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WITH PLEASURE I PRESENT to you the latest edition of our AgScience magazine. In it you will find a stimulating article on breakthroughs in apple production systems from Stuart Tustin, NZIAHS Fellow and our award winner from last year, and some commentary on lifting the productivity of hill country from our Waikato Section Chair, Doug Edmeades – this is a topic which appears to have some policy traction, particularly in the context of the regional growth strategies that have emerged recently.

Earlier in the year it was pleasing to see the Budget giving strong support to New Zealand science and science education in general and biosecurity in particular. I congratulate our ministers on their resolve to invest in these areas, apparently against the advice of Treasury. The additional funding for Bovine TB eradication has since been overshadowed by the more recent announcements regarding the goal of a predator-free New Zealand. The pragmatic amongst us will no doubt question the achievability of this, but the goal is absolutely laudable and the multi-stakeholder public and private investment to back it is very encouraging. For New Zealand, as an isolated nation with a unique blend of biotic diversity and a biological-based economy, it has been rightly said that biosecurity is akin to national security, and thus every dollar we put into it is a worthwhile investment in our economic and environmental future.

Could this be one of those rare decision-making moments when everyone wins? The critical part will be ongoing investment in research and practise to maintain the value of the initial investment, and we should not under-estimate the size of the investment required to get it done on the ground, alongside the innovation that comes from the R&D community.

Meanwhile those budget announcements have more recently been put into action with the awarding of a new cohort of research projects via Ministry of Business, Innovation and Employment’s Endeavour (Research Programmes and Smart Ideas) and Sustainable Land Management and Climate Change funding pools. In this issue Bob Edlin has put together a summary of the key successful primary sector projects. My congratulations to those research leaders who have been successful. But I will reflect again on the now bewildering array of research investment mechanisms we have in this country, all with differing criteria and application processes that seem to evolve rapidly. This has now become both a blessing and a curse for proposal writers because on the one hand they always have another opportunity to pitch their innovative but unsuccessful ideas to funders, but on the other hand they are constantly trapped in proposal-writing mode.

Members may have noted the recent minor amendments to the Hazardous Substances and New Organisms Regulations, as they relate to the definition of Genetically Modified Organisms. Past President David Lewis led our submission on the proposals in December last year, in which we argued for more extensive revisions to account for new technologies that allow for modification within an organisms genome. These present no additional risk beyond long-standing techniques and are now well embedded in international practise. In fact the results in many cases are indistinguishable from non-GM material. While the opportunity to update our regulations was not taken, no doubt the issues will emerge again in policy development, especially in the light of yet another comprehensive report endorsing the safety of GM crops from the US National Academy of Sciences.

Finally, I would like to draw members’ attention to the Trimble Agricultural Research Fund. This is not formally a part of our suite of NZIAHS awards, but as your President I sit on the advisory board for these travel awards. Each year I note that we would willingly award more funds that are applied for, if we had more requests that meet the criteria. So I would encourage you to consider this opportunity for future reference. Inside this issue you will see a list of recent awardees and their supported activities.

– Mike Dodd
President NZIAHS

NZ Horticultural Science Advancement Trust

Seeking applications for funding in the 2017 Round
Available to NZIAHS members working in horticulture.
Individual awards typically range between $1,000 and $2,500.
Closing date 30th November 2016
Application form available from website www.agscience.org.nz
or secretariat@agscience.org.nz
SCIENCE AND INNOVATION MINISTER Steven Joyce regularly announces funding for the science projects that win approval from the decision-makers who pick the winners from the rest.

In recent months he has announced:

- The approval of 245 R&D Experience Grants for 116 businesses to employ students over the 2016/17 summer break;
- The Science for Technological Innovation National Science Challenge’s investment of $826,000 in 10 ambitious new research projects to develop disruptive technology for industry; and
- The Sustainable Seas National Science Challenge’s funding of eight new scientific research projects through the Challenge’s new Innovation Fund.

