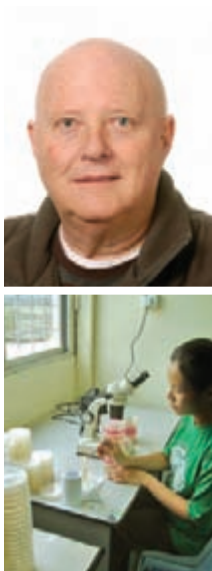




Taking New Zealand Science to the World



Clockwise from left: Dr Robert Hill; White lily, one of the local plants sampled in Sarawak; Norhayati A.S. of the Forest Research Centre in Kuching working in Dr Hill's Sarawak Laboratory. The candle is used for sterilising equipment.

What does it take to transfer high-tech bioprotection research from a New Zealand laboratory to the jungles of Borneo?

Ask Robert Hill, who, armed with a suitcase of basic supplies, equipped a laboratory and successfully isolated potentially beneficial strains of *Trichoderma* from a range of wild and cultivated plants in Sarawak.

The Sarawak *Trichoderma* Project is part of the Planted Forests Project, commissioned by the Sarawak State Government to combine economic development, wildlife protection, and land use by local people. Dr Hill was recruited for his expertise in identifying and developing microbial products to enhance the health and vigour of forest nursery stock. But whereas in New Zealand his success has been with *Pinus radiata*, in Sarawak he is working with *Acacia mangium*, a fast growing tropical tree used for paper production.

"Forestry is a huge industry in Sarawak. The Samarakan Nursery, where I was based, produces about three million trees a month and targets are being increased to a million a week."

A year into the long-term project, Dr Hill has travelled to Sarawak three times. Supported by the project client Sarawak Planted Forest Sdn Bhd and on-site project management staff, he has sampled numerous local plants, isolated promising wild *Trichoderma* isolates and produced inoculum for nursery trials on *Acacia mangium* seedlings. As Dr Hill explains, all this was done with the bare minimum of equipment.

"I took a large suitcase of basic laboratory equipment including agar media, scalpels, forceps and autoclavable bottles and we bought

a pressure cooker locally. The laboratory at the nursery was very basic. It had a bench, tables, a sink, gas ring and cupboards. All working surfaces had to be sprayed and swabbed down regularly with Vircon, a hospital disinfectant. Despite hordes of ants and a variety of flying insects, we managed to avoid any significant contamination. Working without purpose-built facilities requires a lot more time and labour, but it can be done."

Dr Hill is returning to Sarawak in December to evaluate the performance of the nursery seedling trials.

"As effective isolates are identified, we will transfer them from small to large scale nursery trials and then on to pilot-scale plantation trials and finally to large-scale plantation trials. Our end goal is to increase the proportion of healthy acacia seedlings produced in the nursery using selected *Trichoderma* bio-inoculants and decrease plantation losses from Ganoderma disease."

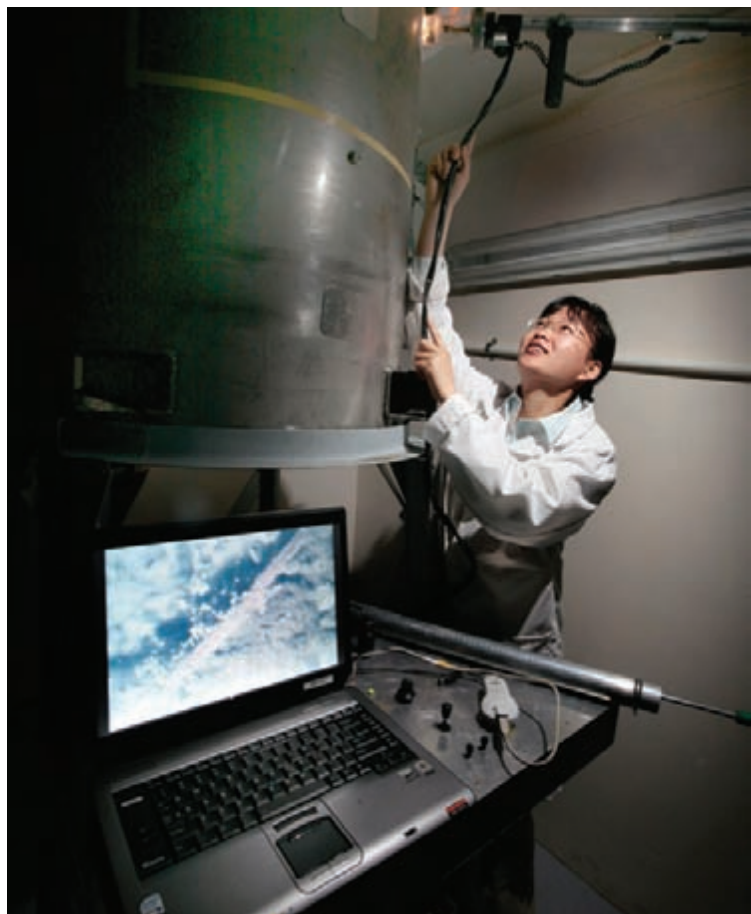
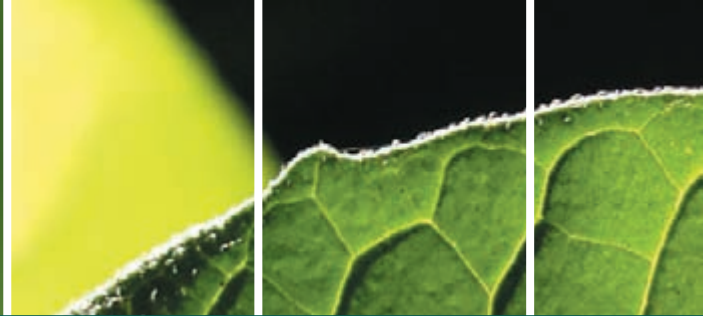
The Planted Forests Project has been named as one of the six most important research projects in the world by Discover Magazine. If it succeeds, it could be replicated in tropical regions around the world.

