Fodder Crops
Research and Development Plan
2009 – 2014
Fodder Crops Research and Development Plan 2009–2014

September 2009

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Foreword

The Fodder Crops Program, part of the Established Rural Industries Portfolio, is managed by the Rural Industries Research and Development Corporation (RIRDC), supported by an advisory committee made up of producers, researchers, exporters and fodder users.

Fodder is the wide range of crop and pasture species that are grown, harvested and lightly processed to facilitate both on-farm use and sales through domestic and export channels. Fodder includes all types of hay and silage.

The total value of fodder production is estimated to have averaged $1.4 billion over the five-years to 2006–07 making the Australian fodder industry similar in size to the barley ($1.6 billion), sugar ($1.5 billion) and poultry ($1.5 billion) sectors. The volume of fodder traded in both the domestic and export market places has increased substantially since the last Five-Year R&D plan was prepared for the Fodder Crops Program.

Drought, and potentially climate change, is resulting in a different profile of Australian fodder products. Climate change, reduced availability of irrigation water, increased competition for land from agricultural and non-agricultural users, together with changes in the relative profitability of crops and pastures have resulted in a reshaping of Australian fodder production and use. There is a need for R&D to provide sustainability and profitability in this uncertain landscape to the fodder industry.

RIRDC is committed to the development of Five-Year R&D Plans for each of its Research and Development Programs in keeping with the Corporate Five-Year Plan 2007–2012 and the National and Rural Research Priorities.

This Plan was funded from RIRDC core funds provided by the Australian Government and is an addition to RIRDC’s diverse range of over 1900 research publications. It forms part of our Fodder Crops R&D Program which supports the development of quality fodder products and the sustainability and profitability of all sectors in the value chain in both domestic and export markets.

Peter O’Brien
Managing Director
Rural Industries Research and Development Corporation
The author (Michael Clarke AgEconPlus) wishes to acknowledge the assistance of RIRDC and the Fodder Crops Research and Development Committee. In particular I wish to thank the following individuals for their assistance with the plan:

- Jeff Hoffman – Chair RIRDC Fodder Crops R&D Advisory Committee
- Lyall Schulz Chair, AFIA
- Colin Peace Executive Officer and Duncan Handley Project Officer, AFIA
- RIRDC staff
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Snapshot of the Five-Year Plan

Goal

To stimulate and promote those R&D efforts that will produce quality fodder products and secure sustainability and profitability for all sectors of the Australian fodder industry value chain in domestic and export markets.

Objectives

Plan objectives that drive the 2009–2014 R&D Program along with expected share of the program budget are:

1. **Markets, Products and ‘Blue Sky’ Research** - Objective one is to explore and develop new export and domestic markets for Australian grown fodder, shore up existing markets and supply markets with new Australian fodder products. This objective explicitly includes a small allowance for investment in pure ‘blue sky’ research with its associated high risk, high payback profile - (5%);

2. **Plant Breeding and Germplasm Evaluation** - Objective two is to address the increasingly specialised nature of world fodder markets through the development, and then adoption, of superior new varieties of the most important fodder crop species for export and domestic customers. The focus of new variety production is to be on cereals (especially oats), vetch and annual pasture species. Superior varieties are to address yield, climate change/ drought tolerance, quality/palatability, pest/disease and agronomic challenges - (45%);

3. **Crop Agronomy and Fodder Production Efficiency** - Objective three tackles crop agronomy and fodder production efficiency through investments in plant nutrition, pests/diseases/weeds, micro-organisms, water use efficiency, farming systems, harvesting / processing technologies, fire management and agronomics to manage chemical residues in fodder. A benchmarking and economics component is also proposed as part of this objective - (10%);

4. **Supply Chain Efficiency Harvesting, Transport, Traceability and Relationships with Allied Industries** - Objective four is to ensure that once fodder has been produced the supply chain is efficient in delivering the best quality product to end users through harvesting, storage, transport, coordination, traceability and building relationships with allied industries. Delivery of Objective 4 will ensure best technologies are available to produce hay and silage, process this for a range of end uses and ensure effective transportation to end users. - (10%);

5. **Improved Fodder Quality** – To ensure that Australian produced fodder in domestic and export markets meets customer expectations for quality in terms of product description, objective test results and quality attributes, such as metabolisable energy, protein content, level of extraneous matter, residues and animal preference - (10%);
6. *Climate Change, Biosecurity and Environmental Management* - To address the climate change challenge facing the Australian fodder industry and its customers. To effectively support the development of fodder industry products which meet international trading standards and comply with import country protocol requirements. To protect the Australian fodder industry from biosecurity hazards. To produce fodder products with minimal negative impacts on the environment - (10%); and

7. *Industry Linkages, Communication, Information Flows, Forecasting Tools and Program Evaluation* - To ensure an informed industry and early successful adoption of R&D program outcomes - (10%).

Program budget allocations are flexible and will be guided by the Fodder Crops R&D Advisory Committee.

The plan is consistent with RIRDC’s overriding aim of maximising the contribution its investments make to the profitability, sustainability and resilience of rural industries and communities.
1. Purpose of the Plan

A program review and five-year research and development (R&D) plan to guide investment through to 2014 will have four main purposes:

1. To outline the rationale for the Fodder Crops R&D program that RIRDC will manage on behalf of the Australian Government and the Australian fodder crops industry.

2. To provide clear signals concerning fodder crop R&D needs and priorities for the period 2009 to 2014.

3. To encourage and support discussion between the fodder crops industry, RIRDC and the research, development and extension (R, D & E) community, that will enable the future needs of the industry to be identified and incorporated in annual and longer term planning.

4. To provide a budget framework for investment in fodder crops R&D for the next 5 years.

The plan is based on the findings of consultation with industry via a survey of industry members including members of the Australian Fodder Industry Association (AFIA) during June 2008, consideration of the outcomes of the Securing Fodder for Our Future Industry Summit Melbourne 11 June 2008, and a follow on workshop involving a broad cross section of the industry and the RIRDC Fodder Crops R&D Advisory Committee 12 June 2008. A draft plan was provided to the RIRDC Fodder Crops R&D Advisory Committee in August 2008 and refined following feedback from the Committee.
2. The Fodder Crops R&D Program

The Fodder Crops R&D System

Current Funding Arrangements
The Australian fodder crops industry has been working through AFIA since 1999 to develop a case to Government for a compulsory R&D levy. The industry has introduced a voluntary levy arrangement to highlight its commitment to R&D. Initially this voluntary levy was agreed for export cereal hay as the collection points were relatively straightforward. Subsequent to this, domestic traded hay has been included. Domestic traded hay producers face difficulties with many levy collection points and multiple stakeholder groups. A lot of hay is traded ‘over the fence’, many growers produce hay as a sideline or rotation crop and consequently don’t recognise themselves as hay/fodder growers.

The R&D program currently relies on voluntary levies, matching government funding and donations to do research work to better all aspects of the industry. The resources contributed by current funding arrangements are much less than would be achieved through a statutory levy (RIRDC 2008).

Voluntary levies are difficult as the usual ‘free-rider’ issue always arises. In 2008, for example, more than 90% of levy revenue was derived from the export sector, which markets 12% of the hay crop. Voluntary support for the program has fluctuated over the years, ranging from a low of $119,538 in 2002/03 to a high of $247,672 in 2001/02 (RIRDC 2008).

At the AFIA Conference in Darwin in 2006, fodder exporters agreed to continue their support for an export cereal hay levy and undertook to engage in a proactive levy collection mechanism, agreeing to take the ‘levy’ from all exported hay. As a result, most exporters have committed to collection of levies (RIRDC 2008).

It was expected that this would increase the amount of income available to the program but in 2006-07 actual contributions from industry were $196,089, less than the $225,000 budgeted. This reduced figure was largely due to the impact of the drought on the export sector.

At the 2005 AFIA Conference domestic fodder trader/contractors agreed to continue their commitment to a voluntary domestic levy. Despite this commitment there were less than ten producers contributing to the program in 2006-07.

After drawing down on reserves in 2006-07, the Program reserves at the end of 2006-07 were $296,319. A summary of the financial statement for 2006-07 is shown in Table 2.1.
### Table 2.1: Financial statement for the Fodder R&D Program 2006-07

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserves at beginning of reporting period</td>
<td>$384,387</td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td></td>
</tr>
<tr>
<td>Industry contributions</td>
<td>$196,089</td>
</tr>
<tr>
<td>RIRDC contributions</td>
<td>$225,000</td>
</tr>
<tr>
<td>Other income (including interest, royalties, sales of publications)</td>
<td>$75,576</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$496,665</strong></td>
</tr>
<tr>
<td><strong>Expenditure</strong></td>
<td></td>
</tr>
<tr>
<td>Research projects</td>
<td>$523,281</td>
</tr>
<tr>
<td>Other expenditure (including committee costs, communications, service fees, etc)</td>
<td>$61,452</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$584,733</strong></td>
</tr>
<tr>
<td><strong>Reserves at end of reporting period</strong></td>
<td><strong>$296,319</strong></td>
</tr>
</tbody>
</table>

Source: RIRDC 2008
Resolutions from the ‘Securing Fodder for Our Future’ Summit June 2008

At the 11 June 2008 Securing Fodder for Our Future Industry Summit Fodder industry leaders delivered a mandate for a new approach to R&D for hay and silage in Australia. Over 50 representatives from research organisations, producer peak bodies, state and federal government, and the export hay sector concluded that for industry good:

- The status quo for fodder R&D funding was not an option for the future;
- Increased and sustainable funding is essential;
- Improved planning and coordination between research organisations and sectors is imperative; and
- Extension and adoption must be a focus of any future gains.

The Summit agreed to establish a cross-sector taskforce to investigate options for funding and implementation of an R&D strategy that will clearly benefit Australian fodder producers. Several funding mechanisms were canvassed, amongst them an industry-funded statutory levy. A suggestion of an approach to the Primary Industries Ministerial Council to consider a National Strategy for Fodder R, D & E was also put forward (AFIA 2008a).

This RIRDC Fodder Crops R&D Plan 2009–2014 is informed by Summit resolutions.

Fodder Crops R&D Advisory Committee

The Fodder Crops R&D Advisory Committee oversees the RIRDC Fodder Crops R&D Program. Committee members are nominated by AFIA and appointed by RIRDC. The Committee consists of persons with a range of skills and experience in the research, production, processing, marketing and consumption sectors of the industry together with representatives from RIRDC. The Committee is responsible for ranking research funding proposals within the framework of the Five-year R&D Plan and provides recommendations on the allocation of research and development contributions (comprising industry voluntary contributions and Commonwealth matching) to the RIRDC Board. Historically, its primary focus has been on those priorities identified by the export sector, as they are responsible for contributing most of the industry’s voluntary levy contributions.

The Fodder Crops R&D Advisory Committee consults with industry bodies to evaluate the requirements of the industry for R&D, to prepare the Five-year R&D Plan, which is reviewed annually, and to monitor and evaluate the impact of R&D projects.
3. Industry Profile and Future Directions

The following profile of the Australian Fodder Crop industry includes up to date information sourced from *Fodder Crops Program Review 2006-07* (RIRDC 2008), the *Fodder Research, Development and Extension Issues Paper* (AFIA 2008) and the *Australian Fodder Industry* (ABARE 2008). Both the RIRDC and ABARE publications were funded with resources provided by the RIRDC Fodder Crops R&D Program.

The Australian Fodder industry has changed markedly over the decade 1999 to 2008. Increasing intensity of livestock feeding, expansion of the export market and climate change have all contributed to a large increase in fodder demand. Drought, reduced availability of irrigation water, increased competition for land from agricultural and non-agricultural users, together with changes in the relative profitability of crops and pastures have resulted in a reshaping of fodder production and use (ABARE 2008).

**Products, Producers and Locations**

Fodder is defined as the wide range of crop and pasture species that are grown, harvested and lightly processed to facilitate both on-farm use and the domestic and export trade. Fodder production includes hay and silage of all types (pasture, cereal, lucerne, clover and others), chaff (coarsely chopped dried whole plants), vetch and pelletised feed (RIRDC 2008).

A changing climate has resulted in a different profile of fodder products. Pasture bailed for hay production now represents a declining portion of total hay production (AFIA 2008).

Total Australian hay production ranges between 4.9 and 7 million tonnes per annum. In 2006/07 this figure was around 4 million tonnes. Around 2 million wet tonnes of silage is produced each year or around 1 million tonnes of hay equivalent (RIRDC 2008 and shown graphically with AFIA forecasts as Figure 3.1 below).

The majority of fodder growers are not specialist producers (RIRDC 2008). Around one third of all Australian commercial scale farms, 38,000 properties, make hay each year. On average, around 70% of fodder used on Australian farms is produced on-farm (ABARE 2008). The balance (up to 30%) is traded and this percentage has increased substantially since 1998-99 (AFIA 2008).

Fodder production is concentrated in Victoria (39% of total production) and New South Wales (19%). The major exporting states are Western Australia (WA) and South Australia. The Midlands and Upper Great Southern Regions of WA, the Yorke Peninsula and Lower-north region of South Australia and central northern Victoria appear to provide a high proportion of the cereal hay and straw exported (ABARE 2008).
Value of the Australian Fodder Industry

The total value of Australian fodder production is estimated to have been $1.5 billion in 2005-06 and to have averaged $1.4 billion for the 5 years 2001-02 to 2006-07. The value of fodder has increased 50% since 1998-99 (RIRDC 2008) and an industry value of $1.5 billion makes fodder production a larger industry than the Australian barley, sugar or poultry industries (AFIA 2008).

The increase in the value of fodder production is due to rising production and record fodder prices in the period since 2001-02 as a consequence of drought (ABARE 2008).

The traded value of fodder crops (ie that percentage of production not consumed in the farm on which it is produced) is thought to be around $300 million including hay, straw and silage (RIRDC 2008).

Fodder is an essential input for the Australian dairy, beef, sheep and equine industries (AFIA 2008). Fodder is also widely used in horticulture for mulches and for erosion control (RIRDC 2008).
Supply, Demand and Markets

The broadacre industries, which include most sheep and beef cattle, are by far the biggest suppliers of fodder to the Australian market place, accounting for an estimated 70% of hay sales and 92% of silage sales for the period 2001-02 to 2004-05 (ABARE 2008).

