



**Australian Government**

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**Department of Agriculture, Fisheries and Forestry**

**Submission to Inquiry into Research  
Training and Research Workforce  
Issues in Australian Universities**

For the Parliament of Australia House of Representatives Standing  
Committee on Industry, Science and Innovation

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## **Executive Summary**

### **Importance of research to Australian agriculture**

Attracting and retaining high quality skilled workers, including researchers, to the agriculture sector is essential to improving the knowledge base of agricultural industries. It is crucial to provide producers with the tools, technologies and new farming systems to enable them to be innovative and address challenges such as climate change and increased international competition.

Innovation and research and development (R&D) have been an important contributor to the long-term productivity growth in Australia's primary industries, which averaged around 2.5 per cent each year from 1954 to 2004.

Science and innovation in the agriculture sector is a complex matrix of investors, providers and users across the production chain. Some of the investors and providers include: state and territory government agencies, the Commonwealth Scientific and Industry Research Organisation (CSIRO), rural R&D corporations and companies (RDCs), cooperative research centres (CRCs) and universities (funded in part through the Australian Research Council).

### **Role of the Department of Agriculture, Fisheries and Forestry (DAFF) in research and training**

The Department of Agriculture, Fisheries and Forestry (DAFF) supports scientific and economic research and analysis undertaken by the Australian Bureau of Agricultural and Resource Economics (ABARE), the Bureau of Rural Sciences, the Office of the Chief Plant Protection Officer, the Office of the Chief Veterinary Officer, the Australian Quarantine and Inspection Service and Biosecurity Australia to underpin evidence-based policy development and decision-making in DAFF.

DAFF contributes, either directly or through the RDCs, to research undertaken by universities, CSIRO and several CRCs. DAFF is a member, for example, of the CRC for National Plant Biosecurity, which undertakes research into improving the diagnosis of plant pests and plant health surveillance. DAFF also works closely with the Australian Centre of Excellence for Risk Assessment to improve decision-making in pest plant eradication programs. It also supported similar work by the Australian CRC for Emerging Infectious Diseases (known as the Australian Biosecurity CRC) on animal disease surveillance.

DAFF also provides financial support to universities through research scholarships. In 2006-07, for example, DAFF funded scholarships for four masters students in the University of Sydney's Veterinary Public Health Management program. ABARE also offers scholarships to economics honours students at the University of Sydney and the University of New England.

DAFF also sponsors the Australian Agricultural Industries Young Innovators or Scientist Awards. The awards enable people aged between 18 and 35 to undertake innovative projects in the fields of agriculture, fisheries, forestry, food and natural resource management.

## **Role of the RDCs in research and training**

The Australian Government's main investment in rural innovation is through the 16 rural RDCs. The RDCs are a partnership between the government and industry.

One of the RDCs' key roles in supporting the competitiveness and sustainability of Australia's primary industries is to invest in R&D services, purchasing from research providers such as CSIRO, universities, state and territory agriculture departments and the private sector. The RDCs commission and manage targeted investment in research, innovation, and knowledge creation and transfer on behalf of their major stakeholders, their industries and the government. In 2006-07, total spending by the RDCs exceeded \$525 million, of which the government contributed over \$209 million.

RDCs make a significant contribution to agricultural research in Australia. Collectively, they will spend \$56.06 million in 2007-08 on activities in support of the Innovation Skills rural R&D priority. These activities foster the skills needed to undertake research and apply the findings. Part of this involves funding a variety of undergraduate, postgraduate and postdoctoral scholarships at CRCs and universities.

## **Challenges for Australian agricultural research and training**

The supply of qualified and skilled workers is one of the greatest constraints to productivity and innovation in Australian agriculture.

The decline in the number of students enrolling in agricultural courses is a significant factor contributing to the industry's skills shortage. Recently, the Australian Council of Deans of Agriculture (ACDA) found that on average there is a demand for at least 2000 new graduates in agriculture per year. However, Australian universities are currently producing fewer than 800 agriculture graduates (ie. science and business) per year (Pratley & Copeland, 2008).

This also creates flow-on effects by reducing the number of students undertaking postgraduate qualifications in pursuit of a career in agricultural research (Pratley & Copeland, 2008). This could also be a result of science and engineering graduates not considering agricultural research to be a viable career option.

The challenge is not limited to supplying the agricultural workforce with specialist skills. There is also a need and role for agricultural scientists with generalist skills to address farming issues from a systems perspective and work across the whole farm system in an integrated way.

