



Australian Government

**Australian Centre for
International Agricultural Research**

SUBMISSION TO THE

**SENATE COMMITTEE ON EDUCATION,
EMPLOYMENT AND WORKPLACE RELATIONS**

**INQUIRY INTO HIGHER EDUCATION AND
SKILLS TRAINING TO SUPPORT FUTURE
DEMAND IN AGRICULTURE AND
AGRIBUSINESS IN AUSTRALIA**

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*Senate Committee on Education,
Employment and Workplace Relations*

*Inquiry into higher education and skills training to
support future demand in agriculture
and agribusiness in Australia*

Executive Summary

The Australian Centre for International Agricultural Research (ACIAR) is a statutory authority that operates within the Foreign Affairs and Trade portfolio. The Centre's activities are part of Australia's Aid Program, with the objectives of advancing Australia's national interest through poverty reduction and sustainable development. ACIAR was established in 1982 to assist and encourage agricultural scientists in Australia to use their skills for the benefit of developing countries while at the same time working to solve Australia's own agricultural problems.

ACIAR facilitates the undertaking of agricultural research in developing country partners by working with the countries to identify their needs and priorities. These are matched with Australian providers who identify the opportunities to extend their work to meet developing country needs in agricultural science and related disciplines. ACIAR also funds R&D to assess and enhance the policy environment affecting the adoption of the results of the research undertakings.

ACIAR commissions research groups and institutions, including universities, CSIRO and State departments of primary industry, private consultants and non-government organisations (NGOs) to carry out agricultural research projects in partnership with their counterparts in developing countries.

Given its agricultural research funding and management roles, ACIAR has a strong interest in many of the issues being addressed in the course of this Senate Committee inquiry. In particular the role of higher education and skills training to enable future agricultural research initiatives in partnerships with developing countries is regarded as essential to addressing the objectives of food security, environmental sustainability and climate change at national and global levels. For this to be realised in the future it is very timely to be considering the apparent decline in demands for tertiary agricultural education and training. It is also opportune to assess possible means by which this trend could be reversed through improved employment information and recognition of the increasingly diverse and multidisciplinary opportunities in the agriculture, fisheries and forestry sectors both in Australia and overseas. For the sake of brevity these three sectors are referred to by the term 'agriculture' in this submission.

Australia is justifiably regarded as a world leader in a range of arid, semi-arid and tropical agricultural research and production systems, much of which is directly relevant to conditions in developing countries. It is important to maintain and enhance this achievement through future education and training to enable Australia to increase its contribution to world agricultural food and environmental challenges.

Introduction

In recent decades prior to recent food security concerns and price volatility there is evidence that developed countries have tended to underestimate the underlying economic, social and environmental importance of agriculture, fisheries and forestry, together with ancillary processing industries, to domestic and international welfare particularly in developing countries that are most exposed to food insecurity.. This complacency persisted in a time of relative international food security and cheaper supplies, and when employment opportunities have been generated by economic diversification in Australia and other economies.

The declining demand for tertiary agricultural courses in Australia is a further corollary of this agricultural sector setting and image. A range of data including from the Department Employment, Education and Workplace Relations (DEEWR) indicate a decline in agricultural, environmental and related studies between 2003 and 2008, further underlining reports by the Australian Council of Deans of Agriculture. There are generally lower levels of formal education and training in the rural sector than in other sectors of the economy, leading to the risk of skill underdevelopment and reduced capacity to research, develop, adapt and implement innovation. With an aging agricultural research and farm management workforce and evidence of an increasing skills deficit, there is a foreseeable threat to the ongoing capacity of Australian research institutes to contribute to the increasingly diverse domestic and international challenges of the agricultural sector.

