

**Outcomes of MLA's  
livestock production  
research and development**

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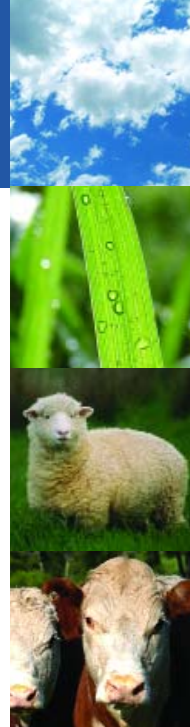
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## Table of Contents

<b>Introduction</b> .....	3
<b>1. Improving animal production</b> .....	4
<b>Genetics</b> .....	6
Genetics research and development .....	7
Beef marbling .....	10
Improving efficiency of beef cattle through selection for net feed intake ...	11
Maternal central progeny test for sheep .....	12
Merino validation project .....	13
<b>Animal health and welfare</b> .....	14
Heat stress risk management on long haul livestock voyages to the Middle East .....	15
Ovine Johne's disease .....	15
Sheep internal parasites .....	17
Bovine TB .....	17
Calf scours .....	17
Temperament and lamb survival .....	17
Heat load in feedlot cattle .....	18
<b>Nutrition and reproduction</b> .....	20
Strategic optimisation of nutrition in Merino sheep meat production ...	21
Bullpower .....	21
Near infrared reflectance spectroscopy (NIRS) .....	22
<b>Supply chain management</b> .....	24
Sheep meat eating quality .....	25
Q Lamb Alliance .....	26
BeefNet .....	26
<b>2. Improving the environment, pasture and feedbase</b> .....	28
<b>Environment</b> .....	30
Sustainable Grazing Systems (SGS) .....	31
Burdekin catchment .....	33
Lucerne breeding program .....	34
Biological weed control for Paterson's Curse & thistles .....	35
National Beef Cattle Feedlot Environmental Code of Practice .....	36
<b>Pasture and feedbase management</b> .....	37
PROGRAZE® .....	38
Silage for prime lambs .....	39
Speargrass, wiregrass, animal management project .....	39
MoreLamb .....	40
Tagasaste .....	40
Grain & Graze .....	41
EverGraze .....	41
<b>3. Improving delivery and capacity building</b> .....	42
Prime Time .....	44
EDGEnetwork® .....	45
BeefCheque/LambCheque® .....	46
Postgraduate scholarship program .....	47
BeefPlan® .....	47
More Beef from Pastures .....	48
PIRD® (Producer Initiated Research & Development) .....	50





# **Outcomes of MLA's livestock production research and development**



## Introduction

Meat & Livestock Australia (MLA) is a producer-owned company providing services to the entire Australian red meat industry. Valued at more than \$15 billion per year, the industry includes producers, processors, meat exporters, live exporters and retailers. MLA's mission is world leadership for the Australian red meat and livestock industry. Its core activities include improving market access, building demand for Australian red meat and conducting research and development (R&D) to provide a competitive advantage for the industry.

MLA was formed in 1998 as part of the Government's 'red meat reform package' to increase the Australian red meat industry's self determination with appropriate industry representation, governance and accountability. Three statutory meat industry bodies, Australian Meat and Live-stock Corporation (AMLC), the Meat Research Corporation (MRC) and the Meat Industry Council (MIC), were replaced by the new producer-owned company.

MLA has around 34,000 livestock producer members whose levies comprise approximately 50% of total funding. The largest contributor to the remaining funding is the Commonwealth Government, which provides dollar-for-dollar matching of money spent on R&D, followed by cooperative contributions from meat processors, live exporters, wholesalers, food service operators and retailers.

## Outcomes for livestock production R&D

This report outlines a selection of MLA's outcomes of livestock production R&D since its formation in 1998. It is not intended as an exhaustive summary; rather, it is an overview with case study details from some of the most significant projects since MLA began. The outcomes represent both new products and new knowledge in different areas, as well as changes of farm and enterprise management practices.

One of MLA's key goals is to ensure sheep, cattle and goat producers are aware of the findings of its research, and to encourage them to adapt their management practices to improve on-farm profitability and sustainability. This leads to outcomes that directly benefit the producer, the wider industry and the Australian community as a whole.

The outcomes have been achieved through collaboration with industry, other research organisations and government. Collaboration with industry ensures research identifies the most critical

needs. Collaboration with other research organisations enables joint approaches to common problems and eliminates duplication of effort. Collaboration with Government ensures that research focuses on economic, social and environmental results.

Livestock production R&D is conducted in the broad areas of improving animal production, improving the environment, feedbase and pastures, and improving delivery and capacity building. In implementation, these areas overlap and interact with each other.

MLA's R&D programs are aligned with the Federal Government's National and Rural Research and Development Priorities.

## More information

For more information on any of the case studies in this report please refer to [www.mla.com.au](http://www.mla.com.au) or write to one of the addresses below.

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PART 1

## **Improving animal production**



## Improving animal production

Changing commodity prices and increasing costs place the red meat industry under constant pressure to increase the efficiency of production in order to maintain current levels of business profitability. Improving animal production is a key driver for success. MLA invests in R&D in different areas of animal production including genetics, animal health and welfare, nutrition and reproduction, and supply chain management.

### Genetics

MLA's work in the area of beef, sheep and goat genetics encompasses a broad spectrum from scientific capacity building to delivery of genetic tools to producers. These tools have been used widely by producers and have directly resulted in significant gains being made through genetic improvement.

MLA is currently investing in the search for more gene markers for efficiency of feed utilisation for beef cattle, marbling of beef, and quality of sheep meat. Investment also continues in genetic evaluation services such as BREEDPLAN, LAMBPLAN® and Merino Genetic Services. MLA's Sheep Genomics Program is a major collaborative venture that aims to identify sheep genes and their functions in order to improve sheep health, welfare and productivity.

### Animal health and welfare

Investment in animal health and welfare R&D supports industry productivity, product quality and market access by providing tools to improve the well-being of Australian livestock. This work also addresses issues of community concern. MLA animal health research programs deliver cost-effective, practical management recommendations for the prevention and management of important diseases of sheep, cattle and goats.

MLA's animal welfare R&D has focused on livestock management issues such as heat stress, ventilation and animal diseases encountered by the feedlot and live export sectors. Production-focussed industry initiatives have also resulted in positive impacts on animal welfare. Examples include buffalo fly control, vaccine development, and the livestock management aspects of the Meat Standards Australia eating quality program.

MLA, together with Australian Wool Innovation Limited, is currently developing a framework for the identification of scientifically-based animal welfare measures. This framework may be useful in directing

welfare measures, research projects, and ultimately identifying scientific measures that may be used to determine best practice animal husbandry.

### Nutrition and reproduction

Efficiency gains in animal nutrition and reproduction affect the overall profitability of all livestock enterprises. MLA has invested in research to understand animal nutrition needs and the effectiveness of various nutrition options on livestock production, as well as programs to assess diet quality and to increase pasture utilisation. Work in reproduction includes research into bull fertility management, improved diagnosis of key reproductive diseases, identification of the causes of losses from pregnancy testing to weaning, the impact on fertility of selecting for increased carcass yield, and demonstration of new management practices. Future investment will include the identification of gene markers for lifetime calf output.

### Supply chain management

A supply chain is a group of businesses linked together for mutual benefit to supply products to customers. A red meat supply chain takes beef, lamb, mutton and goat meat from the paddock to the plate. Supply chain management integrates communication and delivery of R&D projects with management tools and training. This results in strong business relationships and consistent, high quality products being delivered to customers. MLA's work in the supply chain management area ensures that R&D is adopted and commercialised as widely as possible.

Improved environmental outcomes in red meat supply chains are also an MLA priority. MLA has collaborated with industry groups to develop several integrated environmental management systems. One of these has been implemented by Australian Country Choice (ACC), a vertically integrated agri-business consisting of production properties, feedlots and a central processing facility, dedicated to beef and veal production for Coles supermarkets.

Meat eating quality is an important aspect of supply chain management in the livestock production sphere. MLA's R&D has identified practices and processes that will further improve consistency and quality in Australian sheep meat eating quality. Significant contributions have also been made to existing supply chains such as the Western Australian Q Lamb Alliance, and the support of supply chain networks such as BeefNet.



Case Studies  
**Genetics**





## Overview: Genetics research and development

MLA plays an important leadership role in Australian beef and sheep genetics. It encompasses:

- Building capacity for overall genetic improvement of beef and sheep in Australia
- Development of genetic improvement tools such as BREEDPLAN and LAMBPLAN®
- Continuing research into better methods and tools for genetic improvement, such as gene marker research and support for the development of Total Genetic Resource Management (TGRM)

With the right genetic tools, cattle and sheep producers can make decisions to select animals for various qualities that affect profitability. Identifying animals with the most appropriate genes for different target markets has a direct positive impact on the profit of sheep and beef enterprises.

The genes that sheep and cattle possess affect:

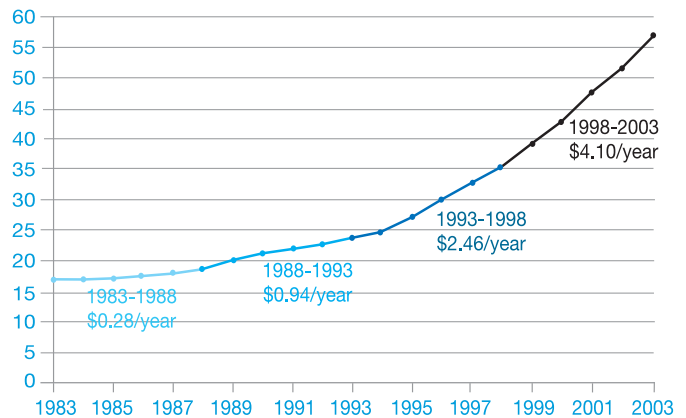
- reproductive performance
- survival rates of lambs and calves
- mothering ability of cows and ewes
- growth rates
- feed efficiency
- health, including the ability to manage parasites
- fatness, muscling and carcass characteristics

Significant work has been done by Australian researchers in the area of beef and sheep genetics since the 1960s. This research has been aimed at improving productivity and profitability through genetic technologies. These technologies include importation of new genetic material, breed change and cross-breeding, and within-breed selection. MLA and its predecessor organisations, Meat Research Corporation and Australian Meat and Live-stock Corporation, have had a significant funding and coordination role in developing beef and sheep genetics in Australia.

MLA investments are part of a larger national investment made by breeders, producers, breed societies, R&D agencies and the wider community through the Commonwealth Government. MLA and its predecessors have contributed around 23% of the national investment in cattle and an estimated 45-50% in the lamb industry. Since its formation in 1998, MLA has continued a substantial investment—up to \$2 million per annum—and work has ranged from basic through to applied science and extension.

The cumulative present value of investments in genetic improvement (1963-2001) is estimated at \$337 million. Total benefits from beef cattle genetics R&D investment over the past 30 years is \$11.5 billion (consumers gaining \$5.75 billion, producers gaining \$3.8 billion). Of this \$11.5 billion, approximately \$10.2 billion is due to the infusion of tropically adapted *Bos Taurus* cattle with the balance approximately equally due to benefits from selection, from use of cross-breeding, and from breed change in the southern industry. An example of improvement over the period 1985 to 2003 for one specific production system market specification is shown in the figure below.

Japanese B3 \$Index



Change in average Japanese B3 \$Index Value over time. Values estimated for Angus cattle registered with the Angus Society of Australia. Reference [www.angusaustralia.com.au/BP\\_Genetic\\_Trends.htm](http://www.angusaustralia.com.au/BP_Genetic_Trends.htm)

During the period 1985 to 2003 the benefit to the lamb industry of R&D investment is estimated at \$3.6 billion, of which genetic improvement is a significant component. Annual rates of genetic improvement in growth and carcass value of lamb and sheep equate to between \$10-15 million extra on-farm income per year, or approximately \$2 billion over the period.

## Scientific capacity and strategic collaborations

MLA has had a key role in the development of Australian capacity for livestock genetic research and a delivery framework. MLA continues to invest in projects that provide the necessary infrastructure for work that will influence the beef and sheep industries in the long-term. Strategic collaborations include BREEDPLAN, the Beef CRC<sup>#</sup>, Sheep Genetics Australia and the Sheep Genomics Program. Ongoing research in development of new traits and estimating genetic parameters underpin the delivery of BREEDPLAN and LAMBPLAN® to industry.



### Genomics

Genomics is the study of the genes within an organism and how they contribute to its phenotype (its observable characteristics). Functional genomics makes use of the vast amount of data generated from genome sequencing. It describes the function and interactions of genes in order to develop new ways to measure economically important traits and to diagnose disease. Genomics has the potential to identify new diagnostic methods and genetic screening tools for livestock in order to improve productivity and health.

MLA's Sheep Genomics Program aims to identify sheep genes and their functions in order to improve sheep health, welfare and productivity. It is a major collaborative initiative in which MLA and Australian Wool Innovation Limited are partners. Ten Australian research organisations are also involved in the project and are providing in-kind funding.

### The Cooperative Research Centres (CRCs) for beef cattle and sheep

MLA has leveraged its own funding investments through strategic collaborations with industry and scientific institutions. A significant collaborative relationship has been with Beef CRC<sup>®</sup>.

