

Submission to the Productivity  
Commission's Inquiry into  
Rural Research & Development

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# Executive Summary

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Thank you for this opportunity to make a submission regarding Rural Research and Development.

I have written this submission on behalf of the Grains Council of Australia's (GCA) Seed Committee which is the national representative body for seed producers. I am a farmer, a seed producer and a levy payer. I am also Chairperson of the RIRDC<sup>1</sup> Pasture Seed Research and Development Advisory Committee

All agriculture begins with the planting of seed. Successful agriculture relies on seed being of good quality, with high germination rates, and true to type. As the current CEO of the Australian Seed Authority recently commented:

*"I think you could conclude the provision of high quality, true-to-variety name seed is an important social benefit for the economy, as all field crops and pastures, and all horticultural annual crops are established from seed. Seed quality is critical in establishing dense, productive crops and pastures, which have the characteristics sought by the farmer. Productive crops and pastures in turn have an impact on the productivity of farmers, and hence of their contribution to the economy, and to making healthy and cheap food and fibre, available to the community."*

Seed producers pay the R&D levy when they get their seed certified. My submission gives some detail of the seed industry, and the importance of seed certification (pages 4-11). The Australian pasture seed industry is estimated to generate farm gate sales of around \$35 million per annum from certified seed (Centre for International Economics (CIE 2005)). It therefore invests a healthy 2.3% of its turnover in R&D.

As Chairperson of the RIRDC Pasture Seed Program, I have first-hand knowledge of just how valuable R&D has been for this industry. Although this program is only small, we have been able to fund projects targeted carefully to respond to industry and government objectives, with projects limited only by funding. The process of selecting projects is robust as I explain on pages 30 -34.

The RIRDC Pasture Seed Program undergoes regular review. An independent review of the Pasture Seeds R&D Program completed by the (CIE) in 2005 revealed that the Program has performed well overall and that four R&D clusters (eight relatively small projects) yielded grower returns sufficient to pay back investment in the entire 53 project portfolio since its inception in 1989.

An important part of the planning process is the five year plan. Representatives of all sectors of the industry are invited to participate. The objectives in the last five year plan virtually mirror the Government's Rural R&D priorities (see comparison on pp 15 to 17).

The RIRDC Pasture Seed R&D Program has funded successful projects covering all the Government's Rural Research and Development Priorities giving wider community benefits, and on pages 17 to 30 I give details of the following examples:

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<sup>1</sup> RIRDC is the Rural Industries Research and Development Corporation

## **1. Productivity and Adding Value:**

Projects falling under this objective may:

- Prevent losses in production through diseases, weeds or pests.
- Increase productivity through better management practices.
- Sort out seed production and processing problems of new species which facilitates the uptake by reducing the costs of seed production. These new species give farmers a greater choice in their farm rotations, and in some instances provide hardy plants for difficult environments – some even have the potential to turn ‘marginal’ areas into areas of reliable, good quality production.
- Improve management practices which may reduce the reliance for chemicals and fertilizers, thus reducing production costs and enabling farmers to be more competitive. Farmers’ profits generally flow into the community thus providing benefits to the region as a whole. Using less chemicals is generally better for the environment and in this way provides a social benefit to the community.

## **2. Supply Chains and Markets**

Several projects have been funded dealing with these issues:

- One project addressed a serious issue which could have resulted in the loss of millions of dollars worth of seed exports as a result of the seed no longer conforming to OECD requirements.
- Another project surveyed consumer preferences.
- Another project researched Alternative Seed Certification Schemes.

## **3. Natural Resource Management**

Water is such an important resource for the Australian community. It is essential to use agricultural water efficiently and effectively. Our projects have seen many successes. Several projects have been funded addressing issues for seed production using South Australia’s aquifer, including a water balance study (leading to the formula now used for water allocation), coping with increasing salinity, best management of drop tube technology. A seed producer commented at a field day, ‘we’re prolonging our lifespan as irrigators using saline water and becoming efficient by becoming more effective.’

## **4. Climate Variability and Climate Change**

Projects include overcoming seed production and harvesting problems for new species which are showing good potential to be drought tolerant. Another project deals with boron tolerance in annual medics, with potential for these tools to be taken up by other species. Low rainfall conditions, already common and likely to worsen in the face of climate change, increase the damage of high Boron (B) levels.

## **5. Biosecurity**

Biosecurity issues are given top priority eg. Projects were urgently required, and provided, to deal with issues surrounding bacterial wilt in lucerne. Also, the threat of the Varroa destructor mite incursion has encouraged a closer look at a native bee for pollination of lucerne.

## **6. Supporting the Rural R&D Priorities**

The RIRDC Pasture Seed program requires accurate and comprehensive reporting using media relevant to target audiences. Also, the annual Hugh Roberts Travel Award enables visits to or from overseas seed experts.

## **7. Developing Technologies**

- There have been several projects to develop diagnostic tools, e.g. rapid tests for Alfalfa Mosaic Virus (AMV) in lucerne and medic seed, and diagnostic tools for sub clover red leaf disease.
- Another project provided farmers with on the spot information regarding quality control of lucerne harvesting, enabling them to alter harvesting techniques to minimize damage. Farmers will be more profitable as more seed will pass certification and be able to be exported. Benefits will flow into the surrounding communities some of which rely heavily on the lucerne seed industry for prosperity.
- In West Australia, now that virgin land is difficult to access, seed producers are faced with great difficulty in obtaining pure crops. Typically, there is more than one variety in their ground. The ‘Establishing a Seed Scheme for Mixed Varieties’ project seeks the identification of the various varieties, and their proportion in a seed sample, through molecular identification.

## **8. Support Government funding**

Producers of pasture legume species are very appreciative of the government’s contribution to the program and support the continuation of this support. It has enabled some very worthwhile projects. The Government’s priorities for Rural R&D are well known, and they influence the choice of projects. Would they be of such influence without the matching funding? Probably not.

The blend of scientific and farming know-how and vision, combined with the guidelines for community benefits (through the Government’s Rural Research Priorities) provides a well balanced model which achieves a great benefits.

### **Identified areas for improvement.**

Although the Rural Research and Development model works well, there is possibly room for improvement such as those mentioned on pages 35 to 40. An area of difficulty this program has encountered is the difficult levy legislation process.

Farmers have an urgent challenge to meeting the growing global demand for food as the world population increases to all time highs. At the same time, the community is insisting this should be done by using less resources, and in the face of increasing climate variability. Producing more with less seems contrary to nature, but I don’t believe this task is impossible. However, Rural Research and Development has a huge responsibility to achieve the community’s objectives. Solutions won’t just happen without proper planning. I urge the Government to decide their objectives, determine the resources required to meet those objectives, and adopt a realistic and achievable plan. I believe the Rural Research and Development model used in Australia will be a valuable resource in this endeavor.

# Introduction

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Thank you for this opportunity to make a submission regarding Rural Research and Development.

I have written this submission as a seed producer, representing seed producers through the Grains Council of Australia's Seed Committee (GCA Seed Committee). I am also Chair of the RIRDC<sup>2</sup> Pasture Seed Research and Development Advisory Committee.(the Committee) As a seed producer and through my involvement in R&D management I am acutely aware of the importance of maintaining a well resourced R&D sector and of the benefits that flow from this.

## Background – the importance of R&D

I need not labor long to illustrate the importance of the seed industry. All Australian agriculture begins with the planting of seed.

As Lindsay Cook, CEO of the Australian Seed Authority (ASA) recently commented<sup>3</sup>, “I think you could conclude the provision of high quality, true-to-variety name seed is an important social benefit for the economy, as all field crops and pastures, and all horticultural annual crops are established from seed.

Seed quality is critical in establishing dense, productive crops and pastures, which have the characteristics sought by the farmer. Productive crops and pastures in turn have an impact on the productivity of farmers, and hence of their contribution to the economy, and to making healthy and cheap food and fiber, available to the community.”

The seed industry is pivotal to all agriculture. Identified social benefits of a prosperous, sustainable agricultural industry rely on the prosperity and sustainability of the seed industry. More qualified people than I, have identified many social benefits with the current R&D programs, as evidenced in the Rural R&D Corporation's Report entitled 'Measuring Economic, Environmental and Social Returns From Rural Research and Development Corporations' Investment', copies of which can be obtained at <http://www.ruralrdc.com.au/WMS/Upload/Resources/Evaluation/Rural%20RDC%20Eval%20Report%20low%20res.pdf>

Importantly, the sector of the pasture seed industry which has committed to paying a Research & Development (R&D Levy) is the legume seed sector. As is commonly known, legume crops improve soils through nitrogen fixation, leading to the added benefit of a reduced reliance on fertilizers.

Plant life is not static, nor is the environment in which it is produced. No matter how 'hardy' a plant variety is, it will eventually succumb to some pest, pathogen or pressure in its

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<sup>2</sup> RIRDC is the Rural Industries Research and Development Corporation

<sup>3</sup> Personal Correspondence, Email 8<sup>th</sup> June 2010

environment, and solutions need to be found. Seed producers look to RIRDC's Pasture Seed R&D program to provide solutions and progress the industry.

It is important to note that because of the success of R&D for the current levied growers - producers of temperate legume seed - there are ongoing discussions with tropical grass seed and native pasture seed producers to join the program. Indeed the Committee has a broad vision which is to provide research and development for producers of all seed, on the provision they contribute by a levy.

## Background – the importance of Seed Certification

An important role of the Pasture Seed R&D Program is to provide research and development to enable seed to continue to reach certification standards.