Despite this generally negative perspective concerning uptake of higher education and career opportunities in agriculture in Australia, there are new prospects presenting themselves through national and international recognition of the integral role of agriculture in meeting the important challenges of world food security, water and soil and other resource constraints, climate change and environmental degradation. This development presents scope for public and private sector employers and agencies, including the universities, to communicate the reality that agriculture is by no means a sunset industry, but rather a sector where new and more diverse requirements are enabling exciting careers in a multidisciplinary context covering scientific, economic and social professions. Linkages between food supply, nutrition and human health in all countries adds to the scope of future career prospects. Work is already underway in this communication agenda, but it will need to be sustained and enhanced to ensure sufficient succession planning. The recent launch of CareerHarvest by the Parliamentary Secretary for Agriculture, Fisheries and Forestry represents a new step forward by providing career information for prospective students of agriculture.

Current situation and outlook for agricultural education

I. Summary data

The analysis of current agricultural education and training data will have been presented to the Committee by relevant university and educational institutions. This submission therefore provides a summary of the data as follows (based on communication with the Australian Council of Deans of Agriculture and Department of Education, Employment and Workplace Relations sources):

- The proportion of the Australian community with tertiary qualifications is now approximates 25 percent compared to 7 percent in the agricultural sector.
- Some 33 percent of the Australian community is without post school qualifications compared to 58 percent in the agricultural industries.
- In the late 1980's agricultural degrees and associate degrees numbered some 800 per annum and on a comparable basis there were only 300 degree graduates entering the workforce at the end of 2010 – this represents a 40 percent decline in the last ten years.

- If graduates from agricultural science and related degrees (horticulture, agribusiness, animal science and agricultural economics) are taken into account the graduate numbers have declined from 1,000 per year in 2002 to some 800 in 2010. This 20 percent decline is more serious when considered that a significant proportion of graduates are animal science students many of whom focus on non-agricultural activities.
- Data on horticulture revealed similar declines from about 120 graduates per year in the early 1980s to 80 graduates in 2009.
- In the case of agricultural economics there has been a 40 percent decline in graduate completions since the 1980s
- For agribusiness/commerce the numbers have declined from 200 graduates in the 1980s to fewer than 100 in 2010.

The above summary numbers which accommodate the adjustment of diplomas and degrees associated with the expansion of university numbers, provide evidence of a declining interest by current and prospective students in studying agricultural sciences and related disciplines. This trend requires attention and fuller analysis, particularly given that studies of the employment market in agriculture (including job advertisements and vacancies) show that Australian universities are producing some 300 agricultural graduates and 700 agriculture and related discipline graduates for a job market assessed at more than 4,000 per annum based on assessments undertaken by the Council of Deans of Agriculture.

A consequence of the decline in student numbers has been the concomitant reduction in the number of agricultural education providers. The number of providers of agricultural courses has halved over the last 20 years and there has been a decline of about two thirds in country campuses offering agricultural syllabuses.

A range of data including Department Employment, Education and Workplace Relations (DEEWR) report a decline in agricultural environmental and related studies between 2003 and 2008 further underlining work by the Australian Council of Deans of Agriculture. The generally lower levels of formal education and training in the rural sector than in other sectors of the economy, runs the risk of skill underdevelopment and reduced capacity to research, develop, adapt and implement innovation. With an aging agricultural research and farm management workforce, and evidence of an increasing skills deficit, there is a future threat to the ongoing capacity of Australian research institutes to contribute to the increasingly diverse domestic and international challenges of the agricultural sector.

Agricultural education and training has suffered a loss of appeal in recent years. One of the misconceptions relate to the perceived separation of agricultural and natural resource training, and a lack of understanding of the breadth of skills and disciplines required within agricultural industries. For example, the social sciences play a very important part in agricultural research for development, both domestically and internationally, and there is increasing emphasis on interdisciplinary and transdisciplinary approaches which should add to the appeal of such courses.