The Beef CRC brings together research and industry partners in order to benefit the whole industry. The venture includes the University of New England, CSIRO, NSW Department of Primary Industries and Queensland Department of Primary Industries & Fisheries, commercial firms, and cooperating cattle breeders. MLA (and predecessor Meat Research Corporation) is the major private sector core partner providing significant cash support.

The Beef CRC integrates molecular and quantitative genetics, meat science, and animal nutrition and health, to identify and understand the factors that influence growth, development and beef quality, in order to ensure Australia's ability to guarantee the eating quality of beef.

The Sheep Industry CRC brings together a range of partners, including several State Departments of Primary Industries as well as processor and producer groups. MLA has been a major industry investor in several project areas, and has been a supporting party to the CRC.

MLA has worked closely with the Sheep Industry CRC, partnering in R&D projects in the areas of sheep meat eating quality and sheep genetic parameters, to assist in tackling the wool-meat balance, and in

projects to better understand managing for both wool and meat in sheep enterprises across a range of environments. The collaboration has been very effective and yielded considerable additional R&D outcomes over what could have otherwise been achieved.

### Sheep Genetics Australia

Sheep Genetics Australia (SGA) is the national genetics evaluation service for the Australian sheep industry jointly developed by MLA and Australian Wool Innovation Limited. SGA unites MLA and AWI's sheep genetics initiatives to integrate and maximise knowledge gained through their respective research and development programs. The establishment of SGA provides a platform for standardisation, calculation and use of credible and accurate breeding information across all sectors of the Australian sheep industry.

### Trait identification and gene markers

Gene markers have been identified for various cattle traits that are critical to productivity and consumer requirements, such as meat tenderness and cattle feed efficiency.

MLA has supported the development of gene markers for beef marbling and tenderness in collaboration with the Beef CRC and CSIRO. These gene markers enhance cattle producers' ability to predict the genetic merit of their animals. Again with the CRC, MLA research has demonstrated that genetic improvement in the efficiency of cattle feed utilisation can be made, and that using the net feed intake as a selection criterion in beef cattle breeding schemes is profitable. It has provided a blood-based test (IGF-1) to reduce the cost of testing, and work continues to identify and commercialise gene markers for feed efficiency.

Research also continues on developing more gene markers for hard-to-measure but economically important traits in cattle and sheep. Alongside this, research is being conducted on better computational methods to incorporate gene markers in quantitative analysis to ensure smooth delivery to industry.

### Genetic delivery—trait selection tools

#### BREEDPLAN

BREEDPLAN is the national genetic recording and evaluation program for the Australian beef cattle industry. Development of BREEDPLAN is co-funded through the Animal Genetics and Breeding Unit at Armidale, NSW, and is delivered by the Agricultural Business Research Institute under license from



MLA, NSW Department of Primary Industries and the University of New England. The program provides performance recording systems that predict an individual animal's ability to produce progeny that meet the requirements of current and future markets. It offers bull breeders the potential to accelerate genetic progress in their herds and to provide objective information on stock they sell to commercial breeders.

BREEDPLAN uses Estimated Breeding Values (EBVs) for economically important traits, including growth, fertility, carcase qualities and calving ease. The adoption rate across Australia is about 51% of registered and recorded cattle. BREEDPLAN has also been successfully implemented in many other countries.

BREEDPLAN delivers an estimated \$15-20 million to industry in additional on-farm returns each year through continued improvement in growth rates, carcase composition, feed efficiency and maternal ability.

MLA's investment in the development of analytical software and the measurement of new traits and genetic parameters underpin BREEDPLAN. MLA co-ordinates national activities to ensure producers can use genetic tools and resources for improved profit.

### **LAMBPLAN®**

LAMBPLAN® is Australia's system for describing the genetic worth of sheep used in sheep meat production. Developed and managed by MLA, LAMBPLAN® started in 1989 and is the world's most effective sheep genetic improvement system. LAMBPLAN® provides a performance recording system that predicts an individual animal's ability to produce progeny that meet the requirements of the current and future markets for lamb products. The system is based on Australian Sheep Breeding Values (ASBVs) that are calculated from raw data collected by breeders and accredited LAMBPLAN® ultrasonic scanning operators. LAMBPLAN® ASBVs are designed to give the best possible estimate of the true genetic merit of sheep from the data.

All major terminal, maternal and dual-purpose breeds in Australia use LAMBPLAN®. Continuing R&D makes ASBVs more accurate, makes breeding programs faster and better targeted, and increases the commercial use of LAMBPLAN®. Currently the LAMBPLAN® system produces breeding values on 1.65 million animals, with an annual evaluation of 100,000 animals. It has directly contributed to

approximately 70% of the gene pool of prime lamb production in Australia, which has demonstrated significantly higher growth in productivity (approximately 5% per annum) compared with the overall sheep population.

### **Merino Genetic Services**

Merino Genetic Services has provided Merino breeders and producers with information on the genetic potential of sheep through ASBVs. Breeders and producers can select the best sire or dam for their breeding objectives across a comprehensive range of commercial production and quality traits. Merino Genetic Services delivers a higher level of control over animal selection. This service allows commercial and stud producers to more effectively use information now available to them through new technologies such as in-shed wool testing. It is available to all Merino clients (both Horn and Poll) that have data submitted to the Merino database.

Merinoselect® is replacing Merino Genetic Services with the introduction of Sheep Genetics Australia.

### **KIDPLAN**

KIDPLAN provides practical information to the Boer and Meat Goat Industry on the value of an animal's genes for production, in the form of EBVs and specialised indexes.

## Case Study: Beef marbling

### Opportunity

**Marbling is the finely distributed fat in beef muscle. It is positively associated with eating quality and has commercial importance, particularly in the USA and Japan. There is substantial genetic variation in these traits, so tests for underlying genetic causes are likely to succeed. Also, producers seek animals that can marble without becoming over-fat and thus be expensive to feed.**

### Projects

There are now five gene markers for production traits in beef cattle: three for marbling and two for tenderness. MLA has been involved in supporting the development of the markers and improvements in the tests using these markers.

#### Gene marker tests for beef marbling and tenderness

MLA's funding, in collaboration with the Beef CRC and the CSIRO Division of Livestock Industries, has developed gene markers for beef marbling and tenderness which increase producers' abilities to predict the genetic merit of their animals. This allows producers to more accurately select feedlot cattle destined for the high value markets such as Japan that require high marbling scores.

A test has been developed for three markers which have been licensed to GeneSTAR Pty Ltd. This was the world's first commercial gene marker test for a production trait in beef cattle. GeneSTAR marbling is a DNA diagnostic test that distinguishes different forms (alleles) of the Thyroglobulin (TG) gene associated with different levels of marbling in the carcass. One form of the gene has been shown to be associated with increased marbling in cattle on lot-feeding programs.

The presence of the first discovered marbling allele is associated with an increase of approximately 11% in the average marbling score in a population of animals.

GeneSTAR has also introduced a DNA test for tenderness. It detects two different forms of the bovine calpastatin gene; one is associated with increased tenderness and the other with increased toughness. This works best in breeds which have a moderate to high frequency of the toughness allele, in that it can be actively selected against in breeding programs.

#### Protein intake and beef marbling

This joint MLA and Beef CRC project tested the effects of dietary protein on the performance and expression of marbling in beef cattle.

Ultrasound scanning of back-fat thickness, eye muscle area and intramuscular fat was conducted throughout the trial, and feed intake recorded. The project found that there were no significant effects on marbling percentage of the protein content of diets. However, the low protein diet resulted in a significantly lower Feed Conversion Ratio (the number of kg of feed used to produce one kg of beef) and less cost for weight gain than both the control and high protein diet.

The protein content of the diet was found to affect feed intake, liveweight gain, Feed Conversion Ratio and cost of gain. Ultrasound scanning at the beginning of the feeding period was found to be the best predictor of marbling outcome.

### Outcomes

#### Objective industry benefits

##### Gene marker tests for beef marbling and tenderness

Genetic seedstock producers see the benefit of selecting cattle to build a genetic base.

Most feedlots supplying this Japanese market segment now ensure they purchase their stock from sire lines that have a proven propensity to marble.

Since December 2004 the marbling test has three markers, and uptake of the technology is expected to increase significantly. More than 15,000 tests for marbling and more than 20,000 tests for tenderness have been sold.

##### Protein intake and beef marbling

It was demonstrated for feedlots that feeding too high a level of protein too late in the feeding period is uneconomical and does not increase marbling. Protein levels are now more aligned to animal requirements and high levels are no longer fed, reducing the cost of feed. This is also partly attributable to many operators ceasing feeding whole cottonseed because of its GMO status.

Scanning was found to be the best predictor of marbling outcomes. This may reduce the cost of feed by feeding fewer cattle (or more targeted selection of cattle to feed) to achieve marbling specifications.



### Intangible benefits

Australia's international reputation is enhanced by this world-first research.

### Triple bottom line

#### Economic

The cost of feed to achieve marbling specifications is reduced.

#### Environmental

Reduction of feed to achieve specifications means a reduction in feed eaten and thus greenhouse emissions per kilogram of quality beef are reduced.

#### Future

The impact of nutrition research on marbling may be revisited in the future.

## Case Study: Improving efficiency of beef cattle through selection for net feed intake

### Opportunity

**Providing feed to cattle is the single largest expense in most beef cattle production enterprises. Improvements in efficiency of feed use per head will reduce costs as well as the environmental footprint of production.**

### Project

This project was the most comprehensive research on feed efficiency in beef cattle in the world. It investigated and demonstrated the economic benefits of reducing the costs of beef production through the genetic improvement of net feed intake. Net feed intake (NFI) is the difference between actual feed intake and the expected feed required for growth and maintenance. An efficient animal is one that has a negative NFI. Most producers consider NFI to be a very important trait, on par with carcass and growth Estimated Breeding Values.

The project showed that selection for reduced NFI should produce steers that are more feed efficient, with no adverse effects on growth performance in the feedlot, beef yield, meat quality or fertility. NFI is heritable and there is a strongly favourable genetic correlation between post-weaning NFI and mature cow NFI.

The project incorporated six major integrated component studies: post-weaning performance,

reproduction and maternal performance, mature cow efficiency, feedlot performance, carcass and meat quality evaluation, and a demonstration herd. It also included a comprehensive industry implementation program to stimulate adoption of the outcomes by the beef industry.

### Outcomes

#### Objective industry benefits

The project demonstrated that genetic improvement in the efficiency of feed utilisation can be made, and that using NFI as a selection criterion in beef cattle breeding schemes is profitable.

A pilot facility for commercialised central testing of industry cattle for NFI and national accreditation for NFI testing facilities were developed.

Comprehensive quality assurance guidelines and standards on feed intake and efficiency recording in cattle were developed.

The project is a world-first study to provide recommendations on the industry implementation of a test for feed intake and efficiency in beef cattle, and the first study to provide genetic parameters for NFI and its relationship with other economically important traits over the whole beef production system.

#### Intangible benefits

Future areas of research have been identified for the disciplines of both nutrition and genomics.

Producers are more aware of the benefits that innovative practices can bring.

Australia is recognised as the world leader in this technology.

### Triple bottom line

#### Economic

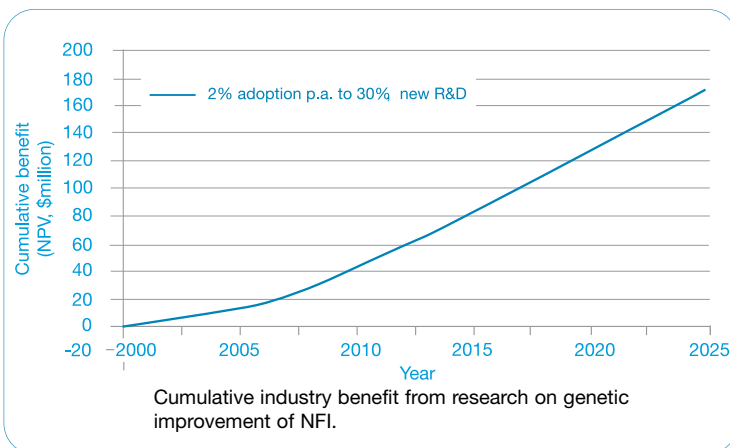
The estimated net present value of the benefit from genetic improvement in NFI to the commercial cattle sector of the southern Australian beef cattle industry is \$162 million over 25 years (see figure below). The estimated net annual benefit per farm is \$630.

#### Environmental

Genetic improvement of cattle has resulted in more efficient use of pasture and grain resources. This in turn reduces production of methane, a key greenhouse gas, for each kilogram of beef produced.

#### Future

Physiological and gene markers are being developed to reduce the cost of testing for NFI.



## Case study: Maternal central progeny test for sheep

### Opportunity

**Differences in maternal genetics have a massive impact on the productivity and profitability of lamb enterprises.**

Relatively little attention has been given in the past to the genetics of the maternal sire (the sire of first cross and dual-purpose ewes). Maternal sire is defined as either a sire that is used across Merino ewes to generate first-cross ewes and to produce saleable wether lambs, or a sire that is used in self-replacing flocks for lamb production. Terminal sires are meat sires used to produce both wether and ewe lambs for sale.

### Project

The Maternal central progeny test project was a joint undertaking between MLA, the NSW and Victorian Departments of Primary Industries, and the Sheep Industry Cooperative Research Centre. The project was carried out at the State Department of Agriculture research stations at Cowra, Hamilton, Rutherglen, and Struan between 1997 and 2001.