Several NZIAHS members seem likely to benefit from Joyce’s September 13 announcement of a total investment of more than $209 million over the next five years in new scientific research projects through the Ministry of Business, Innovation and Employment 2016 Endeavour Fund.

Previously known as the MBIE Contestable Research Fund, this fund “invests in excellent science that has potential impact for New Zealand — economically, environmentally and socially”. It is “an important tool in the Government’s 10-year vision for a highly dynamic science system that enriches New Zealand, making a more visible, measurable contribution to our productivity and wellbeing through excellent science”.

It sits alongside the Marsden Fund, which is designed to promote discovery science, the Health Research Fund, administered by the Health Research Council, and the business-led R&D programmes of Callaghan Innovation.

The successful proposals were selected by the MBIE Science Board, an independent statutory Board, following a review by independent experts. The new research contracts were to begin on October 1.

The Endeavour Fund supports both Smart Ideas initiatives and larger Research Programmes. Smart Ideas initiatives (Joyce said) “catalyse and rapidly test promising, innovative research ideas”. Contracts are awarded for two to three years.

Up to $10 million a year in total will be invested in 28 projects under the Smart Ideas initiative and up to $38 million a year in total will be invested in 28 Research Programmes.

But scientists hoping to score from the Endeavour Fund may find the goal posts have been moved from year to year. Changes were made to the contestable fund last year as a result of a review announced in the National Statement of Science Investment. Further changes were made for the 2016 investment round.

Agriculturally oriented projects (including horticulture and forestry) this year won $8,397,062 of the $26,421,098 total investment in Smart Ideas.

**Among the winning projects are:-**

**AGRESEARCH**

- Plugging into electron flow in the rumen: developing a microbial fuel cell to control electron flow and direct rumen fermentation towards better ruminant nutrition. $1 million over three years.
- World first proof-of-application of Trojan female pest control. $869,562 over three years.
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**LANDCARE RESEARCH**

- Biosecure ID: Machine learning to automate image-based identification of species. $1 million over three years.
- Optimal release strategies to maximise biological control: RHDV in rabbits. $750,000 over three years.

**LINCOLN UNIVERSITY**

- Reducing environmental damage following urea application in pastures by using a bio-inoculant. $977,500 over three years.

Agriculturally oriented projects (including forestry) won $100,622,501 of the $182,781,727 total funding for Research Programmes.

**Among the winning projects are:-**

**AGRESEARCH**

- Capturing the true value of New Zealand meat: Objective measurement of meat quality in beef, lamb and venison. $4,250,000 over five years.
- Evaluating the potential of forages with elevated photosynthesis and metabolisable energy. $10 million over five years.

**LANDCARE RESEARCH**

- Building resilience and provenance into an authentic Maori honey industry. $4,500,000 over five years.
- Innovative ways to reduce farm nitrogen losses by manipulating carbon inputs. $7,301,000 over five years.

**LINCOLN AGRITECH**

- A sensor and model-based analyser for blockscale grape yield prediction. $5,986,600 over five years.
- New breeding technologies for New Zealand’s high value plant industries. $8,500,000 over five years.

**NIWA**

- Maximising the economic benefits of irrigation through dynamic, high resolution weather forecasting. $4,750,000 over five years.

**UNIVERSITY OF Otago**

- Development of next-generation sanitisers for the control of bovine mastitis in the dairy industry. $1,681,443 over three years.

Obviously not every applicant can score funding from the Endeavour trough.

But AgScience can’t assess the merits and worthiness of projects that missed out because there isn’t an online list of unsuccessful applicants or any publicly available detail.

“These aren’t published for reasons of confidentiality, especially commercial sensitivity,” a ministry official told AgScience.

“The work proposed may still be something the organisation itself wishes to follow up, and it may not wish it’s lack of success in securing funding to be widely known.”