The ageing workforce is also posing significant challenges. The 'baby boomers' are moving towards retirement, or at least looking to reduce their workloads. Not only is this likely to result in a significant loss of expertise and knowledge, there will not be enough new people entering the workforce to replace them, thereby exacerbating the shortage of highly skilled, highly qualified workers.

This is likely to result in a decline in the quality of research, a greater reliance on part-time staff and skilled migrants, or a shift away from longer-term public good research

to research that is short term and commercially driven with higher or more immediate economic returns.

### **Meeting the challenges**

One way of attracting the best minds into the agricultural profession is to improve the image of agriculture as innovative, resilient, embracing technology and with a bright future. It is becoming increasingly important for industries and employers, including government and universities to promote agricultural careers in a positive light, to attract and retain skilled people to a vocation in research.

To promote the study of primary industries in schools, DAFF is providing \$75,000 to help establish a joint industry—government initiative, the Primary Industries Education Foundation.

Another key strategy will be to harness the skills and experience that already exists in the sector's workforce.

To help avoid fragmentation and duplication there needs to be a much greater focus on collaboration and partnerships in agricultural research and strengthening the links between government, industry and universities. As an example, DAFF is collaborating with a consortium of universities, and the Cooperative Research Centre for National Plant Biosecurity, to develop a postgraduate, national plant biosecurity curriculum. This will enable ongoing training of biosecurity professionals to meet some of the skills shortages and training needs of government and industry from 2009.

The government's Rural Research and Development Council will also have an important leadership role in rural research in the future, helping to target R&D investment towards priority areas and analyse returns on investment. The council will work closely with stakeholders including R&D corporations, CSIRO, state and territory governments and universities.

## **Introduction**

The Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) welcomes the opportunity to provide a submission to the House of Representatives Standing Committee on Industry, Science and Innovation Inquiry into research training and workforce issues in Australian universities.

This submission provides an overview of the contribution that research makes to Australian agriculture and the role of DAFF and the rural research and development corporations and companies (RDCs) in relation to agricultural research and research training. The submission also discusses the challenges facing agricultural research capacity in Australia in terms of attracting and retaining a high quality and highly skilled workforce.

This submission includes information and comments received from a number of portfolio bodies, including the RDCs.

The Department of Innovation, Industry, Science and Research (DIISR) provides national leadership with regard to research and research training. DIISR has provided a separate submission to the inquiry. While DAFF does not have a lead role in developing or delivering national research and research training policies and programs, it does have a role in ensuring research continues to assist Australia's agricultural, fisheries, food and forestry industries remain competitive, profitable and sustainable.

## **The Importance of Research to Australian Agriculture**

Primary industries are an important part of the Australian economy, contributing about three per cent of Australia's annual gross domestic product (GDP) and accounting for approximately 22 per cent of total exports. Much of the nation's current capacity for primary production has been created over the last 50 years (Henzell, 2007).

Australia's primary industries have strong future prospects and continue to be substantial contributors to the domestic economy and exporters of raw and value-added products in global markets. Growing incomes and increasing industrialisation in the Asia-Pacific will help boost the demand for high quality products providing Australian producers with new export opportunities. Australia is also well placed to capitalise on the region's changing dietary patterns and increasing food consumption, and the growing demand from its processing and textiles industries for raw materials.

Attracting and retaining high quality skilled workers, including researchers, to the agriculture sector is essential to improving the knowledge base of agricultural industries. It is crucial to provide producers with the tools, technologies and new farming systems to enable them to be innovative and address challenges such as climate change and increased international competition.

The agriculture sector has one of the highest rates of connectivity between industry and research, both in terms of solving existing problems and providing new

opportunities (Peacock, 2006). Maintaining a strong focus on agricultural R&D, through a high-quality and targeted research and training system, will ensure these links continue.

### The role of R&D in driving productivity growth and benefits to industry

Innovation and R&D has been an important factor in the long term growth in productivity in primary industries, which has averaged approximately 2.5 per cent over the period from 1954 to 2004 (Mullen & Crean, 2007).

Much of this growth has been achieved through the sector's culture of innovation, investment in research and adoption of findings. This has led to continued improvements in the performance of farm inputs (eg seed, stock, fertilisers), farm machinery, sustainable farm management practices, and improved use of farm, climate and market information (Mullen & Crean, 2007).