The project demonstrated the significant benefits of superior genetics in maternal sires for prime lamb production—around \$35 increased gross margin per ewe joined per year. All sires in the trial had LAMBPLAN® Australian Sheep Breeding Values (ASBVs) produced for a range of traits, and the trial allowed the first comparisons of ASBVs across maternal breeds that are relevant to prime lamb production. The project showed the importance of selecting maternal sires with high ASBVs for prime

lamb production, and that the best genes for prime lamb production are spread across a number of breeds. The variation in lambing rates of first-cross ewes was the major profit driver identified.

## Outcomes

### Objective industry benefits

This project increased industry recognition of, and appreciation of, the importance of the maternal sire.

Since the project has shown that desirable genes reside in a number of breeds, demand for maternal sires with high ASBVs for prime lamb production has increased considerably, along with premiums. Around 25,000 maternal sires are tested annually in LAMBPLAN®.

### Intangible benefits

Industry attitudes have changed by providing factual information about the genetic importance of the maternal sire. Awareness of the value of genetic improvement in sheep production has increased.

Awareness of key welfare issues of lamb survival and internal parasite management has increased.

## Triple bottom line

### Economic

The net annual benefit per farm is \$27,000, and net present value is \$8.8 million, over 20 years, at present adoption rates. The projected net present value is \$147 million.

### Social

Producers who have made better use of maternal genetics in the lamb enterprises have a much greater sense of control of risk—they are now able to choose with greater confidence maternal genetics that will perform satisfactorily (or better).

### Environmental

The ewe flock consumes some 60% of the total resource (feed, water) used in lamb production. Flocks that use superior maternal genetics are making more efficient use of these scarce resources and less use of chemicals in parasite control.

### Future

Across-breed breeding values are being developed by Sheep Genetics Australia (see page 7).



## Case study: Merino validation project

### Opportunity

To improve the genetics of Australian Merino sheep flocks.

### Project

In 2001 MLA funded a three-year project for the validation of genetic information and to facilitate genetic improvement in Merino sheep. The project aimed to provide tools for genetic evaluation of flocks in the Merino industry.

The project achieved this through three main activities. Firstly, validating existing genetic parameter estimates for Merinos. Secondly, obtaining reliable results for the genetic relationships between growth, wool, fertility, carcase and internal parasite resistance traits of Merinos, and incorporating reliable measures of these traits into MLA Merino Genetic Services/LAMBPLAN® OVIS analysis software. Thirdly, through increasing the adoption of across-flock Merino genetic evaluation services nationally.

The project involved research partnerships with up to 50 Merino breeding flocks per year for three years, as well as a number of research flocks and central test sire evaluation schemes. A total of 162 flocks were involved in the project.

### Outcomes

#### Objective industry benefits

Project participants significantly increased the adoption of across-flock genetic evaluation in the Merino industry, as evidenced by the fact that the Merino Genetic Services database increased from 120,000 to 560,000 animals over the three year period.

Participants in the project have provided a significant amount of data to Sheep Genetics Australia (SGA). SGA will be the national genetic provider of Australian Sheep Breeding Values (ASBVs)\* for the Australian sheep industry. Participants receive the most accurate and relevant genetic information on their animals through their involvement.

This project has contributed to the development of a single genetic evaluation system for the Merino industry.

#### Intangible benefits

Awareness of animal welfare and health issues within Merino studs has increased.

Awareness of the value of meat and surplus sheep in Merino production systems is improved.

Collaboration with Australian Wool Innovation Limited has increased.

### Triple bottom line

#### Economic

Participants have been able to provide ASBVs for their clients when selling rams, and there is evidence that this is beginning to improve the prices they receive for rams. In addition, the participating breeders have begun to use the ASBVs in making selection decisions, and this will help them breed more profitable sheep. This will in turn generate benefits in the form of improved gross margins for their clients.

#### Social

Participating breeders have increased knowledge about genetic technologies and about the genetics of their sheep, and in turn greater confidence about managing their breeding businesses effectively. They have also become part of a network of breeders who communicate via email to share ideas and information and use web resources.

#### Environmental

In the longer term environmental benefits will accrue from this project through more efficient use of resources (land, feed, water).

#### Future

The Meat-Wool Interface project and other Sheep CRC programs for improved muscling and higher eating quality are being undertaken. SGA will be further developed. Work will be done on improving carcase value in Merino sheep through VIASCAN.



Case Studies  
**Animal health & welfare**





## Case study: Heat stress risk management on long haul livestock voyages to the Middle East

### Issue

**Heat stress can cause mortality in cattle, sheep and lambs transported by ship to the Middle East.**

### Project

Following a series of investigative voyages involving engineers and veterinarians to record environmental and animal data on commercial shipments, a project was formulated to construct a heat stress risk management model. The model was developed into a computer software package that exporters could use to plan voyages to the Middle East to reduce the risk of mortality of livestock due to heat stress.

The model is a planning tool and will assist to greatly reduce heat stress incidents.

### Outcomes

#### Objective industry benefits

Shipboard mortalities due to heat stress in cattle, sheep and goats are reduced. A major benefit to the industry has been the continuation of the long haul trade in cattle, sheep and goats due to the compulsory use of the heat stress model in the Middle East trade. Any disruption to the trade reduces demand and prices paid for cattle, sheep and goats for both the long haul and short haul export trades.

#### Intangible benefits

The introduction of the heat stress risk management tool on all shipments to the Middle East was instrumental in keeping the long haul live export trade open by giving the Government confidence in the trade. The model is outcome-focussed and relieves exporters and producers from prescriptive standards.

### Triple bottom line

#### Economic

The financial repercussions for producers and exporters if export demand declines due to a heat stress mortality incident would be very significant. The price paid for livestock in other markets will be affected if total demand is affected. The heat stress risk management tool provides producers with additional security of demand for their livestock exported to the Middle East.

### Social

The wider community has an improved perception of the industry's management of animal welfare.

### Future

The heat stress model is continually refined in terms of the biological assumptions used and the user-friendliness of the software.

## Case study: Ovine Johne's disease

### Issue

**Ovine Johne's disease (OJD) is a chronic wasting disease of sheep caused by bacteria that infect the intestinal wall. The resulting inflammation blocks normal food absorption resulting in severe weight loss, emaciation and eventually death. OJD also affects wool production.**

**OJD infection can result in significant financial costs to producers due to increased sheep deaths, decreased production and restricted trading opportunities for infected flocks and regions.**

**The total annual cost to Australian sheep producers of OJD is estimated to be \$53 million.**

**OJD is a complex disease with a very long incubation period, and it may take many years from the time of infection until the development of obvious signs of wasting. Infected sheep shed the OJD bacteria in their dung, contaminating pasture. The organism is very hardy and can survive in the environment for over a year. Lambs less than six months of age appear to be most susceptible to the infection. However, due to the long incubation period, obvious signs of illness are rarely seen in sheep less than 18 months of age.**

### Project

Since 1998, MLA has initiated 28 projects as part of the National Ovine Johne's Disease Program (NOJDP). Most of these are now complete, providing critical information to assist the sheep industry to control OJD. The NOJDP has now finished and MLA has initiated a 'harvest year' to collate and communicate the results of all current OJD research in Australia.



## Outcomes

### Objective industry benefits

#### The evaluation and registration of a vaccine

MLA R&D had a key role in the evaluation of an OJD vaccine which is now registered. This vaccine does not prevent infection, but can reduce deaths by up to 90% and reduce the level of clinical disease within a flock. Importantly, it can also reduce pasture contamination. The vaccine is already widely used and its availability in OJD-infected areas has increased producers' trading options.

#### Grazing management to reduce infection rates

Grazing management strategies have been identified for producers to control the disease and reduce its economic impact. In order to develop these strategies, research has focussed on how OJD spreads within flocks and how disease progression can be controlled.

#### Assessment of the cost of OJD to individual producers

Research into the economic effects of OJD has enabled producers to make more informed decisions on the economic rationale of various control measures within their flocks.

#### Information on the role of other animal species in the spread of OJD

Control programs need to know if other animals can transfer infection to sheep. Current research shows cross infection to cattle and other species to be rare, enabling producers to continue shared grazing practices. However, goats have been shown to be infected with OJD and should be included in all OJD control and eradication plans.

#### Development of on-farm management guidelines for industry

MLA has published a number of OJD on-farm management guides, including three Research Updates and a series of OJD Tips & Tools. These give producers the most up-to-date information on OJD in Australia.

#### Less regulation for producers

Research resulting in better understanding and management of OJD has influenced policy makers to move from a highly regulated approach to one where trading schemes are less regulated.

#### Intangible outcomes

Early eradication strategies for OJD meant large-scale loss for some producers of both stock and bloodlines that had been developed over many generations. This resulted in traumatic effects on individuals, families

and communities. Evaluation of this eradication strategy and development of different protocols, including vaccination, removed the necessity for total de-stocking.

## Triple bottom line

### Economic

The economic loss due to OJD is estimated to be \$7.68 per dry sheep equivalent (DSE). Research outcomes have mitigated this through investigating grazing management strategies and vaccination to limit the impact and spread of the disease.

### Social

Modification of management strategies removing the necessity of de-stocking has a positive social effect on communities affected by OJD.

### Environmental

Research showed that native animals were not potential OJD carriers, indirectly protecting native animal populations. Grazing management protocols mean less contaminated pastures.

### Future

Research continues in the areas of understanding the OJD organism, diagnostic tests, interaction between OJD bacteria and the animal, bacterial factors involved in OJD infection, and identifying risk factors for disease progression.



### In brief: Sheep internal parasites

Internal parasites of sheep are a considerable cost to sheep production. Many of the parasites are resistant to the currently available drugs. MLA and Australian Wool Innovation Limited have jointly committed to invest over \$4 million, over four years, in innovative research with the aim of creating commercially available sheep worm control technologies to address this major industry threat. Following the recommendations of the specially convened scientific advisory panel meeting in 2002, nine projects have been funded. Each project is investigating a different facet of the parasite problem. These projects are using leading biochemical, genomic and proteomic technologies and focus not only on the most economically damaging parasites but also their interface with the host.

### In brief: Bovine TB

Australia is a recognised leader in control programs for bovine tuberculosis in the developed world, declaring itself free from this disease in 1997.

MLA recognised that the detection methods for *Mycobacterium bovis* (the bacteria causing bovine tuberculosis) needed to be improved, both with regard to time and cost. On behalf of Animal Health Australia, MLA contracted research in 2003 to improve detection methods.

As a result of this project, a set of recommended procedures for the isolation, detection and strain typing of *M. bovis* has been established. These techniques will enable a quick response in the event of an outbreak of bovine tuberculosis. Superior screening methods for detection and strain typing of *M. bovis* samples isolated from infected animals will assist in diagnosis and traceback to the source of the infection, an important aspect of disease control.

### In brief: Calf scours

Calf scours (or calf diarrhoea) is a health problem in young beef calves which can lead to death. An outbreak of calf scours is often distressing for producers, and treating affected calves is time consuming and costly. The average cost to producers of a scouring calf was estimated at \$73.30 or \$18.70 per breeding cow. MLA has initiated two projects on calf scours. The

first project included surveys of beef producers and cattle veterinarians to determine the extent of the problem and attitudes towards it. The second project included a comprehensive literature review with the objective of putting in place pathways that will ensure that consistent and scientifically sound advice is provided to prevent, treat and manage calf scours.

Information about developments in the prevention, diagnosis, treatment and control of calf scours with expanded basic management principles for control and prevention is being disseminated to laboratories, producers and veterinarians. This will enable a clear and consistent future approach to calf scours resulting in more healthy calves and reduced producer costs.

### In brief: Temperament and lamb survival

One of the causes of losses of newborn lambs is the absence or late establishment of the vital ewe-lamb bond that occurs in the first few hours after birth.

Sheep's stress reactions to humans and new or threatening environments have been shown to affect their ability to establish a strong ewe-lamb bond. Initial studies have shown that "calm" ewes are better mothers and have about half the lamb mortality rate of "nervous" ewes.

In 2004 a joint project between MLA, the University of Western Australia and CSIRO was initiated to develop a simple, reliable and objective test for the on-farm measurement of sheep temperament.

As the project continues, the interaction between genetic and environmental factors in the establishment of the ewe-lamb bond and subsequent lamb survival will be investigated. On-farm management strategies will also be developed.



## Case study: Heat load in feedlot cattle

### Issue

During a period of extremely hot, humid weather conditions in 2000, a significant number of cattle deaths occurred in a feedlot in southern NSW. The industry recognised the need to address the heat load issue, and the opportunity to improve both animal welfare and community perception of the industry, by working collaboratively with government and animal welfare agencies. Since that time, the feedlot sector has implemented a series of research, development and extension activities to reduce the impact of heat load on feedlot cattle.

### Project

A number of projects have been undertaken to improve the understanding of the heat load issue, develop mechanisms for recognising and forecasting conditions when heat load is likely to be a problem, and develop measures that can be implemented by feedlot operators to ameliorate the impact of heat load. Specific projects have addressed the following areas:

- Increased understanding of the climatic, animal and management factors that affect the heat load of feedlot cattle.
- Development of heat load indices that reflect the impact of climatic heat load on an animal at particular times.
- Development of a forecasting service that predicts these heat load indices up to six days into the future.
- Development of a suite of measures and management practices that will reduce the impact of heat load on feedlot cattle. These include improved manure pad management, manipulation of rations, provision of additional water troughs and cool drinking water, and the provision of shade.
- Development of a risk assessment software package that can be used by feedlot operators to identify the level of heat load risk for their particular site and the measures they need to adopt to offset the level of risk identified.
- Extension of the outcomes of the research work to industry practitioners.