Seed needs to meet very high standards to be Certified. Certification is based on the concept of 'Truth in Labeling.' Consumers of seed, if purchasing certified seed, can be assured that the seed in the bag will be the variety named on the label, that it will have high degree of genetic purity, and high levels of germination. The concept of 'Truth in Labeling' becomes even more important to those sensitive to issues such as genetically modified seed if they wish to avoid it.

Also, I provide the following information from South Australia's Seed Services website at [http://solutions.pir.sa.gov.au/seed\\_services/seed\\_certification/what\\_is\\_certified\\_seed](http://solutions.pir.sa.gov.au/seed_services/seed_certification/what_is_certified_seed) There are other documents available on this topic, but this is concise and easy to understand.

### 'What is certified seed?'

Seed that has been produced to standards set down by Government in a quality assurance scheme. Seed certification is voluntary and adds value and marketability to the seed by documenting its genetic purity and physical quality.

The quality system is focused on maintaining the **genetic identity** of seed by ensuring the pedigree of certified seed can be traced back to the seed originally developed by the breeder. A buyer of certified seed can be confident that the seed in the bag is true to label. A traceable pedigree is important because, although a farmer may choose a particular variety wisely, often the new cultivar cannot be picked by eye from other varieties growing in the paddock.

Certified seed is also grown and processed to meet a number of **physical quality** standards. These include purity of clean seed relative to chaff, dirt, etc; high germination, and a minimum of other crop and weed seeds.

Seed Services works to the Rules and Directives of the Organisation for Economic Co-operation and Development (OECD) Seed Schemes so that South Australian certified seed can compete globally for sales into OECD and European Union countries. These markets currently consume a significant percentage of the certified seed produced in South Australia.

### Who can grow certified seed?

Anyone who can satisfy the requirements of the certification scheme. This usually means farmers who:

- have paddocks free of prohibited and undesirable weeds;



- can afford to invest in more expensive sowing seed;
- maintain paddock records; and
- are prepared to be thorough and adopt often costly and time consuming measures to clean down machinery and control weeds.

Intending growers should contact Seed Services well before making any move towards producing certified seed. Failure to carry out some vital procedure, even before ploughing the paddock, may contravene the rules of the scheme for the particular crop to be grown and preclude the grower from producing certified seed.

Participation is voluntary. Growers who lodge an application form agree to abide by the rules of the certification scheme, but can also opt out at anytime.’

I will also attach the South Australian Seed Certification Scheme’s Procedures and Standards Manual for your further interest. Other Seed Certifiers have similar requirements.

## Background – the importance of the Pasture Seed Industry

### Industry Profile<sup>4</sup>

The Australian pasture seed industry is estimated to generate farm gate sales of around \$35 million per annum from certified seed (CIE 2005). It therefore invests a healthy 2.3% of its turnover in R&D. Total industry farm gate value of certified and uncertified seed was estimated at \$120.5 million by the ABS for the year 2004-05. .

Australian production of all pasture seeds is around 2.6% of total OECD pasture seed production (Fievez 2006). The Australian industry is therefore relatively small by world standards, but has the advantage of a geographic location which isolates species from many pests and diseases common elsewhere in the world. Australia is also able to produce seed while the most of the seed producing world winters. This can be a marketing advantage.

The domestic demand for pasture seeds is derived from demand for fodder crops – predominantly for beef cattle and feedlots, dairy and horses – and improved pasture for grazing. Estimates of annual sales of seed in the main pasture crops required to satisfy the domestic market are shown in Table 1.

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<sup>4</sup> From RIRDC’s Pasture Seed Program’s Five Year Plan 2008-2013

**Table 1: Pasture Seeds Domestic Consumption (tonnes)**

<b>Species</b>	<b>Domestic Consumption</b>
Ryegrass	6,200
Lucerne	2,500
Subterranean clover	2,300
Annual medics	1,800
White clover	800
Tall fescue	450
<b>Total</b>	<b>14,050</b>

Source: RIRDC 2003 but broadly consistent with figures presented to the Pasture Seeds R&D planning in Oct 07.

In 2005-06 Australia imported 7,000 tonnes of pasture seeds valued at \$16.5 million.<sup>5</sup> Since 2001-02 the weight of imported seeds has trended upward yet values of seeds imported have more or less remained constant. Drought has caused an interim spike in volumes imported. Pasture seeds imported have been ryegrass, tall fescue and clover seed. Most imported seeds have arrived from New Zealand (4,700 tonnes valued at \$10 million) and the US (2,000 tonnes worth \$5.5 million). The value of imports of pasture seeds within this Program's scope from 2001-02 to 2005-06 was approximately \$20 million pa (Fievez 2006).

In 2005-06 Australia exported 14,400 tonnes of pasture seeds valued at \$60.5 million. This compares with a five-year average for the period 2001-02 to 2005-06 of 16,500 tonnes and an average value of \$54 million pa. The export value of certified pasture seeds grew steadily 2001-02 to 2005-06 at an average rate of 17% (Fievez 2006).

The US is the biggest importer of Australian pasture seeds, mostly lucerne, worth \$16.4 million to the Australian economy in 2005-06 and totaling about 30% of the Australian pasture seeds market. There are also expanding markets in China, Argentina, Brazil, United Arab Emirates, Saudi Arabia, China, Korea and Germany. The majority of pasture seeds exports were clover and lucerne seed, providing 2,434 tonnes (\$12.5 million) and 6,590 tonnes (\$29 million) respectively to the export market (Fievez 2006).

Leviable pasture seed production is concentrated in South Australia, Victoria and NSW, but there are seed growers in all States and Territories. West Australian seed producers are in the process of developing a procedure to facilitate R&D Levy contributions. Victoria produces the largest share of perennial grasses, and north eastern NSW and Queensland the subtropical grasses. The Northern Territory produces a variety of tropical and subtropical grasses. The majority of pasture seed growers are multi-commodity farmers and do not identify as seed growers in census and survey collections. Seventy-five percent of lucerne seed is grown under irrigation.

Australia is an attractive place to produce pasture seed, particularly as every major world climate can be found within the country, and the nation's relative isolation provides an advantage in achieving pure and disease free lines. There is a clear opportunity for the Australian seed industry to expand with potential to increase exports of pasture seeds.

<sup>5</sup> An objective of the seed industry could be to satisfy the domestic market with Australian product

Indeed, the Australian seed industry is now much more a part of a global seed industry than it was a generation ago and the trend to global growth has accelerated in recent years. For instance, the Australian Seed Federation (ASF) has undergone quite dramatic changes in its relationship with multinational companies. Overseas interests now own all of the major Australian seed companies and this has had an impact on ASF's thinking towards the production and sales of Australian seed to overseas destinations.

The R&D Levy is collected on certified seed of temperate legume species. Seed is certified by Certification Agencies using laboratories accredited by the International Seed Testing Authority (ISTA). To access many international markets, particularly OECD countries, seed must be certified. Although uncertified seed can be sold domestically, much of it is in fact certified. In the past seed certification and R&D Levy collection has relied on the State Departments of Primary Industries (DPIs). NSW Department of Agriculture has withdrawn from this role. Victorian seed certification has been privatised. Legislation was put to the Australian Parliament in 2008 to ensure that privatised seed certifiers are authorised to collect the R&D Levy. Seed that is not certified does not attract the R&D Levy. This results in 'leakage', particularly as some companies offer in-house quality assurance programs to meet the needs of some of their markets.

Australia's five Seed Certification Agencies collect the R&D levy. This makes for ease of administration. The R&D Levy rates are:

- \$11.00 per tonne for sub-clovers and other annual
- \$10.00 per tonne for medics
- \$15.00 per tonne for lucerne and other perennial clovers

Considerable change to the seed industry was anticipated when Plant Breeders Rights (PBR) was introduced, and many of these changes did occur. However, many of the new proprietary varieties have had difficulty attaining market share with public varieties still having approximately half the share. A number of reasons have been put forward to explain this, including

- unwillingness of customers to try something new as they are:
  - not confident that it is an improved product and there is a lack of independent appraisals;
  - unclear about how best to grow it; and
- public varieties tending to be cheaper.

An encouraging trend for the industry has been the better understanding by graziers of the benefits of pasture improvement, and their willingness to improve agronomic practice such as sowing seed suitable to their properties and enterprise. Credit for this change is probably shared by many, including RIRDC, agronomists, and the companies who have increased their level of service (better technical backup, an emphasis on seed quality, and more effective distribution). Associated with this improved understanding is the rapid adoption of seed coating, ensuring that the elements necessary for healthy seedling growth are adjacent to the young plants.

Graziers' improved ability to sow seed suitable to their environment and enterprise has been enhanced by the development of the Pasture Species Database, which has replaced the 'Recommended List'. The Pasture Species Database can be accessed at: <http://axel.infodiv.unimelb.edu.au/grasslands/>. This will be further improved at the

conclusion of a project being conducted by Pastures Australia which will not only include information about species, but will independently assess all varieties, including proprietary varieties.

Although the total level of seed sales fell in the late 1990s, drought notwithstanding, there is now an upward trend. This upward trend is likely to continue, although this will be partially dependent on the economic performance of such commodities as beef, sheep, and wool. The overall value of seed has increased and this is likely to continue for some time.

In 2006 and again in 2007, the volume of Australian production and the levies collected have been affected by drought conditions. In 2008 high fodder prices are also impacted on seed production as growers identified failing seed crops, cut them before seed set to take advantage of favourable returns in an attempt to defray some production costs. Longer term the industry is exposed to climate variability with its resulting implications for water, pest and disease management.