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**Endeavour grants announced**

**Some NZIAHS members should be beneficiaries**

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Some NZIAHS members should be beneficiaries
Orchard systems and the beginning of the future

RESEARCH IMPERATIVES RELATED to the future development of orchard planting systems are inextricably linked with and must contribute to the global challenge of world food supply. Within 25 years the world population will increase by 1.7 billion, arable land for food production is forecast to decline by 30%-40%, and climate dynamism, water scarcity and soil and environmental degradation will all affect world food security and supply. Scenario modelling suggests crop production per unit of land area must double to meet the projected food demand by the increased population by 2030 (Ortiz, 2011). These are research issues of the moment, not the future.

What does this mean for tree fruit orchard production systems? A doubling of the apple production of the most productive regions of the world will require future orchard systems to achieve yields of 150 to 200 tonnes per hectare. Almost certainly such yield increases will need to be achieved within strict production protocols aimed at ensuring the ongoing conservation of the productive ecosystem. Within each fruit crop we cultivate, these challenges apply, so for New Zealand this means cherries, apricots, peaches and nectarines, pipfruit, kiwifruit and avocado, which are our major perennial fresh fruit crops. The big question is how will it be possible to achieve increased production of this magnitude?

Plant scientists internationally are grappling with the same issues for all crops. Indeed, an international plant science network survey recently elaborated on this problem with “one hundred important questions facing plant science research” (Grierson et al., 2011). Prominent within the Environment and Adaptation section was the question: “What is the theoretical limit of productivity of crops and what are the major factors preventing this being realised?”

This question lies at the heart of the future economic, environmental and social sustainability of crop production worldwide and fruit industries are simply a perennial crop subset of this.

THEORETICAL LIMITS

There are two essential contributions of crop physiology to the productivity of tree fruit orchard systems:

• light utilisation by the crop; and
• resource partitioning (the distribution of growth resources within the plant).

We have a good understanding of the light utilisation of modern contemporary orchard systems. For mature apple orchard systems of quite diverse tree architecture and tree spacing, annual yields are well correlated with mid-season proportional canopy light interception (Lakso, 1994). This analysis of multiple studies demonstrated that 60%-65% interception of mid-season incoming light appears to be the practical upper limit for mature apple orchards. In other words, our most efficient modern orchard planting systems fail to utilise 30%-40% of available seasonal light energy.

A more recent study of apple planting system productivity in New Zealand corroborated the Lakso analysis of mid-season fractional light interception (Palmer et al., 2002). Within this study they discussed an extrapolation of the yield responses of three cultivars to light interception to suggest a theoretical yield potential of 169 tonnes/hectare at 90% light interception. Coincidentally, this theoretical yield fits within the range calculated to double the present apple orchard yields of 80-110 tonnes/hectare which the upper quartile of New Zealand orchards currently achieve.

The challenge is to find practical ways to overcome the apparent limitation of orchard system light interception by finding different planting system designs that can achieve >85% light interception without compromising the canopy light transmission characteristics necessary for maintaining high fruit colouration and excellent internal fruit quality. Such planting system designs will also need to be biologically efficient, able to achieve a high harvest index by which the major fraction of seasonal resource acquisition ends up in fruit development rather than vegetative growth. These systems have numerous other practical requirements such as the need to be simplified for greater labour efficiency and amenable to mechanisation, automation and, in the future, robotics, to be truly focused on an economically sustainable future.

The distribution of annual growth (resource partitioning) is the second physiological factor influential in determining the productivity and quality of fruit from orchard systems. While the seasonally available intercepted light energy defines the total resources assimilated and available for growth, these resources are distributed according to some “rules” of allocation, among the main centres of growth, or sinks:

Total growth = the growth of flowers and fruit + leaves + shoots + stems + roots + maintenance respiration.

Harvest index is the measure of the efficiency of the tree biology for partitioning growth to the crop fraction, where a higher proportion is considered a higher efficiency. Intensive dwarf tree apple orchard systems
productivity

have among the highest harvest indices of any crop and have been determined to be as high as 0.7 (Palmer et al., 2002). If we can better understand the growth processes that affect harvest index, we can gain insight into the function and efficiency of trees within the planting system. In particular we need to understand the effects of decisions around the choice of tree architecture and the associated pruning and training of the tree and planting system as they might enhance or detract from the harvest index of the system.

