



The future of potato farming?

Three contrasting papers highlighted in this issue of Chips look at potential methods for optimising potato production in the future.



In the first paper (Larkin & Griffin), the process of biofumigation was investigated using six brassica crops (canola, rapeseed, radish, turnip, yellow mustard and Indian mustard). The volatile compounds released from chopped leaves inhibited growth of a range of soilborne potato pathogens in laboratory cultures, greenhouse experiments and on-farm trials. Indian mustard was particularly effective against *Rhizoctonia solani*, while rapeseed and canola showed good efficacy against powdery scab and common scab. Other non-brassica crops, such as barley and ryegrass, also showed control of some diseases in some trials. In future, this type of information can be used to design specific crops rotations to control diseases present at particular sites.

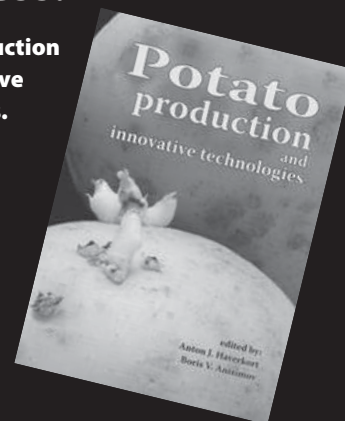
In the second paper (Mallory & Porter), data from 13 years of the Maine Potato Ecosystem Project were used to analyse the long-term effects of soil management, pest management, cultivar and rotation on the yield stability of potatoes. In all but one year, yields were up to 55% higher in an amended soil system (manure, compost, green manure and supplemental fertiliser) than in a contrasting non-amended soil system (synthetic fertiliser). Yields in the amended soil system were less influenced by adverse growing conditions, particularly low rainfall. The pest management system and cultivars used also influenced long-term yield stability but crop rotation did not. Knowledge of these factors can be used to design potato production systems that will give consistent yields over the long term.

The third paper (Yokobori et al.) also considers the long-term factors that may affect potato yields and investigates precision agriculture as a management strategy to use in decision-making. Real-time satellite images have been tested as tools for analysing within-field variability and making decisions to achieve uniform crop growth, but these images are heavily dependent on weather conditions. In this study an unmanned helicopter was used to acquire images of a potato growing area that had differences in previous fertiliser history. A major factor influencing crop uniformity was differences in the organic matter content remaining from preceding crops, and elevation data from the

New book – hot off the press!

Potato production and innovative technologies.

This is the result of the "Potato Russia" international conference that took place in Moscow during August 2007. It covers the whole spectrum of the potato supply chain, from consumer behaviour and marketing, through seed potato multiplication systems, agronomic and crop management practices, crop protection; and plant breeding including molecular aspects, to the technology of mechanization and storage. The book will be of interest to potato producers; breeding, chemical and machinery companies; and potato specialists of all disciplines. *Haverkort & Anisimov (eds) (2007) Wageningen, the Netherlands. 424 pp.*



helicopter indicated that the high organic matter was also found in a concave portion of the field. Quality decreased when excessive nitrogenous fertiliser was applied to areas with a high organic matter content, so variable-rate fertiliser applications could be based on organic matter content.

Control of soilborne potato diseases using Brassica green manures. Larkin & Griffin (2007) *Crop Protection* 26: 1067-1077.

Potato yield stability under contrasting soil management strategies. Mallory & Porter (2007) *Agronomy Journal* 99: 501-510.

Analysis and management of potato yield non-uniformity using helicopter-based remote sensing. Yokobori et al. (2005) *Agricultural Information Research* 14: 1-10.



Agronomy

► Vine desiccation characteristics and influence of time and method of top kill on yields and quality of four cultivars of potato (*Solanum tuberosum* L.).