The seed industry has become more structured, particularly as a result of PBR legislation, which has led to contractual arrangements between growers and seed owners (the holders of the Plant Breeders Rights) – the seed owner being responsible for the marketing of the seed in most cases. Some stakeholders have expressed concern that large corporate distributors are likely to attempt to dominate marketing to farmers and graziers, however, it is likely that regional seed companies will still play a role in pasture seed sales.

The new century has brought substantial changes for seed growers, particularly to the contractual arrangements referred to above (see Reynolds 2007). There has been diversity in ability to cope with these changes. Many seed growers initially welcomed the opportunity to grow seed for a seed company without having to worry about the marketing of the product. However, some are now questioning the value of the benefit to seed growers.

There has been an increased effort in the seed industry to make ‘supply and demand’ for seed more coincident. Success is dependent on the ability to predict which varieties consumers are going to buy and how much of each variety will be needed. This is often determined by the performance of various commodities, and weather conditions and the task is far from easy. Care must be taken, particularly in an over supply situation, that the marketing risks are spread and not just borne by seed growers. The number of professional and experienced seed growers has noticeably declined in the last few years. The reduction in seed grower numbers is commonly estimated at 10% per annum.

A concern for the seed industry is to maintain a satisfactory funding stream for R&D. There have been few changes since 1995 in the species of plants that are levied by the Program and the areas where levied seed is grown.

There are opportunities in the Pasture Seeds industry for productivity and product enhancements through improvements in technology, improved product analysis, standardisation of seed products and crop management. The industry has focused on addressing market requirements, establishing new markets and developing a high quality product.

**I also attach ‘SEED CERTIFIED IN AUSTRALIA UNDER THE OECD SEED SCHEMES’ 1999/2000 – 2008/09**

(2009 data compiled by Australian Seeds Authority Ltd from data provided by the seed certification agencies AGWEST, AsureQuality Australia, QSEED Pty Ltd and Seed Services Australia.)

# Research and Development in the Seed Industry

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There is an incredible amount of research which benefits the seed industry.

## Research from 'other' R&D programs.

Every time a plant pest is controlled, a plant disease cured, a management technique improved, or a more effective pollinator introduced, there will be seed producers of the relevant plants adopting this research to increase their seed quality and/or yields. The seed industry is thankful for this type of research emanating from other research organizations.

## Private Research

There is also an incredible amount of money being spent on plant breeding, which provide benefits to the purchasers of that particular seed as the first link in the industry chain between plant to plate. A large proportion of this investment is made by private companies. Although there is still some public research, increasingly public funding is focusing on the development of 'tools' for plant breeders to utilize.

. Without this investment, very few new varieties would be developed. However, we need to remember that these investments are very much a business decision. The process of plant breeding is extraordinarily expensive and risky. Naturally seed companies will be weighing up the risks and the potential benefits to their company before embarking on any plant breeding project. The beneficiaries of this private funded research are primarily the users of this seed.

It is to be presumed they will favor low risk plants with potentially highly valuable markets. In fact, I don't think there will be too many problems in developing new varieties for popular species (such as wheat) which have firmly established markets. But what of new species with no current markets? I suspect this would be viewed as highly risky and may not attract very much investment. This becomes an issue also when thinking of developing agriculture in marginal areas. I believe we now have the ability to breed plants which will be adaptable to more harsh conditions, but will anyone be prepared to face the risks (which may also include the risk that environmentalists may resist the development of agriculture in these areas)?

### **Is there still a role for public funding of plant breeding for areas of clear social benefit but where private investment can't be attracted?**

After all, private companies using private investments are not obliged, and are often not even inclined to satisfy the Government's requirements of social, environmental benefits as well as private economic benefits. This is in contrast to the approach of the RIRDC Pasture Seed Advisory Committee and that of all RDCs. We are aware of the Government's Rural Research Priorities, and we have a firm commitment to ensure fund contributors get value for

their money, and this includes endeavoring to satisfy the government's Rural Research and Development objectives as co funders of the research.

## RIRDC Pasture Seeds R&D Program

The RIRDC Pasture Seed Program has limited funds so is unable to support plant breeding of varieties as such, although some work has been done to develop and introduce new pasture legume species.

The RIRDC Pasture Seed Program is extremely valuable to the seed industry, and subsequently to Australia's agricultural industries as a whole.

Private research typically concentrates on issues specific to the particular seed company. But there are many issues of a generic nature – i.e. issues which effect the whole industry of large sectors of the industry – where many seed companies are effected. Seed companies are unwilling to increase their R&D expenditure to pay for this broad scope of research. The RIRDC Pasture Seed fills this vacuum.

## Synergy Between Government and Industry Objectives

It is remarkable how much synergy there is between Government and Industry Objectives.

Every five years, the RIRDC Pasture Seed Advisory Committee develops a new five year plan. Representatives from every 'link' in the 'value chain' are invited to be part of this important planning process.

Below is a table comparing the Government's Rural R&D objectives with the strategic directions identified at the last five year planning meeting. These strategies are used to inform the R&D Plan development.

Federal Rural R&D Priorities	Strategic Directions - RIRDC's Pasture Seed Program's 5 Year Plan
<p><b>Productivity and Adding Value</b> - Improve the productivity and profitability of existing industries and support the development of viable new industries.</p>	Strategies to halt the disappearance of grower skills in an ageing production base.
	Developing pasture seed crops with higher metabolisable energy.
	Developing pasture seed crops that are better adapted, more productive and water efficient legumes.
	Optimising breakthroughs in the sustainable production and harvesting of pasture seeds.
	Facilitating required resources for seed production e.g. pollinators.
<p><b>Supply Chains and Markets</b> - Better understand and respond to domestic and international market and consumer requirements and improve the flow of such information through the whole supply chain, including to consumers.</p>	Capturing the opportunities from a swing back toward livestock production and away from back-to-back cropping systems in acknowledgement of the risk spreading benefits.
	Developing a better consumer appreciation of the benefits of improved pastures including renewing pastures after drought, increased soil fertility, and economical in comparison to grain feed.
	Better alignment of product with market preferences.  Improving consumer understanding of species potential e.g. overcoming potential environmental problems.
<p><b>Natural Resource Management</b> - Support effective management of Australia's natural resources to ensure primary industries are both economically and environmentally sustainable.</p>	Developing more environmentally friendly seed production techniques.
	Improving consumer understanding of species potential e.g. overcoming potential environmental problems.



<b>Climate Variability and Climate Change</b> - Build resilience to climate variability and adapt to and mitigate the effects of climate change.	Better preparing pasture seed producers for climate variability.
	Developing pasture seed crops that are better adapted, more productive and water efficient legumes.
<b>Biosecurity</b> - Protect Australia's community, primary industries and environment from biosecurity threats.	
<b>Supporting the Rural R&amp;D Priorities</b> - Improve the skills to undertake research and apply its findings.	Better communication of the great work already done in pasture seed R&D, and providing the seed industry with timely, relevant information.
	Overcoming researcher capacity constraints.
<b>Developing Technologies</b> - Promote the development of new and existing technologies.	Utilising biotechnology including Genetically Modified (GM) plants, and seed implant and coating technologies to meet market demand.
	Developing new technologies that package desirable attributes either in the seed or on its coating.

## Rural R&D Priorities and Project Examples

Here are just a few examples of projects which are meeting the Government's Rural Research and Development objectives. There are many to choose from, but I have limited the selection for brevity.

### Productivity and Adding Value

... Improving the productivity and profitability of existing industries and supporting the development of viable new industries.

#### 9. 'Improved Clover Seed Production: 'Towards 1.5 tonnes''.

This project not only recorded best agronomic practices<sup>6</sup>, but also experimented with various treatments, some of which had never been tried. Seed Producers were glad to find out they shouldn't waste their money on hormone treatments, but other strategies were more successful, particularly certain herbage control techniques, and yields of nearly 3 tonnes per hectare were achieved at a time when a yield of 1 tonne per hectare was considered exceptionally good.

<sup>6</sup> Particularly important considering the disappearance of grower skills in an ageing production base.

## **10. ‘Sulla and purple clover as fodders – Limits to Seed Production’.**

Despite the great potential of sulla and purple clover as highly productive, deep rooted, nitrogen fixing legumes for Southern Australia, seed production and processing was difficult causing constraints to the development of this new industry. Through this project seed production, harvesting and processing techniques were developed which will result in lower cost seed which has been a deterrent to the uptake of these species. The project also identified 74 lines of purple clover with resistance to clover scorch disease, and investigated the anthelmintic properties of sulla. This is the first record of resistance to the clover scorch disease and represents a major breakthrough in the development of purple clover as a species for use in agriculture.

## **11. ‘Improved Seed Production of Lotus tenuis for a global market’**

This project is not yet complete, but is seeking improved seed production and harvestability to develop this perennial species as a pasture crop for Tasmania with prospects of export to New Zealand, Canada, USA, and South America.