To maintain and improve productivity, research and innovation are needed to enable commodities to be produced more efficiently and effectively, encourage new industries, provide information and tools to identify areas of highest returns on investment and add value through improved products and processes that focus on consumer needs. Investment in new platform technologies may provide substantial returns through improving productivity.

Innovative solutions through R&D are needed to address the issues challenging sustainable management of natural resources. Similarly, the ability to forge stronger links between producers, the supply chain and the marketplace will rely on R&D to determine market potential, changing consumer preferences and consumer concerns (e.g. relating to animal welfare and food safety).

Effective biosecurity needs research and innovation to minimise the likelihood of entry and establishment of exotic pests and diseases and where practical eradicate incursions.

Throughout history, technological advancement has enabled industry to develop innovative solutions to the challenges it faces. Biotechnology, nanotechnology, information and communications technology, remote sensing and precision agriculture all have the capacity to deliver further important technological advances.

### The Australian Government's commitment to agricultural R&D

The Australian Government invests in science and innovation because they are important drivers of productivity and economic growth. Public investment addresses important national development and sustainability objectives such as biosecurity and natural resource management, and recognises the significant intra- and inter-industry spillovers and regional and rural benefits accrued from publicly supported R&D. Government investment (both federal, state and territory) also recognises the fact that small producers cannot usually get an economic return from individual investment in R&D.

Science and innovation in the agriculture sector is a complex matrix of investors, providers and users across the production chain. Some of the investors and providers include: state and territory government agencies, the Commonwealth Scientific and Industry Research Organisation (CSIRO), rural R&D corporations and companies (RDCs), cooperative research centres (CRCs) and universities (funded in part through the Australian Research Council).

The government's main investment in rural innovation is through the 16 rural RDCs. The RDCs disseminate new information and technologies, and encourage skills development and new management practices. The RDCs are a partnership between government and industry that aims to:

- expand Australia's agricultural R&D effort
- improve industry efficiency and effectiveness by investing in high priority R&D areas, and
- enhance the international competitiveness of our industries by encouraging greater practical use of the research results.

One of the key roles of the RDCs' in supporting the competitiveness and sustainability of Australia's primary industries is to invest in R&D services, purchasing from research providers such as CSIRO, universities, state and territory agriculture departments and the private sector. The RDCs commission and manage targeted investment in research, innovation, and knowledge creation and transfer on behalf of their major stakeholders, their industries and the government. In 2006-07, total spending by the RDCs exceeded \$525 million, of which the government contributed more than \$209 million.

The RDCs also have a critical role to play in building research capacity and training researchers. Of particular significance are the postgraduate and postdoctoral opportunities they support which reflect industry priorities.

## **The Role of DAFF in Research and Training**

DAFF is responsible for a number of initiatives designed to improve the self-reliance and competitiveness of the agriculture sector, including:

- encouraging collaborative partnerships between industry, government agencies, RDCs and training providers when developing and delivering education and training
- improving the ability of industry to identify opportunities and threats, and develop strategies to address them, including gaps in skills and knowledge
- encouraging innovation by commissioning and disseminating R&D
- increasing the participation of women and young people in industry decision-making via training and mentoring programs
- encouraging the use of sustainable natural resource management practices through education and training, and
- enhancing training in biosecurity (animal and plant health), including the preparedness and response procedures for managing pest and disease outbreaks.

DAFF supports scientific and economic research and analysis undertaken by the Australian Bureau of Agricultural and Resource Economics (ABARE), the Bureau of Rural Sciences (BRS), the Office of the Chief Plant Protection Officer, the Office of



the Chief Veterinary Officer, the Australian Quarantine Inspection Service and Biosecurity Australia that underpin evidence-based policy development and decision-making in DAFF.

DAFF also contributes, either directly or through the RDCs, to several CRCs, CSIRO and universities. For example, DAFF participates as a member of the CRC for National Plant Biosecurity, which undertakes research on the diagnosis of plant pests and cost-effective innovations in plant health surveillance. DAFF is also working closely with the Australian Centre of Excellence for Risk Assessment based at the University of Melbourne to develop tools and methods that will aid decision making in plant pest eradication programs.

DAFF has a number of informal and formal links with Australian universities. For example, BRS has developed a close relationship over a number of years with the Australian National University. It has, for example, a Memorandum of Understanding on the sharing of mutually advantageous activities, such as regular short-term work placements within BRS (the BRS/ANU Summer Scholars Program), seminar participation and access to ANU information services.