### Outcomes

#### Objective industry benefits

Direct regulatory impositions for the management of heat load in feedlot cattle are made unnecessary.

Feedlot operators are enabled to make better decisions about the management of heat load through the knowledge and principles acquired from the research.

Feedlot operators are now starting to recognise benefits from improved summer management practices in the form of improved performance and improved compliance with product specifications.

Partnerships have been developed between industry operatives, government, and animal welfare/ community representatives, in determining research direction and priorities, and overseeing research activities to address identified industry problems. This is a model that could be used in other areas.

#### Intangible benefits

Government regulatory and animal welfare agencies have confidence that the industry is responsibly addressing its animal welfare undertakings.

Adoption of the provision of shade as a means of reducing the potential impact of heat load on feedlot cattle has increased dramatically since 2000, and addresses a significant community perception that lack of shade means poor animal welfare.

### Triple bottom line

#### Economic

Not quantified at this time, but operators are starting to identify benefits in production parameters and compliance with product specifications.

#### Social

Feedlot operators have worked collaboratively with government and community representatives, improving relationships and perception of the industry's animal welfare approach.



## Future

Further research will be conducted to improve the understanding of the impacts of dietary manipulations on the heat load of a feedlot animal.

Many of the outcomes of the research activities will be incorporated into the National Feedlot Accreditation System (the industry QA system), relevant codes of practice and industry guidelines, ensuring they are adopted by all operators.



Case Studies  
**Nutrition & reproduction**



## Case study: Strategic optimisation of nutrition in Merino sheep meat production

### Opportunity

**Genetic factors and the way Merino sheep are fed affect lambing success, wool cut, worm resistance and overall profitability of Merino production systems.**

### Project

This project examined the effect of, and interactions between, several genetic and non-genetic factors on lambing performance, subsequent lamb growth, wool cut and worm resistance in fine-wool Merinos in New England, NSW.

The non-genetic factors that were examined included the body condition of ewes prior to mating, levels of supplementary feeding with cottonseed prior to lambing, and grazing systems.

Two grazing management systems were used. These were a set-stocked system similar to that used elsewhere in the local district, and an intensive rotational grazing system (IRG) that allowed higher levels of pasture production and stocking density. IRG is based on subdivision of the pasture into very small units and intensive grazing periods.

The project demonstrated that supplementary feeding of ewes with cottonseed pre-lambing tended to increase the number of lambs that were successfully reared to weaning.

This project has discovered new opportunities for integrating grazing technologies. More work will be needed to understand the applications of this technology on other environments. Producers in southern Australia are already trialling these packages.

### Outcomes

#### Objective industry benefits

Better management programs that optimise lambing potential and growth rates in fine-wool merinos.

Better management systems for worm control.

Improved flexibility in fine-wool production systems.

### Triple bottom line

#### Economic

The combination of IRG and pre-lambing supplementation trialled in this project allowed an

increase in stocking rate from 6 Merino ewes/ha to 9.7 Merino ewes/ha, and a gross margin increase of 69%, from \$198/ha to \$336/ha. It is anticipated that further enhancements are achievable with the IRG system that could take gross margins to around \$490/ha.

### Environment

Integrated grazing technologies have the potential to increase production while increasing the water use efficiency of pastures, improving soil structure and reducing the demand for chemicals to control parasites.

### Future

Work is being done to increase pasture production and utilisation from weaner management in Merino sheep.

## Case study: Bullpower

### Opportunity

**Fertile bulls are a key aspect of all cattle breeding enterprises. They contribute to the number of calves weaned as well as the pattern of conception and subsequent calving. The number of bulls required to service a given number of cows is an important variable cost in terms of each calf produced (ie, bull cost per calf born). The ability to use fewer bulls would directly reduce the bull cost per calf or enable producers to purchase better quality bulls for the same cost.**

### Project

The Bullpower project was undertaken in two phases and was designed to develop management strategies that maximise the calf output of bulls of desired genetics in northern Australian herds by: identifying predictors of the 'calf getting ability' of bulls, defining required bull joining percentages at different levels of herd dispersion, quantifying the impact of relocation on subsequent bull fertility, identifying traits whereby bulls can be selected for fertility at an early age, and identifying traits that predispose bulls to early breakdowns in their working life.

The project generated a number of key findings including:

- In herds with a wide range of bull joining percentages (4 –12%), bulls varied greatly in the number of calves each sired. One in ten bulls produced no calves at all, 50% of bulls produced less than six calves each, 30% of bulls sired



between seven and 30 calves each, while 10% of bulls sired over 30 calves each. Thus there is a marked difference in the bull cost per calf between the various bulls.

- A range of factors were examined for the widespread variation in calf getting ability of bulls. The most important and consistent factor was semen morphology. It is now recommended that all bulls should have semen morphology assessed as part of a Bull Breeding Soundness Examination (BBSE) prior to joining. Fifty percent normal for semen morphology is considered adequate.
- Given bulls pass a BBSE it is recommended that bull joining rates of 2.5 to 3% can be used in most joining situations. This can represent a significant cost reduction in bull cost per calf born.
- Bulls with high-normal semen morphology get cycling cows in calf much sooner and therefore have a tighter calving pattern than bulls with low-normal semen morphology.
- Under commercial conditions, 50% of relocated bulls failed a BBSE up to three months after sale. These bulls were therefore less than ideal for use as breeding animals. It is recommended that producers buying and relocating bulls need to pay particular attention to the management of the bulls during the transport process and in particular when they arrive at their new destination (eg, nutrition).

## Outcomes

### Objective industry benefits

The findings and recommendations from the Bullpower project have been incorporated in the BBSE protocol of the Australian Cattle Veterinarians.

A survey of northern beef producers in late 2003, prior to finalisation of the second stage of the Bullpower project, found that:

- 24% of producers were aware of the Bullpower project, with a quarter of these having changed their bull management practices as a result
- Management changes included testing for semen quality and reducing bull joining rates
- 47% of producers use a bull joining rate of 3% or less
- 34% of producers have their bulls tested for reproductive soundness

## Triple bottom line

### Economic

Producers and veterinarians now have indicators of the calf getting ability of individual bulls. This enables fewer bulls to be selected with confidence and used, thus reducing the bull cost per calf. Alternatively, producers can now buy fewer, better quality bulls for the same total bull cost. The reduced time to conception also ensures calves are born at the optimal time and is a direct contributor to the lifetime productivity of cows.

### Future

The focus is now on extending the results of the Bullpower project to more producers and other stakeholders. Two of the major mechanisms for doing this are through close links with the Australian Cattle Veterinarians, and incorporation of the findings into MLA's *EDGEnetwork*<sup>®</sup> "The Breeding EDGE" course.

## Case study: Near infrared reflectance spectroscopy (NIRS)

### Issue

**Supplementary feeding of stock is a major cost for most northern beef producers. To assess the need for supplements, the diet quality of grazing cattle in northern Australia must first be measured under commercial conditions.**

### Project

MLA has invested in a suite of three projects with CSIRO and the Queensland Department of Primary Industries and Fisheries using near infrared reflectance spectroscopy (NIRS) to estimate the dietary quality of grazing cattle across northern Australia.

The core project developed the key NIRS calibration equations through the use of paired feeding samples. That is, key diet quality attributes (dry matter digestibility, crude protein) were derived using traditional feeding approaches, with faecal samples collected from the animals and the resultant spectral responses related to the results of the feeding experiments.

The second project considered the accuracy and reliability with which faecal NIRS could predict growth of young cattle and the performance of breeder herds, and the accuracy and reliability with





which faecal NIRS could predict the magnitude of animal responses to urea-based or low levels of protein meal supplements.

The third project was established to trial the new technology with selected producers and to develop appropriate support tools to aid adoption. The first project has been completed whilst the second and third projects are in their final stages.

## **Outcomes**

### **Objective industry benefits**

Significant numbers of northern beef producers are using the NIRS technology to estimate protein requirements and adjust supplementation.

### **Triple bottom line**

#### **Economic**

Supplementary feed costs are an important variable cost for northern beef producers. NIRS provides a tool that allows producers to fine tune their supplementation strategies based on a sound knowledge of what the livestock are actually consuming from the available pasture.

#### **Future**

NIRS technology will be provided to producers on a sustainable commercial basis.



Case Studies

## **Supply chain management**



## Case study: Sheep meat eating quality

### Opportunity

**To deliver a world-class product by defining and improving lamb and sheep meat eating quality.**

### Project

Commencing in 2000, MLA and the Sheepmeat Council of Australia undertook a research project into sheep meat eating quality (SMEQ).

An initial industry consultation phase identified the commercial needs and priority research issues. Over 600 stakeholders contributed to setting research priorities. The SMEQ program devised a model for predicting eating quality based on the results of around 45,000 records of consumer evaluations of lamb and sheep meat. Samples were selected from a range of production, processing, age and other attributes. The project then investigated the importance of the identified research factors, undertaking 17 research projects over two years.

The major factors affecting sheep meat eating quality that were investigated are:

- breed and genetics
- age (lamb, hogget, mutton)
- growth pattern and nutrition
- transport and pre-slaughter stress
- chilling treatment
- electrical stimulation of carcasses to ensure sheep meat enters rigor at the right temperature
- hanging method
- ageing/storage
- cut and cooking method

Currently the project is piloting the implementation of outcomes through five supply chains and investigating options for commercialising the research.

### Outcomes

#### Objective industry benefits

Practices and processes have been identified that will further improve consistency and quality in Australian sheep meat eating quality.

With knowledge of the factors that affect eating quality, producers and processors can aim to improve eating quality and reduce failure rates of their operations.

Approximately 20% of lamb currently fails consumer expectations, but SMEQ practices can reduce that rate to around 5%.

Processing regimes are now known that will improve the eating quality and consistency of all sheep and lambs.

Opportunities have been identified for better commercial use of non-lamb sheep meat, including certain cuts of yearling mutton and the mutton loin.

### Triple bottom line

#### Economic

SMEQ research benefits all parts of the supply chain.

By reducing risk of failure and improving consumer satisfaction of Australian lamb and sheep meat, all industry sectors benefit from increased and consistent demand. This should assist in maintaining, or growing consumer preparedness to continue to support sheep meat prices at the high levels of recent years.

#### Social

Greater pride in the product through the supply chain—breeders, producers, processors and retailers have the knowledge to deliver high quality lamb consistently, and take pride in knowing that such lamb is appreciated and recognised by consumers.

#### Future

A number of options for the commercialisation of the SMEQ research have been investigated, and recommendations for a commercially based system have been approved by the Sheepmeat Council of Australia.

Further research into the eating quality performance of all commercial cuts is currently being investigated in a series of consumer trials which will consider the influence of animal age, cooking method, and the combined influence of fat and bone with muscle.



## Case study: Q Lamb Alliance

### Issue

In the early 1990s a lack of integrated supply chain relationships was resulting in unstable lamb prices and an inconsistent lamb supply in Western Australia. The Q Lamb Alliance was established in 1995 between Western Australian lamb producers and Hillside abattoirs. It aimed to produce and market premium lamb products to capture the benefits of above-average quality product for Alliance members.

As Q Lamb expanded, there was a growing need for a more efficient feedback system to secure product integrity at higher volumes.

### Project

As part of the sheep meat eating quality (SMEQ) pilot trial, a meat eating quality assurance system was established at Q Lamb along with an efficient electronic feedback project.

A trace-back system was developed tracking lamb carcasses to farms of origin. This trace-back system was supported by the development and installation of an electronic feed-back system to provide Alliance supplier members with carcass performance data.

The eating quality assurance system has been implemented based on the research findings from the sheep meat eating quality program (SMEQ). The third-party-audited system is based on HACCP principles.

### Outcomes

#### Objective industry benefits

The trace-back system and the meat eating quality system assisted in the creation of a vertical alliance that provides increased numbers of high quality, consistent lamb product throughout the year and achieves a premium retail price which benefits all three parties (producers, processors and retailers). Sales increased (30%), as well as consumer satisfaction with branded lamb.

An average 12% premium for Q Lambs and stabilised market prices for all Western Australian lamb producers were achieved.

#### Indirect industry benefit

The Alliance is a model for other parts of the industry.

### Triple bottom line

#### Economic

Net present value is estimated at \$88 million, over 20 years, at projected adoption rates.

#### Social

Producers spoke of a new pride in their product and feeling an integral and important part of their industry. It gave producers an increased knowledge and control of their own businesses.

#### Future

The Q Lamb Alliance has now moved to conducting research into the best way to use genetics and management in the on-farm stage of the supply chain, aiming to further improve product quality whilst at the same time improving production efficiency.

## Case study: BeefNet

### Opportunity

Adoption of world's best practice supply chain management in the Australian beef industry could continue to improve its cost-competitiveness and consumer focus.

### Project

BeefNet (Beef Marketing Support Network), a five-year MLA program initiated in 1998, supported the establishment of producer groups throughout Australia and fostered a supply chain culture across the beef industry. The BeefNet mission was "to provide a self-help support network for beef marketing groups to improve viability by fostering commercial developments through consistent delivery of quality assured product".