II The impacts of any shortage on agricultural research

By any measure the evidence is compelling that agricultural industries and research institutes face significant future challenges in maintaining capacity. This is occurring despite the apparent employment demand for agricultural graduates, and younger students are not entering university courses in sufficient numbers to replace current agricultural management and research participants. Clearly there is a perception that the emerging generation does not regard the employment opportunities existing in agriculture as sufficiently attractive compared to other employment and training settings. If this trend in student enrolments continues it is inevitable that other tertiary institutes will abolish agricultural courses which are difficult to re-establish once they have ended.

The medium term implications of this ongoing scenario will inevitably be to put further pressure and limitations on agricultural innovation and productivity enhancement in Australian agricultural industries, and a diminution in Australia's capabilities and potential to engage in international research and innovation systems for the benefit of both global and Australian agricultural systems. Australia's long standing reputation as a world leader in many facets of agricultural research and extension will inevitably be jeopardised in the future. This in turn will impact on a range of Australia's foreign partnerships with countries where agriculture can frequently comprise 50 percent of GDP and up to 80 percent of employment.

Further to the above observations many of the current challenges facing agriculture such as climate change, soil degradation, water supply, energy and other input costs are global in character and require international scientific and policy partnerships at bilateral, regional and multilateral levels to develop, disseminate and adopt mutually beneficial options for improvement. The current food security problems provide an added urgency to this matter.

Australia is particularly well placed to provide agricultural R&D across a range of commodities soil types and climatic zones having a long history of agricultural research in public institutions such as the state departments of agriculture, CSIRO, and the universities. Moreover many developing countries with which ACIAR engages in research partnerships experience similar environmental, biophysical and biosecurity challenges as Australia. These can range from water and salt management issues to pest and disease incursions and controls.

The Australian Centre for International Agricultural Research (ACIAR) facilitates the undertaking of agricultural research in developing country partners by working with the countries to identify their needs and priorities. These are matched with Australian providers who identify the opportunities to extend their work to meet developing country needs in agricultural science and related disciplines. ACIAR also funds R&D to assess and enhance the policy environment affecting the adoption of the results of the research undertakings.

This approach adds value by forming partnerships with international agricultural R&D organisations, Australian organisations and the research agencies in the developing partner countries, thereby enhancing the effectiveness of the R&D investments. Co-funding opportunities and access to expertise and the Australian stock of knowledge lie at the core of these productive partnerships.

To continue and enhance its mutually beneficial agricultural research operations ACIAR will need to have access to an increasingly wide range of scientific, technical, economic and policy research disciplines, including: livestock production systems, animal health, fisheries, crop improvement and management, crop protection, horticulture, forestry, land and water resources, soil management and crop nutrition, post harvest technology and smallholder farm systems. ACIAR also supports economic and social science research in its agricultural development policy and agricultural systems economics and management programs. While at present there are a range of Australian research institutions, both public and private, that can provide high quality professional research and development services, it is highly important that future tertiary and vocational agricultural education be fully assessed and enhanced if Australia is to continue its high standard of domestic and international research undertakings. It is apparent that many of the current agricultural research and capacity building professionals will be replaced within the next ten to fifteen years due to anticipated retirements.

Evidence has been presented that the number of graduates being supplied by Australian universities has been declining significantly and is now less than 20 percent of the number needed to satisfy the job market (J E Pratley, Australian Council of Deans of Agriculture, 2011). If this trend continues future capacity will become a major bottleneck both for agricultural industries in Australia and in maintaining Australia's highly recognized contribution to international agricultural research efforts. This serious development is magnified by the increasing importance of agriculture in the current

global food security, environmental and climate change scenarios. Early action is required by all interested parties to facilitate and encourage agricultural education and training in a multidisciplinary format since it is extremely difficult and time consuming to reverse declining capabilities once they have disappeared.

Influences on agricultural education demands

Both in Australia and in the region increasing demand for food, declining land availability, cost/price pressures and increasing environmental demands are transforming agriculture into a more complex but essential industry. Declining availability of suitable land and other factors of production are making it even more imperative that scientific and policy innovations are developed to secure future food supplies, and to alleviate hunger and poverty in developing countries. It is widely believed that Australia has the latent capacity to make substantially further contributions to world food supply and agricultural knowledge.