Annual hay use has exceeded hay production in 5 of the 9 years since 1997-98 and hay stocks have fallen markedly and are forecast to remain low (ABARE 2008). Projections of ABS data prepared by AFIA put the proportion of hay stocks in June each year declining from 75% in season 1997-98 to only 4% in 2012-13. This leaves consumers of hay exposed to any shortfalls in hay production (Figure 3.1). There are grave concerns about the adequacy of supply to meet the needs of fodder users, particularly in the dairy industry.

Increases in silage production and use over the past 15 years have been dramatic and the pattern of silage use has changed substantially. A major driver for this change has been the adoption of technology that allows use of silage within the year of production (ABARE 2008).

In recent times there has been a growing trend for the dairy industry to rely more on off-farm purchases of fodder with estimates suggesting that more than half of total fodder needs are now purchased off-farm.

The dairy industry is estimated to have accounted for 31% of hay used and 57% of silage during the period 2001-02 to 2004-05, but the dairy industry’s share of total fodder use has declined. Broadacre industries accounted for 45% of hay used and 21% of silage. Exports accounted for 12% of hay use and the horse industry accounted for 6% of hay use. The feedlot sector is estimated to have used 2% of hay and 13% of silage (ABARE 2008).

Hay exporters have been the single biggest purchasers of hay between 2001-02 and 2004-05, followed by the dairy industry, broadacre farms, the horse industry and feedlots. Feedlots were the largest buyers of silage with broadacre and dairy farms also significant buyers (Table 3.1, ABARE 2008).
<table>
<thead>
<tr>
<th>Industry</th>
<th>Hay used (%)</th>
<th>Hay Purchased (%)</th>
<th>Silage Used (%)</th>
<th>Silage Purchased (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadacre</td>
<td>45</td>
<td>20</td>
<td>21</td>
<td>29</td>
</tr>
<tr>
<td>Dairy farms</td>
<td>31</td>
<td>23</td>
<td>57</td>
<td>28</td>
</tr>
<tr>
<td>Exports</td>
<td>12</td>
<td>35</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Horse industry</td>
<td>6</td>
<td>18</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Feedlots</td>
<td>2</td>
<td>4</td>
<td>13</td>
<td>41</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>0</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: ABARE 2008

A large share in the increase in hay sales in Australia over the past 15 years has been for the export markets – two thirds of the increase in hay sales over the period 1994-95 to 2004-05 was for export. In 1994-95 hay exports accounted for 35% of total sales by volume and in 2004-05 they accounted for almost 49% (ABARE 2008).

Demand for export Australian hay has increased steadily from 100,000 tonnes in 1989-90 to over 700,000 tonnes in 2005-06 (Figure 3.2). Successive droughts have reduced exports to around 500,000 tonnes in 2006-07 and 2007-08.
The majority of Australian fodder exports are cereal hays. Most of the balance is stores for use on ship or aircraft during livestock export. Japan typically accounts for over 85% of Australian fodder exports and 99% of exports to Japan are cereal hay or chaff (mostly oaten hay).

World trade in hay and hay products was valued at US$1.2 billion in 2006. The US is the world’s largest exporter and Australia is the second largest with around 19% of the value of world exports between 2002 and 2006. Japan is the world’s number one importer of hay and hay products and the volume of Japanese imports have been rising annually at a rate of around 3.6% (ABARE 2008).

It is perceived that a large untapped demand in Asia will enable the Australian fodder industry to develop many new export opportunities. China, Korea and Taiwan hold promise for Australian fodder exports and the Middle East is also growing as a market for fodder imports.
Increasing Livestock Demand

The demand for fodder is a derived demand, dependent on the outlook for livestock commodities and the forecast for the Australian fodder industry is positive (AFIA 2008):

- **Dairy**: global dairy stocks are at historically low levels, international prices will continue to be volatile, but are expected to remain relatively firm. Australian farm-gate milk prices have increased by about 50% during 2007-08. Asian demand for milk products will increase by more than 50% over the next decade. Intensive feeding on feed pads and requiring prepared fodder is firmly established and likely to gain further traction.
- **Beef**: global beef demand to grow by 14% from 2007 to 2017. Asian demand for beef is forecast to increase by 50% by 2020. In response, demand for Australian feed grains is expected to increase by 350,000 to 450,000 tonnes per year. More Australian cattle will be finished in feedlots.

‘Global feed grain and fodder supplies will need to expand at a much faster rate than has been the case over recent decades in order to meet the additional demand that the expansion of animal protein production will generate. Current global feed grain production growth rates, if maintained until 2020, will only meet approximately one-third of the projected increased demand’ (Australian Farm Institute 2007).

Future Supply Volatility

Against this positive outlook for fodder demand, capacity to supply is somewhat less certain (AFIA 2008):

- **Land use competition**: increasing returns from other agricultural and forestry enterprises will take land from fodder production. High grain prices mean growers are moving away from dedicated hay crops and into grain production. US legislation mandating increased biofuel consumption is expected to further support grain prices in the future. Water trading will see a shift from pasture to other production systems.
- **A changing climate**: climate variability will reduce Australian agricultural production by approximately 10% by 2030. Temperatures are to increase by 1-1.8 degrees Celsius by 2030. There will be 20% more drought months by 2030 and 40% by 2070. Rain will be more intense with longer gaps between falls (ABARE 2007).
- **Reduced water allocations**: uncertain irrigation allocations and high water prices will create a volatile demand for hay and silage. Irrigated fodder production is in decline, including lucerne, which is currently priced out of many dairy rations.

The future capacity of the Australian fodder crops industry to supply outstanding demand opportunities will depend more than ever on an effective R&D program.
4. Key Challenges for the Industry (SWOT)

A fodder crops Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was developed following the 11 June 2008 Fodder Summit, the 12 June 2008 R&D planning meeting and consultation with the RIRDC Research Manager.

**Strengths**

- Australia is a producer of excellent quality fodder
- Strong domestic and international demand for fodder with demand outstripping supply
- Fodder is competitively priced when compared to other feeds such as grain in terms of unit cost of energy and protein
- More specialist producers are emerging and the industry is maturing
- The industry has sound Intellectual Property (IP) on which to draw for varieties, new products and services. This IP is potentially a source of export income and funding support for the R&D Program

**Weaknesses**

- The fodder industry does not have access to sustainable R, D & E funding.
- R&D collaboration could be stronger and there is additional opportunity for engagement across industry sectors and with the Australian dairy and beef industries
- Unreliable seasons/drought (also an opportunity for this industry)
- The industry is fragmented and includes a diversity of opinion
- There are a lot of unprofessional and part time operators
- Transport systems do not favour the fodder industry – eg differences in road rules between states
- More regional supply deficiencies occurring needing long freight hauls
- No consistency of quality or quality assessment system
- Chemical residues, product variability, pathogens and toxins

**Opportunities**

- Climate variability – resulting in the need for more stored fodder in Australia (but potentially less capacity to produce it)
• Back to back droughts in South East Australia exposed shortages of both hay and silage and increased prices significantly
• Strong growth and greater engagement with the Australian dairy and beef industries, who are major purchasers of fodder, is expected
• Further forecast expansion in demand for Australian meat and milk products will place even greater pressure on the uncertain supply of conserved forage
• Strong growth in demand for fodder expected from China, Korea, Taiwan and the Middle East
• A 20% increase in the international fodder trade is forecast by 2013
• Engagement with the international research community to better understand opportunities emanating from say US and EU innovation and opportunities to ‘on-sell’ Australian technical know how
• Information transfer of the value of quality specification to the whole industry
• Improved trading language/market specifications

**Threats**

• Rising input costs including fertiliser, irrigation water and transport costs (for both domestic and export markets)
• Changing land use – competition from agricultural (eg grain production) and non-agricultural uses (eg housing)
• Weed contamination and weed spread
• Unfavourable transport regulations
• Imported fodder – minor volumes only (79 tonnes in 2006-07) and drought linked
• Reduction in current funding for R&D with failure to secure a levy or similar funding base.
5. Review of the Existing R&D Program

Review of the existing RIRDC Fodder Crops program is drawn from the following resources:

- R&D Plan for the Fodder Crops Program 2004-2009 (RIRDC 2004);
- Evaluation of the Fodder Crops Program: An Overview of All Projects – Stage 1 (CIE 2005);
- Evaluation of the Fodder Crops Program: Benefit Cost Evaluations – Stage 2 (CIE 2005); and

A brief summary of each of the first three resources is presented in this chapter along with a detailed performance assessment and a ‘lessons learned’ synopsis to inform R&D plan development for the period 2009–2014.

The Existing R&D Program

The most recent RIRDC five-year R&D plan for the fodder crops industry addressed seven major research objectives:

- **Objective 1:** New markets and products
- **Objective 2:** Plant breeding and germplasm evaluation
- **Objective 3:** Crop agronomy – nutrition, disease, weeds, pests and micro-organism management
- **Objective 4:** Hay and silage production, processing and transport
- **Objective 5:** Improved fodder quality
- **Objective 6:** Industry biosecurity and environmental management
- **Objective 7:** Industry communication and information flows

Details on the nature of these seven research objectives are provided below.
Objective 1: Development of New markets and products
Improve Australian competitiveness in the development and supply of fodder-based products for the intensive livestock industries in Australia and emerging livestock industries in North Asia. Key strategies included identification of new product opportunities in Australia (eg hay silage, rice hull mixes); undertake market research and develop market strategies for East Asia; investigating new processed products (eg hay pellets); and investigating fodder use in pharmaceuticals/nutraceuticals.

Objective 2: Plant breeding and germplasm evaluation
Develop superior varieties of fodder species for domestic and export customers. Key strategies included maintaining and improving existing plant breeding and germplasm programs for oats; review and if appropriate support plant breeding programs (lucerne, medics, subclover, alternative annual pasture legumes, temperate grasses, vetches and tropical legumes, wheat, barley, triticale and other grasses); develop species for higher vegetative growth and nutritional values; develop varieties targeting export markets; and closely collaborate with the Grains Research and Development Corporation (GRDC) to ensure complementarity in plant breeding efforts.

Objective 3: Crop agronomy – nutrition, disease, weeds, pests and micro-organism management
Investigate the effects of plant nutrition, diseases, weeds, pests and micro-organisms (both beneficial and harmful) of fodder production, and develop appropriate management strategies where appropriate. Key strategies included identification and addressing gaps in plant nutrition knowledge; identification of major plant disease, pest and weed problems; development of cost effective and integrated disease, pest and weed management strategies; identification of micro-organisms which have potential to create production benefits; and development of best management guides for different crops.

Objective 4: Hay and silage production, processing and transport
Ensure that best technologies are available to produce hay and silage, process this for a range of end uses and ensure effective transportation to end users. Key strategies included understanding plant physiology in relation to hay and silage making; improving the processing of hay for specific markets; improved water use efficiency; and improved understanding of transportation technologies and the implications of transport regulation.
Objective 5: Improved fodder quality
Ensure that Australian produced fodder in domestic and export markets meets customer expectations for quality in terms of product description and quality attributes, such as metabolisable energy, protein content, level of extraneous matter, residues and animal preference. Key strategies included developing a better understanding of end user requirements; developing standard uniform national quality measurements; developing a common specification language for Australian fodder, benchmarking Australian quality against international competitors; and broadening the application and reliability of rapid laboratory tests for fodder.

Objective 6: Industry biosecurity and environmental management
Effectively support the development of fodder industry products which meet international trading standards and are produced with minimal negative impacts on the environment. Key strategies included identification of feed safety risks (bacteria, moulds and fungi); assessment of chemical residues; better tests for potential contaminants; and assessment of the importance of Environmental Management Systems (EMS) for fodder production.

Objective 7: Industry communication and information flows
Ensure early successful adoption of R&D program outcomes. Strategies included development of industry R&D newsletters, links with peak farmer groups, development of extension packages; and early adoption and implementation of extension materials.
Resource Allocation Under the Current Plan

R&D resource allocation by current R&D plan objective is summarised in Table 5.1 below.

Table 5.1 Expenditure by Fodder Crops Program Area (2004-05 to 2006-07)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Total ($)</th>
<th>Percentage of Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development of new markets and products</td>
<td>5,271</td>
<td>0.38</td>
</tr>
<tr>
<td>Plant breeding and germplasm evaluation</td>
<td>667,637</td>
<td>48.15</td>
</tr>
<tr>
<td>Crop agronomy</td>
<td>84,515</td>
<td>6.10</td>
</tr>
<tr>
<td>Hay and silage production, processing and transport</td>
<td>229,203</td>
<td>16.53</td>
</tr>
<tr>
<td>Improved fodder quality</td>
<td>165,950</td>
<td>11.97</td>
</tr>
<tr>
<td>Industry biosecurity and environmental management</td>
<td>152,579</td>
<td>11.01</td>
</tr>
<tr>
<td>Industry communication and information flows</td>
<td>81,174</td>
<td>5.86</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,386,329</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: RIRDC 2008

During the period 2004-05 to 2006-07, an average of six new projects per annum were approved (RIRDC 2008). A list of projects commencing since the start of the current plan is included as Table 5.2. Currently active projects (June 2008) are:

- Rapid detection of *Rathayibacter toxicus* in hay
- Technology transfer of Best Management Practice/QA systems for quality lucerne hay
- Fodder quality specifications identifying predictors of fodder quality
- Development of improved oat varieties for hay production: national program I & II
- Fungicides for managing diseases and quality in export oaten hay
- Development of an integrated R&D project to specify fodder quality – stage 2
- Development of research protocols for the export hay industry
- Prediction of ARGT risk in southern Australia
Refining Performance Based Standards (PBS) assessment of hay and straw transport for national consideration
Quantifying fodder quality assessments using machine vision
Australian fodder atlas

The following observations are offered on the Fodder Crops R&D Program 2004-2009:

Seven program objectives is a lot for a relatively small program with an historical budget of $500,000 pa and which might have a budget as small as $300,000 pa over the life of the next five-year plan.

Little has been spent on objective 1: developing new markets and products. This low rate of investment reflects the heavily reduced level of funding available to the program and the impact of drought on industry activities.

Objective 2: plant breeding and germplasm evaluation, dominates program investment. The National Oat Breeding Program was the only new project covering this objective funded in 2006-07 and builds on previous research in this area. Unfortunately resources were not available to continue funding the Vetch Breeding Program.

Crop agronomy funding (objective 3) includes Annual Ryegrass Toxicity (ARGT) investments – mapping and tools to manage the risk of incidents - as well as a further study of fungicides for managing diseases and quality of export oaten hay.

