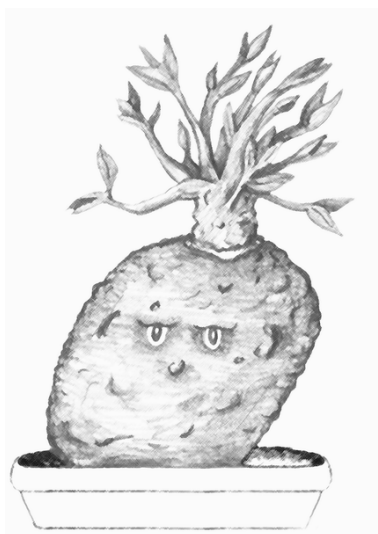


- a look at what's new in potato information and technology



A new art form ... bonsai potatoes

While Japanese bonsai experts may never have experimented on potatoes, it seems plenty of people have! Check out www.bonsaipotato.com/gallery.php?gallery_type=1 to see a huge range of interesting photos of efforts from potato bonsai fanatics who seem capable of torturing growing shoots into an amazing diversity of shapes and sizes ... from windswept shoots to trailing tendrils ... there's everything imaginable. You can even buy a book from Amazon called "Art of the Bonsai Potato Kit" by Jeffrey E Fitzsimmons that comes complete with clippers and tweezers. Now there's something to occupy those long winter evenings ahead!

Chips is a no-frills summary of global R&D in the potato industry. We also provide you with access to full copies of all available papers for private study.

Produced for Horticulture New Zealand and Ausveg by the New Zealand Institute for Crop & Food Research Ltd

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Feature – *Phytophthora infestans*, the late blight pathogen

Four scientific papers investigating various aspects of the potato pathogen, *Phytophthora infestans*, are summarised here. In the first paper (0632-029), New Zealand scientists from HortResearch describe a new model to predict potato late blight disease infections. It will be particularly useful for potato disease management in New Zealand, once it has been fully validated, because it uses local data.

The second paper (0632-019) looks at the evolution of the pathogen by examining plant collections. Different strains of the pathogen and the various epidemics in the US and Europe are discussed, along with molecular techniques to sequence the pathogen's genome.

In the third paper (0632-025), molecular techniques were used to look for genes expressed by plants when they were infected by *P. infestans*. Seventy-six genes were identified and classified into four groups according to the time after infection (24, 48 and 72 h) when the genes were expressed. This indicates that there are multiple defence responses when a plant is infected.

The fourth paper (0632-006) also used molecular techniques to investigate whether genetic changes in *P. infestans* populations have come from non-potato hosts. The *P. infestans* isolates from petunia, hairy and black nightshade were quite similar to isolates found on nearby potatoes. However, tomatoes were infected by two distinct and previously unreported pathogen genotypes that were not closely related to isolates found on nearby infected potatoes. Both weed and cultivated solanaceous species can be infected with strains of *P. infestans* that will infect potatoes.

A further series of articles about late blight disease is described at the end of this newsletter under the "snippets from www.potatonews" heading. First, the infestation of hairy nightshade by *P. infestans* is discussed, followed by summaries of research using essential oils and beneficial micro-organisms to control the pathogen.

0632-029 A new potato late blight disease prediction model and its comparison with two previous models. *New Zealand Plant Protection (2006) 59: 150-154.*

0632-019 Tracking the evolutionary history of the potato late blight pathogen with historical collections. *Outlooks on Pest Management (2006) 17: 228-231.*

0632-025 Screening and expression analysis of *Phytophthora infestans* induced genes in potato leaves with horizontal resistance. *Plant Cell Reports (2006) 25: 1094-1103.*

0632-006 Characterization of isolates of *Phytophthora infestans* from four solanaceous hosts growing in association with late blight-infected commercial potato crops. *Hortscience* (2006) 41: 1635-1639.