### Outcomes

#### Objective industry benefits

##### Powerful alliance groups

BeefNet was a major catalyst for the amalgamation of almost 2,000 cattle producers into 73 local and regional beef marketing groups.

Membership of beef marketing groups gave producers a vehicle to discuss operational, marketing and industry issues among peers.

Commercial development of various branded beef products for both domestic and export markets occurred.

**Stronger supply chain networks**

All processors dealing with producers' alliance groups confirmed that new sales and marketing opportunities had been created as a direct result.

Beef marketing groups successfully established alliances with partners in the supply chain.

Some partners adopted technologies and management systems to improve beef eating quality, cost competitiveness and consumer quality assurance.

Alliance groups piloted R&D technologies such as Meat Standards Australia beef grading.

An important feedback loop between consumers, retailers and producers has been created.

**Improved on-farm management**

More than half the BeefNet producers (58%) modified the on-farm management of their enterprise as a direct result of their involvement through:

- changing breeding and turn-off times to meet specific supply demands (27%)
- reviewing carrying capacity and feeding regimes to increase compliance with market specifications (21%)
- embracing on-farm quality assurance (17%)

**Producers**

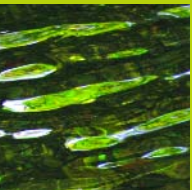
- were better informed on supply chains (100%)
- increased network opportunities with other producers (85%)
- developed marketing objectives (85%)
- received more consistent carcass feedback (84%)
- stabilised and secured cattle sales (66%)
- created avenues for higher returns (60%)

**Triple bottom line****Economic**

More than one-third of producers acknowledged increased farm profit since joining the program.

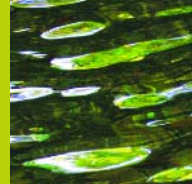
**Social**

Participation in supply alliance groups developed producers' skills to be more consistently competitive in the market place.



## PART 2

# **Improving the environment, pasture & feedbase**



## Improving the environment, pasture and feedbase

MLA has a focus on the environment and developing production systems that provide for win—win outcomes. This work has provided new understandings of production system impacts on the environment and developed thresholds and benchmarks to improve management of soil, water and nutrients. It has primed producers with the skills, knowledge and confidence to make changes to production systems that reduce on and off site environmental impacts.

Pasture species and their management and grazing practices (managing timeliness, frequency and intensity of grazing) are key actions that will directly influence environmental outcomes in:

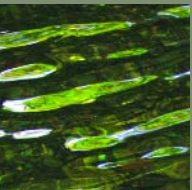
- water quality—on and off farm
- soil health
- erosion of soil by wind and water
- dryland salinity
- soil acidity
- weed ingress
- contributions to greenhouse gas
- biodiversity decline and nature conservation

Scientific investigation supported by MLA has identified grazing management practices that can maintain ground cover, reduce run-off and minimise erosion, whilst at the same time maintaining or improving productivity.

The quantity, quality and utilisation of pasture and feed grown by many Australian grazing enterprises can greatly affect productivity and profitability. Together these three factors determine the most profitable stocking rate, herd or flock structure and target markets for all grazing-based beef and sheep enterprises. MLA supports producers to develop expertise in areas that influence pasture growth and utilisation to boost their productivity, profitability and sustainability.

Environmental management is essential to the sustainability of the Australian red meat industry as the industry relies heavily on healthy ecosystems, market access and continued community support for livestock production. A critical element of MLA investment is not only the development of new knowledge but also ensuring the capability and confidence of producers to make change.

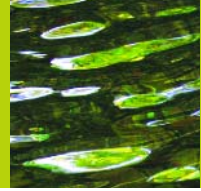
Environment is a high priority area for both State and Federal Governments as well as other R&D Corporations. MLA provides leadership and focuses heavily on collaborating with these different groups to add value to initiatives and deliver greater benefit to the livestock industry.



Case Studies

**Improving the environment,  
pasture & feedbase**





## Case study: Sustainable Grazing Systems (SGS)

### Issue

**Declining pasture productivity and sustainability of grazing systems is a major issue in the high rainfall zone (HRZ) of southern Australia.**

**Pasture degradation is responsible for reduced livestock production and is implicated in environmental problems such as dryland salinity through changed water-use patterns, soil erosion, weed ingress and biodiversity decline.**

### Program

SGS was a five-year program established by MLA and partners in 1996. SGS was established to bring researchers, producers and extension agents into a partnership that could collectively improve the productivity, profitability and sustainability of grazing systems in the HRZ. The program's overall objective was that by 2001 at least 2,000 producers in the HRZ would adopt changes to their grazing systems that can be shown to be at least 10% more profitable and also more sustainable than those they used prior to participating in SGS. SGS aimed for a further 5,000 producers to have trialled at least part of the recommended changes to grazing management systems.

The SGS program was a highly effective combination of research, a training program, and a producer network.

### National experiment model

A network of research sites was established as a single, integrated national experiment. Six sites (Albany, Hamilton, Rutherglen, Wagga, Orange and Tamworth) and five themes (water, nutrients, pastures, animals and biodiversity) provided a comprehensive understanding of the interaction between production and sustainability variables across a wide range of systems and environments. This process has arguably produced the best database for grazing systems in the world.

The national experiment model was critical in providing scientific underpinning and credibility for the recommendations made within SGS.

### Regional producer network

A regional producer network determined local issues and priorities that maximise profit and sustainability, and then managed local demonstration and delivery.

A model of research and extension was developed where an extensive and diverse group of respected producers are in control of research and development to maximise learning and on-ground change.

### PROGRAZE®†

The PROGRAZE course provides producers with the skills, knowledge, confidence and language needed to participate in and trial improved grazing systems for sustainability and profit.

### Integration and management

Integration and management was the adaptive management model adopted by SGS. The integration of research, development and extension assisted producers to understand and implement new practices. It allowed for ongoing modification and improvement, and also ensured a balance between the production, environmental and social perspectives of SGS.

### Harvest year

SGS had a 'harvest year' in 2001/2002. This was a new concept in R&D implementation where mixed teams of producers and researchers worked rapidly to analyse and interpret the results and experiences from the previous four years, and develop and deliver proven products.

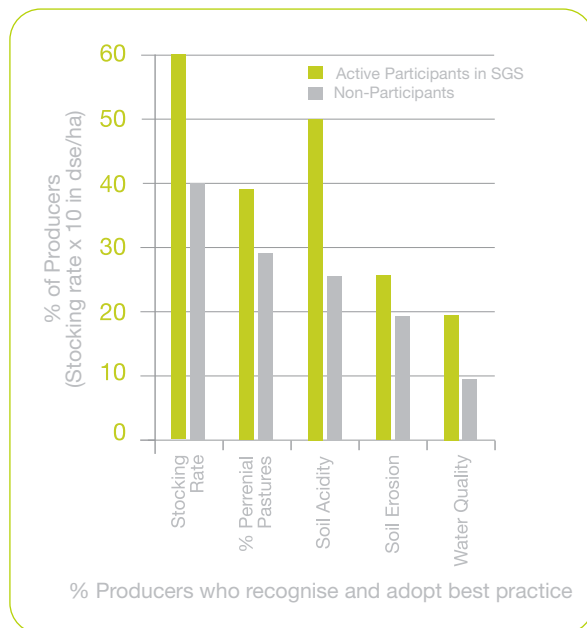
### Outcomes

#### Objective industry benefits

#### Beneficial changes to producers' grazing practices

SGS delivered significant beneficial change to producers, helping them make their operations more profitable and sustainable. Up to 8,000 producers across southern Australia who were associated with SGS have made beneficial changes to their grazing practices that they anticipated would yield financial (78%) and sustainability (81%) benefits.

Participating producers were most likely to recognise environmental issues as a problem on their properties, and having recognised the issues were more likely to adopt best practice. Active SGS participants had higher stocking rates, a higher proportion of perennial pasture, and better recognised and managed environmental issues.



Active SGS participants were very positive about the benefits of involvement in SGS to the running of their livestock enterprise, attributing to SGS many of the benefits they had gained:

- sharing information with other producers (90% of active participants in SGS indicated that it had helped them in sharing information with other producers)
- understanding environmental issues (80%)
- managing soil, water and nutrients (75%)
- managing pastures (83%) and
- managing animals (78%)

#### **A National Experiment model that can be used for future large scale agricultural research.**

The National Experiment framework has provided Australia with a new benchmark for conducting large-scale rural research.

#### **PROGRAZE®**

By 2001, 8,500 producers from about 6,400 farm businesses participated in PROGRAZE® (more than 20% of high rainfall zone producers). Since being delivered through EDGEnetwork® a further 2,800 producers have completed the workshop. For more information see the PROGRAZE® case study on page 38 of this report.

#### **National FarmWalks and harvest year models**

The National FarmWalks was an innovative extension activity organised and delivered by regional committees. The Harvest Year model delivered more from the existing research base and encouraged further adoption of outcomes by producers.

Both these models can be used in future research programs.

### **Triple bottom line**

#### **Economic**

SGS increased producers' returns and efficiencies through changed practices on-farm toward more productive and profitable grazing systems. ABARE found that SGS delivered significant and beneficial change to beef and sheep producers, helping them make their operations more profitable and sustainable.

#### **Social**

Producers and researchers experienced an increased sense of personal satisfaction in their involvement in the livestock industry.

Networks and linkages to shared information were developed.

Producers increased personal growth and improved decision making through increased skills, knowledge and understanding of grazing systems. Producers increased their confidence to make improved management decisions and to adopt new grazing management practices.

#### **Environmental**

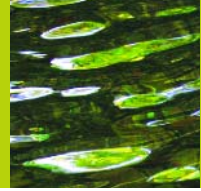
SGS developed and demonstrated more sustainable grazing systems, and environmental issues were recognised and incorporated in core activities.

Producers' knowledge and awareness of environmental issues in the grazing industries was increased, and their ability to understand and manage the key environmental themes (water, nutrients, soils, biodiversity) improved.

### **Future**

The Grain & Graze project helps mixed farming enterprises increase production of crops, pastures and animals while maintaining or enhancing biodiversity and the catchment resources that sustain them.

EverGraze—more livestock from perennials is a joint MLA and Cooperative Research Centre for Plant-based Management of Dryland Salinity project, which integrates production and environmental management. The goal of the project is development and demonstration of innovative animal production systems based on summer-active perennial pastures that are more profitable and better at reducing groundwater recharge than traditional land use systems.



## Case study: Burdekin catchment

### Issue

With an area of 130,000km<sup>2</sup>, the Burdekin River in North Queensland is the second largest catchment emptying into the Great Barrier Reef lagoon, making careful management of nutrient and sediment run-off essential to maintaining water quality and health of the reef.

Burdekin graziers contribute to the estimated 90 million tonnes of sediment that shifts from this catchment annually. This poses a threat to the reef and is a serious loss of soil and critical nutrients to Burdekin beef producers.

### Project

In conjunction with our research partners, (Queensland Department of Primary Industries and Fisheries, CSIRO and Queensland Department of Natural Resources and Mines), MLA has been funding research, development and extension into quantifying and communicating the relationships between grazing, land condition, run-off and erosion. Further, this investment has identified grazing management practices that can maintain ground cover, reduce run-off and minimise erosion whilst at the same time maintaining productivity.

These projects include:

#### Ecograz

This eight year project found:

- Maintaining ground cover at a minimum of 40% is essential for minimising losses of water, sediments and nutrients from the system and for maintaining effective cycling of water and nutrients.
- Land was maintained in good condition by continuous stocking at 25% utilisation or early wet season spelling followed by 50% utilisation.
- Recovery of pastures in poor condition was also achieved through continuous stocking at 25% utilisation or early wet season spelling followed by 50% utilisation.

#### Regional patterns of erosion and sediment transport in the Burdekin river catchment

This large data collection and spatial modelling project found:

- Surface erosion varies by three orders of magnitude across the catchment.
- 95% of the sediment exported to the coast is generated from just 13% of the catchment area.

- Only 16% of suspended sediment and 4% of bedload delivered to the river network in any year is exported from the river mouth. The rest is stored within floodplains, as sand and gravel deposits on the beds of streams, and in reservoirs.
- The high erosion risk areas are the sub-catchments downstream of the Burdekin Falls dam, the Bowen river, and parts of the upper Burdekin catchment.

#### Sustainable grazing for a healthy Burdekin catchment

A follow on to the preceding, this project extends the data monitoring and modelling work as well as testing the ability of Ecograz grazing principles in high risk land systems to maintain ground cover and reduce run-off and erosion.

#### Wambiana grazing trial

This ongoing trial is evaluating the effects of different utilisation strategies on resource condition (including run-off and soil erosion) and animal production at a scale relevant to commercial properties. One of the utilisation strategies involves adjusting stocking rates using an SOI based seasonal climate forecast.

#### Groundcover and biomass/feed availability estimates in tropical savanna system

This ongoing trial is evaluating the use of MODIS satellite imagery to measure ground cover and pasture biomass. If successful, this will enable producers to access spatially explicit, accurate information for the Burdekin catchment (and others) in near-real time.

