On farm

# Review Options to Reduce Feedstuff Supply Variability in Australia

*Volume 1: Main Report*

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Feedlots

# ABSTRACT

This study examines options available to livestock end users to reduce the impact of recurrent feedstuff supply shortages in Australia.

Feedgrains fulfil the majority intensive livestock industries feedstuff requirements. The amount of feedgrain available to industry is dependent upon a number of factors including climatic variability, export commitments and increasing domestic demand not only by the intensive livestock industry but also by other grain users. These factors contribute to recurrent periods of acute regional feedgrain shortages and lead to grain price instability.

The opportunity to increase the domestic availability of feedgrains is curtailed by current quarantine policies, which prohibit the importation of untreated feedgrain for inland usage. The bulk of feedgrain demand is from livestock industries located in inland regions. The only supply side option for feedgrain dependent users under current quarantine policies is the approved treatment of imported grains to ensure that pest/disease/weed infestation potential is reduced to levels approved by quarantine authorities (Biosecurity Australia).

The outcomes of this study provide the intensive livestock industry with a number of workable solutions for reducing the impact of feedstuff shortages. The study involved the development of a model by ABARE and APSRU, which establishes likely supply/demand situations. The model will provide the intensive livestock industry with an important planning tool for the development of appropriate risk management and feedstuff procurement strategies.

# EXECUTIVE SUMMARY

The report has been commissioned by Meat & Livestock Australia (MLA), Dairy Australia, Australian Pork Limited (APL), and Australian Wool Innovation Limited (AWI).

**Study Objective**

The goal of the study is to provide industry with an evaluation of the options available to address the recurrent feedstuff shortage issue as a basis for decision-making on the future direction of the beef cattle feedlot, sheep, dairy and pork industries. The report also assesses the role feedstuff security takes in securing sustainable futures for those intensive livestock industries.

**Information Sources**

Information was gathered from various Australian and International databases to provide current and forecast feedgrain production and utilisation trends both domestically and internationally. Supplementary reports were also commissioned by Macarthur Agribusiness to enable a better understanding of the specific needs on future feedgrain supply and demand by intensive livestock industries driven by industry growth and drought constraints on supply. The issue of feedstuff security and impediments to feedstuff access was analysed through consultation with a number of stakeholders. Precise supply and demand information is difficult to obtain either in the public domain or from company commercial information. Attempts were made however to better quantify supply / demand positions in normal and drought years and to establish the impact of continued growth in the intensive livestock industries.

The development of an integrated ABARE APSRU feedstuff supply model allowed accurate feedstuff supply and demand information to be analysed with respect to climate variability, in particular drought occurrences, across the various feedstuff supply and demand regions of Australia. This enabled the study to simulate the effects of a worst case drought effect on the intensive livestock industries.

**Study Outcomes**

The study found:

- Current demand for feedstuffs is approximately 10.8 MT; a recent ABARE analysis indicated demand is expected to grow to 12.4 MT by 2007 assuming current rates of growth in intensive livestock feeding industries, an overall 14% increase in total feed demand.