Hay and silage production, processing and transport (Objective 4: ‘supply chains’) has invested in ‘super conditioning’ research, an important hay ‘value adding’ technique widely used by fodder exporters along with Performance Based Standards (PBS) research to inform national road transport policy.

Investment in objective 5: fodder quality, has included projects that use machine vision to define fodder quality and systems to predict animal preferences for particular types of hay. The outcomes of these studies will enable the industry to target hay types to markets and provide proof of these hay characteristics.

Objective 6: industry biosecurity and environmental management, includes investments aimed at improving export market access for Australian fodder products. A single project funded in 2006-07 ‘Rapid detection of Rathayibacter toxicus in hay’ will improve testing turnaround time for exporters and reduce processing costs overall.

Industry communication and information flows, objective 7 has remained at stable funding levels over the life of the current five-year R&D plan. Recent projects have provided a comprehensive snapshot of the fodder industry (The Australian Fodder Atlas) and Best Management Practice/Quality Assurance (BMP/QA) systems for quality lucerne production.

A synopsis of recent formal reviews of the Fodder Crops program is presented in the balance of this chapter.
<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Start</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAB-1A</td>
<td>Development of research protocols for the export hay industry</td>
<td>1-Jul-04</td>
<td>31-Jan-07</td>
</tr>
<tr>
<td>DAN-229A</td>
<td>Review of disease constraints to oaten hay production</td>
<td>1-Jul-04</td>
<td>30-Apr-07</td>
</tr>
<tr>
<td>EAV-1A</td>
<td>Chemical use in fodder crops</td>
<td>1-Jul-04</td>
<td>31-Oct-04</td>
</tr>
<tr>
<td>JLB-3A</td>
<td>Dev of an integrated R&amp;D project to specify fodder quality - stage 2</td>
<td>1-Jul-04</td>
<td>30-Apr-07</td>
</tr>
<tr>
<td>PFA-1A</td>
<td>Review of diseases of oats hay: current and future management</td>
<td>1-Jul-04</td>
<td>31-May-06</td>
</tr>
<tr>
<td>SAR-53A</td>
<td>Update of growing oat hay book</td>
<td>1-Jul-04</td>
<td>31-May-06</td>
</tr>
<tr>
<td>SAR-54A</td>
<td>Improve vetch varieties for fodder production</td>
<td>1-Jul-04</td>
<td>31-Mar-07</td>
</tr>
<tr>
<td>FCR05-10</td>
<td>Development of an identification system for hay bales</td>
<td>1-Jan-05</td>
<td>31-Dec-05</td>
</tr>
<tr>
<td>DAW-116A</td>
<td>Rapid detection of Rathayibacter toxicus in hay</td>
<td>1-Jul-05</td>
<td>1-Jul-07</td>
</tr>
<tr>
<td>DRD-5A</td>
<td>Evaluation of drying regimes used to determine forage DM in silage</td>
<td>1-Jul-05</td>
<td>30-Jun-06</td>
</tr>
<tr>
<td>FCR05-01</td>
<td>Fungicides for managing disease and quality in export oaten hay</td>
<td>1-Jul-05</td>
<td></td>
</tr>
<tr>
<td>FCR05-02</td>
<td>Improving fodder crop yields - manipulation of nitrogen cycle bacteria</td>
<td>1-Jul-05</td>
<td></td>
</tr>
<tr>
<td>FCR05-04</td>
<td>Silage production in the wet tropics, tropical grass production systems</td>
<td>1-Jul-05</td>
<td></td>
</tr>
<tr>
<td>FCR05-05</td>
<td>Using silage to finish prime lambs</td>
<td>1-Jul-05</td>
<td></td>
</tr>
<tr>
<td>FCR05-07</td>
<td>Disinfestation of fodder exports using alternatives to methyl bromide</td>
<td>1-Jul-05</td>
<td></td>
</tr>
<tr>
<td>FCR05-08</td>
<td>Oaten hay industry development</td>
<td>1-Jul-05</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Title</td>
<td>Start</td>
<td>Finish</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------------------------------------------------------</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>RDP-2A</td>
<td>Best practice super conditioning to produce quality export oaten hay</td>
<td>1-Jul-05</td>
<td>31-Jul-06</td>
</tr>
<tr>
<td>ARR-1A</td>
<td>PBS assessment of hay and straw transport for national consideration</td>
<td>15-Mar-06</td>
<td>13-Nov-06</td>
</tr>
<tr>
<td>ABA-20A</td>
<td>Australian fodder atlas</td>
<td>30-Jun-06</td>
<td>1-Jul-07</td>
</tr>
<tr>
<td>FCR06-01</td>
<td>Understanding the benefits of using Hay Rite when producing hay</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>FCR06-02</td>
<td>Development of an irrigated fodder industry in the NSW Riverina</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>FCR06-03</td>
<td>Dev alternative cereal hay varieties for export and domestic markets</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>FCR06-05</td>
<td>Enhancing aphid resistance in fodder and pasture legumes</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>FCR06-06</td>
<td>Disease management options for oaten hay and industry dev</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>FCR06-07</td>
<td>Understanding cereal hay yield and quality</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>FCR06-08</td>
<td>Nuffield Farming Scholarship for a farmer anywhere in Australia</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>FCR06-10</td>
<td>Added value products from wet fractionation of lucerne</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>FCR06-11</td>
<td>Fodder conservation management of tall fescue-based pastures</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>FCR06-12</td>
<td>Harvesting, processing and storage of Tagasaste</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>FCR06-13</td>
<td>Assess/management of the safety and toxicity of pasture legumes</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>FCR06-14</td>
<td>Improving cereal fodder production and quality by integrated and judicious use of nutrients and waste</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>MS067-18</td>
<td>Additional costs associated with management of fodder projects</td>
<td>1-Jul-06</td>
<td>30-Jun-07</td>
</tr>
<tr>
<td>No.</td>
<td>Title</td>
<td>Start</td>
<td>Finish</td>
</tr>
<tr>
<td>----------</td>
<td>------------------------------------------------------------------------------------------------------</td>
<td>-----------</td>
<td>--------------</td>
</tr>
<tr>
<td>MUL06-13</td>
<td>Feeding pasture legumes and their role in increasing CLA concentrations in sheep meat</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>MUL06-30</td>
<td>Agronomic development of <em>Arundo donax</em> (giant reed) for commercial/industrial applications</td>
<td>1-Jul-06</td>
<td></td>
</tr>
<tr>
<td>BSC-1A</td>
<td>Prediction of ARGT risk in southern Australia</td>
<td>1-Sep-06</td>
<td>30-Nov-07</td>
</tr>
<tr>
<td>USQ-4A</td>
<td>Quantifying fodder quality assessments using machine vision</td>
<td>1-Sep-06</td>
<td>31-Jul-07</td>
</tr>
<tr>
<td>JLB-5A</td>
<td>Industry practices to meet mandatory export market standards</td>
<td>1-Dec-06</td>
<td>30-Nov-07</td>
</tr>
<tr>
<td>SAR-57A</td>
<td>Dev of improved oat varieties for hay production: National program II</td>
<td>1-Jan-07</td>
<td>1-Jul-07</td>
</tr>
<tr>
<td>RDP-4A</td>
<td>Fungicides for managing diseases and quality in export oaten hay</td>
<td>1-Apr-07</td>
<td>30-May-09</td>
</tr>
</tbody>
</table>

Source: AgEconPlus analysis of RIRDC data
Evaluation of the Fodder Crops Program: An Overview – Stage 1

In December 2005 the Centre for International Economics (CIE) completed a Stage 1 initial assessment of the Fodder Crops program (CIE 2005) and a Stage 2 benefit cost analysis of selected projects (CIE 2005a). The Stage 1 assessment covered all Fodder Crops Program projects since RIRDC program inception in 1990 including the first year of the current R&D program. Results from the Stage 1 review are provided below.

Program Funding
Between 1991/92 and 2004/05 the Fodder Crops program supported 41 projects with an expenditure of $7.18 million. RIRDC contributed 42% of the funds for these projects (including voluntary levies), research organisations contributed 39% and industry members and others made up the remaining 19%.

An excellent overall program leverage rate has been achieved for RIRDC funds – for every dollar invested other parties invest a further two dollars thirty eight.

Project Classification
CIE 2005 classified Fodder Crop program projects according to the Department of Agriculture Fisheries and Forestry (DAFF) classification scheme. DAFF classification forms the first level of the classification used by RIRDC in their evaluations. See Table 5.3.

Table 5.3 Fodder Crops Program by DAFF Classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Number of Projects</th>
<th>Share of RIRDC funding (%)</th>
<th>Share of Research Organisation funding (%)</th>
<th>Share of total funding (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production - industry competitiveness</td>
<td>18</td>
<td>46</td>
<td>45</td>
<td>68</td>
</tr>
<tr>
<td>Production - sustainable development</td>
<td>1</td>
<td>52</td>
<td>23</td>
<td>4</td>
</tr>
<tr>
<td>Processing</td>
<td>4</td>
<td>29</td>
<td>18</td>
<td>8</td>
</tr>
<tr>
<td>Distribution, storage and transport</td>
<td>2</td>
<td>16</td>
<td>28</td>
<td>14</td>
</tr>
<tr>
<td>Markets</td>
<td>1</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Communication &amp; technology transfer</td>
<td>9</td>
<td>84</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Industry training and development</td>
<td>6</td>
<td>50</td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>41</strong></td>
<td><strong>42</strong></td>
<td><strong>39</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: CIE 2005

The majority of Fodder Crop program funding since 1991/92 (68%) is classified as ‘production industry competitiveness’.
Stage of R&D
CIE 2005 also classified the Fodder Crops research portfolio according to the stage of R&D undertaken in the project. R&D can be thought of as a three-stage process:

- **Stage 1**: represents fundamental or basic research. It may be scientific in nature, for example exploring plant physiology, or it can be economic, for example, looking at the potential returns on an activity before it is pursued. The distinguishing characteristic of this research stage is that its outputs are inputs into further research. The RIRDC Fodder Crop program invested 21.2% of available funds into stage 1 projects between 1991/92 and 2004/05;

- **Stage 2**: specific outcome driven research that can be used in some type of production. The Fodder Crops R&D program invested 69.6% of available funds into stage 2 projects between 1991/92 and 2004/05; and

- **Stage 3**: promoting the adoption of research outcomes. Some 9.2% of Fodder Crops program funds have been invested in stage 3, promoting the adoption of research outcomes.

Stage of R&D investment results are presented in Table 5.4.

<table>
<thead>
<tr>
<th>Classification</th>
<th>RIRDC funding (%)</th>
<th>Research organisation funding (%)</th>
<th>Other (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>16.8</td>
<td>30.4</td>
<td>12.3</td>
<td>21.2</td>
</tr>
<tr>
<td>Stage 2</td>
<td>73.6</td>
<td>56.3</td>
<td>87.6</td>
<td>69.6</td>
</tr>
<tr>
<td>Stage 3</td>
<td>9.6</td>
<td>13.3</td>
<td>0.1</td>
<td>9.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: CIE 2005

For established industries like fodder crops there tends to be a higher proportion of stage 2 projects – practically oriented investments with immediate application for industry rather than stage 1 – pure or basic research. Allocation of resources (9.2%) to promoting the adoption of research outcomes is consistent with good practice – industries normally invest around 10% of available funds in encouraging research adoption.

Initial Assessment Results
An initial assessment of the performance of the program was prepared by CIE in consultation with representatives of the Fodder crops R&D Committee. Results are summarised in Table 5.5.
Table 5.5 Initial Assessment by Total Funding

<table>
<thead>
<tr>
<th>Project Impact Ranking</th>
<th>RIRDC funding (%)</th>
<th>Research organisation funding (%)</th>
<th>Other (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>36.2</td>
<td>30.4</td>
<td>15.8</td>
<td>40.6</td>
</tr>
<tr>
<td>Medium</td>
<td>18.6</td>
<td>45.0</td>
<td>24.6</td>
<td>40.1</td>
</tr>
<tr>
<td>Low</td>
<td>6.6</td>
<td>3.6</td>
<td>8.2</td>
<td>8.3</td>
</tr>
<tr>
<td>Input</td>
<td>4.2</td>
<td>3.0</td>
<td>0.9</td>
<td>4.1</td>
</tr>
<tr>
<td>Too early</td>
<td>3.8</td>
<td>0.0</td>
<td>0.0</td>
<td>2.2</td>
</tr>
<tr>
<td>Not known</td>
<td>1.9</td>
<td>2.0</td>
<td>7.8</td>
<td>4.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>71.2</strong></td>
<td><strong>84.0</strong></td>
<td><strong>57.3</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: CIE 2005

The majority of the investment is having a high or medium impact on the industry. The benefit cost evaluations confirm this assessment to a large degree (see Stage 2 report below).

**Evaluation of the Fodder Crops Program: Benefit Cost – Stage 2**

Stage 2 of the CIE review of the RIRDC Fodder Crops program (CIE 2005a) addressed investment returns from four project clusters, they were:

- Testing for annual ryegrass toxicity;
- Testing and simulation of hay-bale loading on semi-trailers;
- Microbial inoculants for hay production; and
- New oaten hay varieties.
Table 5.6  Cluster Evaluation Results – RIRDC Fodder Crops R&D

<table>
<thead>
<tr>
<th>Fodder Crops Evaluation Outcomes</th>
<th>NPV ($M)</th>
<th>Cost ($M)</th>
<th>NBIR (%)</th>
<th>IRR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing for annual ryegrass toxicity</td>
<td>78.40</td>
<td>0.547</td>
<td>143</td>
<td>237</td>
</tr>
<tr>
<td>Testing &amp; simulation of hay-bale loading on semi-trailers</td>
<td>62.00</td>
<td>0.034</td>
<td>1,817</td>
<td>484</td>
</tr>
<tr>
<td>Microbial inoculants for hay production</td>
<td>33.07</td>
<td>1.121</td>
<td>31</td>
<td>22</td>
</tr>
<tr>
<td>New oatene hay varieties</td>
<td>118.2</td>
<td>1.13</td>
<td>105</td>
<td>81</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>291.67</strong></td>
<td><strong>2.832</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: CIE 2005a

Table 5.6 above shows what CIE believes to be the most likely pay offs from R&D and the following comments are made:

- All four projects analysed have satisfied the pay off requirements of RIRDC i.e. a Net Benefit Investment Ratio (NBIR) >8X cost or an Internal Rate of Return (IRR) >25%;
- From a total investment of $2.832 million return was estimated at $291.67 million. Returns from the four clusters analysed, nine projects in a total Fodder Crops portfolio of forty-one projects, were more than sufficient to offset the total cost of the investment portfolio ($7.48 million).
- There was only one environmental and social benefit included in the benefit measurements presented in Table 5.6. The ‘hay bale loading’ cluster has potential environmental outcomes in reduced fuel use. These environmental outcomes deliver economic, social and environmental benefits in the form of reduced health costs, reduced accident and injury, and greenhouse gas benefits. These benefits are estimated at $1.1 million over the 30 year analysis period.
- The investment results suggest that Fodder Crops R&D performed well and results were better than R&D completed in most other RIRDC established industries.
Performance Assessment: Relevance, Efficiency and Effectiveness

This Performance Assessment is completed in accordance with the RIRDC Evaluation Framework (May 2008) Part 1, Performance Assessment. This part of the ‘year four’ program review addresses Fodder Crop R&D program:

- Relevance;
- Effectiveness;
- Management effectiveness;
- Efficiency; and
- Lessons.