Section One: RESEARCH SUMMARIES

Crop Management and Agronomy

0632-024 Dakota Jewel: An attractive, new, bright red-skinned, fresh market potato cultivar with improved storage characteristics. Dakota Jewel is a medium-to late-maturing potato suitable for the fresh tablestock market, directly from the field and following storage. Tubers are early maturing, with a smooth, round to oblong shape, bright red skin and white flesh. Yield potential is medium, being similar to Red Norland. The specific gravity of Dakota Jewel is much higher than Red Norland and Red Pontiac, while sensory evaluation scores of cooked tubers are similar. Dakota Jewel is susceptible to hollow heart. *American Journal of Potato Research* (2006) 83: 373-379.

0632-011 Farm demand for quality potato seed in Indonesia. Supply of potato seed is a major component of production costs in developing countries. Many farmers save seed for subsequent years but this can contribute to a build-up of diseases and loss of yield. This paper presents the results from a survey of 182 potato farmers in the major potato growing areas of Indonesia. *Agricultural Economics* (2006) 35: 257-266.

Pests and Diseases

Aphids

0632-030 Insecticide practice for aphid control in potatoes. This paper describes a New Zealand-wide survey of insecticide use for aphid control in potatoes. While overall there was a poor response from growers, some interesting results were still obtained. Most seed crops received a single seed/tuber insecticide treatment and up to five foliar applications. In general, process crops were seed/tuber treated and then subsequently had 0 or 1 foliar treatments. Only 59% of fresh crops were seed/tuber treated and 14% received a foliar treatment. Imidacloprid was the most common seed/tuber treatment but some phorate was applied. There was a range of foliar applications, including organophosphate carbamate, synthetic pyrethroid and pyridine-azomethine insecticides. *New Zealand Plant Protection* (2006) 59: 235-241.

0632-001 Location of resistance factors in the leaves of potato and wild tuber-bearing *Solanum* species to the aphid *Myzus persicae*. Adult aphids were placed on a plant from one of 20 potato genotypes, and the numbers of nymphs and adults were counted after 8-30 days. There were large differences between genotypes in the size of the aphid colonies that

developed. In addition, for some genotypes there was a difference in resistance according to the age of the leaves, with old senescent leaves being susceptible in those genotypes. Aphid feeding behaviour was analysed using the electrical penetration graph technique, and this indicated that there were large differences between the genotypes in resistance at the leaf surface and in the underlying plant tissues (epidermis, mesophyll and phloem). *Entomologia Experimentalis et Applicata* (2006) 121: 145-157.

Potato mop-top virus and powdery scab

0632-023 Reaction of potato varieties to *Potato mop-top virus* infection in the Andes. The *Potato mop-top virus* (PMTV) is soil-borne and is spread by the fungal vector, *Spongospora subterranea*, which is the causative agent of powdery scab. PMTV has recently and unexpectedly been found at several locations in the USA and Canada. This research involved taking 21 US cultivars to three locations in the Peruvian Andes where PMTV and powdery scab are endemic to investigate their resistance to these potato pathogens. All 21 cultivars were susceptible to PMTV but symptom expression in the foliage was not a reliable indicator of virus infection. Biochemical tests were needed to confirm the presence of PMTV in tuber tissue. There was no correlation between virus infection and either the incidence or severity of powdery scab. PMTV infection did not result in the appearance of spraing or other internal necrotic reactions seen in North America and Europe, but a large number of infected tubers exhibited a reticulate surface cracking. The amount of cracked tubers increased dramatically in hydroponic culture when the nutrient solution was seeded with virus-infested *S. subterranea*. Two cultivars, Monona and Russet Burbank, had low levels of surface cracking. *American Journal of Potato Research* (2006) 83: 423-431.

0632-017 Single cystosorus isolate production and restriction fragment length polymorphism characterization of the obligate biotroph *Spongospora subterranea* f. sp. *subterranea*. The molecular techniques described in this paper will be very useful for understanding the genetic background of *S. subterranea*, the causative agent of powdery scab in potatoes. These molecular markers were used to analyse 24 isolates from 8 geographic locations in North America. Cluster analysis indicated there were two major groups of isolates. Group I included isolates from western North America, with the exception of those from Colorado, while Group II included isolates from eastern North America and from Colorado. *Phytopathology* (2006) 96: 1157-1163.