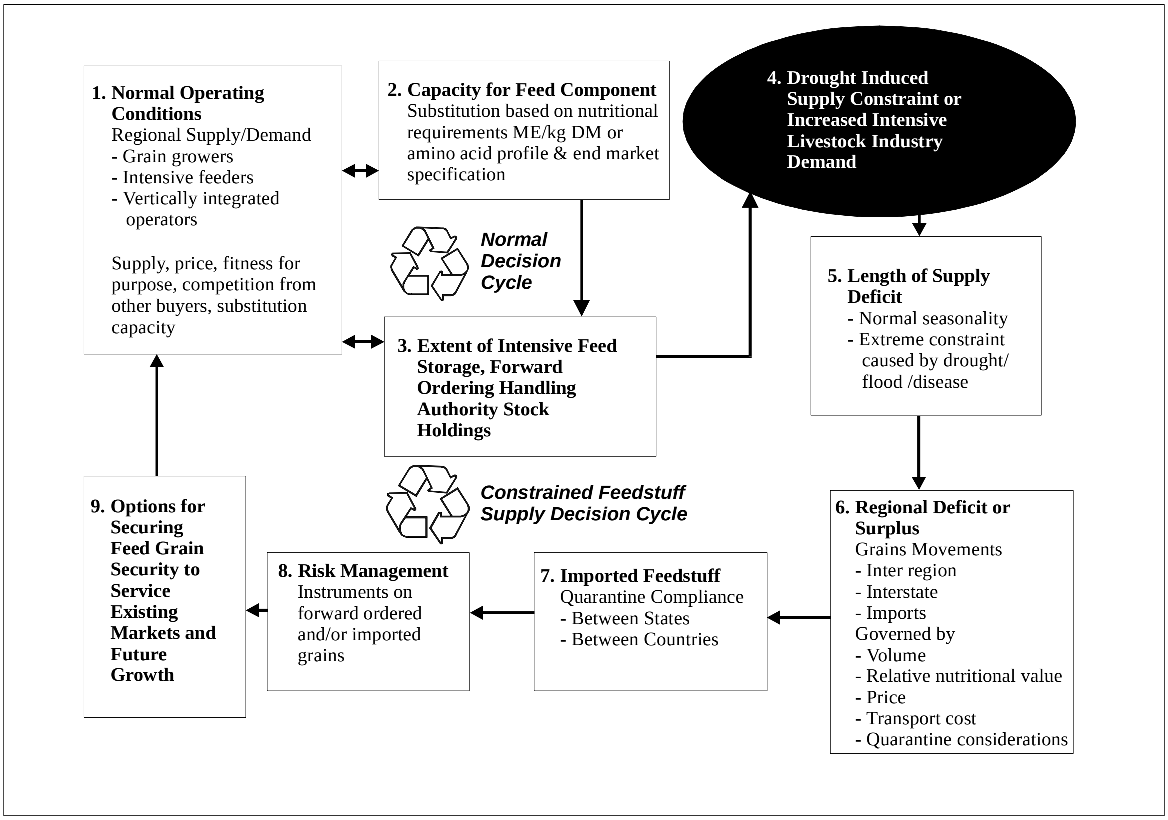
  The ABARE feedstuff supply / demand model defines total feed as wheat, barley, oats, maize, sorghum, triticale, lupins, peas, faba bean, cotton seed, canola meal, soymeal, cotton seed meal, sunflower meal, roughages, millmix (bran and pollard), rice pollard and animal proteins. The intensive livestock industries included in the ABARE model are poultry broilers and layers, pigs, feedlot, dairy, sheep, grazing ruminants, and others including horses, aquaculture and various sunrise livestock industries.

| ABARE Model Australian Total Feed Demand in 2003 and 2007 (kt) | | | | | | |
|---|---|---|---|---|---|---|
| **Feed** | **QLD** | **NSW** | **VIC** | **SA** | **WA** | **Total** |
| Total Feed Demand (2003) | 2,731 | 3,317 | 2,982 | 935 | 877 | 10,841 |
| Total Feed Demand (2007) | 3,200 | 3,848 | 3,288 | 1,051 | 982 | 12,369 |
| % Growth | 17% | 16% | 10% | 12% | 12% | 14% |
| Source: ABARE, 2003 | | | | | | |