Over 3 years and four treatment dates, potatoes were either mechanically flailed or chemically desiccated with diquat. The flailing treatment reduced yields by an average of 4% and specific gravity was equal to or lower than chemical desiccation. Fry colour was not affected by method or timing of top kill. The chemically desiccated potatoes were not ready for harvest until at least 3 weeks after treatment but crops killed by flailing could be harvested immediately. This means that top kill could be delayed when using flailing, which may result in greater yields. There were differences between cultivars in the time taken to desiccate. Harvest dates and yields can be manipulated by using alternative desiccation methods in different situations. *Waterer (2007) Canadian Journal of Plant Science 87: 129-135.*

► **Effects of rotary tillers on potato quality.** This study indicated that the incidence of greening was reduced when a tractor-pulled rotary tiller was used for cultivating potatoes in stony soils. *Geischer & Buchner (2007) Kartoffelbau 58: 160-163.*

Fertilisers

► **Reducing nitrate leaching from arable agriculture: preliminary results from the Netherlands.** The average farm groundwater nitrate concentration in the Netherlands is almost twice the EU target (50 mg nitrate/litre). To assist with environmental monitoring and crop management, this paper describes nitrate measurements and nutrient efficiency indicators, such as nitrogen surplus and residual mineral soil nitrogen. These can be easily measured and linked to fertiliser practices, so have a strong appeal to farmers. *Langeveld et al. (2005) Nitrates in groundwater. Selected papers from the European meeting of the International Association of Hydrogeologists, Wisla, Poland, 4-7 June 2002: 259-268.*

► **Quality and yield improvement through fertigation management.** This paper discusses fertigation treatments to improve potato yield and quality. A number of studies have shown the beneficial effects of drip irrigation combined with simultaneous fertiliser application on potato composition, processing quality and sensory properties. *Koehling (2007) Kartoffelbau 58: 130-133.*

► The effect of different N and K sources on tuber nutrient uptake, total and graded yield of potatoes (*Solanum tuberosum* L.) for processing.

This research was carried out over 3 years on an organic farm in Germany. Four fertiliser treatments were applied annually in spring just before ploughing and sowing two maincrop potato cultivars (Agria and Marlen). Soil nitrate levels were measured throughout the trial and indicated that organic cropping systems are nitrogen limited. Potassium levels in soil and tubers could be increased through application of either cattle manure or potassium sulphate. Tuber yields varied between years but were strongly influenced by fertilisers. Total and marketable tuber yields were greatest when both potassium sulphate and organic nitrogen (horn grits) were applied. Tuber yield responses to cattle manure were inconsistent. *Haase et al. (2007) European Journal of Agronomy 26: 187-197.*

Pests and Diseases

► Effect of mixed viral infections (Potato virus Y-Potato leafroll virus) on biology and preference of vectors *Myzus persicae* and *Macrosiphum euphorbiae* (Hemiptera: Aphididae).

Recently the number of potato plants testing positive for both Potato virus Y (PVY) and Potato leafroll virus (PLRV) in Idaho, USA, has increased. These plants display more severe symptoms than singly-infected plants. This study examined the fecundity and preference of two aphid vectors of these viruses, the green peach aphid (*Myzus persicae*) and the potato aphid (*Macrosiphum euphorbiae*). The number of nymphs produced from adults caged to potato leaflets was significantly higher on doubly-infected plants than on singly-infected plants or non-infected plants. In addition, both types of aphids preferred to settle on doubly-infected than on singly-infected or non-infected plants. *Srinivasan & Alvarez (2007) Journal of Economic Entomology 100: 646-655.*

► **Interactions between *Pratylenchus* spp. and *Rhizoctonia solani* on resistant and susceptible potato varieties.** Although the free-living nematode *Pratylenchus* spp. does not cause the level of damage to potatoes that the cyst nematodes do, this paper has shown that it can interact with *Rhizoctonia solani*, the pathogen causing black scurf. Three varieties with moderate to good resistance to black scurf showed greater disease symptoms in the presence of *Pratylenchus* spp. Other varieties susceptible to black scurf, such as Sante, did not show additional disease symptoms in the presence of *Pratylenchus* spp. Maris Piper showed no increase in the level of black scurf disease with *Pratylenchus* spp., but the nematode did cause a decrease in yield. *Kenyon & Smith (2007) Aspects of Applied Biology: 81-84.*

► ***Synchytrium endobioticum*.** This paper describes procedures for controlling *Synchytrium endobioticum*, the potato wart pathogen. Monitoring, which includes

survey, detection and identification, is the first step. This is followed by containment and suppression, using specific techniques such as steaming tubers, incinerating debris, burying and treating with slaked lime or by using resistant cultivars. Anon (2007) *Bulletin OEPP/EPPO Bulletin 37*: 221-222.