Genetic analyses

0632-028 A survey of genetic variation in *Streptomyces* isolates causing potato common scab in the United States. Like the previous paper, this research used molecular techniques, in this case to investigate the

genetic diversity throughout the US of the genus *Streptomyces*, soil bacteria that cause common scab disease. Incidence and severity of this disease vary across locations and years, due both to environmental conditions and genetic variation in potato cultivars. Little is known about the effect of genetic variation in the pathogen. Streptomycetes were isolated from lesions on field-grown potatoes from six states and classified into species. About half of the isolates belonged to *S. scabies* or *S. europaeiscabiei*, were found in all six states and were pathogenic when reinfected on to potato and radish. The other isolates comprised both nonpathogens and pathogens, including a species not previously reported. Some regional differences were found in the genetic diversity of *Streptomyces*. *Phytopathology* (2006) 96: 1363-1371.

0632-014 Genetic variability in the potato pathogen *Colletotrichum coccodes* as determined by amplified fragment length polymorphism and vegetative compatibility group analyses. Molecular techniques were also used in this research to characterise 211 *Colletotrichum coccodes* isolates from North America. This pathogen is the causative agent of black dot disease. Previous traditional analyses had assigned 112 of the isolates to 6 vegetative compatibility groups, with NA-VCG6 being the most divergent group and including 7 isolates collected from hosts other than potato. A quadratic discriminant analysis (QDA) of the molecular results showed a strong correlation with the groupings assigned by traditional methods. Black dot symptoms developed in plants inoculated with isolates collected from both potato and non-potato hosts, but total yield was not affected by the non-potato host isolates. The molecular technique indicates that genetic variation in the pathogen is presently limited to that already known from traditional methods, but the new technique is rapid and accurate. *Phytopathology* (2006) 96: 1097-1107.

General

0632-016 Effects of pest and soil management systems on potato diseases. This paper describes measurements over 2 years on long-term plots designed to reduce production costs, control crop pests and optimise the sustainability of potato production systems. Different pest management systems (e.g. biological, reduced input and conventional) were tested along with soil amendments and several cultivars. Superior had a higher incidence of white mould and black dot, while Atlantic had a higher incidence of early blight. Pest management system had only minor effects (affected foliar early blight incidence in 1 year) on levels of foliar and selected soil-borne diseases. Tuber black dot incidence was affected by soil amendments. Soil microbial activity was enhanced by the addition of manure and compost but lower disease incidence was not associated with this increased activity. *American*

Journal of Potato Research (2006) 83: 397-408.

0632-005 Farmers' participation and breeding for durable disease resistance in the Andean region. This paper describes an interesting approach to crop breeding used in the Andes. Farmers were involved in the selection of advanced materials rather than being offered finished cultivars. Because of their involvement with farmers, breeders learned more about requirements for the environments and they tended to use more locally adapted cultivars and less foreign material in the breeding programmes. With the successful introduction of new wheat, barley, common bean, quinoa, potato and maize cultivars, the centralised formal breeding approach has now been replaced by decentralised breeding programmes based on local germplasm with extensive farmer participation. *Euphytica* (2007) 153: 385-396.

0632-027 The management of potato cyst nematodes using resistant Solanaceae potato clones as trap crops. This paper describes a series of trials over 4 years that investigated the ability of 10 potato clones to act as trap crops for potato cyst nematode. The clones comprised wild *Solanum* potato species, breeder's hybrid lines and commercial cultivars. They all had high resistance to known PCN pathotypes and were able to stimulate high levels of PCN hatch. It is thought that some of these clones could be used to reduce field populations of PCN, particularly in organic potato production systems. *Annals of Applied Biology* (2006) 149: 271-280.

0632-007 Effect of a combination of chlorine dioxide and thiophanate-methyl pre-planting seed tuber treatment on the control of black scurf of potatoes. These experiments over 2 years in Canada investigated the effect of pre-planting seed tuber treatments (chlorine dioxide (ClO₂) and thiophanate-methyl (TPM), alone or in combination) on a range of potato diseases. Stem canker and black scurf, caused by *Rhizoctonia solani*, were reduced on progeny tubers at harvest and after storage by the combination treatment. However, this treatment did not reduce silver scurf (*Helminthosporium solani*) on stored potatoes. There was a low incidence of scab and dry rot in the control plots and so the effectiveness of the treatments against these diseases could not be evaluated. It is thought that ClO₂ killed the majority of the black scurf sclerotia on the tuber and the ClO₂/TPM combination prevented growth of any surviving *R. solani*. No phytotoxicity was observed and marketable yield was improved by the combination treatment. *Crop Protection* (2006) 25: 1231-1237.