The Performance Assessment was completed through a series of interviews with the RIRDC Program Manager, interrogation of RIRDC Program Manager records and a Program Review Survey that included the R&D Advisory Committee.

A separate project will address Evaluation Framework Part 2, Program Review: Impact Assessment i.e. cost benefit analysis of ‘hero’ and ‘random’ projects.

Relevance

Quality of analysis and priority setting at Plan development and throughout the Program period

Were the priorities set and revised in response to fodder crop industry needs?

Comprehensive analysis and consultation was completed with the industry in 2004 to develop priorities for the Five-year Plan (FYP). An independent consultant and the RIRDC Project Manager prepared an industry R&D issues paper, the paper was circulated for comment, individual interviews were completed and a workshop held to set FYP priorities.

Throughout the life of the FYP the Program Manager and the R&D Advisory Committee have received advice from industry, through AFIA and other sources to ensure research priorities remain relevant. Priorities were not formally revised during the life of the current FYP. However, the R&D Advisory Committee, and through them industry, shaped the terms of reference of projects funded by the Program.

An Annual Fodder Crop Program Review completed in 2006-07 also helped to ensure ongoing Program relevance and responsiveness to emerging industry needs.
FYP strategies have proved to be relevant. However, limited funds for R&D has hampered delivery. Twenty-nine strategies were identified, seventeen were delivered and twelve were not addressed. Strategies not addressed included:

- Objective 1 New Markets and Products
  - New product opportunities
  - Market research scan
  - Market strategies
  - New processed products
  - Potential pharmaceutical and nutraceutical properties
- Objective 3 Crop Agronomy
  - Gaps in nutrition knowledge and development of management responses
- Objective 4 Industry Competitiveness
  - Cutting hay and silage – plant physiology and resultant fodder quality
  - Improving methods to produce fodder with the greatest water use efficiency
- Objective 5 Improved Fodder Quality
  - Development of a common specification language for Australian fodder
  - Benchmarking the quality of Australian fodder against international competitors
- Objective 6 Industry biosecurity
  - Identification and assessment of moulds
  - Assessment of the importance of Environmental Management Systems

The Advisory Committee did not proceed with new market and product investments when ‘core business’ was under threat. The plan was prepared assuming an appropriate statutory levy would be struck. Furthermore, voluntary levies were smaller than anticipated as a result of ongoing drought through much of the plan period. Plan strategies and priorities were relevant, limited funds heightened prioritisation of the projects.

**Quality of strategies developed**

*Were strategies based on realistic expectations, given the funding available and the available R&D capacity?*

Strategies were based on realistic expectations given the R&D capacity available. Funding resources proved to be less than anticipated due ongoing drought for much of the Plan period.
Quality of project proposals submitted and funded

*What proportion of those proposals submitted directly addressed the strategies?*

For the first four years of the Five-year Plan 2004 – 2009 easily accessible data is not available for proposals that were not accepted. This information is stored in a non-aggregated form in archived files (RIRDC Program Manager advice 21 October 2008). In future periods this information will be available through the ‘Clarity’ online database. Advice from the Program Manager is that research proposals were in line with widely communicated Five-year Plan strategies.

*What proportion of those proposals funded did not relate directly to any of the strategies in the FYP?*

Proposal data for the Five-year Plan 2004 – 2009 is not available. However, the RIRDC Program Manager states that the proportion of proposals received that did not relate directly to strategies in the Five-year Plan was small.

Allocation of program resources

*Did the shares of expenditure over the five-years (four years actual and one year programmed) align with the intended allocations across the different objectives/strategies?*

The 2004-09 R&D Plan for the Fodder Crops Program did not define the percentage of funding to be allocated to each objective/strategy. Funding allocation for the period 2004-05 to 2006-07 (Table 5.1 above) shows a high level of resource allocation to Objective 2 ‘Plant Breeding and Germplasm Evaluation’ with 48% of total budget. Six of seven Program strategies have received substantial funding. Objective 1, ‘Development of New Markets and Products’ has received less than one percent of budget.
Effectiveness of the R&D Program Goal

The program goal was to:

*To stimulate and promote those R&D efforts that will produce quality products and secure sustainability and profitability for all sectors of the Australian fodder industry value chain in domestic and export markets*

Stakeholder survey results revealed agreement with the statement that investment in R&D through the current five-year plan had played an important role in ensuring the fodder crops industry remains competitive, profitable and sustainable.

Key Performance Indicators

*What share of R&D Program KPIs have been realised? Given the full five-years of R&D investment, what proportion of Program KPIs are expected to be realised within the next five-years?*

Table 5.7 was completed in consultation with the Program Manager.

Table 5.7 Realisation of Fodder Crop R&D Program KPIs

<table>
<thead>
<tr>
<th>R&amp;D Program KPIs</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective 1: New Markets and Products</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Two or three new fodder opportunities and products identified | o KPI not realised.  
o New fodder opportunity and product research delayed due to insufficient Program funds. |
| Improved market information for fodder and growth in fodder markets | o KPI not realised.  
o No investment in market information due to insufficient Program funds. Fodder markets grew in response to increased demand rather than R&D investment. |
| Improved knowledge of other properties of fodder | o KPI not realised.  
o With limited resources the Program has concentrated on core fodder products and markets. |
| **Objective 2: Plant Breeding and Germplasm Evaluation** | |
| Regular release of improved fodder varieties which are widely adopted | o KPI realised.  
o Three new oaten hay varieties released by this Program in the period 2001 to 2007 – ‘Winteroo’, ‘Brusher’ and ‘Kangaroo’. |
<table>
<thead>
<tr>
<th>R&amp;D Program KPIs</th>
<th>Achievement</th>
</tr>
</thead>
</table>
| Identification of several new species with attractive fodder production attributes | o KPI realised.  
  o Tree legumes evaluated by the program – not attractive.  
  o Initial investigations of culton, chicory and other native grasses completed - some potential identified.  
  o Sulla evaluated and found attractive - some adoption by Australian growers.  
  o Vetch evaluated - 142 selected introductions (common and purple) passed quarantine in 2005/06. Further research delayed due to insufficient Program funds. |
| Commercialisation and adoption levels of new varieties and species                | o KPI realised  
  o Three new oaten hay varieties very successful - ‘Winteroo’, ‘Brusher’ and ‘Kangaroo’. Annual production of these three new varieties totalled approximately 600,000 tonnes in 2007 and is forecast to increase to 750,000 tonnes in 2008 (Lyall Schultz reported in the South Australian Stock Journal 16 October 2008). |

**Objective 3: Crop Agronomy: Plant Nutrition, Disease, Weed, Pest and Micro-organism Management**

<table>
<thead>
<tr>
<th>Action</th>
<th>Achievement</th>
</tr>
</thead>
</table>
| Adoption of best practice for plant nutrition management                | o KPI not realised.  
  o No projects addressed this option.                                     |
| Number of new management options for diseases, weeds and pests         | o KPI realised.  
| New technologies to take advantage of favourable micro-organisms       | o KPI expected to be realised.  
  o Two key projects - UQ 25A ‘microbial inoculants for hay production’ and UQ 82A ‘field testing microbial inoculants for hay preservation’. Results from both projects are being adopted by industry. |

**Objective 4: Industry Competitiveness**

<table>
<thead>
<tr>
<th>Action</th>
<th>Achievement</th>
</tr>
</thead>
</table>
| New technologies for cutting hay and silage                            | o KPI not realised.  
  o No projects addressed this strategy.                                   |
<table>
<thead>
<tr>
<th>R&amp;D Program KPIs</th>
<th>Achievement</th>
</tr>
</thead>
</table>
| Better technologies for processing hay                                          | o  KPI expected to be realised.  
|                                                                               | o  Two key projects - RDP-2A ‘best practice super conditioning to produce quality export oaten hay’ and USQ-4A ‘quantifying fodder quality assessments using machine vision’. Super conditioning project in particular regarded as very successful. |
| Standardised method for hay transportation and uniform regulatory requirements Australia wide | o  KPI expected to be realised.  
|                                                                               | o  Two key projects delivered including recommendations for refined Performance Based Standards (see below). External reviewer questioned findings resulting in delayed implementation. Vic Roads have now implemented and National Roads Board is to implement in 2008/09.  
|                                                                               | o  ROA 2A ‘further testing and simulation of hay bale loading on semi-trailers’ (04)  
|                                                                               | o  ARR 1A ‘refined Performance Based Standards assessment of hay and straw transport for national consideration’ (06)                                |
| Objective 5: Improved Fodder Quality                                            | o  KPI expected to be realised  
|                                                                               | o  Projects resulted in a beneficial change in both policy and export practice (see below)  
|                                                                               | o  JLB 1A ‘development of an integrated R&D activity to specify fodder quality’ (05)  
|                                                                               | o  JLB 3A ‘development of an integrated R&D project to specify fodder quality – stage 2 (07)  
|                                                                               | o  JLB 5A ‘industry practices to meet mandatory export market standards (07)  
|                                                                               | o  RDP 4A ‘fungicides for managing diseases and quality in export oaten hay’  
|                                                                               | o  UA 64A ‘fodder quality specifications identifying predictors of fodder quality across animal species (07) (palatability project)  
|                                                                               | o  DRD 5A ‘an evaluation of drying regimes used to determine forage dry matter in silage’  
<p>|                                                                               | o  CSA 3A ‘Screening methods for monitoring corynebacterium contamination of Australian Fodder – resulted in development and adoption of an ELISA disease screening test |</p>
<table>
<thead>
<tr>
<th>R&amp;D Program KPIs</th>
<th>Achievement</th>
</tr>
</thead>
</table>
| Implementation of a standard set of measures for hay and silage quality | o KPI expected to be realised  
  o Recommendations from the above research were channelled by RIRDC and the researcher through the AFIA Quality Evaluation Committee for implementation, particularly in relation to fodder exports. Subsequently recommendations have been incorporated in ChemCheck and adopted by growers. ChemCheck is a service designed specifically to verify safe use of agricultural chemicals. |
| Research based support for standardised laboratory tests which are accepted by industry | o KPI realised  
  o ELISA test developed in project CSA 3A (see above) has been adopted                                                                                                                                                                                                                                                                                                                                                                                                   |

**Objective 6: Industry Biosecurity and Environmental Management**

| Application of research results to all important biosecurity issues for the industry | KPI partially realised.  
  o Research results were made available and applied to diseases, weeds, pests and micro-organisms that impact on fodder production including ARGT, Corynetoxins and Rathayibacter. However due to insufficient funds not all important industry biosecurity issues were addressed eg there was no work completed during the plan period on fodder moulds. |
|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Introduction of appropriate tests to facilitate management of contamination threats | KPI partially realised  
  o ELISA test developed in project CSA 3A (see above) has been adopted                                                                                                                                                                                                                                                                                                                                                                                                   |
| Implementation of EMS procedures by industry                   | KPI not realised  
  o No projects addressed this strategy                                                                                                                                                                                                                                                                                                                                                                                                                                  |

**Objective 7: Industry Communication and Information Flows**

| Effective reporting of R&D activities to industry               | KPI realised  
  o Reporting activities included a six monthly newsletter which is mailed out to all AFIA members and other known stakeholders, occasional articles prepared and disseminated through the rural press and presentations made at each AFIA conference. AFIA conference presentations by the Program include research completed, research underway and future planned investments. |
<table>
<thead>
<tr>
<th>R&amp;D Program KPIs</th>
<th>Achievement</th>
</tr>
</thead>
</table>
| Well accepted R&D communications activities       | o KPI realised  
|                                                  | o All Program funded research projects are conditional on a RIRDC agreed adoption pathway and budget. A common adoption pathway for producer oriented R&D is an industry field day. Fodder field days are accepted by industry as the best way to communicate research findings |
| High levels of adoption of R&D outcomes           | o KPI realised  
|                                                  | o High levels of adoption achieved for:  
|                                                  | o New oat varieties bred with Program funding  
|                                                  | o Science based measures for fodder quality attributes – chemical residue management recommendations adopted through ChemCheck  
|                                                  | o ARGRT risk management strategies adopted  
|                                                  | o Best practice guidelines for new lucerne growers widely distributed  
|                                                  | o There is some evidence that Rathayibacter toxicity levels are lower than they were in 2000 but attribution to research findings would be difficult to establish |

Source: Program Manager Survey

In summary, twenty-nine strategies with twenty-one KPIs resulted in:

- The delivery, expected delivery or partial delivery of fifteen KPIs by 2014;
- Key achievements included:
  - The development, launch and uptake of three improved oat varieties for Australian fodder production
  - The machine vision system for the objective assessment of hay quality – prototype developed and tested
  - Incorporation of research results on chemical residues into the ChemCheck system and their application to the certification of fodder exports
  - Oaten hay disease identification and fungus treatment research
  - ARGRT identification, risk management and elimination in order to meet domestic and export market expectations
  - Rapid detection of Rathayibacter toxus in hay resulting in an improved testing turnaround time for exporters and reduce processing costs overall
  - The development and testing of microbial inoculants for hay preservation
- Noted disappointments included failure to secure sufficient R&D funds to continue the vetch breeding program.

The R&D Program in its underfunded state has delivered well for fodder industry stakeholders.
Projects

Of the completed projects, what proportion delivered substantially on the expected outputs?

Projects completed since 2004 and their delivery of expected outputs is summarised in Table 5.8.