In these circumstances and with the apparent discord between the supply of agricultural graduates and market demand in Australia and overseas, it is difficult to find simple explanations for the current apathy exhibited towards tertiary education in agriculture, fisheries and forestry opportunities in Australia. Most likely it is the result of a combination of influences which warrant attention from industry, government and educational institutions in the future. These include:

- An apparent complacency in the Australian community and other in developed countries, generally over food supply, particularly following the green revolution of the 1960s/70s and an era of relatively cheap and diverse food supplies (in many developed countries consumer expenditure accounts for some 12 percent of incomes compared with up to 80 percent in poorer developing countries).
- Related to the above observation real expenditures on agricultural research have either plateaued or declined over the last decade and there is concern that reduced levels of productivity growth in agriculture in recent years is caused in part by a slowdown in the growth of international public spending on R&D and extension (Pardey and Alston, 2010). This decreased investment in R&D reduces opportunities across the education system.
- While this may be changing in current serious world food circumstances, the perception of agriculture as an old and conservative industry has prevailed in some quarters and likely discourages younger people from engaging in the sector.
- Notwithstanding the underlying demand and supply data, the perception that agriculture cannot offer exciting and rewarding careers persists.
- Declining farm numbers with structural adjustment have increased urbanization, and diversification of the Australian economy has resulted in increased competition from non-agricultural industries attracting younger talent into alternative tertiary courses and subsequent careers.
- A number of potential students in agriculture are probably undertaking studies that could be related to the rural sector such as environmental sciences and ecosystem management which need to be integrated with agricultural and food production systems curricula and subsequent employment pathways. This is happening to some extent already but is an important consideration for attracting new talent to careers in research and production.

Options for action

Apart from the obvious need for public and private funding to redress the declining growth in agricultural education activity in Australia and a number of other developed countries, there are a range of actions that can be taken to improve the prospects of alleviating the increasing skills deficit

with an aging research and farmer workforce. It must be underlined that such action would require the combined efforts of governments, agricultural industry organisations, food processing companies and institutions, schools and universities. Such actions will not provide instant solutions, but could incrementally contribute to reducing the envisaged skill shortages. Options for consideration include:

- Government agencies can continue the current reviews of agricultural research systems in Australia and strategic directions for future international agricultural research partnerships, which could in turn develop new opportunities for current and potential future agriculture graduates. This Senate Committee inquiry is a timely contribution to such reviews.
- Relevant industry and government entities may consider individual or combined national awareness campaigns in schools and other institutions with a view to providing a more accurate and positive reflection on the critical importance and current career challenges and opportunities in agriculture and ancillary industries in Australian and international settings.
- Career advisory services at schools and universities to be further consulted to ensure up to date information on career pathways and opportunities are available. Career advice should recognise that employment opportunities in agriculture in the future will be considerably more diverse than in the past, given agriculture's central role in food supply, environmental sustainability and climate change responses. The recent launch of the new CareerHarvest website is a new example of addressing information gaps.
- The diversity of career opportunities can be better projected by building on to the renewed political and human importance of food production and security over the next forty years when the global population is expected to exceed 9 billion and food supply will need to increase by some 70 percent. The next 40 years will approximate the working life of current graduates opening up exciting career challenges and opportunities.
- Universities have taken important strides to 'modernise' undergraduate and postgraduate agricultural courses to reflect the increasingly diverse needs and role of agriculture in areas such as the environment, regional development and human health – this should be an ongoing process to provide prospective students with more multidisciplinary agricultural training for the future.
- The communication of demonstrated high impacts from agricultural research, as measured by cost/benefit returns, needs more fulsome communication to governments and private sector research investors. In the consideration of future public/private investment decisions, such information could be persuasive, including returns from the wide array of agricultural research undertaken at Australian universities, CSIRO and State Departments for stakeholders in Australia and overseas. Such results underpin the importance of agricultural sciences in achieving national and global food security priorities.
- Universities and public/private employers should also focus on the scope for nominally non-agricultural degrees such as botany, zoology, chemistry and business studies to include an agricultural focus and/or provide career information that might attract such graduates into agricultural pursuits (including research) in the future.