Similarly, DAFF, through Biosecurity Australia, has well-developed links with the University of Sydney, particularly through its Master of Veterinary Public Health Management program. DAFF has contributed to the design of the program and the associated postgraduate certificate and diploma courses, and continues to provide support both in terms of participating postgraduate students and in having its staff teach and facilitate several units of the program.

DAFF also provides financial support to universities through research scholarships. In 2006-07, for example, DAFF funded scholarships for four masters students in the University of Sydney's Veterinary Public Health Management program. ABARE also offers scholarships to economics honours students at the University of Sydney and the University of New England

DAFF also sponsors the Australian Agricultural Industries Young Innovators or Scientist Awards. The awards enable people aged between 18 and 35 to undertake innovative projects in the fields of agriculture, fisheries, forestry, food and natural resource management. Winners receive up to \$20,000 for a 12 month period. Since 2001, DAFF has offered financial support to more than 80 young people from all over Australia.

## **The Role of the Rural RDCs in Research and Training**

RDCs make a significant contribution to agricultural research in Australia. Collectively, they will spend \$56.06 million in 2007-08 on activities in support of the Innovation Skills rural R&D priority. These activities foster the skills needed to undertake research and apply the findings. Part of this involves funding a variety of undergraduate, postgraduate and postdoctoral scholarships at CRCs and universities.

RDCs also support the career development of researchers with an interest in agricultural issues, but employ different approaches to supporting research training at universities. They do not generally select candidates based on whether they are linked

to a university or other institution, although the leading research universities tend to attract students with the strongest academic records, and have the most effective supervisory and collaborative networks.

An important consideration for RDCs when supporting research training (both at universities and other institutions) is the relevance of the research outcomes and the quality of the science. Also important is setting up teams of researchers with realistic budgets and with the intention to support future industry research needs.

As an example, selection criteria for Meat and Livestock Australia (MLA) postgraduate awardees include:

- the relevance of the proposed research program to MLA's strategic priorities (worth 30 per cent of the total selection score for a candidate)
- the likelihood of the candidate making a long-term contribution to the red meat industry (20 per cent)
- academic performance (20 per cent)
- supervisory and collaborative networks (15 per cent)
- referees reports (five per cent)
- previous research or laboratory experience (five per cent), and
- feasibility of the research approach (five per cent).

Proposals must be well-focussed, with clear research outputs, achievable outcomes and performance-oriented milestones. The benefits to the industry should also be significant, well-defined, and, if possible, quantified in the proposal.

The major considerations for RDC funding of university research training are building research capability, in terms of both numbers and expertise, to ensure the current and future needs of the industry are met, ensuring the best return on the investment and leveraging RDC funds with those of the universities, CSIRO, CRCs and state research agencies.

For RDCs, the benefits of supporting university-based research training include:

- a growing number of students graduating with an awareness of industry issues and a willingness to use science for community benefits
- industry awareness of a pool of talented young graduates keen to be employed once their training is completed
- the contribution graduates make to boosting the rate that industry makes use of new innovations, and
- postgraduate student research becoming more widely available in the public domain.

For postgraduates, some RDCs offer fully funded scholarships, or top-up CRC or Australian Postgraduate Award scholarships, some of which may include an additional stipend that often assists with travel. Funding may be provided to visiting fellows so they can share knowledge they have gained overseas. Support is also provided to postdoctoral fellows in areas of particular industry need. This enables them to gain valuable research experience before applying for a tenured position.

For undergraduates, RDCs may fund their research projects. This includes short projects and honours projects. RDCs may also provide access to leadership and

management training for key industry researchers; travel awards to support conference attendance and other relevant travel and sponsoring professional conferences. RDCs sometimes also provide younger scientists, advisers or technical staff with in-service training awards to enable travel, secondment or interchange between institutions.

For example, in 2007–08 the Grains RDC provided \$1.25 million to support researcher training in Australian universities, \$0.94 million of which was for postgraduate research scholarships. During the same period, Australian Pork Limited provided \$300,000 to support research training as well as spending approximately 30 per cent of its R&D project budget (\$1.05 million) on university-based projects.