0632-012 Behavioural response of Colorado potato beetle (*Leptinotarsa decemlineata*) larvae to selected plant extracts. Extracts from five plant species were applied at three rates (2, 20 or 200 g/kg) to potato leaves, which were then exposed to Colorado potato beetle larvae. There was no effect of any extracts on leaf consumption at the low rate, but at 20 g/kg there

was significantly more leaf tissue remaining on potatoes treated with *Arctium lappa*, *Bifora radians*, *Humulus lupulus* and *Xanthium strumarium* than with *Verbascum songaricum*. At the highest rate, all species reduced feeding, particularly *H. lupulus* and *X. strumarium*. Observations suggested that at higher rates the extracts affected feeding behaviour, such as feeding frequency, feeding duration and rejection of treated leaves. *Pest Management Science* (2006) 62: 1052-1057.

Nutrition and Processing

0632-010 Potato glycoalkaloids and metabolites: Roles in the plant and in the diet. While potatoes provide carbohydrate, protein, fibre and vitamins to the diet, they also contain a number of biologically active secondary metabolites. These include glycoalkaloids, calystegine alkaloids, protease inhibitors, lectins, phenolic compounds and chlorophyll, which may have both adverse and beneficial effects when consumed. This review considers the effects of potato glycoalkaloids, both in the plant where they are reported to be involved in host-plant resistance, and in animals and humans where they are known to have adverse and beneficial effects in the diet. Topics covered include glycoalkaloid content and biosynthesis throughout the potato plant, dietary significance, pharmacology and toxicology, and anticarcinogenic and other beneficial effects. The interactions of glycoalkaloids with other nutrients are also considered. *Journal of Agricultural and Food Chemistry* (2006) 54: 8655-8681.

0632-021 Retention of folates in cooked, stored and reheated peas, broccoli and potatoes for use in modern large-scale service systems. This paper examined the retention of folate, an important dietary nutrient, in peas, broccoli and potatoes during different cooking methods. Only blanching of peas, boiling of potatoes and oven-baking of unpeeled potatoes caused a significant reduction in folate concentration. There was no further significant loss of folate after storage at various temperatures and over different lengths of time followed by reheating. *Food Chemistry* (2007) 101: 1095-1107.

0632-026 Distribution of selenium in different biochemical fractions and raw darkening degree of potato (*Solanum tuberosum* L.) tubers supplemented with selenate. In this study, potato plants were grown at five selenate concentrations and tubers harvested after 16 weeks. Following storage at 3-4°C, Se concentration did not decrease for 1-12 months. Daughter tubers grown from the Se-enriched seed tubers had increased Se concentrations, indicating relocation of Se. At low Se concentrations the processing quality of potato tubers was improved and raw darkening reduced. *Journal of Agricultural and Food Chemistry* (2006) 54: 8617-8622.

0632-009 A meat and potato war: implications for cancer etiology. This paper discusses the carcinogens

that are generated during cooking. Cooking food clearly has benefits for humans, such as killing micro-organisms and improving flavour, texture and digestibility. However, a disadvantage is the generation of potentially toxic compounds at high temperatures. For example, acrylamide, an amine carcinogen, has recently been found in cooked carbohydrate-rich foods, particularly potatoes. In addition, amino acids, creatine and sugars in meat may generate heterocyclic amine carcinogens during cooking. The paper considers the risks from these dietary carcinogens based on available scientific data. *Carcinogenesis* (2006) 27: 2367-2370.

0632-022 The effects of potato pulp and feeding level of supplements on digestibility, *in situ* forage degradation and ruminal fermentation in beef steers. A potato pulp silage-based diet was compared to a grain-based diet for six Japanese Black steers. A nylon bag was placed in the rumen to measure degradation of the two diets. Dry matter intake, total volatile fatty acids concentration and digestibility did not differ between the two treatments, but steers fed the grain diet had a lower ruminal pH than steers fed the potato pulp silage-based diet. These results suggest that there are no adverse effects of a potato pulp silage-based diet. *Animal Science Journal* (2006) 77: 587-594.