For more information see:
www.discovermagazine.com/2007/dec/the-6-most-important-experiments-in-the-world

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New technique for rhizosphere sampling



PhD student Shengjing Shi inserts a camera into a rhizotron. The resulting image can be seen on the screen in the foreground.

The rhizosphere, or area of soil immediately surrounding a plant's roots, is the site of intense and complex interactions between the plant, the soil and numerous associated microorganisms.

Plants are known to influence microbial community structure and activity in the rhizosphere, thereby affecting soil function and biogeochemical processes. However, it is very difficult to collect representative samples of root exudates and rhizosphere soil.

Destructive sampling is used in most studies. This means exudates are collected by water extraction of excised roots, and rhizosphere soil is removed by shaking excavated root material.

In the New Zealand Biotron, a team of scientists led by Sustainable Bio-Protection Theme co-leader Professor Leo Condrón has developed and refined an innovative system for in-situ sampling of root exudates and rhizosphere soil from plants grown in large-scale rhizotrons.

This involves creating horizontal access portals at different depths by removing soil with a corer. The access portals are maintained by inserting an inflatable tube which is removed prior to sampling.

A medical endoscope system consisting of a powerful light source and camera is used to locate suitable sampling sites within the rhizotron.

Precision calipers are then used to attach an anion exchange membrane to a specific area of root to collect exudates, while a combination of calipers and scissors are used to collect samples of root and rhizosphere soil.

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Butterfly Biodiversity

If it's a nice day in North Canterbury, chances are PhD student Mark Gillespie will be tramping the hills around Waipara armed with a butterfly net and notebook. He's

carrying out a survey of butterflies in the area and has a particular interest in the New Zealand Southern Blue, a species that experts believe is inter-breeding with the introduced Australian Common Blue to create a hybrid form.

"From a local conservation viewpoint, this could be bad – the hybrids could replace the Southern Blue in the area, reducing the unique biodiversity. On the other hand, it's a natural process that happens anyway. We're not sure if it's a bad thing just yet – that's what I'll be investigating."

Mark is studying butterfly behaviour, abundance and population dynamics to help him identify their habitat preferences and requirements.

"Conserving butterflies is not just about providing them with food plants. They need a complex set of resources for thermoregulation, courtship, roosting etc. Behavioural work seeks to untangle this complexity.

"I follow one butterfly at a time for as long as possible and I measure how much time they spend engaged in activities like basking, resting, searching, interacting. I also record which habitat structures and resources they use when exhibiting each type of behaviour - things like flowers, plant species, and bare ground. Once I have this kind of data for a large number of individuals, I can make conclusions about what habitat resources are essential to butterfly populations. This is vital when trying to make recommendations about how to conserve them."

Back at Lincoln University, the detective work begins. He'll be using DNA analysis to shed light on the hybridisation issue and also comparing butterfly populations in areas planted with natives

as part of the Greening Waipara project, with remnant areas of existing native bush and with properties that have not been planted.