Role of the Australian Centre for International Agricultural Research

ACIAR is a statutory authority that operates within the Foreign Affairs and Trade portfolio. The Centre's activities are part of Australia's Aid Program, with the objectives of advancing Australia's national interest through poverty reduction and sustainable development. ACIAR was established in 1982 to assist and encourage agricultural scientists in Australia to use their skills for the benefit of developing countries while at the same time working to solve Australia's own agricultural problems.

ACIAR commissions research groups and institutions, including universities, CSIRO and State departments of primary industry, private consultants and non-government organisations (NGOs) to carry out agricultural research projects in partnership with their counterparts in developing countries. This includes:

- Commissioning research into improving sustainable agricultural production in developing countries.
- Funding project-related training (postgraduate and short training courses).
- Communicating the results of research.
- Conducting and funding development activities related to research programs, including capacity building.
- Administering the Australian Governments' contribution to the International Agricultural Research Centres (IARC).

As an agency that operates as an interface between Australia's agriculture research and innovation capacity and its development assistance program ACIAR is closely interested in future agricultural education and skills training to meet the research and associated activities under its mandate. The research organizations in Australia with which ACIAR has close working relations are significant employers of agricultural, fisheries and forestry graduates and postgraduates. For ACIAR to maintain and improve the quality and impacts of its important international research commitments it is essential that the Australian higher education system produces a sufficient number and diversity of agricultural and associated university and vocational education graduates for the future. Australia has a well earned reputation as a world leader in both agricultural research and efficient farming practices in an array of arid, semi-arid, tropical and temperate agricultural systems. It is important that Australia maintains and enhances these capacities to meet both domestic and international demands, most particularly in the current context of world food security, productivity, sustainability, and climate change challenges.

Agricultural research for development

World Bank research indicates that agricultural growth in developing countries is twice as effective in reducing poverty as non-agricultural growth (World Development Report - Agriculture for Development, 2008). The same report underlines the necessity for more research to drive sustainable productivity growth into the future in which an increase of some 70 percent in food supply will be needed to feed anticipated population expansion and global food demand. The technological challenges facing agriculture in the 21st century are in many ways more daunting than those of recent decades. Land and water are becoming increasingly scarce, which will compel the need to produce more with less. The key role for ACIAR is to act as a catalyst for applied agricultural research to boost productivity for the world's small farmers particularly in Asia-Pacific and African countries. This research partnership for development approach encompasses: animal health and production; crop improvement and management; fisheries, forestry and horticulture; land and water resources, soil management, crop nutrition, cropping systems development; economic advancement through agricultural development. Capacity building through joint research and formal training is included as an integral part of all such activities.

ACIAR's success in generating research benefits for developing country partners builds on its ability to attract Australia's scientific resources into looking at particular categories of agricultural problems. This use of Australian research resources provides the link to Australia's innovation and research system.

These linkages are illustrated in chart 1. Schematically, ACIAR enables a number of important interactions. The best known interaction is illustrated in quadrant II of the chart, the delivery of research outcomes to developing country agriculture.

This is an effective way of transforming aid funds into benefits, and explains why ACIAR was established as part of Australia's international development cooperation program (quadrant I of the chart). ACIAR funds bilateral R&D projects in cooperation with agencies in developing partner countries. It also draws on resources in the international agricultural research system, such as the International Agricultural Research Centres (IARCs) under the Consultative Group on International Agricultural Research (CGIAR) umbrella, and other research undertaken in developed countries.