Land and Water Australia's Innovation Program currently funds 22 postgraduates in universities across Australia with a total investment of \$1.90 million. The program has produced more than 40 postgraduates during its nine years. The Cotton RDC has funded 15 postgraduate scholarships in 2007–08 and, since 1992, has awarded 79 postgraduate scholarships.

RDCs also invest in the Cooperative Venture for Capacity Building (CVCB), managed by the Rural Industries RDC. This venture was established in 2001 to enhance capacity building in Australia's rural industries. The program invests in R&D that focuses on enhancing the understanding of learning, improving organisational arrangements and inspiring innovative farming practices.

The GRDC provides an example of how RDCs are building research capacity through university-funded scholarships (Box 1).

#### **Box 1 – Ryegrass Research**

Improved management of annual ryegrass resistant to the herbicide trifluralin is the ultimate aim of research being undertaken by the University of Adelaide's Ben Fleet, whose PhD work at the Cooperative Research Centre for Australian Weed Management is supported by the University of Adelaide as well as by growers and the Australian Government, through the Grains Research and Development Corporation (GRDC). Mr Fleet has been investigating the mechanisms employed by trifluralin-resistant annual ryegrass, which is an issue of growing importance for grain producers in south-eastern Australia, who have become more reliant on trifluralin for weed control. He has found that some ryegrass populations recently confirmed as trifluralin-resistant tend to have a much higher level of resistance than the older populations that were identified as resistant in the late 1980s. These newer populations show little response to trifluralin, even at double the recommended rate of the herbicide. Mr Fleet's research has shown that the mechanisms employed by these highly resistant ryegrass populations in South Australia are different to those used by the older moderately resistant populations. The finding will have important implications for managing the problem.

Source: GRDC Grain Flashes, June 2008

Effective dissemination of R&D outcomes to facilitate adoption of innovations by industry is also important in maintaining productivity. As state governments withdraw direct support for on-the-ground extension, there is increasing need for the private

sector (such as agribusiness and private training agencies, including universities) to offer these services.

## **Challenges for Australian agricultural research and training**

Research is fundamental in addressing the challenges facing agriculture (e.g. arising from climate change) and in driving productivity to meet the increasing demand for agricultural products. Professionals with expertise in a range of disciplines are needed to improve the knowledge base of the industry and provide producers with the tools, technologies and new farming systems to enable them to be innovative.

Unfortunately, the lack of highly qualified and highly skilled workers is one of the greatest constraints to productivity and innovation in Australian agriculture.

### Declining numbers of agriculture graduates and researchers

In Australia, the decline in the number of students enrolling in agriculture courses is contributing significantly to the skills shortage. Recently, the Australian Council of Deans of Agriculture (ACDA) found that, on average, there is a demand for at least 2000 new graduates in agriculture per year. Australian universities are producing fewer than 800 agriculture graduates per year (Pratley & Copeland, 2008). The ACDA suggests this shortage is not due to a lack of tertiary education providers in agriculture but rather a continuing decline in enrolments in tertiary agricultural courses (Pratley, 2008). Factors that may contribute to this include:

- a negative image of agriculture as an industry with poor career prospects (the ongoing drought, as well as high profile issues such as mulesing, is fostering negative perceptions about the future viability of agriculture)
- comparatively low starting and ongoing remuneration for graduates (compared with other industries, such as mining).

This also creates flow-on effects by reducing the number of students undertaking postgraduate qualifications in pursuit of a career in agricultural research (Pratley & Copeland, 2008). The reduction in postgraduate students could also be attributed to declining numbers in science and engineering graduates not considering agricultural research careers. This may be a result of a research career in agriculture not being seen as a viable option because of:

- the time taken to gain the necessary qualifications (up to eight years to gain the qualifications to become a research scientist)
- postgraduate stipends being below average weekly earnings
- an increasing proportion of graduates having HECS debts they have to re-pay, and
- remuneration for new graduates pursuing careers outside research being comparable or higher than for a qualified research scientist.

The shortage of highly skilled and dedicated agriculture graduates will create major problems for farming, especially in research and agronomy, with debilitating effects on our international competitiveness, especially in areas such as gene technology and adapting to climate variability. However, the challenge will not be limited to supplying specialist skills to the agricultural workforce. There is also a need and role for agricultural scientists with generalist skills to address farming issues from a systems perspective and work across the whole farm system in an integrated way.

A shortage of people with these generalist skills will reduce Australia's capacity to test and apply research outcomes on the farm.