## **12. Disease and Pest Problems**

Many projects have (or will) successfully address diseases and pests including:

- Weed control for white clover seed crops
- Weed control for *Trifolium tumens* and *Dorycnium hirsutum* seed crops
- Control of *Rhizoctonia* Burr Rot of Sub clover
- Control of *Phytophthora* root rot in Sub clover
- Control of lucerne seed wasp in lucerne seed crops
- Control of ‘lucerne yellows’ disease in lucerne
- Management of bacterial wilt in lucerne seed crops
- Control of white fringed weevil in lucerne seed crops

Projects falling under this objective may:

- Prevent losses in production through diseases, weeds or pests.
- Increase productivity through better management practices.
- Sort out seed production and processing problems of new species which facilitates the uptake by reducing the costs of seed production. These new species give farmers a greater choice in their farm rotations, and in some instances providing hardy plants for difficult environments – some even have the potential to turn ‘marginal’ areas into areas of reliable, good quality production.
- Improve management practices which may reduce the reliance for chemicals and fertilizers, thus reducing production costs and enabling farmers to be more competitive. Farmers profits generally flow into the community thus providing benefits to the region as a whole. Using less chemicals is generally better for the environment and in this way provides a social benefit to the community.

## **Supply Chains and Markets**

... Better understanding and response to domestic and international market and consumer requirements and improving the flow of such information through the whole supply chain, including to consumers.

### **13. 'Improved Maintenance and Basic Seed Production of Public Pasture Varieties'**

This project addressed a serious issue which could have resulted in the loss of millions of dollars worth of seed exports as a result of the seed no longer conforming to OECD requirements.

I can't explain any better than this summary from the Foreword of the project report:

*"Fifty five countries, including Australia, participate in the OECD Seed Schemes for the Varietal Certification of Seed Moving in International Trade. Standardised OECD Rules for the production, processing and labelling of Certified Seed are designed to facilitate international trade in seed and contribute to the removal of technical trade barriers. Market access for seed to many countries, including the European Union, requires OECD Certification. Domestic seed certification schemes in Australia are also based on the OECD Rules.*

*Varieties must remain under active maintenance to be eligible for certification under the OECD and domestic certification schemes. The maintainer of the variety is responsible for ensuring that multiplication of Breeders and/or Pre-Basic Seed is carried out in a satisfactory manner so that only authentic, uncontaminated Basic Seed of the variety is released for further multiplication under the certification schemes. An incomplete survey commenced by the Australian Seeds Authority (ASA) in 2004 revealed that the state of variety maintenance of public varieties was poor and that a significant effort by ASA, certification agencies and the seed industry was needed to provide the seed industry with assured supplies of high quality Basic Seed.*

*This project funded by the Rural Industries Research and Development Corporation enabled ASA to complete the survey of all maintainers of Australian pasture plant varieties certified under the OECD Seed Schemes to determine whether or not listed varieties remain under active maintenance and to work with maintainers to address deficiencies associated with inadequate maintenance plans. It also enabled the establishment of an industry panel to identify public varieties required for future trade and to facilitate the transfer to industry entities of the maintenance responsibility for important public varieties which will not be further maintained by current maintainers.*

*The importance of this project is that the information generated enables Australian seed producers and seed marketers to identify varieties in danger of being lost and to initiate corrective action. The project findings will be captured by seed producers and marketers through the production and marketing of public varieties that would otherwise not be available for certification and export.*

*Key outcomes for seed producers and seed marketers are more reliable supplies of Basic Seed of public varieties required for the production of commercial quantities of Certified Seed, greater choice of varieties to meet domestic and export market requirements, and assured export market access to countries which require OECD Certified Seed. Seed consumers also benefit from continued access to high quality true-to-variety seed of public varieties.*

*This project was funded from industry revenue which is matched by funds provided by the Australian Government."*

## **14. ‘Nationwide Survey of Consumer Demand for Temperate Pasture Seeds’**

The objectives of this project were:

To develop a survey that would assist in developing marketing strategies to increase the use of pasture legume seeds. The main objectives were to determine:

- Major roles of permanent and ley pastures.
- Farmer practices with respect to pasture species use, source of seed and resowing of pastures.
- Future intentions regarding the use of pastures on the farm and sources of seed
- Farmer opinion on improvements thought desirable in the management of their pastures.
- Needs for improvements in pasture legume cultivars.
- Sources of information used for decision on pastures.

As with all industries, accurate marketing information is essential, particularly to ensure adequate supply to satisfy demand, and provide a guide to the products which need to be developed.

It’s important that the plants suit the environment in which the seed is sown. This is important for regional development. It will increase productivity and minimize loss. Surveys such as this will identify the sort of information the seed customers need.

## **15. ‘Alternative Seed Certification Schemes in Europe and USA for Adoption in Australia’**

The objectives achieved with this project were:

- To examine first hand how seed certification schemes implemented in USA and Europe differ from existing schemes in Australia.
- To determine how procedures and methods implemented overseas have contributed to these low or lower cost schemes.
- To identify which procedures can be implemented in Australia to make our schemes more cost efficient and effective whilst maintaining eligibility and status with the OECD certification scheme.

Since this project, Australia has joined the USA’s AOSCA (Association of Official Seed Certifying Agencies) scheme facilitating the export of millions of dollars worth of seed.

## **Natural Resource Management**

... Supporting effective management of Australia’s natural resources to ensure primary industries are both economically and environmentally sustainable.

Much of Australia’s lucerne seed is produced in South Australia using artesian water. The quality of the water has declined, the cost of the water has increased, and seed producers are encouraged to use less water.

This program has funded several projects aimed at improved water management practices. I will mention two of them.

## **16.A Water Balance Study for Lucerne Seed Production Resourced by an Underground Aquifer**

Here is the background to the project:

*The irrigated lucerne seed producer's ability to irrigate provides an opportunity to obtain yields above that of a dryland system and generate an income that otherwise would not be possible. The right to irrigate comes with inherited responsibilities to use the resource in an efficient and ecologically sustainable manner. Such responsibility is under increasing political and social scrutiny as the demand for the resource increases. Present day and future lucerne seed irrigators need to be seen by all sections of the community to be actively researching a solution to efficient and effective water use thereby justifying existing demand for irrigation in a sustainable system.*

*The research aimed to develop a reliable method for quantifying the movement of salts from the applied irrigation water, through the soil, beyond the root zone en route back to the ground water during and between irrigation seasons. Research such as this is needed for irrigated lucerne seed producers to quantify the impact of their irrigation practices on their water quality. This information will provide the benchmark data for development of sustainable irrigation practices for the future. In the short and long term the research is essential for irrigated seed producers to quantify the direct impact of their irrigation practices on the underground aquifer to enable them to support their requirements in water allocation policy and licencing system implementation.*

*This research is significantly funded from irrigated lucerne seed producers and will provide information upon which to develop improvements in efficiency whilst at least maintaining production and will be evidence to relevant government authorities and communities of irrigators consciousness of the importance of developing management systems that permit profitable yet ecologically sustainable irrigation water use. Irrigators require their own independent research to collect data that can be used to support their business interests and they need to be an active participant in the research so as to achieve a fair and equitable result.*

After James de Barro's project successfully concluded, the Department of Water, Land and Biodiversity Conservation (South Australia) Embarked on The Volumetric Conversion Project. I quote:

*'This is a 4-year, \$2.275 million project aimed at the conversion of the area based water licences to licences based on volumetric allocations, by 2006. The conversion approach that is adopted will need to recognise the range of variables including crop type, irrigation system, soil type, water quality and climatic zone that impact on the volume of water extracted by the irrigator to meet on-farm irrigation needs. The Project faces the difficult task of implementing a volumetric conversion process that is fair and equitable to all commodity groups, yet does not compromise the sustainability of the resource. ...*

*FIST (Field Irrigation System Trials) program methodology is based on existing water balance field research undertaken by agricultural consultant James de Barro from Keith as part of his RIRDC/DBAC jointly funded project and by Rural Solutions SA staff in Loxton as part of their MDBC SI&E funded project.' (Dividing the Droplet: A Water Balance Study for Lucerne Seed Production Resourced by an Underground Aquifer).*

## **17. Conversion From Border Check to Drop Tube Irrigation for Lucerne Irrigated with Saline Water**

Australian Agriculture Natural Resources Online (AANRO) reports on this project:

### ***Objective***

*The project aims to evaluate the success of a drop tube centre pivot irrigation system as an alternative and significantly more efficient ground water-sustainable system, for the irrigated production of certified lucerne seed and hay production using saline water above 4000 ppm total dissolved salts. Salinity in excess of 4000 ppm will not be tolerated by lucerne seed crops under a conventional centre pivot spray system and results in reduced seed and forage production. Success of a drop tube system could revolutionise irrigation application methods for the lucerne seed industry in South Australia.*

*The research will quantify the reduction of the volume of saline water pumped and applied for irrigated lucerne seed and hay production, whilst maintaining profitable yields, in comparison to existing flood irrigation of lucerne for the same purposes.*

### ***Progress***

*Research sites were operating on 22/11/05 ahead of any initial irrigation. Each site had a C-probe soil moisture monitoring device which permitted the scheduling of irrigation on the two centre pivots and the flood irrigation sites. Water meters on the flood and centre pivot pumps recorded flow rates and total flow through the irrigation period.*

*Both the centre pivots (var. Flairdale) and the flood paddock (var. Aurora) were irrigated for lucerne seed production after two hay cuts, which were irrigated as required. All production inputs such as fertilising, spraying, hay production (i.e. mowing, raking, baling and carting), crop consultant monitoring, windrowing, harvesting, seed cleaning, fuel and labour were recorded and costed. Income from cleaned seed and hay sales was recorded. The costs of production were similar for both irrigation systems with the major difference being a three fold labour expense for managing flood irrigation (\$217/ha for the flood compared to \$80/ha for the pivot).*