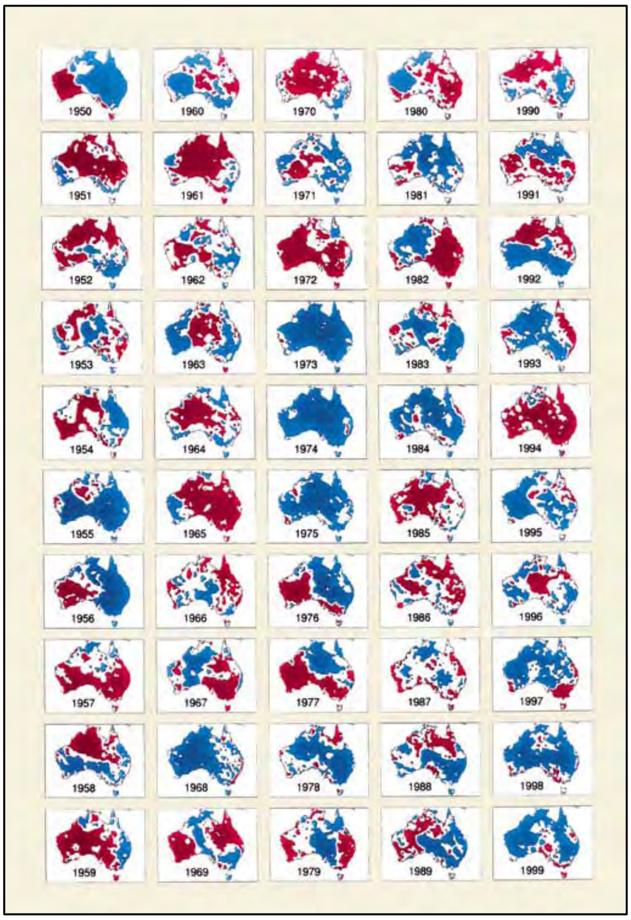
An important conclusion is that strongest demand growth is projected in Queensland and NSW, the States where supply shortages have been most acute, and where intensive animal production for meat purposes is concentrated;

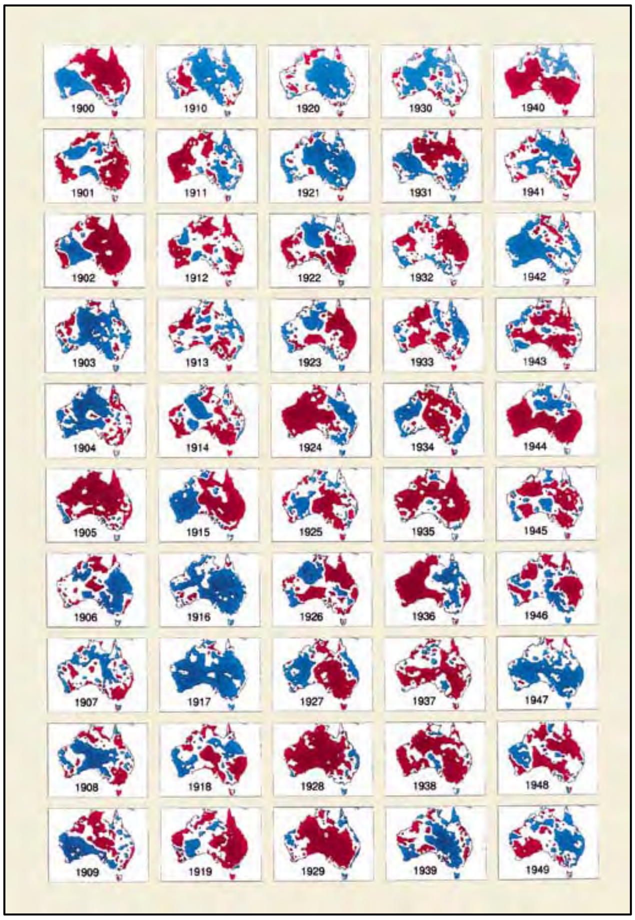
- Drought is a key component of cyclical grain and feedstuff shortages in Australia. The severity of droughts is not consistent across Australia and in most years there are sufficient supplies of feedgrains at current usage rates. The decision cycles in drought and industry growth scenarios are different and require different approaches for their resolution;

- The feed use profile consists of various dimensions which are governed by either drought or the need for continued industry growth. A decision cycle comes into play when there is restricted feedstuff supply in drought scenarios as seen in the following chart:




- Australian is a drought prone country where drought is more the norm rather than the exception. Perhaps this can be best illustrated by the following chart based on Bureau of Meteorology analysis showing below average rainfall in each year from 1900 to 1999.