Despite the importance of the harvest index in increasing orchard productivity, only limited research has been done in this area. Recent studies in New Zealand by our group have suggested that further increases in the harvest index of apple trees are possible. New methods of crop load management were used, which reduce the floral spur density of branches by artificial spur extinction and reduce annual vegetative growth increments and total tree size (measured as trunk cross-sectional area) while maintaining yield and fruit quality.

These studies, although preliminary, indicate that growth distribution is modified so that typical growth increment (fruit plus spur structure) may remain unaffected at the spur level while growth increment in the branch and main stem fractions is reduced compared with trees grown using conventional fruit thinning for crop load control.

THE “ENERGY GAP”

Why do current orchard systems utilise just 60% of seasonally available radiant energy? The answer is remarkably simple. Even high-density intensive orchard systems are designed to allow machinery access between rows of trees, which means orchard systems are discontinuous canopies. The evidence shows this has the cost of up to 40% loss of radiation interception. Hence the solution appears equally simple – that new planting system designs need to reduce the between-row spacing to reduce the energy gap to as little as possible. Herein lies the complexity of tree canopy design requirements. There are two dimensions to canopy light relations of deciduous fruit tree crops: light interception by the leaves is required for productivity while light penetration to the sites of flowering and fruiting is required for optimising fruit quality. Any canopy re-design must satisfy both requirements simultaneously.

In the Future Orchard Planting Systems programme we have used the principle that every component of the orchard systems is up for re-evaluation and re-design in the quest for systems that can approach the biological upper limit for productivity. We have designed new planting system arrays and tree architectures from first principles, beginning with decisions that between-row spacing need to be reduced from the current 3–3.5 metres to 1.5–2.0 metres apart. The closer row determinations are based on the space required for people to freely work rather than current machinery (future machinery will clearly also need to be designed according to these spatial limits). With that major design change, there arises the need to alter tree architecture away from a three-dimensional conical canopy because that tree form induces excessive shading and access issues at such close-row spacing.

For that reason, together with attention to practical crop management, a planar two-dimensional tree design has been formulated. It is worth noting that the innovation was not in the tree design (as we have numerous centuries-old examples of elegant planar tree structures), but the notion to dramatically reduce between-row distances. The planar canopy is structured as two opposing cordons which support 10 vertical fruiting stems spaced at equidistant intervals along the direction of the row (Fig 1). The vertical fruiting stems are minimally branched, ensuring the whole tree structure remains a very narrow and light-porous canopy. Although planted at close between-row spacing, each tree unit extends for 3 metres along the row, thereby enabling a very intensively populated orchard canopy of 16,000–22,000 vertical fruiting stems per hectare although achieved with the planting of only 1667–2222 trees per hectare.

This concept for new apple, pear and stonefruit orchard systems breaks many of the accepted pomological practices. Fruiting stem height is anticipated to reach 3 metres, recommended tree height: row width ratios used in current three-dimensional canopies will not be possible. Our view is that this new canopy concept has so many different architectural elements that many current rules will no longer apply. Our eco-physiological calibration of these canopies as they develop will inform us quickly whether these assumptions have any veracity.

While a critical aspect of the new orchard system design is to raise radiation utilisation close to the maximum possible, the structural considerations of the new tree design have also included the issues of resource use efficiency and harvest index. The potential for minimal branching and its control using apical dominance in apple was a major contributor to the design choice to use vertical fruiting limbs. Our hypothesis is that such a fruiting canopy structure will evolve quickly to a condition of very minimal annual pruning. That feature alone has a major (but as yet unquantified) influence on the resource distribution and harvest index of tree crops. The key attributes to successfully achieve and maintain this state is to ensure the complement of light interception and light distribution are both managed close to their optimum.