*The drop tube irrigation system was observably a very effective and efficient method of irrigating lucerne for seed. Irrigation was best applied to these crops by large irrigations (75 - 125 mm per irrigation event) as it wet the soil surface more evenly and permitted more even infiltration. The nature of the non wetting sand did create an uneven initial growth pattern that, in conjunction with variable soil type across the irrigated area, remained throughout the season and was likely to have negatively influenced the total seed yield. From commencement of the next irrigation season the large irrigation events will be implemented to assist in creating more even production.*

*Both pivots yielded well with an average clean yield of 713 kg/ha compared to the flood, which yielded 587 kg/ha. Together with hay income, the gross margin for drop tube irrigation was \$1665/ha, which was 13% greater than the flood irrigation being \$1425/ha. With the inherent ability of Flairdale to produce more seed/ha than Aurora the yield advantage would be less than 10%.*

*The centre pivot required 4.16 ML/ha to be pumped and applied for seed/hay production compared to 8.26 ML/ha for the flood irrigation. The season's results indicate the drop tube*

*irrigation process requires less water to be pumped than the flood irrigation with no reduction in the comparable gross margin. It creates significant evidence that the system can be used as a replacement for flood irrigation where the water salinity is too high for conventional spray centre pivot systems to provide optimal yields, and hence provides the potential to significantly reduce pumping requirements.'*

South Australia's NRM's (Natural Resource Management) newsletter 'NRM Directions' Issue 22 featured these two projects in the following report:

***'Irrigators lucerne up at Keith field day***

*If irrigation is to be sustainable then new approaches, new research and people-power will be the key - according to a major Rural Industries Research and Development Corporation (RIRDC) report launched at the Keith field day in the Upper South East.*

*The Dividing the Droplet report is a study of water balance in the production of lucerne seed. The report quantified the water balance of surface and centre pivot irrigation systems in the production of lucerne seed in the Keith region - an area which produces most of the lucerne seed grown in Australia.*

*After the launch irrigators toured trial sites around the district to see four projects funded under the South East Natural Resources Management Board's Innovation Grants Program.*

*South East NRM Board Irrigation Efficiency Project Officer, Terry Strickland, said, the tour focused on the use of down tubes on centre pivots to produce lucerne seed using saline irrigation water and the sealing of surface irrigation delivery channels to reduce seepage losses.*

*"The use of traditional pivot spray packs applying highly saline water onto a lucerne plant canopy can cause significant production losses through the scorching of leaves and aborting of flowers. In addition, the water spray disrupts bee activity which is critical to pollination," Mr Strickland said.*

*The downtube trials, first initiated by Mark Wenzel at Keith, replicate the advantages of surface irrigation by reducing the wetting of foliage while reducing water use and achieving production yields similar to those produced under surface irrigation.*

*Mark Wenzel said:*

*"we're prolonging our lifespan as irrigators using saline water and becoming more efficient by becoming more effective".*

*Wayne Lehmann and Reece McDonald, who are trialling down tubes on pivot and lateral systems, said the results of their trials to date have also shown considerable promise.'*

*Water is such an important resource for the Australian community. It is essential to use agricultural water efficiently and effectively. Our projects have seen many successes.*

## Climate Variability and Climate Change

Building resilience to climate variability and adapting to and mitigating the effects of climate change.

### **18. Commercial seed technology for *Bituminaria bituminosa* var. *albomarginata***

The Summary of the Project:

*'After 3 years of legume species evaluation in WA in areas with annual rainfall from 200 mm to 450 mm, albo tедера was found to be one of the most drought tolerant and productive herbaceous forage legumes evaluated in Australia. During two of the driest summer/autumns on record in WA (2006/2007 and 2007/2008), plants of albo tедера remained green without shedding its leaves and was far superior to lucerne under the same conditions. Albo tедера also tolerates grazing as part of a mixed sward and importantly, competes well with annual species.'*

*The project "Perennial forage legumes for cropping systems in a drying climate" funded by the FFI CRC is breeding albo tедера for low rainfall Mediterranean climates. The UWA/DAFWA project funded by RIRDC in 2007 "Drought tolerance of novel perennial legumes" is conducting glasshouse and field trials to characterise the mechanisms conferring drought tolerance to albo tедера and other forage legumes.*

*However, none of these existing projects in Australia or elsewhere in the world will be conducting research into the technology required for commercial seed production. This research is a key issue for the seed industry and is fundamental for commercialisation and adoption of the promising species. Within this project we propose to (a) characterise the variability amongst 20 accessions in time of flowering, flowering pattern, pod development, pod shedding and seed germinability; (b) research the technologies available for harvest operation (c) study the effect of water stress on seed production.*

### **19. Molecular tools for Boron tolerance in annual medics**

The Summary for this project is:

*'Annual medics (*Medicago* spp.) form an important component in cereal crop rotations, improving soils through nitrogen fixation and are also a high value pasture species. B toxicity affects about 50% of the grain belt with neutral-alkaline soils of South Australia and Victoria.'*

*Low rainfall conditions, already common and likely to worsen in the face of climate change, increase the damage of high B levels. A large range in response to B has been observed within the different medic species with intolerant lines showing a reduction of about 40% of dry matter versus only 10-15% in medium-tolerant lines (5). Genetic variation with regards to B toxicity tolerance exists in many plant species investigated, with no exception for annual medics.*

*Genetic variation in cereal crops has been successfully used to develop B tolerant varieties in wheat and barley. Molecular tools in the form of closely linked or diagnostic markers have been developed for these cereal species but not yet for pastures. In this project we will*



*address this deficit and utilise the genetic diversity of medics and publicly available genomic resources to develop closely linked and most likely even diagnostic markers. These markers shall be used to ensure that B tolerance is part of newly developed annual medic varieties.'*

Low rainfall conditions, already common and likely to worsen in the face of climate change, increase the damage of high Boron (B) levels. This project will result in B tolerant medics – a hardy pasture which also improves the nitrogen levels in the soil. This will increase the sustainability of farmers in these areas which may experience unreliable rainfall, and protect the prosperity of the communities they are part of.

## Biosecurity

Protect Australia's community, primary industries and environment from biosecurity threats.

Fortunately there haven't been many Biosecurity threats in Australia's Seed Industry, but when they occur, they are given top priority and dealt with as quickly and effectively as possible.

An example of this was when South Australia's 'Area of Freedom' for bacterial wilt was queried. Seed with bacterial wilt can't be exported to several countries. As no other sector in the Seed Industry was willing (or financially able) to address the issue, the RIRDC Pasture Seed Program funded a new survey to be conducted.

The program had already funded a new Enzyme-linked immunosorbent assay (ELISA) test to identify bacterial wilt on seed, and this has since been accepted by the International Seed Testing Authority (ISTA), and it is invaluable to our seed industry.

## 20. Pollinators

An important series of projects has been to address pollination concerns with lucerne.

Lucerne is a difficult crop to pollinate. It is not attractive to the European honey bee. One of the reasons is that the flower has a trip mechanism. The flower must be tripped for seed to set, yet the mechanism knocks the bee, so the bees frequently use a technique which avoids tripping the flower and being hit.

This puts Australia's lucerne seed industry at a disadvantage, as the countries we are competing with use leaf cutter bees which are far better pollinators of lucerne. Research projects have been funded to import leaf cutter bees safely. Unfortunately, survival and multiplication has been difficult in Australia's harsh conditions. Research has improved the management, but it will be considerable time before we see any great numbers.

In the meantime, researchers working with the native blue banded bees have identified a potential for this species to be good pollinators of lucerne. Preliminary work has now begun, including the development and provision of suitable nesting materials.

This project investigates the usefulness of the native blue banded bee as a pollinator for lucerne, and explores management techniques for these bees. The need for alternative pollinators has become more urgent with the likelihood of the Varroa destructor mite's devastating impact on the feral European Honeybee population.

## Supporting the Rural R&D Priorities

Improving the skills to undertake research and applying its findings.

Research is not really useful unless the findings are taken up. The RIRDC Pasture Seed Program has a variety of avenues to communicate the results of research work:

- An annual newsletter – distributed through the Certification Agents to ensure all R&D Levy payers receive a copy.
- Reports available free of charge on the internet and hard copies from RIRDC.
- Researchers presentations to R&D Levy payer meetings.
- Field days & symposiums.
- Presentations at Seed Industry events such as the ASF Annual Business Convention.
- Reports to the GCA Seed Committee which are then distributed to the Seed sectors of the various State Farming organizations.

Many of the projects have been suggested by various groups of R&D Levy payers. This seems to facilitate the adoption of the research results.

The RIRDC Pasture Seed Advisory Committee recognizes the importance of international research and has made a provision for the Hugh Roberts Travel Award to fund travel overseas for seed industry related information, or to fund overseas experts to visit Australia for presentations etc.. This has the potential of developing the skills and knowledge of Australian researchers.

The RIRDC Pasture Seed program requires accurate and comprehensive reporting using media relevant to target audiences. The annual Hugh Roberts Travel Award enables visits to or from overseas seed experts.

## Developing Technologies

Promoting the development of new and existing technologies.

There have been several projects to develop diagnostic tools, e.g. rapid tests for Alfalfa Mosaic Virus (AMV) in lucerne and medic seed, and diagnostic tools for sub clover red leaf disease.

## 21. Understanding and Managing the Causes of Abnormal Seedling in Lucerne

A relatively simple test, but extremely valuable has recently been developed to identify abnormal seedlings in lucerne. Too many abnormal seedlings will prevent the seed attaining certification. It was found that there is a direct link between damaged seeds and abnormal seedlings.