Section Two: POPULAR ARTICLES

Book

Haase, N.U. and Haverkort, A.J. 2006. Potato developments in a changing Europe. Wageningen Academic Publishers, Wageningen, Netherlands.

This book covers a wide range of information about the potato industry in a rapidly changing Europe. It is divided into 8 sections and contains the following subject headings: Introduction, Modern breeding practices, Sustainable and organic production, Crop protection and fertilisation, Product quality and certification, Trade of seed and ware potatoes, Consumer behaviour and marketing, and Issues of the potato industry per country. Further information can be obtained from: info@WageningenAcademic.com

Potato Review

November/December 2006

"Diseases: Look out for storage rots this winter" p. 6

Warm, wet weather at harvest in the UK has led to lots of problems with storage rots, particularly the bacterial or soft rots caused by *Erwinia* species. These rots can be identified by washing the infected tuber under water; the rotted flesh will wash away leaving a hard edge on the tuber. Levels of the pathogen in the field have been high, causing wilt and stem rot and blackleg. A key to minimising rots in storage is drying the tubers by good ventilation for up to 3 weeks after the crop has entered

the store. It is also important to reduce the temperature to 12°C as soon as possible. Pink rot, watery-wound rot and black dot are also prevalent in warm, wet conditions. While the warm, wet autumn has led to these disease problems, the dry summer led to severe cases of common scab in non-irrigated crops.

**“Field trials: Can varieties be ranked on tolerance?”
p. 16**

Trials looking at tolerance of varieties to the potato cyst nematode, *Globodera pallida*, were conducted at two sites in the UK over two seasons. Tolerance is the ability of a variety to yield in spite of pest attack. One half of each plot was treated with the nematicide Vydate. Maris Peer was the variety with least tolerance to PCN while Cara exhibited most tolerance. Another tolerant variety was Everest, and this has the added advantage of being resistant, so that PCN won't multiply under this crop. Another tolerant variety was Maris Piper, with other low tolerance varieties including Lady Rosetta, Marfona and Santé. Santé is interesting in that it has low tolerance but high resistance.

**“Machinery: SP machines should mean more output”
p. 22**

This article discusses the use of self-propelled potato harvesters. James Daw grows 800 acres of maincrop potatoes and has just become one of the first UK growers to test a Dutch-built Ploeger 4-row self-propelled harvester. He believes that the machine could harvest the crop more economically than his two harvesters and a windrower, which require three tractors and operators. The machine runs on two rubber tracks and can hold up to 12.5 t of potatoes so does not need another tractor and trailer beside it. This is particularly useful in wet conditions. The topper unit at the front can discharge haulms to the left or right and this reduces the amount of material being taken into the harvester. The harvester has automatic controls and is backed up with extensive warning and monitoring systems. On a reasonable day it is expected to harvest 25 acres. Despite its good performance there were some teething problems and Mr Daw commented that there were enough niggles to make sure he never put the spanners away.

Potato Country

November 2006

“Compost and tea applications proving beneficial for foundation seed operation” p. 14

Bill and Scott Kimm are certified potato seed growers from Montana, USA, who have a reciprocal arrangement with a nearby 700 cow dairy farm. The dairy farm sources alfalfa (lucerne) hay and bedding materials from the Kimm operation, while the Kimms compost the dairy manure on an 8 acre site. The composting process takes 3½ months. Over 700 t of compost is produced three times each year and is applied to potato fields in summer and autumn. The soil quality is improving with more

humus, organic matter and worms found after compost has been applied. In addition, liquid teas are applied to the potato crops. The teas are created by aerating a water solution and adding different types of biologicals, depending on the type of tea needed. Some teas are applied via tillage instruments and help to break down crop residues more quickly. Other teas are applied six times per season through the pivot irrigation system directly on to the potato foliage. The 5-7 crop rotation consists of potatoes to wheat, followed by alfalfa for 3 years and back to wheat, then potatoes again. Compost is also applied to alfalfa after cutting.