An innovation towards this management is the practice of selecting the quality and spatial position of floral spurs along vertical fruiting stems and thinning out those not needed using artificial spur extinction, to set a defined number/density thereby predetermining the crop load at or around bud break. This is a key tree management intervention.

The programme is in its early phase with just two years of experimentation. To date the development of these new prototype systems has met or exceeded our plans and expectations. An example of our first prototype cordon orchard is shown in (Fig. 2) producing its inaugural crop in the second year from planting, when yields of 21.26 tonnes/hectare were achieved from the 2 metres and 1.5 metres row

Figure 1
A prototype tree concept composed of multiple, minimally branched vertical fruiting stems, to facilitate between-row spacing of 1.5 – 2 metres.
Trees are grown on dwarfing rootstocks planted 3 metres apart so that the combined cordon length is 3 metres and is comprised of 10 vertical stems, 30 centimetres apart.
Figure 2.
Second year planar-cordon tree orchard systems (Fuji Supreme/M9) with the first crop produced just 20 months from planting. April 2015.

Spacing with the Fuji apple cultivar. Trees of the first prototype achieved between 22% and 30% light interception by the end of their second year from planting. In a second prototype planted one year later and using specially grown two-axis nursery trees, orchard plantings achieved the same light interception as Prototype One, but by the end of their first year after planting (Fig. 3).

In conclusion, a dramatic rethink of apple orchard layout and tree architecture is under way. This is being driven by a need to improve yields, for economic and sustainability reasons. Detailed measurements of traits associated with production of a fruit crop as well as the physiology of the trees are being used, in real time, to identify the emerging properties and potential of these new orchard systems and their practical management, which will be paramount for any commercial uptake in the future.

References

Obituary

Dr Harvey C Smith
(29 January 1926 – 30 August 2016)

Harvey Smith M.Agr.Sc., Ph.D. (Camb.) was a former President and an Honorary Fellow of the New Zealand Institute of Agricultural and Horticultural Science. A graduate of Lincoln College (awarded their Bledisloe Medal in 1970), he did postgraduate research at Cambridge University and in the Plant Research Institute in Canada after joining the Plant Diseases Division of DSIR.

Pat Palmer, a long-time colleague (and NZIAHS Fellow) says: “Harvey was the best scientist I ever worked with. He was the outstanding plant pathologist of his generation in New Zealand, and stood high internationally. His insight that pastures and roadside biodiversity were reservoirs for crop diseases was a significant new thought. And his insistence in understanding the life history of the pathogen was a keystone of his approach and he had the sharpest eye for spotting an errant plant.”

As a plant pathologist Harvey made significant discoveries in relation to diseases (including dry rot in brassicas and barley yellow dwarf virus in cereals) of importance to the country’s agriculture and horticulture. He demonstrated the importance of aphids in the transmission of diseases in cereals, potatoes and peas, too, which opened the way for the use of insecticides for disease control where previously no control existed.

At the time, infection of many diseases such as dry rot of brassicas was assumed to be via infected seed. By finding the Leptosphaeria (perfect) stage of the fungus, he demonstrated that the infection actually originated from the fungus on old crop debris. This was the justification for the brassica breeding programme at Gore to introduce dry rot resistance.

Harvey was appointed Director of Crop Research Division, DSIR, in 1964 where he had substantial influence on cropping developments such as cultivar evaluation and release and in the introduction of plant variety rights into New Zealand.

He retired from Crop Research in 1983 but remained engaged in mycological research and managing his family orchard at Prebbleton. He was honoured by former colleagues by having the new plant disease research building at Plant & Food Research, Lincoln, named after him.
Fertiliser advice in New Zealand: an assessment of the current situation

AFTER 20 YEARS OF working one-on-one with farmers, I am appalled by the quality of the fertiliser advice they are being offered. This is reflected in the statistics (2002-2016) from our client database at agknowledge Ltd. Most farms (70%) presented initially with nutrient deficiencies of one or a combination of phosphorous, potassium or sulphur. These deficiencies were enough for pasture production – particularly clover growth – to be severely compromised.