Future experiments will try to enhance butterfly populations by planting the right food plants for the caterpillars and providing the best nectar sources for the adult butterflies.

Mark is collaborating with Professor George Gibbs, of the Victoria University of Wellington's School of Biological Sciences, Brian Patrick of Otago Museum, and Dr Rob Cruickshank of Lincoln University.

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Truly sustainable biofuels



Prof Alison Stewart

From the Director

The Centre has been a hive of activity with respect to marketing and promotion over the last six months. The new website was launched in October and we have already seen significant benefits from this upgrade through increased daily hits and increased enquiries from prospective students, overseas researchers, industry and business agencies.

The launch of the Greening Waipara vineyard trails in November furthered our media profile and following on from our success at Mystery Creek and the Royal Agricultural Show, we are well through the planning phases to create a strong Centre presence at a number of high profile events in 2009 including the Ellerslie Flower Show which has recently transferred to Christchurch.

In October Prof Wratten ran another successful transferable skills workshop, this time for the Centre's postgraduate students. This sets the scene for a number of other development and mentoring programmes that the Centre has planned for 2009. We aim to provide our young researchers with a broad work experience during their stay in the Centre to better prepare them for entry into the scientific workforce.

The new cohort of Centre PhD (14) and postdoctoral fellowships (7) were advertised in October and it was extremely pleasing to see the number of high quality applications that were received both from within New Zealand and internationally. We are looking forward to welcoming these new researchers in February 2009.

We are always proud to see our young researchers leaving the Centre well equipped to take up a wide range of exciting new positions in science, agribusiness and government. It seems that everywhere I look these days there is a former Centre postgraduate or postdoctoral fellow assessing or inspecting me!

Many thanks to the management staff and research leaders for their support throughout the year. It looks as though 2009 is going to be another busy year for all of us so let's make sure that the summer break really is a break. Of course, I say this every year and FRST bidding invariably stuffs it up.

Kind regards

Around the world, the search is on for biofuel production systems that won't inflate food prices, damage productive ecosystems and burn ever more fossil fuel.

All these issues will be addressed in the Bio-Protection Research Centre's newest project which aims to establish a sustainable biofuel industry in New Zealand. Professor Steve Wratten, who is leading the project, explains that it has four sustainability goals.

"First and most important we want to identify high yielding oil feedstock crops which can be grown on marginal land. This will ensure that our biofuel production isn't compromising food production and forcing up food prices.

"Second, we will be finding ways to grow those crops without damaging the existing services supplied by nature such as biocontrol, pollination, mineralisation of plant nutrients and so on. In fact we will be aiming to improve the cropping ecosystem if possible.

"Thirdly, once we have identified the plants and got them growing well, we'll be investigating the use of natural microbes as soil inoculants to increase both crop yield and oil production. The cost of biodiesel feedstock, or raw material, is 80% of the overall production cost, so it's essential to produce it as efficiently as possible.

"Finally, throughout the whole project we will be measuring total energy inputs and outputs. This energy life-cycle analysis will provide the hard data to back up sustainability claims."

Professor Wratten says the inclusion of the sustainability aims has resulted in the inclusion of numerous partners.

"Biodiesel Feedstock" is a \$4 million, six year project funded by the Foundation for Research Science and Technology, with global fuel producer Chevron as the principal commercial partner and co-funder. Also collaborating are Solid Energy New Zealand, the owner of Biodiesel New Zealand; Plant and Food Research; Nufarm, crop protection experts; and Lincoln University, whose staff carried out initial research for Chevron into crops with potential to produce novel biofuels.

"We are also working with two Maori groups, the owners of the Taharoa C Block Incorporated (King Country) and Te Runanga o Ngai Tahu to identify blocks of land which are suitable for crop growing."

Dr Dick Martin from Plant and Food Research, Prof. Alison Stewart from the Bio-Protection Research Centre and Assoc. Prof. Bruce McKenzie of Lincoln University will be working with Professor Wratten as research leaders.