Table 5.8 Delivery of Expected Outputs

<table>
<thead>
<tr>
<th>Delivery of Expected Outputs?</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes outputs delivered</td>
<td>19</td>
</tr>
<tr>
<td>Mostly delivered</td>
<td>3</td>
</tr>
<tr>
<td>Some outputs delivered</td>
<td>1</td>
</tr>
<tr>
<td>No, outputs were not delivered</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>

Source: Program Manager Survey

Completed projects have delivered expected outputs in 79% of investments. This does not include projects that have ‘mostly delivered’ or provided ‘some’ project outputs.

Risk/return mix

What share of projects (by level of investment) were assessed at proposal stage to be high risk?

Ex-post, what share of these projects delivered the expected outputs?
Table 5.9  High Risk Projects

<table>
<thead>
<tr>
<th>High Risk Project</th>
<th>RIRDC Total Cost</th>
<th>Total Project Cost</th>
<th>Delivery of Expected Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development and commercialisation of a new perennial forage legume (forage peanut) for fodder production in semi-arid tropics of Northern Australia</td>
<td>$4,000</td>
<td>$43,380</td>
<td>Project terminated</td>
</tr>
<tr>
<td>Fodder quality specifications identifying predictors of fodder quality across animal species</td>
<td>$347,005</td>
<td>$416,861</td>
<td>Mostly</td>
</tr>
<tr>
<td>Quantifying fodder quality assessments using machine vision</td>
<td>$50,052</td>
<td>$50,052</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$401,057</strong></td>
<td><strong>$510,293</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: Program Manager Survey

Three projects were assessed as being high risk, a total RIRDC investment of $401,057 in a five-year investment Program of $2.47 million, around 16% of project budget. Only one high-risk investment (forage peanut with a total RIRDC cost of $4,000) will not deliver some form of beneficial output (see Table 5.9 above).

**Effectiveness of Management**

**Participatory approaches**

*Were the approaches to developing and delivering the FYP sufficiently inclusive to capture all relevant views, and gain ownership of the R&D outputs by a large share of the industry (and other relevant stakeholders)?*

Program Manager interviews revealed that a comprehensive consultation process was used to develop the Five-year Plan and delivery has been via an Advisory Committee that is representative of the industry. The Advisory Committee includes:

- Fodder producers;
- Hay consultants;
- Nutritionist;
- Broker/transporters;
- Exporters; and a
- Researcher/producer.

A new Advisory Committee will be formed to implement the FYP 2009 to 2014. Ongoing membership of this committee by representatives with an understanding of the dairy, beef feedlot and grains industries is recommended.
Financial support

What share of the total project funding and resources was provided by industry?

Perhaps unusually for an Established Rural Industry the largest share of Program funding has come from RIRDC core funds (40%) with industry contributing a relatively modest 27%. Other project funding includes project specific grants from industry and other stakeholders (see Figure 5.1 below).

Figure 5.1 Share of Total Project Funding by Stakeholder 2004 to 2008

![Pie chart showing funding sources](image)

Source: AgEconPlus analysis of RIRDC Program data

R&D capacity

Has the program enabled the maintenance of, or enhanced the capacity for, undertaking R&D for the industry and related industries (researchers, skills, and research infrastructure)?

Informal consultation completed as part of this Performance Assessment found agreement with the statement that ‘the Program has enabled the maintenance of, or enhanced the capacity for, undertaking R&D for the fodder and related industries - researchers, skills and research infrastructure’.
R&D provider performance has generally been good, however the pool of experienced researchers to choose from is small and most researchers undertake projects over a broad range of areas (RIRDC 2008).

In addition the projects offered through the Fodder Crops R&D Program are too small and their scope too narrow to attract and retain researchers on a sustainable basis. The oats breeding program, for example, only operates at a maintenance level (Program Manager pers. comm. September 2008).

The Program has sought to enhance fodder industry R&D capacity. For example from 2003 to 2006 the Program provided a postgraduate scholarship ‘top-up’ for Sarah Pain for work in relation to the palatability of fodder crops across species and their associated nutritive value.

Research capacity has been enhanced by the operation of the Program but more work is required to ensure Australia is in a sustainable position with regard to fodder research capacity.

Communications

*Has the program provided good communications channels between researchers and industry members and potential members?*

Informal consultation completed as part of this Performance Assessment found agreement with the statement that ‘the Program has provided good communication channels between researchers and industry members and potential members’.

The Program Manager (pers comm. September 2008) added to this statement that while the Program does provide good communication channels they are only at maintenance level. Current budgets do not permit proactive endeavours.

Communication activity detail is provided in Table 5.7 above. The Program has strong communication links with AFIA. AFIA members are a ‘whole of supply chain’ blend of fodder producers, contractors, consumers, traders, exporters, grower organisations, machinery manufacturers, input suppliers, state government departments, researchers and testing laboratories (www.afia.org.au).

Efficiency

Timeliness

*What proportion of projects was completed on time? For current projects, what proportion has met their milestones on time?*

A ‘snapshot’ of management actions required as a result of lack of timeliness and other non performance issues is provided in the RIRDC Annual Program Review: ‘In 2006-07 seven final reports were submitted for clearance. Four of these reports were delayed in publication including:

- Delayed due to the need for re-testing of one aspect of the trials
• Final report rejected and sent for rewrite
• Awaiting assessment by PhD examiner before publication
• A further report has been restructured and rewritten after peer review and is awaiting finalisation of text and additional chapters’ (RIRDC 2007).

Program timeliness and management is closely monitored. Approximately 50% of projects are completed on time.

Reducing duplication

Is the advisory committee aware of R&D being undertaken outside of the RIRDC Fodder Crops program in making decisions about Program investments?

Black and Scott 2008, in a Fodder Crops R&D program commissioned report, reached the following conclusions and recommendations:

‘Current investments into fodder specific research is from a diverse group of organisations including RIRDC, Dairy Australia, hay exporting companies, seed companies and state governments. The areas for investment are not well coordinated and duplication exists.’

There is a need to ‘Integrate fodder RD&E projects across a common organisation to improve coordination, reduce unnecessary duplication and increase return on investment for the industry.’

‘Currently fodder RD&E is dispersed across a wide range of research funding organisations which results in some overlap of projects and inefficiencies in administration.’

Through its commissioning of the Black and Scott 2008 report the RIRDC Fodder Crops program Advisory Committee is aware of duplication and the need for improved coordination of fodder crop research to avoid duplication. The Black and Scott 2008 report’s findings suggest a need for greater awareness of fodder crop research being undertaken outside the RIRDC program. The Advisory Committee, with its strong scientific background will continue to assist with this process.

How many projects have been amended to reflect other known research?

Strong linkages exist between the RIRDC Fodder Crops program and Dairy Australia, hay exporting companies, seed companies and state governments. Projects are modified as a consequence of consultation with these organisations. Data on the number of projects modified as a result of these linkages is not available.
Promoting partnerships

*How many new partnerships have been formed as a result of the program bringing together researchers (and industry members)?*

Projects rely on a strongly collaborative approach. For example JLB 5A ‘Industry practices to meet mandatory export market standards’ created new and lasting partnerships between exporters and the science community. Partnerships between industry and new organisations or new individuals within established contributing organisations included:

- Agrilink Agricultural Consultants
- NSW Department of Primary industries
- Eureka Agricultural Research, Victoria
- Pierre Fievez & Associates
- John Black Consulting
- South Australian Research and Development Institute
- Department of Agriculture Western Australia
- Rural Directions Pty Ltd
- ARRB Group Ltd
- ABARE
- BSC Nominees, South Australia
- University of Southern Queensland

In total twelve new partnerships were formed as a result of the program.

Management resources

*In Full Time Equivalents (FTE) what is the estimated time spent by RIRDC program management staff on the program (annual average over the program life)?*

Estimated time spent by RIRDC staff includes 0.1 FTE General Manager Established Rural Industries, 0.1 FTE Program Coordinator and 0.3 FTE Senior Program Manager, a total of 0.5 FTE.

Aggregation of Performance Assessment Results

In order to reduce the biases inherent in subjective analysis the aim was to elicit responses from stakeholders representing at least three different perspectives to the questions (triangulation). AgEconPlus has triangulated subjective data wherever possible. PR Survey questions were answered using a five-point scale. Survey questions were framed in terms of strength of agreement with the statement: strongly disagree (-2), disagree (-1), neutral (0), agree (1), strongly agree (2).
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Measurement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relevance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Priorities set and revised based on industry needs</td>
<td>PM Consultation</td>
<td>1 – agree</td>
</tr>
<tr>
<td>Plan objectives proved relevant</td>
<td>PR Survey</td>
<td>1 – agree</td>
</tr>
<tr>
<td>Strategies were realistic given funding and research capabilities</td>
<td>PM Consultation</td>
<td>-1 – disagree</td>
</tr>
<tr>
<td>Share of project proposals directly addressing strategies</td>
<td>PM Consultation</td>
<td>2 – agree</td>
</tr>
<tr>
<td>Alignment of expenditure with Program indicative allocations</td>
<td>PM Records#</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Effectiveness of the R&amp;D</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share of KPIs at <em>objective level</em> realised or expected to be realised within 5 years</td>
<td>PM Consultation</td>
<td>N/A</td>
</tr>
<tr>
<td>Share of KPIs at <em>strategy level</em> realised or expected to be realised within 5 years</td>
<td>PM Consultation</td>
<td>71%</td>
</tr>
<tr>
<td>Share of completed and current projects delivering expected outputs</td>
<td>PM Consultation</td>
<td>79%</td>
</tr>
<tr>
<td>Share of projects assessed <em>ex-ante</em> as medium to high risk</td>
<td>PM Consultation</td>
<td>16%</td>
</tr>
<tr>
<td>Share of these projects delivering expected outputs</td>
<td>PM Consultation</td>
<td>66%</td>
</tr>
<tr>
<td><strong>Effectiveness of management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry involvement in Program is representative of full range of industry participants</td>
<td>PM Consultation</td>
<td>1 – agree</td>
</tr>
<tr>
<td>Share of total project funding provided by industry (cash and in-kind)</td>
<td>PM Records</td>
<td>27%</td>
</tr>
<tr>
<td>The R&amp;D investments helped to maintain R&amp;D capacity in critical areas of industry/stakeholder need</td>
<td>PR Survey</td>
<td>1 – agree</td>
</tr>
<tr>
<td>The Fodder Crop Program has direct communication channels to industry members through newsletters, web sites, other media</td>
<td>PR Survey</td>
<td>1 – agree</td>
</tr>
</tbody>
</table>
### Efficiency

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>Source/Method</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of projects completed on time</td>
<td>PM Consultation</td>
<td>50%</td>
</tr>
<tr>
<td>R&amp;D undertaken outside the Fodder Crops Program is known and taken into</td>
<td>Black &amp; Scott 2008</td>
<td>-1 – disagree</td>
</tr>
<tr>
<td>consideration in selecting and advising on proposals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of partnerships formed as a result of the Program (research and</td>
<td>PM Records</td>
<td>12</td>
</tr>
<tr>
<td>other)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTEs required for RIRDC program management (annual)</td>
<td>PM Consultation</td>
<td>0.5</td>
</tr>
</tbody>
</table>


PR = Program Review, PM = Program Manager, AC = Advisory Committee, FTE = Full Time equivalent

### R&D Program Status

Without a statutory levy the fodder crops R&D program will struggle to remain viable. Due to low incomes caused by the absence of a statutory levy compounded by drought, the program has not been able to fund longer-term projects and for projects such as the National Oat Breeding Program there are implications for the types and frequency of outcomes the industry can expect and the level of competitiveness and progress the industry will achieve.
Lessons Learned

The following ‘take home’ messages are recorded from a review of the current R&D program:

- The program has been very successful and resource allocation between research, development and extension has been appropriate.
- The number of projects generating either a ‘high’ or a ‘medium’ return for industry is more than 80%.
- Cost benefit analysis results show a return to industry and the Australian community of close to $300 million on investments of less than $10 million.
- Relevance – the FYP 2004-2008 was relevant and realistic, it addressed industry’s needs.
- Effectiveness – a high level of KPIs (71%) and outputs (79%) have been delivered by the Program.
- Effectiveness of management – industry was involved, the program assisted with research capacity and communication was effective.
- Efficiency – 50% of projects were completed on time and external review by Black and Scott 2008 reveals the potential for duplication in the program. There is scope to improve these efficiency indicators.
- R&D projects that have contributed to industry production and market outcomes include new oat varieties, ChemCheck work, Export standards and the forthcoming fodder atlas.
- In the last two years, the program has started to ‘run out of steam’. In the presence of drought research investments had to be pared back.
- The paring back of research investments has implications for the level of competitiveness and progress the industry will achieve.

Lessons learned from the review of the current R&D program inform 2009–2014 research priority setting and budget development.
6. External Priorities and R&D Priorities in Other Industries

Priorities for the RIRDC Fodder Crops R&D Plan 2009–2014 need to be set against knowledge of:

- The broader national R&D agenda including Australian Government National Research Priorities, Australian Government Rural Research Priorities and RIRDC Corporate Goals;
- International fodder crops research trends – including similar programs in New Zealand and the United States; and
- Investments in linked and similar industries – including priorities in the pasture seeds, grains and dairy industries.

A review of research priorities in each of these areas along with a summary of lessons learned is presented in this chapter.

National Priorities and Rural Research Priorities

Australian Government National Research Priorities are:

- An environmentally sustainable Australia;
- Promoting and maintaining good health;
- Frontier technologies for building and transforming Australian industries; and
- Safeguarding Australia.


Rural R&D Priorities:

- **Productivity and Adding Value** - improve the productivity and profitability of existing industries and support the development of viable new industries.
- **Supply Chain and Markets** - 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.
- **Natural Resource Management** - support effective management of Australia’s natural resources to ensure primary industries are both economically and environmentally sustainable.
- **Climate Variability and Climate Change** - build resilience to climate variability and adapt to and mitigate the effects of climate change.
- **Biosecurity** - protect Australia’s community, primary industries and environment from biosecurity threats.
Supporting the Rural Research and Development Priorities:

- **Innovation skills** - improve the skills to undertake research and apply its findings.
- **Technology** - promote the development of new and existing technologies.

The Government Priorities for Rural Research have been incorporated into RIRDC Corporate Goals and the objectives of the Fodder Crops R&D Plan 2009–2014.