I believe reaching the goal the Government has set for the pastoral sector (a 25% increase in exports by 2025) could significantly be achieved simply by applying the known science and technology of soil fertility and pasture nutrition.

But first we must review, revise and modernise our current approach to offering fertiliser advice to farmers. Old recipes no longer work. The science of soil fertility and pasture nutrition has much more to offer them.

In the last decade major reviews have been published on the nutrient requirements – phosphorus (P), potassium (K) and sulphur (S) – of clover-based pastures. This has resulted in adjustments to the P, K and S pasture production functions and some changes to the critical levels for soil tests and modifications to our interpretation of some soil tests such as Organic S and the Reserve K (Edmeades et al. 2005, 2006 and 2010).

It was previously thought that most sedimentary soils contained K reserves not measured by the soil potassium Quick Test (QTK), and that accordingly they could be farmed at low QTK levels. But increasingly, soil K deficiencies are being reported on these soils. Several reasons can be suggested. The soil K reserves have been exhausted or the plant demand of soil K has increased with land intensification (such as conversion to dairying). The latest review referred to above indicates that pasture responses to applied K are not related to soil K reserves and that the probability of getting pasture responses to K only becomes less than 20% if the soil QTK is >7.

A soil test to measure has been developed and calibrated to demonstrate that soil organic matter is a source of plant available S. Importantly, this source of plant S makes up about 95% of the plant available S whereas sulphate S is only a small portion (<5%). Moreover soil sulphate S is extremely variable (+/- 30-40%) because of leaching events, whereas organic S is unaffected by leaching and is a more reliable measure of the soil’s ability to provide plant S. This test should be used as matter of routine. Unfortunately it is not.

We need to ditch some old habits. The word “fertiliser” and the phrase “soil fertility” do not just mean phosphorus (P) or Olsen P. Clover-based pastures need 16 nutrients and all must be present in defined amounts to optimise production. Plants can grow only as fast as the most limiting nutrient.

Regarding fertilisers as sources of individual nutrients leads to an objective way to compare fertilisers and select the least-cost product(s) to deliver the required nutrients. Such comparisons should be based on the cost per unit nutrient, taking into account the agronomic value of the nutrients. A kg of slow release P may not have the same agronomic – and hence monetary value – as a kg of soluble P, for example.

Some nutrients are cheaper than others. A kg of sulphur costs about $0.70; potassium cost about $1.40/kg and phosphorous is the most expensive at $3.20/kg. Among the important practical implications, it is sensible not to limit the expression of the most expensive nutrient by restricting the cheaper nutrients. Also, because it is so cheap the attitude towards S deficiency should be “search and destroy”.

The nutrient K presents some problems for some people. The concentrations of K and N in pastures are about 3% to 4% whereas they are 0.3% to 0.4% for P and S. There is 10 times as much K in the soil/pasture/animal cycle than P and S. Thus, much larger amounts of K are required, relative to P and S. As land use intensifies, furthermore, the amount of fertiliser K required to maintain (not increase) soil K levels increases. These days about 80-100 kg K/ha are required to maintain soil K levels under typical dairy production. Intensive sheep/beef operations may require 25-30 kg K/ha a year for maintenance. Also large amounts of fertiliser K are required to increase soil K level. The rule of thumb is 70 kg K/ha for each unit increase in QTK.

For these reasons some argue it is not economic to use fertiliser K. This is nonsensical. First, fertiliser N costs about the same as K. We are happy to recommend 150-200 kg N/ha per year but balk at doing the same with K, and, the effects of K fertiliser last much longer than the effects of N fertiliser. Also, when thinking about cost and benefit it must be appreciated that increasing the soil K level from, say, QTK 4 to 7 results in large increases in pasture production (30-40%).