#### Grazing Land Management

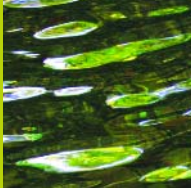
Grazing Land Management (GLM) is one of the training courses of MLA's EDGEnetwork<sup>®</sup>. GLM is a 3-day workshop which has been developed to provide the best available information on land management (including the results of the above research) in an integrated manner. The course covers topics including the calculation of short and long-term safe stocking rates, use of fire, and control of weeds.

### Outcomes

#### Objective industry benefits

Producers are more aware of the downstream impacts of grazing, and more willing to modify management practices for productivity and environmental benefit.

Findings from the studies have also assisted with prioritising of local environmental projects.



Findings are being delivered to producers through the Grazing Land Management (GLM) training module of EDGEnetwork®.

A survey in late 2003 found 34% of north Queensland producers were aware of Ecograz, and that 48% and 52% respectively considered above ground biomass and seasonal climate forecasts when adjusting their stocking rates.

### Triple bottom line

#### Social

Producers in the region are more confident that management practices are available that will help ensure the future of beef production in the Burdekin catchment.

#### Environmental

Improved management practices have resulted in less soil erosion and less degradation of local waterways and the Great Barrier Reef.

#### Future

The program is ongoing.

### Case study: Lucerne breeding program

#### Issue

**Greater water efficiency reduces environmental problems such as rising water tables and nutrient pollution of water resources. Agricultural systems also need to increase dry matter for livestock production.**

#### Project

Lucerne is recognised as the only current legume option for reducing deep drainage and subsequent groundwater recharge. Farmers grow lucerne to increase livestock production over summer and improve the sustainability of their farming system.

This program investigated various Lucerne characteristics, including: a variety of winter activities, persistence matched to farming system, high productivity, disease resistance, quality, aphid tolerance, broad adaptation to lucerne zones, seed production, grazing tolerance, salt tolerance, and seedling vigour.

The following Lucerne varieties have been developed:

#### SARDI 7

SARDI 7 is a winter-active Lucerne with improved performance over Eureka in cold wet environments and under disease pressure. SARDI 7 is expected to persist for 7–10+ years and is grazing tolerant.

#### SARDI 10

SARDI 10 is a highly winter-active Lucerne that has retained a bushy appearance. It has exceptional persistence under grazing for its class and is developed for farming systems where maximising winter production is important. SARDI 10's largest market is in low-medium rainfall cropping systems, but it is by far the most suitable Lucerne for highly intensive, short cycle grazing rotations (ie, graze back times of 15–20 days) on dairies or hay properties.

#### SARDI 5

SARDI 5 is a semi winter-dormant Lucerne to be released in 2005. A replacement cultivar for Prime and PL55, SARDI 5 is highly resistant to every major Lucerne disease and is bred for Australian conditions. SARDI 5 will be grown where premium quality hay is desired, or in permanent pastures in cold, wet environments for summer production in mixtures with winter-active grasses.

### Outcomes

#### Objective industry benefits

Improved Lucerne cultivars are available and Septre and Eureka are now being phased out. SARDI 5, SARDI 7 and SARDI 10 are replacement cultivars that offer additional opportunities for farming system integration.

Royalties generated from the seed sales provide R&D opportunities in Lucerne development.

### Triple bottom line

#### Economic

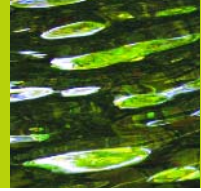
Increased livestock production and reduced pasture management costs result from application of improved cultivars.

#### Environmental

Increased planting of Lucerne is actively being promoted to reduce water tables and assist in addressing dryland salinity.

#### Future

A greater extension effort is underway promoting the benefits of Lucerne for production and salinity management. Further screening can provide benefits for tolerance to aluminium toxicity and development of new cultivars with these traits.



## Case study: Biological weed control for Paterson's Curse and thistles

### Issue

**Paterson's Curse is a dominant pasture weed in temperate Australia that causes loss of pasture production. It can also reduce livestock weight gain and wool production and in severe cases can lead to stock death. Thistles (onopordum, slender, nodding) also reduce pasture productivity and can cause injury to livestock and shearers.**

**Insects could provide a biological control for these weeds resulting in a decreased need for herbicides and an increase in pasture productivity.**

### Project

MLA has made a long-term investment in biological weed control projects with Australian Wool Innovation Limited (AWI), CSIRO Entomology and other partners. Fourteen insect agents were successfully released, and monitoring of these biological control agents is currently in various stages of progress. Producer groups and Landcare have established and maintained regional and strategic nursery sites.

### Outcomes

#### Objective industry benefits

The nature of the project means that significant benefits will only be evident in the long-term, although some producers are already experiencing tangible benefits. These are the likely outcomes:

- reduced need to use chemicals
- improved pasture and livestock performance
- reduction in weed seed banks
- increased stocking rates
- improved stock movement to feed and water
- lower penalties for contaminated wool
- improved stock health
- reduced environmental impacts
- reduced tillage

#### Intangible benefits

Producers gained experienced with biological weed control programs.

The project provided a basis for improved collaboration between MLA, AWI, CSIRO and state agencies.

### Triple bottom line

#### Economic

Annual benefits in terms of increased productivity of grazing lands are projected to rise from near-zero in 2000 to some \$75 million by 2015. The net present value for the 1972–2050 period is estimated to be \$1.074 billion (calculated using a 5% discount rate).

Producers report noticeable decreases in numbers and spread of thistles resulting in less chemical needed, reduced weedicide spraying costs, decreased negative impact of chemicals and weeds on livestock, and reduced aerial spray costs. Others indicated that substantial financial benefits would be evident in the future.

#### Social

Community engagement has improved through the Landcare and Catchment Authority networks.

#### Environmental

Reduced chemical use and fewer weeds benefit the environment.

#### Future

An integrated weed management approach to capture benefits from tactical use of grazing, herbicide and fertiliser in conjunction with biological agents is underway. MLA is also investing in biological control research for Giant Rats Tail grass—a major weed of coastal Queensland and northern New South Wales.

## Case study: National Beef Cattle Feedlot Environmental code of practice

### Opportunity

The feedlot industry needed to draw together divergent opinions on standards of environmental management across Australia and consolidate it into a single approved document that would form the basis of future environmental activity.

### Project

The development of the National Beef Cattle Feedlot Environmental code of practice was initiated in 1998 to address the environmental legislative requirements of all States and Territories.

The process adopted for the development of the code was consistent with the approach employed in the successful development of the *National Guidelines for Beef Cattle Feedlots in Australia*, satisfying the requirement to achieve a balance between self-regulation and public accountability.

Representatives of all government agencies that had environmental regulatory interactions with the feedlot sector were directly involved in the code's development, along with relevant industry organisations.

The Standing Committee on Agriculture and Resource Management (SCARM) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) endorsed the code in March 2000.

The Feedlot Industry Accreditation Committee has adopted the code as a replacement for the ALFA *Code of Practice for Protection of the Environment*, ensuring that all feedlots accredited under the National Feedlot Accreditation Scheme must now comply with the code.

### Outcomes

#### Objective industry benefits

The code provides nationally accepted environmental performance objectives, operational objectives and practices that can be used by feedlot management and staff to achieve compliance with the environmental duty of care.

As a result of the development of the code, Victoria has phased out its regulatory monitoring of feedlot environmental performance in favour of an industry self-regulatory approach. Other states are looking at following this example.

#### Indirect industry benefits

The code provides industry agencies, the community and government regulatory authorities with a benchmark against which to assess the industry's performance, underpinning community confidence in the environmental performance of the industry.

A partnership between industry operatives, Government and community representatives in addressing identified industry issues is a model that could be used in other areas.

### Triple bottom line

#### Economic

Operators are starting to identify benefits in production parameters and compliance with product specifications from improved environmental practices.

#### Social

Feedlot operators have worked collaboratively with government and community representatives resulting in an improved community perception of the industry's environmental performance.

#### Environmental

The feedlot sector has made improvements in environmental practices. MLA with industry has initiated a survey to measure this.

#### Future

The Feedlot Industry Accreditation Committee is currently considering a revision of the code to incorporate new information from R&D activities and the practical experience of operators. The updated code will be incorporated into the National Feedlot Accreditation System, ensuring its adoption by all operators.

Case Studies  
**Pasture & feedbase  
management**





## PROGRAZE® †

### Opportunity

**Opportunities were identified to facilitate change in producers' attitudes to grazing management and help them gain the knowledge of pasture and animal assessment emerging from research.**

### Project

Conceived by NSW Department of Agriculture, the development of PROGRAZE® was supported by MLA (then the Meat Research Corporation). Following a successful first year, MLA then supported the development of the same basic model of content and delivery in association with the State Agriculture Departments in Victoria, Tasmania, South Australia and Western Australia.

Initiated in 1994, PROGRAZE® was a nation-wide training program developed for producers, primarily conducted in each state by the relevant state department.

By 2001, 8,500 producers from about 6,400 farm businesses have participated in PROGRAZE® (more than 20% of high rainfall zone producers). The program relied on participative group learning where producers shared their skills with each other and delivery staff, and vice versa. PROGRAZE® is now being delivered under the EDGEnetwork® banner and over 2,800 producers have completed the workshop since 2001.

### Outcomes

#### Objective industry benefits

PROGRAZE® gave producers the skills, knowledge and confidence to make improved decisions on matching pastures and animals. PROGRAZE® changed the attitudes and practices of most producer participants towards pasture management and sustainability. For instance, around 50% of participants have adopted rotational grazing since attending.

PROGRAZE® influenced participants to make changes that they believe will benefit them financially (89%) and improve the productivity and sustainability of their grazing enterprises (95%).

#### Intangible benefits

PROGRAZE® provided a practical adult learning environment where producers are able to determine principles of grazing management which they can apply in their own situation. It also became a stepping stone to deliver other related workshops within the group environment.

### Triple Bottom Line

#### Economic

The net annual benefit per farm is \$3,000. Over 20 years, the net present value is \$147 million at present adoption rates, and \$580 million at projected adoption rates.

#### Social

PROGRAZE® groups provide a supportive environment for producers who report having increased confidence in their management decisions.

#### Environmental

95% of producers consider the knowledge and skills they have gained results in more sustainable pastures. Benefits from PROGRAZE® are likely to include improved management of perennial pastures, better water usage and less opportunity for weed development.

#### Future

PROGRAZE® is being delivered through EDGEnetwork®, and continues to attract new participants. The PROGRAZE® content is regularly updated by current research findings.





## Case study: Silage for prime lambs

### Opportunity

Many farmers often have surplus forage that otherwise has no direct use. Silage could be used to finish lambs, particularly in winter. Lamb prices are generally higher in winter due to lack of supply, hence being able to finish lambs in winter would increase profitability.

### Project

The project was conducted at the NSW Agriculture Research and Advisory Station in Cowra during 1997–99. The project successfully showed that lambs fed high quality silage can reach target weights in winter and that meat quality is unaffected. Even better results were demonstrated when silage was used in combination with grain. Silage production was shown to increase productivity of pastures by reducing weed infestation, hence increasing stocking rates. Improved pasture yield and quantity due to silage cutting in spring was demonstrated. This project has provided information to producers to consider silage as an option for finishing lambs under different economic and management conditions.

### Outcomes

#### Objective industry benefits

Producers are well positioned to adopt silage production when economic circumstances change. In some areas many producers now use silage for either lamb finishing or ewe maintenance as a result of this project.

#### Triple bottom line

##### Economic

The net annual benefit was assessed as \$9,787 per farm, over a period of 20 years.

Silage is a financially beneficial option when grain prices are at a certain level.

##### Environmental

Silage reduces weed infestation and increases quality of pastures.

##### Future

When economic parameters change, use of silage may be favourable for some producers.

## Case study: Speargrass, wiregrass, animal management project (SWAMP)

### Issue

Black speargrass pastures in the southern speargrass zone in Queensland were degraded.

### Project

Conducted jointly with the Queensland Department of Primary Industries and Fisheries, research found specific pasture management practices that would restore pastures to a better composition of less wiregrass and more black speargrass. These practices are annual spring burning for three years, coupled with summer destocking for four to six months or reducing the stocking rate by half. Producers were strongly involved in this program. Demonstrations were located on commercial properties and producer groups were involved in each demonstration.

### Outcomes

#### Objective industry benefits

Restoration of degraded speargrass pasture to a sustainable speargrass pasture was shown to be practically feasible on commercial properties, and quantified for cost and time.

Producers are enabled to make better decisions about their pasture and stock management through the knowledge and principles acquired through the program.

The program had the following benefits to producers:

- more sales per breeder (16%)
- more Kg per sale (35%)
- increase in per Kg price (15%)

#### Triple bottom line

##### Economic

The net present value was assessed at \$3.8 million in 2001, with a net annual benefit per farm of \$34,196 and \$30 million at projected adoption rates, over 20 years.

##### Social

Farmers gained support from each other and researchers, and influenced the way the project was organised.



### Environmental

The project demonstrated how a degraded native pasture can be restored to a sustainable and more productive state on commercial properties.

### Future

This project provides a model for taking research results to industry in a participative way that greatly improves the likelihood of adoption. The outputs from the project continue to influence on-farm management through their inclusion in the grazing and fire management sections of MLA's EDGEnetwork® workshop on Grazing Land Management.

## Case study: MoreLamb

### Opportunity

**Different pasture management enables producers to increase lamb production.**

### Project

In 2004, MLA joined with the Department of Primary Industries Victoria to investigate pastures that could increase lamb production. Five commercial properties in south-western Victoria were partners in the research.