### RIRDC Corporate Goals

RIRDC’s Corporate Goals, expressed through RIRDC Corporate Plan 2007-2012 are:

- Develop new opportunities – to achieve a more diverse rural sector through development of new agricultural and related industries;
- Adopt new technologies and systems for established industries – to enhance and foster innovative rural industries through targeted investment in research and development;
- Improve the competitiveness and sustainability of Australian agriculture - to enhance the efficiency and sustainability of agriculture by research into trade and environmental options to improve profitability while safeguarding future agricultural production potential; and
- Underpin innovation and change in Australian agriculture – to build a broader comprehension of farm and regional community opportunities and human capacity for change, learning and innovation in Australian agriculture.

RIRDC’s Corporate Goals are driven by the principle that it will invest in less commercially attractive projects.

### New Zealand and United States Research

No New Zealand or United States (US) fodder crop R&D program was identified. Current USDA research priorities across pasture, forages, rangelands and turf include [http://www.ars.usda.gov/research/programs/programs.htm](http://www.ars.usda.gov/research/programs/programs.htm):

- Improved water management, storages and practices;
- Collection, enhancement and preservation of germplasm;
- Improvement in pest management practices;
- Understanding and improving industries role in the environment;
- Enhancement of soil and soil management practices; and
- Development of integrated farm management systems.

The US places a strong emphasis on the natural resource management aspects of fodder crop research along with whole farm systems.
Pasture Seeds R&D Program

Pasture seeds, like fodder crops, is a long established Australian agricultural industry that has grown in importance over the last ten years. Both pasture seeds and fodder crops are part of the RIRDC Established Industries portfolio.

The Pasture Seeds R&D Program is currently funded by a statutory levy on certified temperate legume pasture seeds and Commonwealth dollar for dollar matching funds. Levies apply to certified seed for lucerne, clovers, subclover, medics and serradella, with sulla and biserulla currently being added. Levies are collected by the Seed Certifying Agencies at the time of certification. R&D priorities for this industry, as defined in the Pasture Seeds R&D Program 2008-2013 are:

- Industry communication and capacity building;
- Improved seed production and processing technologies;
- Environmentally sustainable processing technologies;
- Monitor, evaluate and adopt emerging sciences and technologies; and
- Develop new pasture seed products, markets and farming systems.

Pasture seed R&D objectives are similar to those for the fodder crops industry with additional emphasis on emerging sciences and technologies and farming systems.

Grains R&D Corporation Program

The Grains R&D Corporation (GRDC) is responsible for planning, investing and overseeing R&D, delivering improvements in production, sustainability and profitability across the Australian grains industry. GRDC invests approximately $130 million pa. Its priorities, as expressed through its Strategic R&D Plan 2007-12, are new variety development (50% of funding), cropping practices research including sustainability and crop protection (34%), new product development including value chain and business development investments (10%) and communications and capacity building (6%).

The communications and capacity building budget is similar to the fodder crops program as a percentage of available funding but reflects the economies of scale achievable for a much larger program. A 10% allocation for new product development is noted as relevant for the fodder crops industry.
Dairy Australia R&D Program

The dairy industry is a major purchaser of fodder crops (see Chapter 3). Dairy industry R&D is managed by Dairy Australia (DA) under three business groups, they are: (1) farm productivity and delivery, (2) value chain innovation, and (3) technical issues. R&D investment in ‘farm productivity and delivery’ is most relevant to understanding possible linkages with the Fodder Crops R&D program. High level farm productivity and delivery issues identified by DA include ‘increasing the amount of fodder/pasture grown and eaten’. Investments made in this area include ‘Feedbase’ – a program designed to enable farmers to grow and utilise more feed for their animals – a key productivity driver for the dairy industry. The Feedbase Program is made up of four sub-programs (http://www.dairyaustralia.com.au/content/view/306/287/ accessed 14 July 2008):

- Future forages;
- Future feeding systems;
- Future decision support; and
- Pasture plant breeding – including Marker Assisted Selection, Biotechnology and Pastures Australia.

There is potential for cross over and shared investment between DA and the RIRDC Fodder Crop R&D program.

Lessons Learned

Review of national research priorities along with R&D priorities in other industries reveals the following lessons:

- There is a national emphasis on productivity, supply chains, natural resources and biosecurity. Skills development is receiving additional attention;
- US industry research priorities are consistent with those in Australia with a strong emphasis on natural resource management but also whole farm ‘farm management systems’ research;
- The Fodder Crops sister program Pasture Seeds has similar R&D objectives with additional emphasis on emerging sciences and technologies and farming systems;
- The grains R&D program, like the Fodder Crops R&D program, has a strong emphasis (50% of budget) on variety development. New products, market access, communications and capacity building are also important; and
- There is potential for cross over and shared investment between DA and the RIRDC Fodder Crop R&D program.

National research priorities along with priorities in other programs were used to set directions for the Fodder Crops R&D Program 2009–2014.
7. Consultation Findings

Consultation to secure broad ownership of future research directions was completed with fodder crop producers, exporters, linked industries, researchers and AFIA using the following process:

- Review of the Fodder Crops R&D program including current plan objectives, history, performance and outlook for the R&D program, national research priorities, research priorities in other industries and key questions for consideration;
- Distribution of a returnable Fodder Crops R&D survey informed by the program review. Twenty four survey sets were returned across all stakeholder groups;
- Presentation of the review of the Fodder Crops R&D program to the 12 June 2008 Melbourne workshop and workshopping of potential research priorities with stakeholders;
- Targeted follow-up with key stakeholders with additional requests for comment on specific objectives and strategies; and
- Circulation of a draft five-year R&D plan to the Fodder Crops R&D Advisory Committee for comment.

Results from the consultation process have been aggregated and reported in the section below.
**Future R&D Priorities**

Industry stakeholders were asked whether the RIRDC Fodder Crops R&D program should spend more or less of its total budget on its seven current research objectives and whether they could nominate any new areas requiring research that the program was not addressing.

Priorities, relative to expenditure for the period 2004-2009 are shown in Figure 7.1.

**Figure 7.1 Future R&D Priorities – Relative to Expenditure 2004-09**

![Bar chart showing relative importance of different research areas]

Source: Fodder Crops industry survey results

From Figure 7.1 it can be seen that relative to the high levels of expenditure on plant breeding and germplasm evaluation (48% of available budget) during the period 2004-09, more research was requested on:

- Development of new products and markets;
- Crop agronomy;
- Fodder quality; and
- Industry communication and information flows.

It is possible that results from the survey, which was distributed to all AFIA members, may be skewed toward small fodder crop producers who are not involved in exporting or paying voluntary levies.
Specific Research Suggestions

Specific suggestions for new areas of research to ‘flesh out’ the above priorities were developed after considering survey results and the outcomes of both the 11 June 2008 Fodder Summit and the 12 June 2008 R&D Planning Workshop. Suggestions included:

**New markets and products:**
- Research new export markets (eg China, Korea, Taiwan)
- Particular emphasis on the Middle East
- Deeper knowledge of developments in the all important Japanese market
- Fodder additives – independent evaluation of their worth
- New products for biofuel – eg pelletised straw
- Northern Territory hay silage development
- Human health benefits of livestock fed forage diets (compared to say grain)
- Broaden scope of R&D to investigate other uses of fodder – eg oil extraction, paper manufacture

**Plant breeding and germplasm evaluation:**
- Breeding to improve yields - maximum yield has not been achieved (more volume per unit area)
- Breeding to improve pest and disease resistance and quality attributes
- Breeding for greater soil phosphorus utilisation
- Breeding for acid soil tolerance
- Breeding for drought tolerance
- Improved cereal crop and pasture varieties for fodder production
- Less emphasis on oaten hay varieties
- More emphasis on pasture, clovers and vetch type hays for domestic markets

**Crop agronomy:**
- Plant diseases, weeds and pest control
- Hay production from annual (cereal) crops
- Benchmarking of production efficiency
- Machinery evaluation (eg when and what new equipment to purchase)
- Harvesting and processing technologies
- Economics of hay production
- Chemical residue management systems to ensure safe feeding and regulatory compliance
- Causes of hay fires including an audit of moisture meters and stack monitoring
- Impact of overheating (not just fire) for hay and silage
- R&D to prevent hay fires
• Research on large scale cropping systems (eg groups of growers forming production cells)
• Managing paddock rotations
• Water use efficiency, irrigation practice
• Agronomics to improve production efficiency

**Supply chain - production, processing (harvesting) and transport:**
• Supply chain coordination
• Storage and handling methods for fodder
• Tarpaulin systems for hay and straw
• OH&S research – strapping down trucks
• Transport system safety
• R&D for uniform national road laws (eg accidents in NSW during drought rules)
• Automatic bale tagging for export/integrated logistics
• GPS based quality monitoring / tagging individual bales
• Evaluation of mechanised technologies (especially in handling and transport)
• Understanding and improving efficiency of domestic and export supply chains
• Developing stronger links with allied industries (eg dairy, feedlots, etc)
• Shared R&D projects with other industries (eg superior hay for the dairy sector)

**Improved fodder quality:**
• Techniques to lift hay quality
• R&D to minimise bailed hay quality loss
• Systems to measure storage and feeding losses
• Traceability systems for hay to manage weed and other contaminants
• Residue testing tools for Australian conditions
• Chemical residues – detection and management systems
• Quality tests for energy and protein
• Rapid tests for hay sugar content
• Testing systems to ensure grower gets rewarded for quality production
• Tests for nutrient levels and *mycotoxins, aflatoxins* (from funguses)
• Producing hay for clients with QA systems (eg supply to the feedlot sector)
• Producing fodders that meet specific requirements – human nutrition, cow flatulence, etc
• Dispute resolution/risk management tools to facilitate objective assessment of hay quality
• More feedback on Annual Ryegrass Toxicity (ARGT) - samples that test positive, positive samples that are toxic, location of toxic samples for low test jurisdictions, etc
• Large square bale silage – boosting dry matter percentage, preventing storage losses, etc
• Silage – quality, quantity, storage, assessment, fermentation best management practices
• Additional value adding opportunities – pelletisation, hay cubes, super conditioning, targeting of hay types to specific animal markets, wrapping and nutrition enhancement (currently hindered by strong demand for existing formats)

**Biosecurity, environmental management and climate change:**
• Biosecurity in Australia for plants used in fodder production (eg minimising the risk of lucerne aphid incursion and establishment)
• Climate change – monitor/communicate implications for production and markets
• Update fodder production best practice guidelines and previous R&D findings for climate change outcomes
• Biosecurity R&D to inform export market access applications
• R&D to support a biosecurity plan and membership of Plant Heath Australia by the fodder industry

**Industry extension, adoption and communication:**
• A national audit of current and previous fodder research across all RDCs
• Improved planning and coordination between research organisations and sectors with an interest in fodder crops
• More information about the R&D program to contributors and beneficiaries on a regular basis
• Ongoing funding for current communication tools
• Training initiatives for industry workers
• Allocation of budget to R&D program monitoring and evaluation

**New areas:**
• Managing landuse competition eg competition from high priced grain
• R&D to address supply variability/shortfall issues (eg supply and demand forecasting tools)
• Across industry coordination – ie drought fodder management systems
• Blue sky research opportunities – new technologies currently not envisaged

Consultation findings drive development of the new R&D plan.
8. Industry Commitment to Research

The Australian fodder crops industry is strongly committed to R&D. Questions posed during R&D plan preparation revealed overwhelming support for:

- The RIRDC Fodder Crops program – all survey respondents indicated that the program has played an important role in ensuring the fodder crops industry remains competitive, profitable and sustainable;
- The role played by government – 100% of respondents indicated that government should continue to match each dollar producers and exporters provide to the program; and
- AFIA initiatives to secure a more substantial and sustainable funding base for Australian fodder crop R&D – including support for initiatives to investigate R&D funding options.

Additional specific comments in relation to commitment included:

- ‘This program is absolutely essential’;
- ‘Development of the industry needs to continue through R&D, higher production costs cannot always be absorbed by producers’;
- ‘The R&D program has reaped great rewards for the fodder industry in the past and must be maintained for the future’;
- ‘As input costs such as fertilisers and chemicals increase and rainfall becomes less certain, growing fodder will become an increasingly risky business proposition. Producers will seek out low risk options. Those industries who have invested in R, D & E over time will be more sustainable’
- ‘The Fodder Crops R&D program provides essential information for farmers and industry. Project selection is driven by the grass roots. Projects improve farmer and industry viability’;
- ‘Our joint investment in R&D has resulted in the development of improved fodder crops eg oats and vetch varieties’;
- ‘Government should continue to match each dollar domestic growers and exporters provide to the RIRDC program’;
- ‘RIRDC management of our R&D program provides us with government matching funding but just as importantly the ‘know how’ to be effective’;
- ‘Government matching funding is an essential commitment to a partnership. It is extremely important as we work our way through climate change issues’;
- ‘Even with current matching funding it is difficult to effectively fund the necessary research for a vibrant and viable industry in the long term. This research is critical in the face of climate change to ensure all resources are fully utilised to their highest and best use - especially in drought years’;
• ‘More funds are necessary to help what is a major industry to continue to improve varieties and fodder quality, communications, etc’; and
• ‘The program needs a funding increase’.

Support for the program, and comments in relation to climate change, have also shaped the proposed five-year plan.

Key Themes Shaping Future Research Directions

Key themes emerging from the program review, external priorities, consultation and the direction-setting workshop are:

- Climate change – research required to understand the implications for Australian fodder production;
- New products and markets research – requires investment in addition to that made under the current R&D plan and an allowance should be made for ‘blue sky’ research;
- Plant breeding and germplasm development – would receive proportionality less resources in an appropriately funded R&D program but is an essential ‘core’ activity when funds are rationed;
- Product traceability and chemical residue management – R&D investment needed to ensure ongoing access to markets;
- Automation, mechanisation and integrated logistics – to improve supply chain efficiency;
- Fodder quality R&D to minimise dry matter and nutrient loss between bailing and consumption;
- Rapid tests required for fodder energy and protein levels;
- Biosecurity is an issue for this industry – both in terms of ensuring exotic pests/diseases do not become established in Australia and ensuring Australia has access to export markets;
- Developing stronger links with allied industries is an R,D&E area – dairy, feedlots and others; and
- A national auditing of current and previous fodder research across all RDCs will ensure integration and avoid any possible duplication.