It is often not possible to identify damaged seeds visually, but when soaked for a few minutes in a chemical solution which has been developed, the damaged seeds are clearly seen. A kit has been developed for seed producers to conduct this test during the harvesting. If the level

of damaged seeds becomes a concern, the producer has the opportunity to make some minor adjustments to ‘tweak’ to his harvesting machinery in order to prevent the damage.

This project provides the farmer with on the spot information regarding quality control enabling him to alter harvesting techniques to minimize damage. Farmers will be more profitable as more seed will pass certification and be able to be exported. Benefits will flow into the surrounding communities some of which rely heavily on the lucerne seed industry for prosperity.

## **22. Establishing a Seed Scheme for Mixed Varieties**

Unlike some species, different varieties of sub clover are indistinguishable with visual inspection. Paddock history, and proof of the planting of early generation seed becomes very important. ‘Paddock history’ means that similar varieties can’t have been sown for a number of years prior to the seed crop. Many varieties of sub clover seed have a hard seed component. This means they may remain viable in the ground for six years (maybe even longer). This makes it difficult for sub clover seed producers to swap from one variety to another in response to market trends.

In West Australia, now that virgin land is difficult to access, seed producers are faced with great difficulty in obtaining pure swards. There is more than one variety in their ground.

The Establishing a Seed Scheme for Mixed Varieties seeks a solution to this predicament by enabling the identification of the various varieties, and their proportion in a seed sample, through molecular identification.

This project will result in the establishment of a seed accreditation scheme for subterranean clover. It is estimated that up to 1000 tonnes of currently uncertified subterranean clover of mixed varieties could be certified annually under the proposed scheme. Pastures sown with accredited seed are likely to be more productive by increasing the amount of seed of known varietal composition in the domestic marketplace. In addition, the project will deliver improvements to the current seed certification scheme for subterranean clover and expand the funding base of the Australian Seeds Authority and RIRDC through the generation of a leviathan product.

The project uses DNA identification techniques, and has been successful in obtaining recognition through an international competition.

I quote the media release<sup>7</sup>:

Media Release – 10/9/08

‘College student Oliver Tester, who placed third in the North American BioGENEius Challenge Competition at the Bio2008 Convention in San Diego, USA. *BioGENEius SHINES THROUGH AT SATURN BIOTECH*

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<sup>7</sup> Authorised by SABC and issued on its behalf by Brendon Cant & Associates, Tel 08 9384 1122

*Discovery of unique protein markers in subterranean clover, which can be high in oestrogen and cause infertility in sheep, will fast track development of a quick molecular test for seed purity which could save sheep producers thousands of dollars a year.*

*Project leader, Adjunct Associate Professor Chris Florides, Managing Director of Saturn Biotech, said the research involved the extraction of seed proteins, subsequent in-vitro digestion and analysis using mass spectrometry.*

*Saturn Biotech is based at the WA State Agricultural Biotechnology Centre (SABC), Murdoch University -- a centre of excellence in agricultural research that provides platform technologies, state of the art equipment and facilities for research and development in agricultural biotechnology.*

*“Researchers from universities, state government and industry use these world class facilities,” Professor Florides said.*

*He indicated the starting point for the project was suspecting that techniques used for testing cereal grains could be applied to clover seed of varieties normally indistinguishable from each other.*

*“Using prOTOF, a high powered mass spectrometer and the only one of its kind in Australia, we obtained unique protein profiles for eight different sub-clover varieties.*

*“The test differentiates between varieties with similar morphological features and effectively reduces testing time from two months to two days,” he said.*

*The research is funded by the Rural Industries Research and Development Corporation (RIRDC) and conducted in collaboration with the Department of Agriculture and Food WA (DAFWA). The culmination of the project will ultimately be a high throughput molecular test used by DAFWA in its sub clover seed certification scheme.*

*Professor Florides said part of his role as a member of the agricultural research community was mentoring young scientists and providing them with a platform to showcase their abilities.*

*He recently mentored 16 year old Murdoch College student Oliver Tester, who placed third in the North American BioGENEius Challenge Competition at the Bio2008 Convention in San Diego, USA.*

*The BioGENEius Challenge of WA enables top secondary science students from years 10-12 to pursue a year-long science project, working with a leading WA scientist.*

*Oliver first presented his research results at the WA BioGENEius Challenge, sponsored by the WA government through the Department of Industry and Resources and was one of two winners who then represented WA at the Bio2008 Convention in San Diego, accompanied by their mentors.*

*“This is the first time in this competition that research outside North America received such an accolade, proving that research in Western Australia can be as innovative and successful as anywhere in the world,” Professor Florides said.*

### **As you can see**

The RIRDC Pasture Seed R&D Program has had many exciting breakthroughs, seeking to prosper the seed industry by assisting it to successfully respond to the constant changes demanded of it. The seed industry is a comparatively small industry with only a few hundred producers yet they are often at the cutting edge of change. For example, they are the first group which needed to comply with the extra stewardship protocols to enable genetically modified materials to be carefully segregated.

A lot of good work has been done by this relatively inexpensive program. The average annual 'spend' is only \$350,000. Administrative costs are kept to a minimum, with only two meetings per year, and one of these is sometimes only a teleconference. We would have even more remarkable achievements if we had more money to spend.

# Other Issues Raised by the Productivity Commission

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I hope I have adequately illustrated that the RIRDC Pasture Seed R&D Program is addressing many of the issues of concern to the Productivity Commission. Using just a few of our projects as examples, you have seen how Government's contribution to the funding has provided great returns economically, environmentally and socially.

You have seen many successful projects securing food supply. You have seen projects which will help seed producers cope with more extreme climate conditions, and enable them to better manage their natural resource base. You have seen projects which will enable the seed industry to better understand and respond to their markets and consumers. You have also seen projects dealing with Biosecurity threats.

Some of the projects address market failure issues, but many of them proactively address emerging issues to ensure the Pasture seed industry remains viable and sustainable.

## Wider community benefits

An independent review of the Pasture Seeds R&D Program completed by the Centre for International Economics in 2005 revealed that the Program has performed well overall and that four R&D clusters (eight relatively small projects) yielded grower returns sufficient to pay back investment in the entire 53 project portfolio since its inception in 1989. RIRDC has managed this portfolio since inception and the industry covered by statutory levies is strongly supportive of both the Program and the Australian Government's matching funding contributions.

I'm sure you will be able to easily identify wider community benefits in many of the projects I've already described. RIRDC understands the importance of considering wider community benefits, and therefore wider community benefits are secured as part of the process of developing projects.

## Process for Selecting Projects

Our process of selecting projects follows stringent requirements. These are the typical issues our Committee addresses:

### Potential Benefits

- Magnitude of potential benefits
  - Economic? Environmental? Social?
  - advancement of knowledge?
  - will there be a negative impact on sustainability?
  - will there be a negative impact on biodiversity?

### Risk Assessment

- What are the risks to project success?
- Have they been comprehensively identified

- Will the risks being managed?
- Are residual high risks acceptable?
- Are additional controls needed?

#### Communications / Adoption / Commercialisation

- Plans for technology transfer / adoption (do they concur with character of target population)?
- Extent and rate of adoption?
- Is a realistic commercialisation strategy proposed and are there any constraints / risks relating to the use of other parties IP?

#### Project design

- Conceptually sound and technically feasible?
- Will the design provide the desired project outcomes?
- Achievable within the indicated time frame (check milestones)?

#### Researcher capability

- Skills and track record?
- Facilities and resources?

#### Legislative and related requirements

- Is there any legislative or regulatory requirements that need to be fulfilled before this project can proceed?  
*eg permits to collect wild plants or animals, approval by ethics committees, approval by the Therapeutic Goods Administration, approval by the Gene Technology Regulator.*

#### Budget and IP

- Is the budget reasonable?
- Is IP ownership requested by industry / company commensurate with the level of industry/company support?

## **Typical responses to Questions re Economical, Environmental and Social Benefits**

You may note that one of the questions we ask is regarding the potential benefits – economically, environmental, social.

Here are two (typical) responses from our last round.

First – from a scientist

### **23.Economic**

*Nitrogen inputs from (legume) pastures (25 kg N/t DM) are becoming increasingly important as fertilizer prices increase back to long term averages after a decade of very low and unsustainable prices. Further price rises can be expected as energy and fuel costs continue to escalate. Intolerance to root lesion nematodes impedes the growth of legume pastures and hence affects their ability to fix nitrogen. Development of RLN tolerant annual medic cultivars would therefore help to maintain the nitrogen contribution of the legume component in ley-farming systems. With over 90% of the fields tested in 2003/04 showing the presence of RLN, the generally intolerant annual medic and also lucerne crops all suffer yield losses that can at least in parts be prevented with introgressed tolerance.*

*Based on our observations of the hybrid medic lines in early field selections, we believe it is reasonable to expect an improvement in the production of existing medic pasture by 10% once *Pratylenchus* tolerance has been introgressed. On nitrogen contributions alone this would represent a return of \$6,750 (e.g. 500 ha x 0.3 t/ha x 30 kg/ha/t x \$1.50/kg N) on an average cropping property.*

## **24.Environmental:**

*With genetic diversity for RLN tolerance being present in the gene pool and already identified, the development of new varieties that carry natural resistance and tolerance is the most favoured options to reduce the impact on crop yield due to RLN. Other controls of nematodes include soil fumigation and steaming but costs and risks to the environment are prohibitive.*

## **25.Social:**

*The tools developed from this project would equip breeders to develop *Pratylenchus* tolerant cultivars of annual medics are also likely to help understanding intolerance to this pathogen in related pasture and grain legumes. The identification and use of tolerant cultivars would reduce the risk of production losses thereby helping farmers to maintain a viable farming system.*

Second: - from a group of seed producers

*The economic benefits include the higher quality and quantity of lucerne seed, hay and fodder production. The local economy relies heavily on the lucerne industry, so any enhancement will have far reaching benefits. From an environmental perspective, the major significance of a better understanding of lucerne is its application as a salt tolerant species, capable of reclaiming salt affected land. As this is the number one environmental issue for this area, the trial's appeal will be more widespread than for any other species. The social impact will come from our annual symposium which is a gathering of growers, handlers and traders who will share their knowledge among the attendees, further strengthening the local community ties.*

## **Strengths of Current System**

I can only comment about RIRDC's Pasture Seed Program, and I note a number of significant strengths.