Storage

► **Fungi causing dry tuber rots of seed potatoes in storage in Scotland.** A mean rot index was calculated that combined the prevalence of a pathogen in 156 samples (each comprising up to ten rotted tubers) over three seasons with the incidence of tubers affected by the pathogen within those samples. *Phoma foveata* (gangrene) had the highest rot index, while *Fusarium avenaceum* appeared to be the greatest cause of *Fusarium* dry rots. The mean rot index for *Cylindrocarpon* spp. was slightly more than that for *F. avenaceum*. Region of production affected the prevalence of *P. foveata* and *F. avenaceum*. Reduced sensitivity to the fungicides thiabendazole and imazalil was seen in some isolates of *F. avenaceum*, particularly for imazalil. Choiseul et al. (2007) *Potato Research*.

► **Biological principles of potato storage. Pt I.**

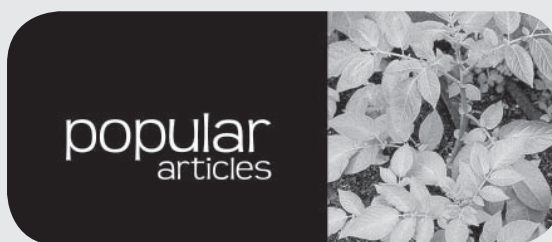
This article examines the biological processes occurring during potato storage, including respiration and transpiration; wound healing; pathogen defence mechanisms; dormancy and germination; and physiological ageing. Schuhmann (2007) *Kartoffelbau 58*: 186-191.

► **Biological principles of potato storage. Pt II.**

Storage rots, blackspot, changes in composition. Following on from the previous paper, this article looks at causes, infection pathways and symptoms of *Erwinia* storage rots, *Fusarium* dry rots and *Phoma* dry rots; methods for prevention of potato storage rots; occurrence of black spot in stored potatoes; and changes in potato composition during storage, such as effects on nitrates, vitamin C and glycoalkaloids. Schuhmann (2007) *Kartoffelbau 58*: 244-249.

Patent

► **Method of preparing novel healthy potato & taro instantly edible food.** This patent describes a method of cooking raw potatoes and taro in water and drying them to obtain a bar, slice or sphere. The process does not create harmful materials during preparation and a variety of nutrients is maintained in the product. The products have a natural puffiness and crispness, taste good and are convenient to eat and store. Yi (2007) *PCT International Patent Application WO2007071111 [FSTA: 2007-Jv3937]*.



Potato Country

► **Maximising the nutritional content of potatoes.**

This article discusses how only about 1% of the genetic diversity in the potato family is used in domestic varieties of potato. It is believed that examining the more than 200 wild species from around the world may reveal species that contain high levels of vitamins, phytofactors and other potential health-promoting compounds. A study funded by the Washington State Potato Commission has shown a wide range in the concentration of folic acid in different potato varieties. Folic acid is an important component of the diet of pregnant women, because low levels have been associated with birth defects. Yellow-fleshed potatoes, such as Satina, Carola and Golden Sunburst, tended to have the highest levels of folic acid, while small, fresh ("new") potatoes had very high levels of folic acid, up to 50% higher than at the traditional main harvest in autumn. Phenolic compounds, which have numerous health-promoting effects, also vary widely in potato varieties over 10-fold. These compounds are colourless, so can be found in high levels in white-fleshed potatoes such as Norkotah. Like folic acid, phenolic compounds have been found in higher levels in "new" than in autumn-harvested potatoes. 2007, *May*, p. 14-15.

Potato Processing International

► **Potato Protector.** A team of scientists at the Scottish Crop Research Institute has developed strains of Desirée and Mayan Gold potatoes that have 6-7 times the carotenoid concentration of their parent varieties. Carotenoids are fat-soluble antioxidants that are responsible for many of the red, orange and yellow colours of plants. A transgenic approach was used to develop the new varieties and the advantage and disadvantages of these potatoes must be considered carefully. The increased levels of two specific carotenoids, beta-carotene and lutein, may have significant health advantages, such as protection from eye disease and premature death, particularly in developing countries. Carotenoids may alter the flavour of the potatoes and tests must be carried out on the safety of the new strains. 2005, *January/February*, p. 48.

Snippets from www.potatonews

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.