### Outcomes

#### Objective industry benefits

The project demonstrated on-farm pastures that increased lamb production by 30-40% compared to normal practice. Summer grazing of lambs on arrowleaf clover, compared to ryegrass/clover mixtures and subterranean clover monoculture pastures, was found to give high quality lambs with higher growth rates. It was also identified that some new pasture species and cultivars can extend the pasture-growing season to improve production efficiency.

This project provides the knowledge for lamb producers to be able to extend the growing season with new pastures, and improve the continuity of supply of lamb to the marketplace.

#### Intangible benefits

The partnership between the scientists and the collaborating producers has encouraged further on-farm trialling of options for improving production efficiency. It has also stimulated new ideas for research and for immediate implementation that aim to improve lamb production efficiency and profitability.

### Triple bottom line

#### Economic

Less seasonal fluctuation in availability of lamb assists all levels of the supply chain.

Lamb production was increased from grazing arrowleaf clover by 30-40%.

#### Environmental

The new pasture varieties, together with better management of existing grazing systems, have improved pasture utilisation, and hence water use efficiency should also be improved. By spreading the grazing load across time, grazing pressure at key times is reduced, which reduces the risk of over-grazing that leads to bare soils, excess water run-off, salinity and soil erosion.

#### Future

The data generated from the on-farm sites will assist in the development of realistic weightings on the factors contributing to profit in a lamb production system. A decision-tree framework and database to enable MoreLamb producers to identify critical points in lamb production to increase profitability is being developed.

This project has stimulated new applications for using existing cultivars and likely will lead to further on-farm R&D in this area. Participating producers are experiencing production benefits and within the high rainfall areas of Victoria and southern South Australia there is now a greater awareness of pasture species and high input finishing of lambs.

## Case study: Tagasaste

### Issue

**The perennial shrub Tagasaste had been planted on poor sandy country in the West Midland and Esperance areas of Western Australia in the 1980s and was responsible for a three to five fold increase in carrying capacity. However, cattle feeding on tagasaste were failing to gain weight when livestock exporters required them in late summer and autumn, even though the foliage was green and leafy.**

### Project

Department of Agriculture WA, with cooperation from scientists at Murdoch University and CSIRO, developed grazing and supplementary feeding strategies that overcome the reduction in growth rate in cattle when grazing Tagasaste in late summer and



autumn. Researchers found good evidence that branch chain volatile acids arising from protein fermentation may be a limiting factor for microbial protein supply and that supplementing with lupin grain would overcome Tagasaste's limitation.

## Outcomes

### Objective industry benefits

Up to 50% of the beef businesses using Tagasaste are using lupins as supplements when they need to meet particular market weights and times.

The age that steers reach sale weight has been reduced from 22 months to 17 months. Adoption by up to half the beef producers so soon after project results were available indicates that the project provided a simple, economically viable solution to a real need. Further uptake is expected.

### Triple bottom line

#### Economic

This is a highly cost-effective way to overcome lack of cattle growth. In 2002 the net annual benefit per farm was assessed at \$7,000, with a net present value \$2.8 million, and \$9.7 million at projected adoption rates, over 20 years.

#### Environmental

Tagasaste provides stability to sand-based soil in Western Australia, reducing wind erosion, and it can lower the water table thus helping to reduce further salinity.

#### Future

Forage shrubs provide a new layer of feed for livestock, as well as producing production benefits through shelter and reducing water loss to the water table (arresting dryland salinity). The EverGraze project (see below) is incorporating shrub investigations for recharge benefits, and scoping work of a larger multi-agency underway.

## In brief: Grain & Graze

Grain & Graze is a research program that is working with producers and catchment groups in Australia's wheat-sheep zone to improve on-farm profitability and productivity while also achieving local catchment management targets. Grain & Graze is a joint initiative between MLA, Grains Research and Development Corporation, Australian Wool Innovation Limited and Land & Water Australia.

The key objectives of Grain & Graze are more profit for broadacre farmers (especially from the pasture

phase of rotations), better water quality (eg reduced recharge through using deep-rooted pastures) and enhanced condition and diversity of plants and wildlife on farms and across catchments.

The Grain & Graze partners are working together to share the huge amount of information and knowledge that is already available about the best ways to manage farming systems within a catchment context. Producers, researchers and catchment planners will design and implement on-farm trials to improve the understanding of the financial and environmental impact of broad acre management.

Grain & Graze aims to increase profitability of livestock production by 10% and of crop production by 5%.

## In brief: EverGraze-more livestock from Perennials

A joint program of MLA and the Cooperative Research Centre for Plant-based Management of Dryland Salinity, EverGraze is investigating perennial-based grazing systems to reduce groundwater recharge and increase productivity for producers in the high rainfall zone. EverGraze is investigating the whole farm system of pastures, animals and management. The program is applying a common high-performance lamb production system and using perennials strategically to achieve high weaning percentages and therefore improve profitability. The project is developing and testing new farming systems in different environments to ensure relevance across the whole of the high rainfall zone of southern Australia. Through modeling, EverGraze will estimate catchment-scale impacts of the widespread adoption of future farming systems.

EverGraze is aiming for increases of up to 50% in profitability of a dual-purpose sheep enterprise while reducing groundwater recharge by 50%.



PART 3

## **Improving delivery & capacity building**



## **Improving delivery and capacity building**

MLA is committed to supporting the Australian red meat industry to adapt to change through building the capacity of producers as well as advisers, researchers, scientists and students in the livestock science area.

Capacity building is the fostering of people's ability to acquire knowledge and manage change to achieve goals.

### **Producers and advisers**

MLA engages in a number of activities to communicate results of its R&D to producers and encourage them to change management practices for increased profitability and sustainability. Methods to assist producers adopt R&D range from traditional information access and technology-transfer techniques to a facilitated adult learning approach with an emphasis on active user groups.

### **Researchers and scientists**

MLA supports future and current researchers and scientists in the area of livestock production and environmental sustainability to build scientific capacity in the Australian community for the future. In particular, recipients of its post-graduate scholarship program have made significant contributions to the red meat industry during their careers, with more than three quarters still in the industry or wider Australian agriculture.

### **Students**

MLA supports the agricultural education sector through a variety of programs. Targeted at secondary, vocational and tertiary levels, it jointly invests with the Australian Sheep Industry Cooperative Research Centre to encourage students to pursue careers in the sheep industry and update and develop skills and knowledge needed by the industry. MLA also supports a number of scholarship programs for students including the Australian Rural Leadership Program, the Nuffield scholarship and various undergraduate courses.



## Case study: Prime Time

### Issue

**In 2003, a chronic shortage of sheep and lambs until at least 2007 was predicted. MLA recognised this as a serious threat to producer sustainability and Australia's reputation as a reliable, global supplier of lamb, mutton and wool. In addition, there were significant opportunities for on-farm productivity improvements to offset declining producer terms of trade.**

### Project

Supported by the Sheepmeat Council of Australia, MLA with event partners the Sheep Industry Cooperative Research Centre, Landmark, Roberts and Elders, developed the Prime Time campaign to raise awareness about the shortage, the opportunities in lamb and sheep meat production, and practices that boost flock productivity and profitability. Key programs and resource materials were promoted to help producers boost their sheep numbers and flock productivity through increased fertility, flock management, stocking rates and carcass weights. Key genetics-based breeding and selection tools were showcased. Producers attending Prime Time forums were given information to enable them to:

- wean up to 10% more lambs
- get up to 50% more from pasture
- increase profitability from ewes by up to 25%

The first phase of these forums, conducted in spring 2003, was aimed at sheep/lamb producers in the Wheat-Sheep Zone, particularly to encourage increased sheep/lamb production from these areas.

The second phase, *Making More from Merinos*, was conducted in 2004 (and in early 2005 in collaboration with AWI), and targeted Merino producers. It encouraged producers to rebuild the declining national Merino ewe flock, the critical link in the supply chain for first and second cross lamb production.

The third phase, *Prime Time for Prime Lambs*, ran in autumn 2005 and focused on improving the productivity of prime lamb producers.

Over the three campaigns, more than 60 producer forums have been held in rural/regional areas across six states (including other producer forums in which Prime Time information has been presented). Approximately 18,000 producers were reached with the Prime Time information during 2003–2005.

In addition to the forums, MLA has provided other opportunities for producers to extend their knowledge, skills and confidence through:

- a) specialist hands-on workshops for small groups of producers in conjunction with stock and station agents
- b) funding for lamb and sheep producer groups to conduct on-farm flock 'productivity' research trials
- c) more in-depth training in specific subject areas through MLA's EDGENetwork®

### Outcomes

#### Objective industry benefits

More than two-thirds of lamb/sheep producers (67%) participating in Prime time/Making More from Merinos activities have changed management practices as a result of their participation (including improving pasture management, reviewing lambing management and joining practices, sourcing better genetics, improving ewe/weaner nutrition, considering lot-feeding/finishing of lambs, and thinking about performance in terms of production per hectare rather than per head).

Mixed farmers adopted better on-farm management practices. Producers using LAMBPLAN® rose from 9% to 42%, use of Merino Genetic Services increased from 6% to 28%, and use of PROGRAZE® principles increased from 6% to 12%. Three-quarters of mixed farmers agreed higher sheep productivity could be achieved without affecting grain production. Mixed farmers intending to increase the size of their flocks (when seasons returned to normal) increased from 13% to 37%.

MLA's 2004 Lamb Survey reported a 16% increase in ewes mated to produce Merino lambs, a 13% increase in estimated number of lambs on hand, a forecasted 5% increase in ewes joined to produce prime lambs, a 9% increase in expected lamb sales in that spring, and 25% the following autumn.

While the 2005 Lamb Survey indicates a continued but slight increase in the number of lambs on hand at national level, particularly Merino lambs, drought and wool prices have placed downward pressure on lamb numbers in some key lamb-producing areas. Where these issues are not a factor, lamb supply is expected to continue to show significant growth.

While seasonal factors and market pricing clearly play a significant role in producers' decisions, Prime Time



has created awareness in lamb and sheep producers of the opportunities for increasing production, and provided the practical tools and information to assist them to change their management practices to take advantage of those opportunities.

### Triple bottom line

#### Economic

Increased productivity per hectare will lead to improved profitability (depending on ruling market prices) and potentially securing of market access by meeting market specifications.

#### Social

Producers have increased their knowledge, skills and confidence to change management practices. Increased sheep and lamb production will maintain Australia's reputation as a reliable, global supplier.

#### Future

Lambmax is a new research program to maximise lambing rates and boost lamb survival. Its objective is to optimise lean meat yield by integrating genetics, pasture use, animal health and welfare, and enhanced carcase feed back.

Links with consultants and supply chains are being developed to help producers reduce their lamb production costs per hectare by optimising market specifications, genetics, pasture resource management, and marketing initiatives.

The Superlamb project will identify key genetic factors, pasture and reproductive management that influence lamb eating characteristics to address human health issues (eg, essential trace elements, omega 3 fatty acids etc).

Programs for sheep meat eating quality and future sheep genomics are being implemented through producer networks.

### Case study: EDGENetwork®

#### Opportunity

**MLA's livestock production R&D programs continually identify opportunities for producers to increase their profitability and sustainability by adopting current technologies. MLA can encourage producer learning and help to equip producers with the skills and knowledge to assist them in their on-farm decision-making through programmed learning.**

#### Project

EDGENetwork® is a range of 50 practical workshops and learning opportunities which help livestock producers gain knowledge and develop skills to improve their enterprises. In partnership with the Victorian Department of Natural Resources and Environment, MLA developed EDGENetwork® in 1998. EDGENetwork® is now a nation-wide training program for producers through independent licensees and deliverers in each state. To minimise duplication and maximise coordination of the EDGENetwork® program, MLA worked with the formal education and training sector in developing the program.

There have been more than 9,500 producer participants in EDGENetwork® workshops developed under seven content areas:

- pastures/feedbase
- animals
- natural resource management
- people
- business/finance
- quality assurance
- marketing

#### Outcomes

##### Objective industry benefits

As a result of their participation 78% of producers have changed at least one management practice: increasing pasture production, stocking rates, natural resource management and business planning to meet market specifications.

Producer participants have reported increased capacity or skills in these areas:

- purchasing sires on Estimated Breeding Value (EBV) scores
- formulating supplements for feed mixes
- estimating pasture quantity and availability
- adopting advanced grazing strategies
- adopting early weaning strategies to increase profit and run more stock
- using future pricing tools

An established delivery system for R&D information to producers, EDGENetwork® has resulted in a greater uptake of past R&D findings by livestock producers.

Participants report high satisfaction with the quality of the workshops (average score of 8.2/10).



## Triple bottom line

### Economic

Producers reported an increase of about 4-5% for short-term productivity and/or profitability and long-term increases of up to 12%.

### Social

EDGE**network**<sup>®</sup> has improved producer knowledge, skills and confidence to change management practices.

### Environmental

Producers improved their on-farm management practices for natural resource management

### Future

EDGE**network**<sup>®</sup> is an ongoing program. Modules are added to maintain relevance.