### **Talented Team**

#### **26.Involvement of Industry**

No one is better placed than seed producers to identify threats to, and opportunities for the seed industry. As is common with the farming community, they are intensely practical and inventive and soon come up with good ideas to enable the industry to press forward.

#### **27.Involvement of the Scientific Community**

Another source of inspiration is the science community. Talented and committed researchers work at improving the seed industry by:

- finding solutions to problems,
- preventing problems,



- discovering better ways to do things,
  - and sometimes even coming up with an invention that changes the industry!
- The blend of scientific and farming know-how and vision is a great combination.

## **28. Involvement of the Government**

Balancing this already great team is the involvement of the government through funding and setting the National Rural Research and Development priorities. This influence is beneficial as it tends to have a broader picture point of view which is essential to ensure the pasture seed industry is linking well with the expectations of the other agricultural sectors and the community as a whole.

## **29. Involvement of the Administrators – the Research and Development Organizations**

Seed producers acknowledge the value of the program management provided by RIRDC. They are like the engine to a vehicle, their work helps the industry move forward.

The three main ways the industry participates is by:

- Members of the industry being part of the Pasture Seed Advisory Committee,
- The GCA Seed Committee, which is the national organization representing the R&D Levy payers, nominate the members of the Pasture Seed Advisory Committee
- Members of the industry take part in the five year planning process.

The GCA Seed Committee represents seed producers in all States and are nominated by the State Farming Organizations. See Attachment for chart explaining the structure and communication process of the GCA Seed committee.

Of the seven members of RIRDC's Pasture Seed Advisory Committee,

- 3 R&D Levy paying seed producers, each from different States.
- 1 retired, very well respected and much published pasture seed scientist,
- 1 economist with strong corporate governance skills and a wealth of experience with government and bureaucratic processes,
- 1 Senior Research Manager,
- 1 Program Coordinator, and
- the remaining member is a seed specialist recommended by Lucerne Australia.

This is a great team with a wide spread of skills and experience which facilitates good decision making. We all share the vision - a profitable and sustainable pasture seeds industry based on a reputation for the reliable supply, domestically and internationally, of a range of pasture species.

R&D Levy payers can be further involved by putting forward ideas for research. This can, and is, done in a number of ways. The usual strategy is to discuss the idea with researchers (usually local) and flesh out some ideas, and put together a preliminary proposal. If the Committee believes it is likely to be a good and worthwhile project, a full proposal is requested which will go into a lot more details about the idea.

Another way is that ideas can be brought forward through the State farming organization process where it is discussed at regional, State and then national levels, the suggestion then passed on to RIRDC's Pasture Seed Advisory Committee who will discuss the idea during the Annual review of issues still requiring research. This is not to suggest the idea will automatically be taken up. A rigorous process similar to the Preliminary Proposal and Full Proposal processes occurs, and even if it gets through this robust check, there also needs to be sufficient money to fund it.

### **30.RIRDC Research Managers**

As well intentioned and committed as the Committee members are, they have neither the skills or the time to manage projects, organizing contracts with researchers, ensuring projects reach milestones, required reports are given in time, final reports up to standard etc.. The RIRDC Research Managers do indeed need to be multi skilled. People skills are absolutely essential, but so is an eye for detail and a quiet determination that things are done 'right'. One of the strengths of the current Rural Research and Development organization is the caliber of the personnel involved at the Program / Research Management level.

The Issues Paper raises the question of merging the R&D Organizations. Maybe a case could be made to merge the Boards governing the organizations, and possibly even a CEO. However, I don't believe any merging could be done at the Project Management level without creating a great deal of confusion and inefficiency.

### **31.Government Support**

The Commonwealth contribution is very much appreciated. Without it we could only fund half the projects – and I hate to think which half would have to be cut, as they have all been good and worthwhile projects.

Without successful research, the seed industry would be far less competitive. In reality we are not competing on a level playing field on the international markets. A farmer in a country enjoying high levels of subsidies and government assistance doesn't need to be so reliant on how much each hectare is producing. In Australia every kilogram from every hectare makes a difference. Research has increased our productivity and kept us viable, but we still have a long way to go before we've overcome all productivity restraints.

# Possible Improvements for the R&D Program

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Although the current system is very good, I think we should always be improving, and I think there is a little room for improvement in the current system.

## More Funding

There's still plenty of research to be done. Certainly for the RIRDC Pasture Seeds Program anyway. It is a shame we have to refuse projects on the basis that there aren't sufficient funds.

We currently have a dozen items on our priority list – all important and reasonably urgent work, which we can't afford.

For example,

- Integrated Pest Management for the Seed Industry
- The efficacy of chemicals, particularly Group B herbicides and their residues.
- Nematodes – true cost to the lucerne seed industry and strategies for management
- Production guide for Sulla.

## Increasing the Levy?

There are several ways to increase funding:

- Increase the R&D Levy rate.
- Broaden the R&D Levy base to include the 'free riders'.
- Broaden the R&D Levy base to include other species.
- The Government to contribute more.

The GCA Seed Committee is reviewing whether the R&D Levy rate should be increased, and they are implementing a strategy to broaden the R&D Levy base.

The GCA Seed Committee have agreed that it would be best if the R&D Levy rate was a certain % of the value of pasture seed (value based on a five year rolling average), rather than having to constantly change the legislation to adjust the R&D Levy rate to keep up with inflation and the changes in the value of the different species. However, the legislation would need to be changed and that is not a simple process.

The Levy Revenue Service indicated that a referendum may well be required, and their preference for referendums seems to be those conducted by the Electoral Office. This is a very expensive process, and if the aim is to ensure all levy payers are canvassed, this objective can be achieved through the Seed Certification Agents. The required information could be mailed out with the bill. As difficult as the Levy Revenue Service (LRS) advice has been, we appreciate their advice. They understand the Government's wishes, and it would be a waste of resources to conduct a referendum which didn't satisfy the Government's requirements.

## Less Free Riders

We do have ‘free riders’. Western Australian pasture legume seed producers can’t participate in the R&D Levy, as their seed is such an admixture, it doesn’t get certified. The WA Seed Producers’ group is working towards participating, but it is somewhat reliant on the success of the project **Establishing a Seed Scheme for Mixed Varieties** (discussed on page 20).

## Adding species?

There is a possibility for other species to be included.

The seed industry recognizes that pasture seed of temperate legume species will participate in the RIRDC Pasture Seed Program. This program has actually funded the development of some promising temperate legume pasture species for difficult environments. It was assumed they would automatically have the R&D Levy collected on them when they were commercially released, but this has not happened. The general understanding of the industry is that a levy will be collected on certified pasture legume species. When we inquired with the Levy Revenue Service we were informed that the legislation would need to be changed.

Whenever there is any change, it seems there is a need to conduct a referendum amongst those who will be paying the R&D Levy – preferably an Electoral Office referendum. At this early stage of a species commercialization, there would be very few seed producers of the new species. There might only be two or three. We wonder that an Electoral office referendum would be needed! Also it’s likely they’re already seed producers of other temperate legume pasture species. They must be curious to know why an R&D Levy isn’t being collected on the new species, particularly because it’s the industry’s expectation. For the \$11, or perhaps \$15 a kg that would be received as a levy, it just isn’t worth spending thousands of dollars required for such a referendum. How many years would it take to recoup the thousands of dollars spent? Yet if difficulties arise, and they’re very likely to in the first few years of a species release, should we fund research where there isn’t a levy?. If there are problems producing the seed of the new species, the adoption of the new species will stop in its tracks and could waste all the research money that’s gone into the development of the new species.

Also, the native grass seed producers, and the Tropical Grass Seed Producers have suggested they participate in the program by contributing an R&D Levy. We went to the Levy Revenue Service (LRS) for advice, and again we received the same discouraging information.

I wonder how many other small industry groups miss out on R&D because of similar problems. Where there are only small numbers, and members dispersed, if there isn’t an organization interested in helping them, do they just give up because of the difficulties?

It would be best if smaller industries had someone to help them work their way through the levy legislative processes.

Consider how much time, and how many resources are required for an industry to comply with their requirements for change. Frequently the industry is required to address all of the Levy Principles and Guidelines from the beginning. This should hardly be necessary if a

R&D Levy is already in place. For example, pasture seeds should not have to provide a research plan, when we have a program with RIRDC with all its reporting structures.

Special provisions should be made for smaller industries, many of whom do not have access to people who have the skills and experience to deal with difficult to understand bureaucratic processes. If the objectives can still be achieved by using easier and cheaper methods, these should not be discouraged. Most small industries are not cashed up.

### Interpreting the Legislation

Another tension with the LRS is their interpretation of the legislation. The legislation requires the R&D Levy to be collected on certified pasture legume **species**. Yet the LRS now tell us that it's to be collected on all the certified **varieties** of pasture legume species. There are thousands of varieties for the lucerne species alone! This will require industry to constantly update the list of varieties involved, which is not an easy task, not necessary, very frustrating and takes people away from their more productive work.