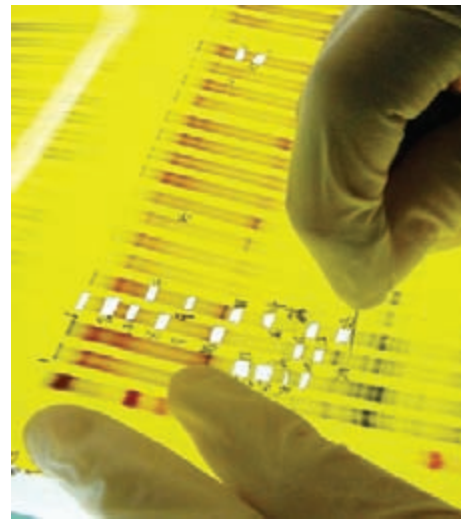
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Dr Dick Martin, Prof. Steve Wratten, Prof. Alison Stewart and Assoc. Prof. Bruce McKenzie inspect a brassica crop.

Instilling excellence in young scientists



Excision of DNA bands from a DGGE gel

Natural suppression of wheat disease

A recently completed PhD study has shown that natural suppression of the devastating fungal root disease, take-all, can occur in New Zealand wheat crops. This is the first record of the phenomenon in this country.

Soonie Chng, working with Dr Marlene Jaspers, Prof Alison Stewart, Dr Matthew Cromey (Crop & Food Research) and Dr Sarah Dodd (Landcare Research), has identified field sites where pathogen inoculum levels were high, but take-all severity was low.

These sites had grown continuous wheat crops for the previous three to four years, and were showing signs of classical 'take-all decline'.

Denaturing gradient gel electrophoresis (DGGE) was used as a tool to characterise microbial diversity in soils with different levels of suppressiveness.

Take-all decline was due both to specific and general suppression. Specific suppression was associated with a group of micro-organisms (*Pseudomonas putida*, *P. fluorescens*, *Nocardioides* sp., *Gibberella zeae* and *Penicillium allii*). This form of suppression was transferable between soils in a pot assay.

The mechanisms of general suppression, which was not transferable, is likely to be more complex, involving physical, chemical and biological soil factors.

This research could form the basis of new approaches to take-all management. These could include use of suppressive micro-organisms or modifications of crop rotations to utilise natural take-all decline.

Soonie took leave from Crop & Food Research to complete her studies. She has again taken up full-time employment in the newly formed Plant and Food Research CRI, as a plant pathologist.



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Moving on up...

The Noble Foundation is a privately run agricultural research center in Ardmore, Oklahoma. It promotes extension/consultation of farmers and ranchers in a 100 mile radius from the foundation. It consists of three operating divisions, Agricultural, Plant Biology and Forage Improvement.

Meet Dr Carolyn Young, an Assistant Professor in the Forage Improvement division at The Noble Foundation in Ardmore, Oklahoma and a Bio-Protection Research Centre graduate.

Dr Young's primary role is leading a programme on endophytes of cool season grasses. Working with the Foundation's grass breeder, Andy Hopkins, and a team of post-docs, associates and technicians, she ensures the right types of endophyte go into elite cultivars of tall fescue being developed for the Oklahoma climate. Alongside this she is also investigating endophyte-host interactions by analyzing the predicted transporter genes and looking at their expression profiles under different nutrient conditions.

She also has two smaller projects around legumes which, thanks to increasing nitrogen fertilizer prices, are becoming more important in the state's agricultural systems. The first of these involves developing lucerne cultivars resistant to an endemic root rot pathogen while the second is trying to develop rhizobia inoculants for the specialty legumes that are used in Oklahoma.

Dr Young gained Centre funding for the final part of her PhD and is quick to name her supervisor Prof. Barry Scott of the Institute of Molecular BioSciences at Massey University as the person who has most influenced her career.

"Barry had a huge impact on my career development as I spent more than 15 years in his lab both working and studying. He is a fabulous mentor and runs a great programme. He really understands students and recognizes that we are all individuals."

Two other important Centre staff, were Kim Plummer, formerly HortResearch, but now La Trobe University, Melbourne and Rosie Bradshaw also from Molecular BioSciences at Massey University. "Kim and Rosie were great mentors and female role models."



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Dr Carolyn Young



Scott Harper and Elaine Chan

Student winners

The winners of the Bio-Protection Research Centre Best Student Presentation awards at the 8th Australasian Plant Virology Workshop in Rotorua in November were: Elaine Chan, "Characterisation of plant protein kinase R" and Scott Harper, "The *Citrus tristeza virus* resistance-breaking strain in New Zealand and the South Pacific".

Excellence across the board

There's more to developing a successful science career than producing good science. That was the message for a group of 18 PhD students at a two-day Bio-Protection Research Centre workshop at Lincoln University in October.

The students learned to identify their own, and others', strengths, weaknesses, biases and preferences, and the ways these can be employed to build strong teams in a complex working environment.