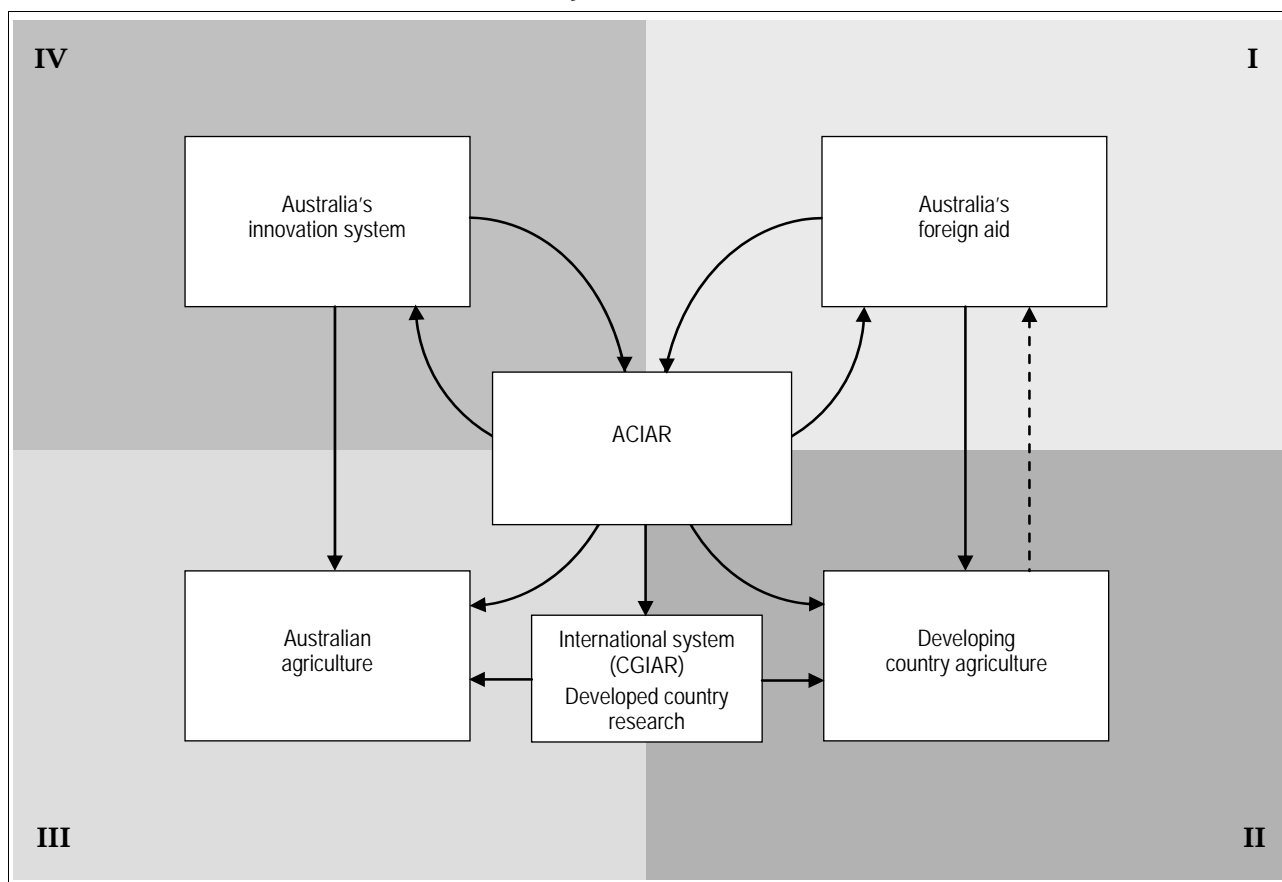
ACIAR funded research also delivers direct benefits to Australian agriculture (quadrant III). These benefits arise through ACIAR's ability to access the global knowledge base and to combine aid funding with Australian research expertise, to examine issues that are of benefit to agriculture in partner countries and around the world. The extent of these mutual research benefits varies from project to project and the focal issues of each research endeavour.