## Case study: BeefCheque<sup>®</sup> /LambCheque<sup>®</sup>

### Opportunity

**The capacity of producer groups to identify key information and develop skills to improve grazing management practice could be increased using a group learning model. The producer community created the demand for these groups.**

### Project

Funded by MLA, the Department of Primary Industries Victoria and the Beef Improvement Association, BeefCheque<sup>®</sup> commenced as a pilot project of 15 groups of Gippsland beef producers (total 420 producers) in 1995 and ran until 2000. Over 1000 beef businesses from 65 groups have participated in the program, 27 of which have completed all three years of BeefCheque<sup>®</sup> (281 businesses). Four LambCheque<sup>®</sup> groups have also been completed (36 businesses). Each group meets approximately once a month, usually at a focus farm owned by one of the producers. Led by an expert consultant, the producer group has a 'farm walk' and discussion, and decides what is to be done on the focus farm. Future meetings examine the results of these decisions. Producers control the groups' agendas.

### Outcomes

#### Objective industry benefits

BeefCheque<sup>®</sup> and LambCheque<sup>®</sup> have equipped producers with pasture management principles and the confidence to use them. Two reports on the impact of BeefCheque<sup>®</sup> in Gippsland have shown

significant benefits to participating producers in terms of practice change, increased productivity and profitability.

In the pilot project it was demonstrated that participating producers gained an average of 18% liveweight output per hectare and significant increases in saleyard price, gross farm income, net income and farm operating surplus.

At the end of the first five years, 94% of respondents had tried one or more new grazing management practices, and 54% had tried at least 11 new grazing management practices.

An analysis of all farms involved in benchmarking over four years (10-21% of producers involved in BeefCheque<sup>®</sup>) showed significant increases in total liveweight output (+157kg/hectare), saleyard price (+\$0.39/kg beef liveweight), trading profit (+\$240/hectare), net income (+\$268/hectare) and farm operating surplus (+\$287/hectare).

#### Indirect industry benefits

BeefCheque<sup>®</sup> has provided a good model for extension to other parts of the red meat industry and an excellent example of effective technology transfer through partnerships between producers and expert advisers. Benefits were also experienced outside the groups through participants influencing other producers in their local areas to adopt changed new practices.

## Triple bottom line

### Economic

In 2002 net annual benefit per farm was assessed at \$4,650, net present value at \$11 million, and \$27 million at projected adoption rates, over 20 years.

### Social

Producers benefited from a network of peers where problems can be openly discussed, particularly in difficult times such as drought.

### Environmental

The rotational grazing system, a central part of the management system adopted by BeefCheque<sup>®</sup> and LambCheque<sup>®</sup> producers, is effective in minimising the area of a property that is exposed to poor ground cover. This reduces weed invasion and soil erosion and makes better use of water. Pasture management knowledge also enables better decisions about the use of herbicides and fertilisers.





## Future

BeefCheque® and LambCheque® continue to be delivered across Victoria under the EDGENetwork® banner.

## Case study: Postgraduate scholarship program

### Opportunity

**The industry needs innovative scientists with experience and an interest in livestock science to conduct R&D and become leaders for the industry.**

### Project

MLA supports the bridge from education to agricultural research through its postgraduate program and various scholarships. 223 postgraduate students have been supported through MLA and its predecessor organisations since 1975.

The scholarship program supports students doing postgraduate studies (mostly PhDs) for the three years of their candidature. Students receive a stipend higher than Australian Postgraduate Award stipends, plus support for project costs. Students' projects are varied and cover a wide range of industry-related topics, and include all areas of interest in MLA's livestock production R&D programs. Many students supported by this scheme are working within these funded research programs, whilst others are working on projects independent of MLA programs. Upon completion, more than 70% of students supported by this scheme continue to work within the meat and livestock industry. A significant proportion go on to play important leadership roles in agricultural and livestock industries.

Students are supported for the three years of their candidature, and the program is ongoing with an intake of around 10 students per year.

### Outcomes

#### Objective industry benefits

Around 75% of MLA scholarship recipients have made high-level contributions during their careers and around 79% are still involved in various segments of the red meat industry and other aspects of Australian agriculture.

## Intangible benefits

A number of current industry leaders have been supported in their postgraduate studies by MLA and its predecessors.

## Triple bottom line

### Social

The capacity of the research community to deliver science to advance the industry in the future is increased.

### Future

The program is ongoing with an intake of around 10 students each year. The program may be further enhanced through a post doctoral fellowship program and specific undergraduate leadership training.

## Case study: BeefPlan

### Issue

**Conventional top-down scientific research does not always result in research results being widely adopted on farms.**

### Project

BeefPlan is an experiment in producer driven research, development and extension. Launched in 1998 by MLA, BeefPlan formed and funded groups of producers in the northern Australian beef industry to develop improved and sustainable property management systems in whatever ways producers saw fit. There are around 11 groups and 110 members.

BeefPlan members undertake strategic planning and synthesise available information to develop systems and tools for integrated whole property management in their own businesses.

### Outcomes

#### Objective industry benefits

Producers have developed systems and tools to effectively integrate production and resource management.

Producers and researchers have an improved understanding of whole-farm systems. BeefPlan producer-run events, attended by other BeefPlanners and members of the industry, lead to increased knowledge as well as awareness of the need for greater knowledge.



### Intangible benefit

Producers become more confident and capable in decision-making.

### Triple bottom line

#### Economic

The financial bottom line of many of the BeefPlan group members has improved due to BeefPlan activities, although this is not always easily measured or separated from non-BeefPlan causes.

#### Social

BeefPlan has contributed to the development of strong social support networks of producers that improve family, group and industry relationships and increase personal confidence in managing the business.

#### Environmental

When making decisions affecting their production and financial performance, environmental factors are considered. At least two of the groups have experimented with Environmental Management Systems and this has benefited the industry.

#### Future

Existing groups and new groups have a three-year agreement with MLA.

## Case study: More Beef from Pastures

### Opportunity

**Livestock production has become increasingly complex due to the social, political, natural and economic operating environments and the vast array of available technologies. Technologies developed from R&D are not universally appropriate for all businesses and environments. The challenge for producers is to identify and focus on the 20% of decisions that have 80% of the impact on their profitability and sustainability, and to choose the most appropriate technologies for their circumstances. This includes their physical resources, access to capital, attitude to risk and social perspective.**

### Project

More Beef from Pastures covers the whole beef business, recognising that every beef enterprise is different and the producer is the key decision-maker. This is the first time that the industry's best practice recommendations and key research outcomes have been assembled in a do-it-yourself decision support tool designed by producers.

The MLA More Beef from Pastures program has three key components:

- a producers' manual to enable producers to make the right decisions for their situation
- an awareness and support program
- direction to further training and advisory services

As a result of participation 66% of southern beef producer participants have changed management practices. In the program's first 12 months 4,000 manuals in hard copy and CD have been sold (representing around 6% of southern beef businesses) and over 3,000 producers have attended a forum featuring the More Beef from Pastures program. This is considerable given the drought conditions at the time, and reinforces the risk management approach of the program.

### The producers' manual

This do-it-yourself, step-by-step guide to getting the most important decisions right was written by leading southern beef producers using the HACCP risk management process, with support from technical experts. The manual has been designed so that new or improved tools can be added as they become available from R&D.

### Awareness and support program

This program to encourage implementation of the manual by producers and service providers is spearheaded by a national coordinator, six state department based coordinators<sup>1</sup> and a group of producer advocates. Activities include partnering in producer and service provider forums, specific More Beef from Pastures forums and field days, and trade displays at larger events. Workshops on key parts of the manual are also conducted.

### Extended learning opportunities

The More Beef from Pastures program is positioned to lead producers to public and private sector training and advisory services to increase their depth of understanding of the key principles and tools included in the More Beef from Pastures program. These include MLA's EDGE<sup>network</sup>® courses and grants for producer group demonstration trials.

### Outcomes

#### Objective industry benefits

On a single enterprise basis, adoption of decision-making processes and underpinning practices from the More Beef from Pastures program have been shown to result in a doubling of return per hectare, while improving the natural resource base and enabling control of risk associated with climate variability and market volatility.

**Indirect industry benefits**

Producers applying the manual are well positioned to receive and implement new knowledge and tools resulting from ongoing R&D immediately. Likewise, they are well positioned to identify potential new R&D that will improve their decision making.

**Intangible benefits**

Collaboration is promoted between MLA, R&D providers and the private sector.

**Triple bottom line****Economic**

The More Beef from Pastures framework is designed to help producers identify the critical parts of their beef business where they can increase profitability.

Increasing pasture utilisation by 10%, which is demonstrably achievable by application of relevant More Beef from Pastures key principles, would result in a net present value of \$280 million, based on a conservative adoption rate of 30%. Application of key principles for genetic selection alone would result in a net present value of \$70 million over a period of 20 years.

**Social**

Producers are empowered as the decision maker rather than being the passive recipients of technologies. This builds producers' confidence in their ability to manage risk.

**Environmental**

Implementation of the More Beef from Pastures principles can improve soil fertility, soil structure, clean groundwater run-off, as well as increasing carbon sequestration and the efficiency of rainfall use. More efficient conversion of pasture to meat and more appropriate land class use would result.

**Future**

New and improved tools being developed in a number of R&D programs will be incorporated within the More Beef from Pastures framework to enhance its application for producers. One example is the Rainfall to Pasture Outlook tool, which is a web-based application that uses meteorological records, and links with the current Southern Oscillation Index to provide a three month outlook for rainfall and pasture growth. This assists producers with management decisions such as stocking rates and pasture utilisation.



## Case study: PIRD® (Producer Initiated Research and Development)

### Opportunity

There is an ongoing interest by producers in trialling technologies to solve local issues.

### Project

The PIRD® program was started in 1992 by MLA's predecessor the Meat Research Corporation. The program aimed to enable cattle, lamb, sheep meat and goat producers to conduct R&D to address everyday problems and find practical solutions using an adult learning approach, and to trial new technologies in their own environments.

PIRD® is a producer research support program providing grants of up to \$15,000 over three years to producer groups. Projects that are supported with a grant are selected by an Evaluation Committee according to industry, MLA and program objectives. The proposal must have direct value for the beef and/or sheep meat production activities of its group members. It must attempt to solve local problems and improve industry productivity. Measuring project achievements requires the assessment of the change in the performance of an enterprise.

Major users have been independent beef and sheep producer groups and production/marketing alliances. The next largest user group has been formal associations and their branches and networks, for example the Beef Improvement Association.

PIRD® groups commonly conduct research in the areas of animal production, farm management and breeding, pastures, feed and grazing.

### Outcomes

#### Objective industry benefits

Overall this program has directly involved about 15,000 producers across Australia, of which 7,458 have been involved since MLA formed in 1998. PIRD® groups typically extend their information and learning to other producers, so it is estimated that a similar number of producers have been indirectly influenced by PIRD outcomes.

Independent evaluation has shown that on average 67% of producers that participate in a PIRD change

management practices as a result. Over time, other producers with similar issues have observed or heard of PIRD® results and made practice changes.

#### Indirect industry benefits

MLA has received direct market feedback on issues of producer interest through producer groups identifying a problem and committing to testing and applying ideas.

#### Intangible benefits

PIRD® helps establish producer support networks.

### Triple bottom line

#### Economic

Economic modelling has suggested a return to producers and the meat industry of \$25-30 million on 170 projects in the 9 years up to 2001.

#### Social

Producer networks and linkages have been developed in order to share information, and many of the PIRD project groups have gone on to develop further R&D within their enterprises or regions. This has built producers' confidence in their abilities to identify problems and possible solutions and to test those solutions for themselves or in partnership with researchers.

#### Environmental

Improved natural resource management has occurred for those projects focusing on this component of the grazing system.

### Future

This program is ongoing.

### Rotational Grazing Project, Badgingarra PROGRAZE® PIRD group, Western Australia, 2000

This 17 member group visited farms where rotational grazing had been implemented, to identify the likely obstacles and ways of overcoming them when establishing and implementing rotational grazing. They developed a plan for the implementation of rotational grazing on four properties as a demonstration. The remaining group members trialled rotational grazing by splitting one paddock into four or five sections and moving stock on rotation through these sections.



All of the PIRD group members learnt how to implement and manage rotational grazing. As a result of this project, the group members now have a much better understanding of how to manage their pastures to optimise production. One of the objectives of the project was to compare the performance of rotationally grazed paddocks with continuously stocked paddocks. Most group members felt that the benefits obtained from rotational grazing compared with continuous grazing were too great to be bothered with maintaining the continuous grazing paddocks simply for the purpose of comparison.

### **Outcomes**

About half of the respondents are now using rotational grazing over all of their properties. The rest of the respondents said they use rotational grazing on 20-80% of their properties.

## Notes

Unless otherwise specified, all net present values cited in this report are calculated using a discount rate of 7% over a period of 20 years.

\* Estimated Breeding Values (EBVs) for sheep are to be referred to as Australian Sheep Breeding Values (ASBVs).

† PROGRAZE® is a trademark owned by NSW Department of Primary Industries.

§ The *EDGEnetwork*® concept is jointly owned by Meat & Livestock Australia Limited and the Department of Primary Industries, Victoria.

|| Except in Victoria where the Mackinnon project is contracted.

# MLA and its predecessors have been involved with three Beef CRCs, commencing with the CRC for the Cattle and Beef Industry (Meat Quality) in 1993–1999. Most of the activities mentioned on page 8 of this report were undertaken with the CRC for Cattle and Beef Quality in 2000–2005. Currently, MLA is a major private sector partner of the CRC for Beef Genetic Technologies, which began in June 2005.

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