The workshop, organised by Professor Steve Wratten and run by Vargo + Lewis Consultants is thought to be the first of its kind for PhD students in Australasia. It follows on from a similarly successful one run last year for Centre post-doctoral fellows.

Professor Wratten says the workshop programme was designed to provide the students with another layer of life skills which they can apply to their developing careers.

Climate change in vineyards

Dr Marco Jacometti has received a three year Foundation for Research Science and Technology Post-Doctoral Fellowship to investigate the potential impact of climate change on beneficial natural systems in vineyards.

Climate change is a serious threat to biological control and other natural systems which reduce agricultural pest populations, and scientists predict it could cause an increase in pest pressure and epidemics.

Dr Jacometti's project, which will be conducted in commercial vineyards in Canterbury and Hawkes Bay, will use sun-sails made of hot-house film rigged over the rows to alter daily temperature fluctuations and rainfall, mimicking the effects of climate change.

The vineyards will then be managed either to standard practice or with enhanced ecosystem services, allowing Dr Jacometti to assess the natural system's ability to cope with, and mitigate the effects of, changing environmental conditions.

In the Canterbury vineyard he will be concentrating on Botrytis bunch rot, the light brown apple moth (whose larvae facilitate the disease), and the moth's primary parasitoid. In Hawkes Bay, the focus will be on the citrophilus mealybug and its parasitoids, ants (which enhance mealybugs) and leafroll virus (*GLRaV-3*), which is vectored by them.



Dr Marco Jacometti under a sun sail used to mimic climate change conditions in vineyards

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Bio-Protection
Bioprotection science for New Zealand

2008 Biosecurity Award for Excellence to Centre Director



Murray Sherwin (Director General MAF), Jim Anderton (Minister of Biosecurity and Agriculture), Alison Stewart, Barry O'Neill (Deputy Director General MAF Biosecurity)

Professor Alison Stewart, Director of the Bio-Protection Research Centre is the recipient of the 2008 Biosecurity Award for Excellence.

In presenting the award, Minister for Biosecurity Jim Anderton outlined Professor Stewart's research, leadership and management expertise, stating that

"the success of the Bio-Protection Research Centre has been due, in no small part, to her commitment to bioprotection and biosecurity".

Professor Stewart received the award at the Sixth New Zealand Biosecurity Summit in Christchurch in November.

Ngai Tahu Hui-a-Tau

The Ngai Tahu Hui-a-Tau (AGM) at Kaikoura in November provided a great opportunity to promote Centre science and tertiary study options.

Maori Development Co-ordinator Melanie Mark-Shadbolt set up a display with other members of Te Tapuae o Rehua, the collaborative company owned equally by Ngai Tahu, Lincoln, Canterbury and Otago Universities and the Christchurch and Otago Polytechnics. Melanie spoke to numerous visitors about the Greening Waipara Project and about studying at Lincoln University.

The hui, which attracted thousands of people over three days is held annually to discuss the future of the iwi. This year it also celebrated 10 years since the Ngai Tahu Treaty settlement.



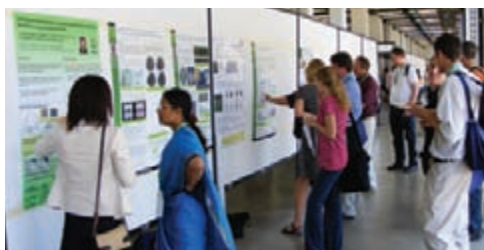
Prof. Richard Falloon; Prof. Lodovica Gullino (ISPP President Elect); Dr Timothy Hall (European Commission) and Dr Corrado Clini (Italian Ministry for Environment, Land and Sea).

ICPP Congress

Centre Deputy Director Richard Falloon presided over the 9th International Congress of Plant Pathology in Torino, Italy in August.

Researchers from the Centre and collaborating institutes made a strong show at the Congress which is the key world event in Plant Pathology and is held every five years. ICPP2008 attracted over 1600 offered papers and was attended by 2000 delegates from 84 countries.

Professor Falloon retired from his position as President of the International Society of Plant Pathology at the end of the Congress, to be succeeded by Professor Lodovica Gullino from the University of Torino.



Poster session ICPP 2008

New Zealand Royal Show



You don't need a lot of space to grow vegetables. Kitset planter boxes attracted a lot of interest on the Bio-Protection Research Centre site at the Royal Show in Christchurch in November. The site was promoting the use of companion plants and beneficial insects in the home garden.