Snippets from www.potatonews

Listed below are 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.

July 2006: Feature Articles

“Increased potato nitrogen uptake through specific placement of controlled release fertilizer”

This report (<http://solanaceae.scientific-conference.net/engine/search/index.php?func=detail&aid=363>) describes a study from the University of Florida where three nitrogen rates (112, 168 and 224 kg N/ha) and four fertiliser placements (banded 5 cm above-seed, banded 5 cm below-seed, mixed homogeneously throughout the row, and side-dressed at early emergence on row shoulders, i.e. grower practice) were tested. Significantly higher nitrate concentration in sap from potato plants was seen in below-seed than other placements. Below-seed and mixed treatments produced higher dry biomass than the other two treatments. Highest marketable and total tuber yields came from the below-seed and mixed placement at the high N-rate and the below-seed placement at the medium N-rate. The side-dressed treatment produced tubers with a significantly higher percentage of rots and internal heat necrosis and lower tuber specific gravity than the other treatments.

“Management of volunteer potatoes”

Surveys have shown that up to 186,000 tubers/acre can be left after potato harvesting. A bulletin has been produced (<http://cru.cahe.wsu.edu/CEPublications/eb1993/eb1993.pdf>) that discusses the biology and ecology of volunteer potatoes and how to manage this serious weed.

“Best management practices for preventing spread of soil-borne pests, including PCN”

This 2-page information sheet (www.ag.uidaho.edu/potatopath/alerts/Preventing_Spread_of_Soil-Borne_Pests_May_2006.pdf) was compiled by the University of Idaho in May 2006 after the first finding of potato cyst nematode in the USA. It emphasises the importance of strict sanitation in controlling and preventing the spread of this serious pest. Best management practices are described, such as cleaning machinery between fields, keeping soil from potato

processing operations away from potato fields, growing non-host crops in long rotation with potatoes, planting cover crops to prevent soil erosion and spread of cysts, and informing staff of the seriousness of the pest and providing them with proper cleaning and disinfection procedures.

“Potato nutrient management efficiency”

This document is the online version of Chapter 8 from the book, “Potato Production Systems” (www.ag.uidaho.edu/potato/production/files/NUTRIENT%20MANAGEMENT.pdf). It describes patterns of nutrient uptake throughout the potato growing season and examines the factors affecting nutrient requirements. These include potential yield, as well as soil and environmental conditions. The 17 essential nutrients required by plants are listed and methods of determining nutrients required are discussed, such as soil and plant tissue analysis. The chapter also considers fertiliser application methods. Management of the major nutrients nitrogen, phosphorus, potassium, sulfur, calcium and magnesium is described in detail and there is also a section on some of the micronutrients (zinc, manganese, iron, copper, boron and chloride).

December 2006: News Headlines

“United States: Spud pest requires vigilance”

New Zealand and Scottish experts were recently invited to Idaho to discuss potato cyst nematodes (PCN), a pest that has only very recently appeared in America’s largest potato production area. A report from Capital Press staff writer, Dave Wilkins (www.capitalpress.info), discussed some of the advice given by John Marshall and Mark Phillips. PCN are very persistent and difficult to control once established. Nematicides can help, but they’re not cheap and they’re not completely effective. The most effective control is to avoid plant potatoes in infected ground. Of the two species of PCN, Idaho has the most difficult to control, pale PCN (*Globodera pallida*). Nematode cysts can persist in the soil for 20 years or more. In New Zealand resistant potato varieties have allowed growers to shorten their rotation and grow host crops more frequently. In addition, New Zealand growers have found that seed potatoes can be disinfected by immersing them in a solution of sodium hypochlorite, basic household bleach.

“United States: Mustard helps foil soil pests”

Mustard is being grown as a bio-fumigation crop against soil pests in south-east Idaho. This report from Harry Morse, a freelance writer for Capital Press (www.capitalpress.info), describes how the crop has recently become very popular, with 8-12,000 ha being planted this year. After 6 weeks of growth, the crop is ploughed back into the soil, where it decomposes to emit a substance similar to metam sodium. The main benefits are increased green manure and some nematode control, with some improvement in soil

stability and percolation rates.

