomitcheva et al. (2009) Journal of Phytopathology 157: 507-510.*

▶ **Crop border and mineral oil sprays used in combination as physical control methods of the aphid-transmitted potato virus Y in potato.** *Boiteau et al. (2009) Pest Management Science 65: 255-259.*

▶ **Planter skips and impaired stand favors potato virus Y spread in potato.** *Davis et al. (2009) American Journal of Potato Research 86: 203-208.*

▶ **Border treatment to reduce insecticide use in seed potato production: biological, economic, and managerial analysis.** *Carroll et al. (2009) American Journal of Potato Research 86: 31-37.*

▶ **A single tube, quantitative real-time RT-PCR assay that detects four potato viruses simultaneously.** *Mortimer-Jones et al. (2009) Journal of Virological Methods 161: 289-296.*

▶ **Targeted insecticide regimes perform as well as a calendar regime for control of aphids that vector viruses in seed potatoes in New Zealand.** *van Toor et al. (2009) Crop Protection 28: 599-607.*

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