Finally, we now have defined production functions relating relative pasture production to soil P, K and S levels. We can now base fertiliser advice to farmers, at a specific farm or farm x block, on the likely economic outcome over time. As with any forecasting, assumptions must be made but this approach drags the basis for giving fertiliser advice to farmers out of the past and into the future. It should be where we are heading.  ❖
THE TRIMBLE AGRICULTURAL RESEARCH FUND was established to support overseas travel for scientists in agricultural research, without limitation on the branch of agriculture, but with an emphasis on research likely to produce results of a nature that will have a direct application to the agriculture industry in New Zealand.

Applicants for Trimble Fellowships must be eligible for membership of the NZIAHS and the NZIAHS Council is represented on the advisory board which makes recommendation to the trustee, the Guardian Trust.

These fellowships were awarded for funding in 2016:

**Dan Bloomer**, of Paige Bloomer and Associates, based at the Centre for Land & Water, Hastings, will travel to Europe for a study tour of agricultural field robotics research and development. Dan is investigating the development and introduction of field robots in agriculture. This step-change technology can reduce labour demands and enable plant-by-plant – even fruit-by-fruit – assessment and management. Robots are light and have much less negative impact on soil and because they have no driver they can operate day and night. Dan is particularly interested in the area of weeding as a first stage development, because herbicide options are reducing and chemical resistance is increasing. A new approach is essential for sustained viable production. Understanding how to apply sensing and robotics to weeding also builds base knowledge for further development, such as robotic picking machines.

**Richard Falloon**, of Plant and Food Research, based in Lincoln, will travel to Switzerland to study the Spongospora/potato interaction for improved crop productivity. His plans include participating in the 3rd International Powdery Scab Workshop in Switzerland, to access the latest information on a disease and pathogen that are widespread and severe in New Zealand potato crops. This knowledge will be used to guide future research strategies in this country and will assist development and application of practical methods for reducing the harmful effects of soil-borne diseases. A key output from the collaboration assisted by this Fellowship will be a review paper outlining the current state of international knowledge on powdery scab and root diseases caused by the powdery scab pathogen.

**Keith Funnell**, of Plant and Food Research, based in Palmerston North, will travel to China for a research collaboration in bulbous and ornamental crops. Keith leads a research and development programme in New Zealand, developing technologies aimed at increasing the diversity of plants within various breeding programmes of horticulturally important crops (such as kiwifruit, pipfruit and berryfruit). By improving the networking and communication between scientists and industry partners in New Zealand and China, Keith hopes to expand Plant & Food Research’s collaborative efforts, especially with regard to new ornamental crops. New Zealand industry will benefit from access to an increased amount of new cultivars, off-season market windows for exports and technology advances.

**Allister Holmes**, of the Foundation for Arable Research, based in Hamilton, will travel to the USA to investigate Precision Agriculture methods for increasing sustainable profitability in cropping systems. Allister will meet with researchers, growers and other users of Precision Agricultural technologies at Purdue, John Deere, AgLeader and DuPont, to better understand how to successfully use precision agriculture to add profit to production systems. He will also attend two conferences on Precision Agriculture technologies — the International Conference of Precision Agriculture and InfoAg — to learn from experienced and successful users of Precision Agriculture technologies and systems, then use his knowledge to meet the goals of a Sustainable Farming Fund project, “Transforming Variability to Profitability”, to use Precision Agriculture to increase profit in New Zealand arable systems.

**Alison Popay**, of AgResearch, based in Hamilton, will travel to the USA to visit the Noble Foundation and attend the International Congress of Entomology. Alison will present a paper on the invasion of the African black beetle into Australia and then New Zealand. The larvae of this insect is a major agricultural pest in both countries, causing damage by feeding on the roots of grasses. Understanding how these and similar beetles can readily invade other countries is important to improve border security. Alison will visit the Samuel Roberts Nobel Foundation to further her knowledge of fungal endophytes of grasses and develop a new collaborative programme with Dr Carolyn Young, a renowned molecular biologist working in fungal endophytes.