- Across Australia the overwhelming nutritional input that was in shortest supply during the recent 2002-2003 drought event was water forcing many operations to curtail activities even though higher priced foodstuffs were available. Irrigation water availability is critical for fodder production as is the ongoing availability of livestock drinking water and water needed for the various activities in intensive livestock production. Future assessments of feedstuff security need to factor in water availability for these activities;

- The Australian intensive livestock industries are growing and will require increased quantities of feedstuffs in the future in line with international trends;

- Each intensive livestock industry has its own demand profile driven by nutrition requirements, ration formulation and pricing considerations and geographic availability of certain feedstuffs;

- The principal feedstuffs required will be primarily cereal grains, pulses and some roughages;

- There are “no silver bullet cures” to ensuring feedstuff security now or in the future. Some players see the new CSIRO Stored Grains Research Laboratory fumigation technology as being the ultimate solution to the grain import scenario as it offers promise in being able to kill pathogens and insects and devitalize feedgrains. However extensive research and development is needed to ensure the outcomes of this technology comply with AQIS highly conservative quarantine protocols for imported grains;

- Alternative feedstuffs to cereal grains are unlikely to be used in quantity because of limited availability, nutritional constraints, possible anti nutrition factors, export competition issues, real cost of energy on a MJ/kg, DM basis and some concerns about possible contamination or residue levels;

- The Eastern States, where the majority of intensive livestock industries are located, will form the greater part of the domestic market for feedgrains and it is likely that there will be increasingly fewer exports of feedgrains from these States in the future. However as the domestic intensive livestock industries grow demand will be satisfied in part from interstate transfers of feedgrains from WA and SA. This, in turn, adds to the importance of improving the competitiveness of coastal shipping which is currently regulated;

- Despite the severity of the 2002-2003 drought it still is not one of the most severe droughts Australia has experienced. This is illustrated in the following table using APSRU data that examines the impact of feedstuff availability in 2003-2004 compared to a drought with a severity of that in 1911-1915 (a prolonged continental drought):