### Ageing workforce

An ageing workforce is also posing a significant challenge to maintaining Australia's research capabilities. The baby boomer generation is moving towards retirement or at least looking to reduce workloads. Not only is this likely to result in a significant loss of expertise and knowledge, but the number of people entering the workforce will not be sufficient to replace them, thereby exacerbating the shortage of highly skilled, highly qualified workers. This is likely to have serious ramifications for the agricultural industry, including a decline in the quality of research, a heavy reliance on part-time staff and skilled migrants or a shift away from longer term public good research to research that is short term and commercially driven with higher or more immediate economic returns.

### Flexible funding arrangements for research and research training

The level of flexibility in relation to the funding of university research and research training may be affecting R&D outcomes. Support for university researchers, unlike that provided outside the university system, offers little opportunity to utilise those researchers outside of a particular research project, limiting opportunities to realise greater value for R&D investment. Universities may also need to look at how they could better partner with industry to solve research problems.

### Quality in training

Universities vary in their ability to train postgraduate students who are able to contribute meaningfully to the agricultural research community. The important distinguishing factors are:

- the number of university academics actively involved in the supervisory group; the bigger the team, the better the outcome
- the infrastructure and resources that universities contribute to the work of the student
- the professionalism of university research offices for contract and financial matters, and
- the amount and quality of co-curricular resources that the university provides to the student (e.g. thesis writing, time management, career planning, intellectual property awareness).

## **Meeting the challenges**

The need to boost productivity through addressing skills and labour shortages and strengthening Australia's innovation system was discussed at the recent 2020 Summit held in Canberra (19–20 April 2008). Summit delegates acknowledged the importance of R&D and innovation for Australia's future and raised the shortage of labour and skills as a particular issue for rural Australia. Ideas for attracting, recruiting and retaining people and businesses to research and to rural areas were proposed, which included directing effort towards improving Australia's research capacity, directing funding across the innovation spectrum and strengthening national and international

collaborations. The government has committed to responding to all the ideas raised at the summit by the end of 2008.

### Encouraging school students to study agriculture

To promote the study of primary industries in schools, DAFF is providing \$75 000 (GST exclusive) to establish the Primary Industries Education Foundation.

Specifically, the foundation will:

- provide national leadership and coordination of initiatives to encourage primary industries education in schools through a partnership between industry, government and educators
- commission, co-ordinate, facilitate and manage national projects to encourage primary industries education in schools
- provide a source of credible, objective and educational resources for schools to maintain and improve community confidence in Australia's primary industries, and
- communicate primary industries R&D outcomes in an accessible format and encourage interest within schools in primary industries related careers.

DAFF also offers various policy and program work experience opportunities to school and university students through vacation programs. DAFF offers work experience to students in year 10 for one week in an area of the department that aligns with their interests. The University Vacation Employment Program (UVEP) is a six-week paid work placement where university students are employed to complete a specific work project for the department. UVEP is available to students from all disciplines and is designed to give students valuable work experience while they receive an introduction to the department and the APS. The BRS Summer Scholars Program offers eight university students per year a stipend to work on a science-related project for up to six weeks during the summer holidays. The Vacation Employment Program offers employment in ABARE for up to 10 economic honours students in January/February.

### Making better use of our existing skills

Another way to deal with the growing demand for agricultural expertise is to harness the skills and experience that already exist in the workforce. This could include:

- harnessing the skills of retired researchers and academics in Australia, an approach the government uses to deal with real-life pest and disease outbreaks—for instance, calling on a reserve of veterinary trained workers (including retired veterinarians) to respond to the equine influenza outbreak in 2007
- upgrading the skill levels of older agricultural producers and employees and increasing their involvement in agricultural research
- using the skills of researchers in training—for instance, high-quality graduates intending to do higher degrees could work a few days a week for science agencies during their higher degree (for such a scheme to work, reward for the work would need to be commensurate with industry, which is currently competing for such people, but with some sort of 'educational contract' between the university, science agency and individual)
- providing incentives for retaining high-quality researchers to stay in Australia. The government has already shown a commitment to encouraging, supporting and nurturing future generations of Australian and international researchers by

providing \$844 million to the Future Fellowships Scheme. The scheme aims to attract and retain the best and brightest Australian and international mid-career researchers and promote research in areas of critical national importance (including science and agriculture)

- de-mystifying agricultural biotechnology. The ongoing debate over the future of gene technology in Australian agriculture has contributed to a significant loss of Australian scientists overseas. Through good research and improved communications, educating the public of the benefits to agriculture would result in greater acceptance and uptake of the technology. This would provide incentives for people to pursue a research career in biotechnology or for scientists to return to Australia, and
- funding capacity-building programs that develop experts for specific research activities (e.g. plant or animal disease diagnostics).