► **United Kingdom: Growers can reap the advantages of weed burning technology.** This article describes how the technology associated with Thermoweed, a liquefied petroleum gas (LPG) weed burner, has recently been improved. The 6 m wide burner can be used for pre- and post-emergence weed control, desiccation and debris destruction. *August 2007: News Headline.*

► **Australia: South Australian potato growers got right to collectively bargain with processors.** The Australian Competition and Consumer Commission has recently given the South Australian potato growers the same bargaining power as their Victorian counterparts. This gives growers some confidence in the industry and will enable them to get the prices they need to stay in business. *August 2007: News Headline.*

► **Australia: Tasmanian potato growers receive 12 pc price increase from Simplot.** The extra \$30 a tonne for first grade potatoes and \$27.50 for all other processing potatoes will help cover rising production costs and reduce the number of growers pulling out of the industry. *August 2007: News Headline.*

► **Saving the world with potatoes.** At the recent Horticulture New Zealand annual conference, plans to celebrate the International Year of the Potato were announced. Activities include new resources and recipes that will be produced on the theme 'everything goes with potatoes'; new cookbooks written by key food writers, a new potato buyers guide and wallet card, radio and magazine competitions and a celebrity recipe swap. An international speakers' tour will focus on nutrition, potatoes and their role in satiety (feeling full), while potatoes will be the major focus of the 5+ A Day campaign in November 2008 that includes a "Grow Your Own Potato" kit for children. More details are available at www.vegetables.co.nz and www.potato2008.org. *Press Release (31 July 2007): Horticulture New Zealand.*

► **Manage potato diseases to minimize fungicide resistance.** This latest issue of "Spudvine" from the University of Idaho (<http://www.if.uidaho.edu/~bingham/Jun%202007.pdf>) describes the processes that lead to fungicide resistance and gives recommendations on how to prevent or delay it. For example, the full manufacturer's recommended rate should be used, and fungicides should be applied early in a disease epidemic. A useful table listing chemical groups, common names and some trade names is presented. *Feature Article: August 2007.*

► **Best management practices for nematode control.** This PowerPoint presentation (<http://www.colostate.edu/Depts/SLVRC/research/2007SRMAC/2007SRMACIngham.pdf>), by researchers at Oregon State University in the USA, gives some good pictures of three nematodes (root-knot nematode, stubby-root nematode and root-lesion nematode) that may affect potato crops. It also summarises current research into control methods and damage minimisation. *Feature Article: August 2007.*

► **Sprout inhibitors around the world!** A Canadian researcher is seeking information from countries around the world about the actual use or popularity of methods for potato sprout inhibition, such as low temperature methods, chlorpropham (CIPC), maleic hydrazide (MH), dimethyl naphthalene (DMN), carvone (Talent), jasmonates, ethylene, hydrogen peroxide, shaded huts, rustic storage, etc. Please send any details to Dr Barbara Daniels-Lake at danielslakeb@agr.gc.ca. *PotatoReporter Online – Research: July 2007.*

► **Prototype irrigation system 'listens' to plants.** American Agricultural Research Service scientist Robert Evans has built a state-of-the-art irrigation system that uses the latest in wireless technology for "communicating" with crops. The system comprises Bluetooth technology, sensors, weather stations and traditional irrigation equipment. *PotatoReporter Online – Research: July 2007.*

World Potato Congress news

► The CD of the Proceedings from the 6th World Potato Congress, held in Boise, Idaho, USA, 20–26 August 2006, was unable to be distributed to delegates. However, PowerPoint presentations are now on the website (www.potatocongress.org) for anyone to view. Topics covered include papers on potato tuber moth, future trends in global potato production, co-operatives and family partnerships, control options for a range of potato diseases, irrigation and potato storage.

► The 7th World Potato Congress will be held in Paris, France, in March 2009. Two other major international agricultural events, including one focused on machinery and equipment, will be held in the same week near Paris.

► The WPC Potato Tour to Australia and New Zealand will be on 10–27 February 2008. There will be 12 days in Australia, visiting Melbourne, Toolangi, Wagga Wagga, Canberra and Sydney, and 5 days in the South Island of New Zealand, with stays in Christchurch and Queenstown. The tour will be led by John Rich, a former WPC International Advisory Committee Member. More details at <http://quadrantaustralia.com/TOURS/TWPC2008/index.htm> or you can email John directly at enquiry@agtour.com.au.



Interesting fact

► The world's biggest potato, grown in Germany in 1997, weighed 3.2 kg (7 lb).