It would be good to see common sense prevail.

## Less Bureaucracy

### Less Navel-Gazing?

The level of reporting required by Research Managers has increased dramatically in the last few years. I think it's now an excessive amount for a small program such as the RIRDC Pasture Seed Program. Typically Research Managers are managing several programs, and I assume the same amount of reporting is required for each. I suspect the hours spent in writing reports is a large proportion of staff's time which likely would be better spent in managing the research projects. This work must add to the costs of running the programs, and unless it's really necessary, it represents waste.

### Simpler Project Application process

I also feel rather sorry for researchers who spend many hours and expend much effort in preparing Preliminary Research Proposals (PRPs) which have a reasonable chance of being rejected. This is another form of waste in our industry. There have been some projects rejected by our Committee which should never have even arrived at the PRP stage. Maybe a new process could be formulated where a **very** basic outline (one pager) of the concept is given approval by the Committee to go to the PRP stage. This could be done by Email voting.

### More Perceptive Evaluation of Programs

Evaluations would be more valuable and productive if the assessor knew something about the industry involved.

## Intellectual Property Not Too Restrictive

A fine balance needs to be achieved in this area, so that intellectual property coming from public funds is accessible for further research without unnecessarily infringing the rights of the intellectual property owner. A watch must be kept.

## Some Issues Need a Better Approach

### Pollination

Although the vast majority of agriculture is well served with the current model, some things are, or have been in danger, of slipping through the cracks. A recent example of this was the Pollination Industry, but with a big effort from many organizations, this sector is now receiving long overdue support. I wonder how many other areas are not adequately provided for?

### Pastures Australia

One area which comes to mind is Pastures. The RIRDC Pasture Seed Program provides research for pasture seed. But what has become of research for pastures? For many years several organizations had a 'pasture component'. This led to some duplication of effort and inefficiencies. Four or five years ago, these organizations decided to pool their 'pasture resources' and form a new group – Pastures Australia – so that pastures could be looked at holistically.

It was quickly apparent that the requirement of Research and Development for Pastures outstripped the funding resources available. Worse still, difficult years in agriculture saw R&D organizations cut back to core business, and Pastures Australia was virtually cut off.

Now we are facing the situation that animal prices are high, and grain prices low. People are restocking and needing to sow pastures. They need the results of research projects such as independent scientific testing of the many new varieties that have been released to the market with only the company's glossy seed brochure to indicate the characteristics and performance of the plants. One of the projects Pastures Australia was working on was to provide a database of reliable information, but funding is a problem.

### Impending Global Food Shortage – Need to Produce More Using Less

We are very concerned there may be a global food shortage. We are also well aware of the problem of limited resources. I am in a position to be acutely aware of the problem of limited water. I farm irrigated land in Northern Victoria, and this year we didn't have seed to harvest, although we had gone to the expense and taken all the care required for a certified seed crop. When we needed to water our wilting seed crop, there was 0% water allocation for the Murray system. By the time water was made available, the seed crop had died. Irrigators are also extremely concerned about the rising cost of water. At least we didn't incur harvest, cleaning, testing and packaging expenses. We won't be able to farm much longer if we continue to sustain such losses.

Seed producing irrigators have reached a situation where they need to consider on an annual basis whether the returns on the seed crop will justify the expense of irrigation – and seed is considered a high value crop.

Seed producers, farmers, and the Australian community as a whole, look towards Research and Development to provide the solutions. That's sensible, as it's the Rural Research and Development Organizations provide an existing infrastructure that has a good record of achievements. However, there will need to be extra resources - and careful planning to ensure effectiveness, efficiency and avoid duplication of effort amongst the Research

organizations. This is an area which needs an holistic approach! Some of the solution may even require government support for plant breeding programs.

Despite being contrary to nature, I don't believe the task of producing more yet using less resources is impossible. But it won't happen by itself. It needs to be managed. I urge the Government to decide their objectives, determine the resources required to meet those objectives, and adopt a realistic and achievable plan.

Can Research and Development find that path forward for Australia's agriculture to:

- be globally competitive
- produce more using less resources
- adjust to variable climates
- produce safe, nutritious and attractive food supplies
- foster regional development?

I'm confident that it can. Even our tiny program has been finding that path for a number of years, and we plan that this shall continue.

# Conclusion

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I have written this submission on behalf of the Grains Council of Australia's (GCA) Seed Committee which is the national representative body for seed producers. I am also Chair of the RIRDC<sup>8</sup> Pasture Seed Research and Development Advisory Committee

It is the seed producers who pay the R&D levy when they get their seed certified.

I am a seed producer and all the seed we grow is submitted for certification. I pay a lot of levies. Do I like paying levies? No. Do I want research and development? Yes! Absolutely! I believe the industry only has a limited future without it. Even if the only role of our research program was to combat pests and diseases (and our program is about a lot more than that), it would still be absolutely essential. The environment in which plants grow is continually evolving. Eventually the plant will succumb to attack from some pest or disease as they become more virulent, and the plant's defense system can no longer cope. Seed producers need some help in that warfare.

Strangely, farmers are very prone to put up with things. They know farming is difficult. There's so much they can't do anything about – recent droughts are perfect illustrations. What does the farmer do? ... His best, he just hopes to ride out the rough patch.

There are heaps of minor disasters every season for a farmer. He contends to the best of his ability. He has a great talent to identify the problem and the best solution that's been invented, and he applies that solution in the best way he knows how.

Let's use locusts as an illustration. Just a few decades ago, if there was a locust plague, the farmers' thought pattern would be ... "it's a locust plague, there's nothing we can do about it. Better luck next year." These days, the farmers say, "what's the latest best practice in dealing with locusts?" They look it up on the internet, follow advice, and hope for the best.

See where the role of public R&D comes in. As an individual farmer, there's no way he would say "locusts are a terrible problem, and I can fix it as an individual farmer." These days he would probably say "locusts are a terrible problem, what's the Government doing about it? I'm paying R&D levies what are those R&D programs doing about it?" He has more ownership of the R&D, and the ability to influence the direction for R&D, as I've explained in the submission.

The Government support of Rural R&D is very valued. Thank you. The extra funding allows so many more projects. As I've illustrated in the submission, the Government's priorities for Rural R&D are well known, and they influence the choice of projects. Would they be of such influence without the matching funding? Probably not.

I believe the Pasture Seed R&D Program works very well indeed. RIRDC has administered the program very well, and there have been benefits from the cross pollination of ideas between our program and other programs in the RIRDC family e.g the pollination program, & fodder program.

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<sup>8</sup> RIRDC is the Rural Industries Research and Development Corporation



Trying to put myself in the Government's position for a minute, I would think a Government would be very much in favor of Research and Development. When anything goes wrong, people tend to blame the Government. If an industry comes across a situation which could lead to market failure, people tend to think "why has the Government let this happen?" But rural R&D programs do minimize the risk of disaster, because the industry involvement goes a long way towards identifying potential risks well in advance, and finding a solution before it becomes a disaster. Because industry money is involved, the solution is likely to be cheap but effective. That has to be good.

The community has given Rural Research and Development the challenge of meeting the growing global demand for food as the world population increases to all time highs. At the same time, they are insisting this should be done by using less resources. Despite being contrary to nature, I don't believe this task is impossible. But it won't happen by itself. It needs to be managed. I urge the Government to decide their objectives, determine the resources required to meet those objectives, and adopt a realistic and achievable plan. Obviously, this research effort will require adequate funding.

There has been some fear and amazement that the Government might consider withdrawing funds from Rural Research and Development programs. If Government was to withdraw any support to these programs, I believe there would be outrage. Farmers already think they have a raw deal. For example they have a perception that:

- their competitors enjoy many government benefits they don't get to see,
- the 'worst drought ever' has just clobbered them,
- the high Australian dollar has decimated markets,
- the economic downturn has had negative effects on every front
- the costs of farm inputs are far too high, and the farmer can't pass these costs on
- Government regulations make life difficult – hard to keep abreast of them, and unreasonably restrictive to their work.

The farming community does, however, appreciate the support the Government has given many during the drought. However, many 'successful' farmers who never qualify for assistance, who are really struggling. These are often the 'leading farmers', morale is low.

Finally, if someone was to suggest to me that R&D levies should be compulsory for all rural industries, I would heartily agree. What is the future of our agriculture industry, and consequently the prosperity of our regions without them? As it is, sections of a small industry trying to participate in their R&D program through the contribution of an R&D levy, find it almost impossible to do so. In my opinion, if anything needs changing, it would be to facilitate small industry participation in Rural Research and Development to enable them to more easily participate in programs such as the RIRDC Pasture Seed program. For example, by providing a less daunting legislative process.

Penny Hendy,  
GCA Seed Committee

## Attachment 1

South Australian Seed Certification Scheme's Procedures and Standards Manual

(Refer to 'Seed Certification Manual.pdf')

## Attachment 2

### **SEED CERTIFIED IN AUSTRALIA UNDER THE OECD SEED SCHEMES 1999/2000 – 2008/09**

2009 data compiled by Australian Seeds Authority Ltd from data provided by the seed certification agencies AGWEST, AsureQuality Australia, QSEED Pty Ltd and Seed Services Australia.

(Refer to 'OECD CERTIFIED SEED 1999-2000 to 2008-2009 22 Dec09.pdf')

## Attachment 3

GCA Flow Charts.doc