Goal

To stimulate and promote those R&D efforts that will produce quality fodder products and secure sustainability and profitability for all sectors of the Australian fodder industry value chain in domestic and export markets.
Objectives

Seven objectives updated from the current five-year plan drive the 2009–2014 R&D program:

1. Markets, products and blue sky research
2. Plant breeding and germplasm evaluation
3. Crop agronomy and fodder production efficiency
4. Supply chain – harvesting, transport, traceability and relationships with allied industries
5. Improved fodder quality
6. Climate change, biosecurity and environmental management
7. Industry linkages, communication, information flows, forecasting and program evaluation

Objectives should be regarded as complementary, with flexible boundaries to enable key issues to be addressed either simultaneously or sequentially through several components of the program.

Strategies

Strategies indicate specific research areas that will contribute to achieving the seven objectives. Strategies have been defined at a level that gives research providers guidance on where RIRDC is intending to target its investments over the period 2009–2014 and are intended to contribute to the longer term planning requirements of those providers. Strategies will be complemented with more specific research priorities published annually that provide more detailed guidance about the project areas that RIRDC is seeking to fund in the coming year.

Performance Indicators

Performance indicators are provided to assess whether the research strategies have contributed to the R&D objectives. Where possible, performance indicators have been linked to benchmarks for previous fodder crops industry performance.

Resource Allocation

Budget allocation has been prepared following analysis of historical allocations and consultation findings see Table 9.1.
<table>
<thead>
<tr>
<th>Objective</th>
<th>Historical Allocation (3 years to 0 June 07)</th>
<th>Group 1 R&amp;D Planning Workshop</th>
<th>Group 2 R&amp;D Planning Workshop</th>
<th>Group 3 R&amp;D Planning Workshop</th>
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</tr>
</tbody>
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Source: AgEconPlus analysis and industry survey
Objective 1: Markets, Products and ‘Blue Sky’ Research

Objective
Objective one is to explore and develop new export and domestic markets for Australian grown fodder, shore up existing markets and supply markets with new Australian fodder products. This objective explicitly includes a small allowance for investment in pure ‘blue sky’ research with its associated high risk, high payback profile.

Strategies
- Deepen our knowledge of the status, and developments in, the all-important Japanese fodder market. Understand the threat posed by a more competitive United States (low $US) and the risks of new un-favourable Japanese regulations and MRLs.
- Research new Australian fodder crop export markets in China, Korea, Taiwan and the Middle East. The Middle East is thought to be particularly ‘prospective’ for Australian fodder crop exports.
- Provide research support for the developing Northern Territory hay silage industry. This industry has potential for strong growth under northern agriculture development policies, the intensification of cattle production in this region and climate change scenarios.
- Complete a series of independent evaluations of fodder additives (inoculants, preservatives, nutrients) to determine whether their incorporation in fodder products under Australian conditions results in new value added products and whether there is a net benefit for consumers and producers.
- Support a single ‘blue sky’ project, possibly in partnership with another RDC. ‘Blue sky’ project might be drawn from ‘funds permitting’ strategies.
- Funds permitting, invest in the development of new fodder traits – cow flatulence, bloat tolerance, rumen bypass proteins, ultra high ME, vitamin/mineral content fodder, etc.
- Funds permitting, research the human health benefits of livestock fed forage crop diets, compared to say grain based diets, and use the resultant knowledge to market industry products.
- Funds permitting, investigate blended fodder crop products (eg mixes of hay, silage and rice straw), processed products (eg hay pellets, hay cubes, super conditioning) and the pharmaceutical /nutraceuticals properties of fodder (eg peptides to reduce worm burdens and omega 3 fodder).
- Funds permitting, broaden the scope of the R&D program to investigate other uses of fodder crops eg pelletised straw for biofuels, oil extraction from fodder, paper manufacture, etc.
Performance Indicators and Related Measures

- Market report updating the industry on strengths, weaknesses, opportunities and threats in the Japanese fodder industry by the end of 2009.
- Industry understanding of market opportunities for one new export destination, preferable in the Middle East, by 2010 and a further destination, say China, by 2014.
- One project commissioned for NT hay silage industry by 2011.
- Independent knowledge of the worth of fodder additives under Australian conditions and where they create new value added products by 2012.
- Industry knowledge of the human health benefits of fodder fed livestock by 2011.
- Investment in one new product (eg biofuel, oil extraction, paper, etc) by 2014.
- Make one ‘blue sky’ investment by 2014.

Indicative Share of R&D Budget

- 5% of the program budget to be allocated to Objective 1.
- Under the current R&D plan this objective has not received funding. Industry stakeholders are keen to see the lack of funding for new markets/products addressed in the new plan.

Objective 2: Plant Breeding and Germplasm Evaluation

Objective

Objective two is to address the increasingly specialised nature of world fodder markets through the development, and then adoption, of superior new varieties of the most important fodder crop species for export and domestic customers. The focus of new variety production is to be on cereals (especially oats), vetch and annual pasture species. Superior varieties are to address yield, climate change/ drought tolerance, quality/palatability, pest/disease and agronomic challenges.

Strategies

- Resource the national oats-breeding program.
- Funds permitting, re-establish support for vetch breeding endeavours.
- Funds permitting, resource the breeding of annual pasture, lucerne, medics, sub clover, clover, legumes, temperate grasses, tropical legumes and other non-cereal fodder crops.
- Breeding priorities to address maximum yield, maximum drought tolerance/water use efficiency, pest and disease resistance, fodder quality attributes (eg palatability high sugar, high protein, multi-leaf traits, low lignin, high ME fodder), soil phosphorus utilisation, acid soil tolerance and controlled flowering.
- Ensure all plant breeding and germplasm evaluation research fills a fodder crop industry need not being addressed by other RDC programs (especially GRDC and possible DA). Achieve this through an ongoing dialogue with Pastures Australia.
Performance Indicators and Related Measures
- Regular release of new improved higher yielding fodder varieties that are widely adopted by producers.
- At least one new oats variety before 2014 that specifically targets reliable production in a reduced rainfall/climate change affected environment.
- Funds permitting, one new vetch variety by 2014.
- Commercialisation and adoption levels of new varieties and species to be the KPI for this objective.
- New varieties that are able to achieve an average yield improvement over current popular varieties of more than 8%. Historically the program has achieved this result.

Indicative Share of R&D Budget
- 45% of the program budget to be allocated to Objective 2.
- Historically this area has received 48% of the R&D plan budget and there is stakeholder support for this ongoing investment. Percentage of total budget allocation may decrease with a secure program-funding outcome that increases overall R&D resources.

Objective 3: Crop Agronomy and Fodder Production Efficiency

Objective
Objective three tackles crop agronomy and fodder production efficiency through investments in plant nutrition, pests/diseases/weeds, micro-organisms, water use efficiency, farming systems, harvesting / processing technologies, fire management and agronomics to manage chemical residues in fodder. A benchmarking and economics component is also proposed as part of this objective.

Strategies
- Invest in agronomics to improve production efficiency including ongoing investments in plant nutrition, pest/disease/weed resistance traits and micro-organisms (both beneficial and harmful bacterium, mould and fungi).
- Develop and update water use efficiency and irrigation practice systems and guidelines for a water constrained operating environment. Consider the role of lucerne in maximising water use efficiency.
- Support farming systems research including managing paddock rotations and research to support large-scale cropping systems eg groups of growers forming production cells to meet the market needs of large fodder exporters.
- Develop a better understanding of plant physiology associated with cutting hay and silage and its impact on quality.
- Research the causes and impact of hay and silage overheating, not just hay fires. Invest in hay fire R&D including an audit of moisture meters and stack monitoring techniques.
• Develop agronomic advice and management systems (eg databases) to prevent chemical residues occurring in fodder to ensure safe livestock feeding, customer QA and regulatory compliance.

• Funds permitting, invest in machinery evaluation research eg when and what new equipment to purchase. Do this in partnership with not-for-profit advisors such as the Kondinin Group.

• Funds permitting, invest in harvesting and processing technologies for the Australian fodder industry where meaningful gaps in private sector and other RDC activity are not delivering for the fodder industry (eg new machines for conditioning and processing hay and silage).

• Benchmark production efficiency and the economics of hay production.

Performance Indicators and Related Measures
• Agronomic recommendations that address fodder production best practice with limited irrigation water by 2010 (a high priority for the R&D program).

• Updated crop agronomy aimed at lifting on-farm fodder production productivity by 2014. This might include best practice nutrient management, new management options for diseases/weeds/pests and new technologies to take advantage of favourable micro-organisms.

• A 50% reduction in hay fires from 2007 to 2013 measured through media reports and/or a targeted industry survey.

• Most industry members with a clear understanding of production efficiency benchmarks and the economics of hay production by 2013.

Indicative Share of R&D Budget
• 10% of the program budget to be allocated to Objective 3.

• Historically this area has received 6% of the R&D plan budget. However, the scope of this objective has been expanded to include production as well as agronomic strategies.
Objective 4: Supply Chain Efficiency – Harvesting, Transport, Traceability and Relationships with Allied Industries

Objective
Objective four is to ensure that once fodder has been produced the supply chain is efficient in delivering the best quality product to end users through harvesting, storage, transport, coordination, traceability and building relationships with allied industries. Delivery of Objective 4 will ensure best technologies are available to produce hay and silage, process this for a range of end uses and ensure effective transportation to end users.

Strategies

**Harvesting**
- R&D to develop electronic and other technologies that permit the cost effective and accurate measurement of plant moisture at harvest.
- Develop support systems to ensure compliance with chemical withholding period requirements in fodder crops.
- Support fodder industry harvesting machinery research (strategy linked with Objective 3 crop agronomy and fodder production efficiency).

**Storage**
- Research more efficient fodder storage and handling methods. This might include, for example, effective, labour saving and safe tarpaulin systems for hay and straw.
- Develop systems to manage high moisture hay, spontaneous combustion of hay, silage fermentation and preservation (strategy linked with Objective 3 crop agronomy and fodder production efficiency).

**Transport**
- Invest in R&D to support transport system safety (eg R&D to inform national road rules and the redundancy of non-drought period load rules in NSW).
- Invest in R&D to support OH&S research (eg strapping down trucks).
- Develop systems to ensure transport is as effective and low cost as possible.
- Support, through R&D, the adoption of best practice truck loading rules
- Initiate and maintain ongoing dialogue with state road authorities on the applicability of road rule legislation affecting fodder haulage.
Supply Chain Coordination and Logistics

- Understand and seek ways to improve the efficiency of domestic and export supply chains including evaluation of mechanisation technologies, especially in handling and transport.
- Invest in R&D to ‘lift’ supply chain coordination. This might include development of automatic bale tagging for export/integrated logistics. Systems might embrace GPS based quality monitoring and the tagging of individual bales.

Traceability

- Development of low cost and effective traceability systems for hay to manage weed and other contaminants.
- Prepare guidelines for producing hay for clients with QA systems (eg supply to the feedlot sector). Guidelines to be prepared in consultation with the client sector.
- Develop and make widely available Annual Ryegrass Toxicity (ARGT) risk management systems - samples that test positive, positive samples that are toxic, location of toxic samples for low test jurisdictions, etc.

Industry Relationships

- Developing stronger links with allied industries (eg dairy, feedlots, etc)
- Invest in shared R&D projects with other industries (eg superior hay for the dairy sector)

Performance Indicators and Related Measures

- One new system for either harvesting, storage or transportation of hay ready for commercialisation by 2013.
- Widespread adoption of transport safety and OH&S research outcomes and their reflection in state transport and work cover regulations by 2013.
- An understanding of the role modern logistics management systems might have in fodder supply chain coordination by 2012.
- An effective and low cost traceability system in place for one new and significant fodder supply chain by 2011.
- One shared project, possibly an audit of fodder industry research, in place with another RDC by 2010.

Indicative Share of R&D Budget

- 10% of the program budget to be allocated to Objective 4.
- Historically this area has received 17% of the R&D plan budget. However, the scope of this objective has been contracted and production strategies have been incorporated into Objective 3.
Objective 5: Improved Fodder Quality

Objective
To ensure that Australian produced fodder in domestic and export markets meets customer expectations for quality in terms of product description, objective test results and quality attributes, such as metabolisable energy, protein content, level of extraneous matter, residues and animal preference.

Strategies
• Investigate customer requirements for a common product description language for Australian fodder and the key characteristics of hay and silage that satisfy the requirements of end users.
• Develop low cost rapid testing tools for Australian fodder crops that:
  – Are relevant to Australian production and supply chain conditions
  – Ensure the grower gets rewarded for quality production
  – Assist in dispute resolution and risk management
  – Measure fodder nutrients including energy (sugar), protein (high and good quality), multi-leaf/mega-leaf traits, low lignin/hemicellulose (high ME fodder)
  – Measure chemical residues including tests for ‘new generation’ agricultural chemicals
  – Measure toxins such as mycotoxins and aflatoxins from funguses
  – Measure animal preference and palatability
• Undertake R&D to minimise bailed hay quality loss. R&D to include all aspects of the supply chain and storage from bailer to consumption.
• Benchmark the quality of Australian fodder against our international competitors.
• Undertake R&D to enhance large square bale silage quality – boosting dry matter percentage, preventing storage losses, etc.
• Undertake R&D to enhance silage quality, quantity, storage, assessment/testing, use of inoculants and fermentation best management practices.

Performance Indicators and Related Measures
• A basis for developing a common product description language for Australian fodder if the market place requires one by 2010.
• A fodder quality test ‘tool kit’ that provides rapid, low cost and accurate measures by 2012 (A high priority R&D activity).
• A 25% reduction in disputes involving fodder producers and clients – establish by survey of AFIA members in 2013.
• R&D outcomes that reduce bailed hay quality loss by 2013.
• Up to date international benchmarks of Australian fodder quality for use in lifting Australian product quality and directing ongoing research priorities. Benchmarks established by 2013.

Indicative Share of R&D Budget
• 10% of the program budget to be allocated to Objective 5.
• Historically this area has received 12% of the R&D plan budget.
Objective 6: Climate Change, Biosecurity and Environmental Management

Objective
To address the climate change challenge facing the Australian fodder industry and its customers. To effectively support the development of fodder industry products which meet international trading standards and comply with import country protocol requirements. To protect the Australian fodder industry from biosecurity hazards. To produce fodder products with minimal negative impacts on the environment.