### Collaboration and partnerships

Collaboration and partnerships in research overcome fragmentation and duplication and create more efficient and effective investments in R&D and capacity-building. These collaborations must strengthen linkages between government, industry and universities on agricultural research activities and training.

As an example, DAFF is working closely with a consortium of universities and the Cooperative Research Centre (CRC) for National Plant Biosecurity in the development of a postgraduate national plant biosecurity curriculum. With funding from the Australian Government Department of Education, Employment and Workplace Relations (DEEWR) through its Collaboration and Structural Reform Fund (CASR), the Queensland University of Technology, is working in collaboration with the CRC for National Plant Biosecurity, Murdoch University, Latrobe University, University of Adelaide and Charles Darwin University to develop the curriculum and associated course units.

DAFF has worked closely with the collaborators and with state and territory governments to ensure the curriculum framework will meet current and future training needs. The curriculum comprises postgraduate certificate, postgraduate diploma and masters courses in subject areas such as plant pests, detection and diagnostics. It is to be co-taught and flexibly delivered by the five universities. This program will enable ongoing training of biosecurity professionals in order to address some of the skills shortages and training needs of government and industry from 2009.

Similarly, the department is a partner in the Australian CRC for Emerging Infectious Diseases (known as the Australian Biosecurity CRC), which is playing an important role in training future specialists in animal health to fulfil roles in diagnostic laboratories, academia and research. The Australian Biosecurity CRC, within three years since its formation, has more than 50 postgraduate students engaged in animal health research. These students will help to fulfil current and future gaps in animal health diagnosis and research.

The government's Rural Research and Development Council will also have an important leadership role in rural research in the future, helping to target R&D investment to priority areas and analyse returns on investment. Applications for

positions on the council are being received at the moment. The council will work closely with stakeholders, including RDCs, CSIRO, state and territory governments and universities.

Australia must also draw on international expertise, knowledge and experience and apply it domestically and must work collaboratively with international partners on large-scale strategic projects to leverage greater benefits from our R&D investments.

### Engaging with regional universities

Engaging with universities is an important way for the government to address the demand for a highly skilled workforce. The government is exploring ways to engage more beneficially with universities to attract and retain young people in primary industries. It will also involve engaging regionally based universities that have close links to the agricultural industry and provide significant 'spin-off' benefits to rural communities.

In addition to the benefits regional universities offer in terms of capacity-building, regional universities also create more jobs and increase incomes in the surrounding regions. A report by the Western Research Institute (2005) found that Charles Sturt University (CSU) generates 3100 jobs and \$230 million to regional New South Wales, and the University of Ballarat contributes \$500 million and generates 3000 jobs a year for the western Victorian economy.

There are also less tangible benefits a university brings to a region, such as R&D symmetries, partnerships with local industries, skilled labour retention and social and cultural improvements. Regional universities help mitigate talent 'drift' to the big cities. The Western Research Institute (2005) found that about 70 per cent of graduates emerging from CSU and Ballarat found initial employment in the regions and that 20 per cent of students who initially came from the big cities found employment within the region.

To also avoid education and research silos, more planning and integration is needed across regional universities to integrate investment and knowledge. Collaboration and partnerships between the agricultural industry and universities will also improve industry's input to the direction of research and its access to research outcomes. This may also include developing curriculum material for agricultural students in conjunction with industry, such as the CRCs.

## **Conclusion**

Australian agriculture in the 21st century is a highly advanced, technical, mechanised and innovative industry sector requiring a highly skilled and flexible workforce. However, an increasing shortage of skilled workers is threatening the productivity, innovation and competitiveness of the industry.

Attracting professional staff to agriculture is increasingly difficult as a result of declining numbers of university graduates, an ageing workforce, poor remuneration (compared to other sectors such as mining) and the image of agriculture not being a prospective and exciting career.



Measures to improve participation in agricultural research and build research capacity are needed. Existing research skills need to be better utilised and efficiencies in research and training activities improved, through collaboration and partnerships. This will take time, commitment and resources from government, universities and the agricultural industry.

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