ACIAR's activities interact with Australia's innovation system (quadrant IV) largely through the involvement of Australian researchers and research institutions (universities, state departments of agriculture and government research bureaus, Cooperative Research Centres and the Commonwealth Scientific and Research Organisation). These include:

- leveraging funding into areas of importance for agriculture in developing countries and Australia;
- providing access to a broader pool of researchers for problems of interest — that is, providing access to international expertise and environments;
- increasing the overall research base for agricultural issues of interest to Australia and our partners; and
- contributing to the overall stock of knowledge in an international context and thus helping identify both promising areas for research as well as 'dry holes'.

In particular ACIAR's places an emphasis on agricultural research to achieve sustainable development and natural resource management by funding research that directly contributes to Australia's pursuit of better outcomes in areas such as water management, soil degradation, biodiversity and climate change responses. Similarly, ACIAR's projects dealing with food safety, animal and crop health and biosecurity concur with and contribute to Australia's need to maintain and enhance its agricultural and food health and safety status as well as those of our partner countries. This achievement is partially a reflection of the fact that many developing countries with which ACIAR engages in research partnerships experience similar environmental and biosecurity challenges as Australia. In some instances research undertaken in developing countries can constitute a more cost effective means of information generation than research undertaken in Australia alone.

1 ACIAR, aid and Australia's innovation system



Source: Pearce, Monck, Chadwick and Corbisley, 2006

ACIAR research benefits

ACIAR's impact assessment program provides robust evidence of the size of the benefits being delivered by its activities. It is estimated that the 130 ACIAR-funded projects that have been subject to impact assessments have delivered benefits that total \$31.9 billion (with \$15.9 billion attributable to ACIAR investments) to developing country partners and Australian agriculture for a total outlay of \$379 million. A conservative estimate of total benefit:cost returns across all ACIAR projects since inception is around 6:1.

These benefits are secured through a number of pathways. The most obvious is through direct productivity improvements from new production technologies or techniques, or through new breeds and varieties. ACIAR research has also led to benefits from management of, and protection against, disease and pest incursion, increased demand in third country markets from meeting food safety, quarantine and quality requirements, and environmental, bio-diversity and sustainability improvements associated with management of natural resources.

Independent impact evaluations of ACIAR-funded projects suggest that these have delivered significant spillover benefits to Australian agriculture. Available evidence from past ACIAR funded projects suggests important benefits to Australian agriculture. Based on independent estimates, the aggregated returns to Australia of ACIAR investments were around \$2.2 billion (in 2010 dollar equivalents). This represents some 17 percent of total returns.

These quantified benefits in Australia arise in four main categories:

- Direct production benefits arising through research findings that directly improve the productivity of Australian agriculture.
- Indirect protection from disease or pest incursion that arises from applications of research findings that lower the chance of a disease or pest ever entering into Australia.
- Direct protection from disease or pest incursion (arising from research findings that allow more effective quarantine or more effective control of disease or pests incursions).
- Increased trade benefits arising through research that increases the value of Australian exports.

It is not possible to attribute all of the benefits to ACIAR alone. Given the highly networked nature of Australian agricultural research, the benefits to these projects are likely to have emerged because of a combination of ACIAR funding and past funding from other agencies. At the same time, there are further sources of benefits to Australian agriculture that are difficult to quantify. These include improvements in biodiversity in partner countries that may be valued by Australians, training of researchers and general increases in the stock of knowledge that may be applicable in the Australian context, and may increase the probability of success or lower the cost of other research.

As well as these direct benefits, ACIAR's activities are well acknowledged in partner developing countries, enhancing Australia's recognition in the region. ACIAR's comprehensive program of impact evaluations guides investment in consultation with developing countries. ACIAR has been undertaking impact evaluations of its projects since 1986.