Strategies
- Invest in climate change awareness including monitoring and communicating the implications of climate change/variability on production and markets. Investment to include awareness and response activities.
- Update fodder production best practice guidelines and previous R&D findings for climate change outcomes.
- R&D to support favourable market access in key current and potential export destinations.
- R&D to ensure Australian biosecurity for plants used in fodder production (e.g., minimising the risk of lucerne aphid incursion and establishment).
- R&D to support a biosecurity plan and membership of Plant Heath Australia by the fodder industry.
- The fodder industry to take the ‘next step’ in relation to development and management of an effective EMS that demonstrates that Australian fodder is produced with minimum negative impacts on the environment.

Performance Indicators and Related Measures
- Producers, exporters and other customers to understand the implications of climate change forecasts on fodder supply and demand. Documentation and delivery of best practice response by 2010 (high priority for the fodder industry).
- Australian fodder welcome in all target export markets on the basis of sound science by 2013.
- The fodder industry to be ‘paid up’ members of PHA with a supporting biosecurity plan by 2011.
- Fodder industry with EMS style proof of its efforts to minimise environmental impacts by 2012.

Indicative Share of R&D Budget
- 10% of the program budget to be allocated to Objective 3.
- Historically this area has received 11% of the R&D plan budget.
Objective 7: Industry Linkages, Communication, Information Flows, Forecasting Tools and Program Evaluation

Objective
To ensure an informed industry and early successful adoption of R&D program outcomes.

Strategies
- Complete a national audit of current and previous fodder research across all RDCs.
- Liaise with research organisations and sectors with an interest in fodder crops to ensure planning and coordination between organisations is as efficient and effective as possible.
- Develop tools to forecast supply variability and shortfall issues to enhance the industry’s planning ability and its capacity to respond to climate change related demand opportunities. Forecasting tools could be developed in partnership with a ‘data rich’ organisation like ABARE.
- Support current newsletters and communication activities to ensure that information about the R&D program is available to contributors and beneficiaries on a regular basis.
- Allocate 1% of program budget to R&D program monitoring and evaluation to ensure investment outcomes are as efficient and effective as possible.

Performance Indicators and Related Measures
- Audit of current and previous fodder research complete by December 2009 (this is a high priority for the industry).
- Investigation of a forecasting tool to assist with cross industry coordination and management of climate change related supply variability/shortfall issues by 2010.
- Newsletters and communication tools employed by the Fodder R&D program that are at least as effective in 2013 as they are in 2008.

Indicative Share of R&D Budget
- 10% of the program budget to be allocated to Objective 7 with 9% proposed for ‘extension’ type activities and 1% for program evaluation.
- Under the current R&D plan this area has received 6% of the R&D plan budget. Historically, between 1991 and 2005 it received approximately 9%.
10. Communication Plan for Fodder Crops

Purpose and Communication Objective

This communication plan was prepared in accordance with the RIRDC Communications Strategy (Coxs + Inall Communications September 2008). It references Currie Communications (July 2008) plan for sustainable RD&E funding for the Australian fodder industry.

Its aim, consistent with RIRDC’s corporate mission, is to maximise the knowledge outcomes from Fodder Crop R&D investments.

Approach – Application of the Decision Tree

The communication plan was prepared after working through the Cox Inall developed RIRDC Communications Decision Tree. The decision tree provides for a review of audiences and the best way to communicate with them; stakeholders who need to be informed of Fodder Crop Program research; industry and other networks that could be used to help disseminate information; and the best methods of extension and adoption.

Target Audiences for Fodder Crops R&D Outcomes

The target audience for R&D outcomes, in priority order, is:

1. Export fodder producers – committed to the R&D Program, contribute voluntary levies, set priorities and implement project outcomes.

2. Domestic fodder producers who sell hay and silage – professional in outlook, are part of the market economy, generally speaking are larger producers with interest in adopting R&D outcomes.

3. Dairy farmers – produce hay and silage largely for their own use. Need to be convinced of the merits of the Fodder Crops R&D Program.

4. Domestic fodder producers who produce hay and silage for their own usage – smaller in scale, large in number and more difficult to communicate with. This group may not see themselves as part of the fodder industry.

5. Fodder buyers – feedlots, dairies, horse industry, etc. Communicate with these groups to create ‘pull through’ for research outcomes.
6. Key influences – see list below, includes representatives from the dairy industry such as Dairy Australia, animal nutritionalists, AFIA representatives, large exporters and influential growers.

7. Policy makers – generally less relevant to this program.

**Early, Late or Mainstream Adopters**

Communication activities differ on the basis of whether the target audience is dominated by early, late or mainstream adopters.

- Early adopters – some export fodder growers and processors, key influencers.
- Mainstream adopters – most export fodder producers, domestic fodder producers who sell hay and silage, dairy farmers, fodder buyers, policy makers.
- Late adopters - domestic fodder producers who produce hay and silage for their own usage.

All three groups make up the target audience but given limited resources and the status of the industry (leading exporters already on board), most effort should be placed on mainstream adopters.

**Expected Key Messages from the Outcomes of the R&D Program**

Key messages from Fodder Crops R&D 2009–2014 are expected to include:

1. New export and domestic market knowledge – understand the new profitable and sustainable market opportunities, in say the Middle East, available to support your business.

2. Superior new fodder crop varieties – adoption of these new oaten hay and possibly vetch varieties produced by the R&D program will boost average fodder yield by a minimum of 8%.

3. Improved agronomic practice – adopt the program’s agronomic research outputs to lift productivity and thrive in a high production cost, low water availability environment.

4. Supply chain innovation – modern manufacturing sector inventory management systems have much to teach the fodder industry, adopt these systems for greater efficiency, traceability and industry profit.

5. The Fodder Crops R&D program is directly relevant to the dairy industry producing fodder products that drive the profitability of Australian dairying.
6. Fodder crop quality, as perceived by our customers is all important – adopt the new product description language and rapid quality testing tools produced by the R&D program to ensure you are producing and being rewarded for product of appropriate quality.

7. Understand the implications of climate change forecasts on the supply and demand for Australian fodder.

8. Fodder buyers in export markets can purchase Australian fodder safe in the knowledge that it meets import protocol requirements.

9. Australian fodder is produced in an environmentally sustainable way as evidenced by the industry’s participation in and compliance with relevant EMS systems.

10. The industry understands exactly where it is up to with R&D having completed an audit of previous research, developed linkages with other programs and directing scarce funds to the highest industry priorities.

Communication Materials in Languages Other Than English

None envisaged, industry players are long established in the Australian community.

Targets for Adoption

Given the large number of growers (38,000 properties in any single year), spread across all Australian states and territories, many of which do not even recognise themselves as fodder producers (they are dairy or mixed farmers or graziers in the first instance), an adoption rate of 60% is ambitious. A target adoption rate of 60% also recognises the small scale of this program and its limited communication resources.
**Known Industry Networks**

Known industry networks, associations, grower groups, etc in the Australian fodder crops industry that would be effective in communicating R&D Program results include:

- Australian Fodder Industry Association (AFIA) – the peak body for the fodder industry with approximately 1,100 members [www.afia.org.au](http://www.afia.org.au);
- AEXCO – not for profit company which commercialises new oaten hay varieties and represents export hay processors;
- Southern Farming Systems – farm driven, not for profit organisation helping higher rainfall farmers with real world research and results [www.sfs.org.au](http://www.sfs.org.au);
- Birchip Cropping Group – farming research for the grains industry [www.bcg.org.au](http://www.bcg.org.au);
- State based agencies with an extension role including but not limited to NSW DPI, SARDI, Vic DPI Dept Ag WA, QDPI&F and DPI&W;
- Agri-political organisations that supply information to members – Cattle Council, Sheep Meats Council, Grains Council of Australia, NSWFA – Dairy Committee, VFF - United Dairy Farmers of Vic, SA Dairy Farmers Association, AgForce, Queensland Dairy Farmers Organisation, Australian Dairy Farmers, Agforce Qld, SAFF, WAFF, PGA of WA, TFGA, Australian Dairy Products Federation, Mushroom Growers Association;
- The Gardiner Foundation – established to improve the international competitiveness of the Victorian dairy industry [www.gardinerfoundation.com.au](http://www.gardinerfoundation.com.au);
- Peak industry bodies such as Lucerne Australia, Australian Association of Ruminant Nutrition, Racing Australia, etc;
- Feedtest – uses Near infrared Spectroscopy (NIR) to assess the digestibility of feed [www.feedtest.com.au](http://www.feedtest.com.au);
- R&D Corporations with fodder linkages - Dairy Australia, MLA and Livecorp, GRDC, AWI, Pastures Australia and relevant CRCs (eg Future Farm Industries);
- Dairy processing companies including Fontera and Murray Goulburn;
- Australian Lot Feeders Association [www.feedlots.com.au](http://www.feedlots.com.au);
- Horse sector including pony clubs (Pony Club Australia and state affiliates) and Thoroughbreds Association (Thoroughbred Breeders Australia Association and the Thoroughbred Owners and Breeders Association); and
- Rural merchandisers – through their agronomist and retailer networks.
Major Events Where Fodder the Industry is Represented

Major events, conferences, field days, etc where the fodder industry is represented and where R&D program outcomes could be effectively profiled include:

- AFIA conference and associated field visits – annual event next held in July 2009;
- AFIA regional seminars – eg ‘drought feeding’ and ‘securing fodder for our future’; and
- Field days and meetings such as Henty Machinery Field Days and Ag-Quip Gunnedah.

In addition the RIRDC Program Manager maintains a calendar listing of all such events and ensures the R&D program is represented at appropriate opportunities.

Key Influencers in the Fodder Crops industry

Key influencers in the fodder crops industry that could be targeted by the R&D Program as champions for research findings include:

- Executive Officer of the Australian Fodder Industry Association (AFIA);
- RIRDC R&D Advisory Committee chair;
- AEXCO – with members in all fodder exporting states; and
- Balco, Gilmac, Balmain Enterprises, Breona Farming, Miakite and Jenharwill Baling who are all significant producers and processors of oaten hay.

Key Publications, Websites and Media

Key publications, websites and media appropriate for communicating R&D outcomes include:

- AFIA newsletter – published four times per annum;
- AFIA website – www.afia.org.au ; and
- Rural press publications – such as The Land, Weekly Times, Qld Country Life and Stock Journal in which R&D key outcome reports are placed at least three times per year.

Conclusions

Further refinement of the communication plan will be appropriate when the R&D Plan has been adopted.
11. Proposed Budget

RIRDC and the Fodder Crops R&D Advisory Committee will determine annual funding priorities. However, determination will be driven by:

- Outcomes of the current funding review process which may result in an annual budget of approximately $2.5 million or retention of the status quo with an annual budget of approximately $350,000.

To a lesser extent the five-year program budget will also depend on:

- Annual fodder crop production;
- Other emerging unforeseen priorities;
- Any further changes to RIRDC/Fodder Crop Committee’s reserves policy; and
- Other relevant matters.

This budget relies on voluntary levies largely from the fodder export sector results in annual voluntary contributions (VC) of approximately $190,000 pa – the average of VC receipts over the five-years to 2006-07. Commonwealth Contributions, managed by RIRDC, are made on a ‘matching’ basis.
### Table 11.1 2009–2014 Five-year Plan Budget

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12. References


AFIA (2008a) Securing Fodder for Our Future Industry Summit Outcomes – Briefing Note 13 June 2008

Australian Farm Institute (2007) The Implications for Australian Agriculture of Changing Demand for Animal Protein in Asia, October 2007

Black and Scott (2008) Gap Analysis and implementation program for research in the Australian fodder industry Draft in Confidential at this stage

Cox + Inall (September 2008) RIRDC Communications Strategy


Currie Communications (July 2008) Towards Sustainable RD&E Funding for the Australian Fodder Industry: Communications Plan


Appendix 1: Contacts for the R&D Program

Senior Program Manager

John De Majnik

Rural Industries Research and Development Corporation
PO Box 4776 KINGSTON ACT 2604
Phone: (02) 6271 4138
Fax: (02) 6272 5877
Email: john.demajnik@rirdc.gov.au
Web: www.rirdc.gov.au

Chairperson

Dr Jeff Hoffman

‘Ceranya’
Lockhart NSW 2656
Ph: 02 6920 6233
Fax: 02 6920 6202
Mobile: 0429 206 233
Email: johoffman@bigpond.com
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
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<tr>
<td>AFI</td>
<td>Australian Farm Institute</td>
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<td>AFIA</td>
<td>Australian Fodder Industry Association</td>
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<td>ELISA</td>
<td>Enzyme Linked Immunosorbent Assay</td>
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<td>ARGT</td>
<td>Annual Ryegrass Toxicity</td>
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<td>ARRIP</td>
<td>Australian Rural Research in Progress</td>
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<td>BMP</td>
<td>Best Management Practice</td>
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<td>CIE</td>
<td>Centre for International Economics</td>
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<td>CPI</td>
<td>Consumer Price Index</td>
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<td>DA</td>
<td>Dairy Australia</td>
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<td>DAFF</td>
<td>Australian Government Department of Agriculture Forestry and Fisheries</td>
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<td>DPI</td>
<td>Department of Primary Industries</td>
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<td>EMS</td>
<td>Environmental Management Systems</td>
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<td>FYP</td>
<td>Five-year Plan</td>
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<td>GM</td>
<td>Genetically Modified</td>
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<td>GRDC</td>
<td>Grains Research and Development Corporation</td>
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<td>GVP</td>
<td>Gross Value of Production</td>
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<td>IRR</td>
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<td>SWOT</td>
<td>Strengths, Weaknesses, Opportunities and Threats analysis</td>
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The Fodder Crops Program is managed by the Rural Industries Research and Development Corporation (RIRDC) in consultation with an advisory committee of producers, researchers, exporters and the consumption sectors.

The total value of fodder production is estimated to have averaged $1.4 billion over the five-years to 2006–07 making the Australian fodder industry similar in size to the barley ($1.6 billion), sugar ($1.5 billion) and poultry ($1.5 billion) sectors.

Climate change, reduced availability of irrigation water, increased competition for land from agricultural and non-agricultural users, together with changes in the relative profitability of crops and pastures have resulted in a reshaping of Australian fodder production and use. There is a need for R&D to provide sustainability and profitability in this uncertain landscape to the fodder industry.

This Plan was funded from RIRDC core funds provided by the Australian Government and is an addition to RIRDC’s diverse range of over 1900 research publications. It forms part of the RIRDC Fodder Crops R&D Program which supports the development of quality fodder products and the sustainability and profitability of all sectors in the value chain in both domestic and export markets.