“New Zealand, United Kingdom: UK and NZ researchers working together to improve potato cyst nematode sampling”

Researchers from the New Zealand Institute for Crop and Food Research Limited are being funded by the British Potato Council to investigate potato cyst nematode diagnostic methods. The 2-year collaborative project with the Central Science Laboratory in York will investigate molecular testing methods. The tests will rapidly identify the species present and measure the numbers of nematodes in the sample. New laboratory methods will allow processing of greater volumes of soil and increase the speed and accuracy of the measurements. (Source: www.fwi.co.uk/Articles/2006/11/21/99652/new-zealand-researchers-to-improve-potato-cyst-nematode.html)

“Australia: Shortage puts south-east Australian potatoes in demand”

Because of the widespread Australian drought, potatoes from south-east South Australia are in high demand. The chip producer McCain has increased their price offer by \$10, which is a welcome incentive for potato growers who have had to start watering earlier than usual. (Source: www.abc.net.au/news/newsitems/200611/s1790803.htm)

“New Zealand: New Zealand potato growers to trial organic compost”

Crop & Food Research scientists believe that potato growing is the most promising industry to test organic composts. Local government agencies and members of the compost industry will meet with stakeholders in the potato industry to look at market development opportunities. (Source: tvnz.co.nz)

December 2006: Feature Articles

“Storage costs are part of potato production costs”

The September 2006 issue of “the SPUDVINE”, a grower newsletter produced by the University of Idaho, examined the costs of potato storage (www.if.uidaho.edu/~bingham/Sep%202006.pdf). The storage facility and associated equipment are major capital investments and a careful analysis of the costs should be undertaken. The article examines various costs involved in potato storage, including ownership costs or “fixed costs” and operating or “variable costs”. The latter vary directly with the quantity of potatoes stored and the length of storage, and include shrink, interest, electricity, sprout inhibitor, sanitation chemicals, and labour.

“Irrigation Association New Product Winners”

Three products were winners in the 2006 Irrigation Association New Product Contest. The first was “Come Unglued”, a device that quickly disassembles glued PVC pipe by heating the pipe to the exact temperature needed to remove it from a fitting without causing damage. The

second product was the “Metafix water-to-water injector” used for fertigation, and this was described as being portable, easy to use and maintain with its required energy being obtained from the water flow. The third product, “Paige’s splice kit”, provides a connector assembly for splicing wires in underground installations, such as irrigation system wires and cables. (Source: www.potatogrower.com/?pageID=10&newsID=900&page=1)

“Weed Implicated in Potato Blight Persistence”

This article (www.ars.usda.gov/is/pr/2006/061212.htm) describes research that has identified hairy nightshade as an alternate host of *P. infestans*, the late blight pathogen, in Maine, USA. In this state 55% of potato fields were found to be infested with the weed. The article notes that the International Potato Center in Lima, Peru, has estimated that the disease costs the world’s growers more than \$3 billion each year in fungicides and other control measures. Two other articles about control of late blight are also referred to. The first of these (www.ars.usda.gov/is/pr/2006/060313.htm) described research that looked at plant essential oils, including oregano, thyme and lavender, and other biologically based approaches to the control of late blight. In laboratory tests the essential oils, particularly oregano, greatly inhibited the growth of *P. infestans* fungi, but their effectiveness was reduced in growth chamber studies. Because the essential oils are quite volatile, more research is needed on how to retain them on plant leaves, but this must be balanced against phytotoxic effects (e.g. burning of leaves) of high concentrations of the oils. Another way to increase the efficacy of the essential oils may be to apply them with other natural products, such as beneficial micro-organisms. The second article (www.ars.usda.gov/is/pr/2004/040927.htm) looks at research to delay sprouting and suppress dry rots on potatoes. US Agricultural Research Service scientists have patented methods for using 18 strains of *Pseudomonas* and *Enterobacter* bacteria to prevent losses in stored potatoes. Recent studies have shown that these biocontrol micro-organisms are also effective against *Phytophthora infestans*. Three of the most effective of these beneficial bacteria reduced late blight by 25-65% in small-scale studies, while in a warehouse-simulation trial reductions in late blight of 35-91% were seen.



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