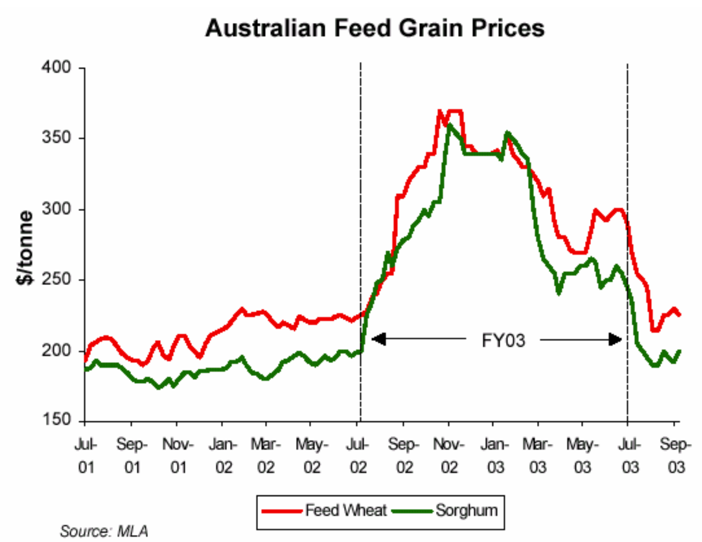
| State | Main Feed Production | Livestock Demand | Surplus | Inflows from other States | Outflows to Other States | Exports O'seas | Imports from O'seas |
|---|---|---|---|---|---|---|---|
| **BAU – BASELINE (kt)** | | | | | | | |
| QLD | 1,734 | 1,988 | -254 | 866 | 0 | 611 | 0 |
| NSW | 4,751 | 2,678 | 2,073 | 92 | 1,113 | 1,072 | 20 |
| VIC | 3,373 | 2,698 | 675 | 635 | 67 | 1,269 | 27 |
| SA | 3,513 | 713 | 2,800 | 74 | 0 | 2,876 | 2 |
| WA | 8,148 | 665 | 7,483 | 0 | 486 | 6,997 | 0 |
| **Total** | **21,518** | **8,742** | **12,776** | **1,666** | **1,666** | **12,825** | **49** |
| **1 – INITIAL DROUGHT IMPACTS (kt)** | | | | | | | |
| QLD | 2,032 | 1,990 | 42 | 882 | 0 | 924 | 0 |
| NSW | 4,972 | 2,692 | 2,280 | 97 | 1,209 | 1,177 | 10 |
| VIC | 3,332 | 2,699 | 633 | 714 | 88 | 1,286 | 27 |
| SA | 3,339 | 717 | 2,622 | 93 | 0 | 2,717 | 2 |
| WA | 7,078 | 665 | 6,413 | 0 | 489 | 5,924 | 0 |
| **Total** | **20,752** | **8,762** | **11,990** | **1,786** | **1,786** | **12,028** | **39** |
| **2 – INITIAL LOW LEVEL DROUGHT CONTINUES (kt)** | | | | | | | |
| QLD | 1,339 | 1,982 | -643 | 905 | 0 | 262 | 0 |
| NSW | 4,401 | 2,671 | 1,730 | 116 | 993 | 877 | 24 |
| VIC | 3,286 | 2,688 | 598 | 593 | 50 | 1,174 | 33 |
| SA | 3,417 | 712 | 2,706 | 71 | 0 | 2,779 | 2 |
| WA | 7,906 | 664 | 7,242 | 0 | 642 | 6,600 | 0 |
| **Total** | **20,350** | **8,717** | **11,633** | **1,685** | **1,685** | **11,692** | **59** |
| **3 – CONTINUED DROUGHT (kt)** | | | | | | | |
| QLD | 1,710 | 1,983 | -273 | 852 | 0 | 579 | 0 |
| NSW | 4,167 | 2,671 | 1,497 | 127 | 853 | 792 | 21 |
| VIC | 3,223 | 2,690 | 534 | 572 | 60 | 1,077 | 31 |
| SA | 2,958 | 714 | 2,244 | 95 | 0 | 2,341 | 2 |
| WA | 8,036 | 665 | 7,371 | 0 | 733 | 6,638 | 0 |
| **Total** | **20,095** | **8,724** | **11,372** | **1,646** | **1,646** | **11,426** | **54** |
| **4 – SEVERE DROUGHT (kt)** | | | | | | | |
| QLD | 1,553 | 1,972 | -420 | 783 | 0 | 451 | 88 |
| NSW | 3,252 | 2,646 | 606 | 89 | 480 | 242 | 28 |
| VIC | 1,328 | 2,671 | -1,343 | 1,267 | 26 | 35 | 137 |
| SA | 1,555 | 729 | 826 | 55 | 628 | 310 | 59 |
| WA | 5,891 | 664 | 5,226 | 0 | 1,059 | 4,173 | 6 |
| **Total** | **13,578** | **8,683** | **4,895** | **2,193** | **2,193** | **5,212** | **318** |

| State | Main Feed Production | Livestock Demand | Surplus | Inflows from other States | Outflows to Other States | Exports O'seas | Imports from O'seas |
|---|---|---|---|---|---|---|---|
| 5 – RECOVERY (kt) | | | | | | | |
| QLD | 1,252 | 1,982 | -730 | 977 | 0 | 248 | 0 |
| NSW | 4,511 | 2,672 | 1,839 | 120 | 1,010 | 970 | 21 |
| VIC | 3,637 | 2,695 | 942 | 571 | 58 | 1,483 | 28 |
| SA | 4,044 | 720 | 3,324 | 57 | 0 | 3,382 | 2 |
| WA | 9,119 | 666 | 8,454 | 0 | 657 | 7,797 | 0 |
| **Total** | **22,563** | **8,734** | **13,829** | **1,725** | **1,725** | **13,880** | **51** |

- In severe back to back continental droughts substantial quantities of feedgrains will need to be imported. Because of AQIS quarantine provisions imported grains will be used principally in metropolitan areas to service poultry and compound stockfeed manufacturers. In the 1994-1995 drought 440,506 tonnes of feedstuffs were imported principally to eastern seaboard ports. In the 2002-2003 drought 430,431 tonnes of feedstuffs have been imported. There is limited scope to import higher tonnages based on portside milling facilities given existing obligations to domestic market clients. Current milling capacity is 1,040,000 tonnes per annum. Industry observers note that there is little free capacity available that could be utilised to comply with current AQIS grain import protocols;

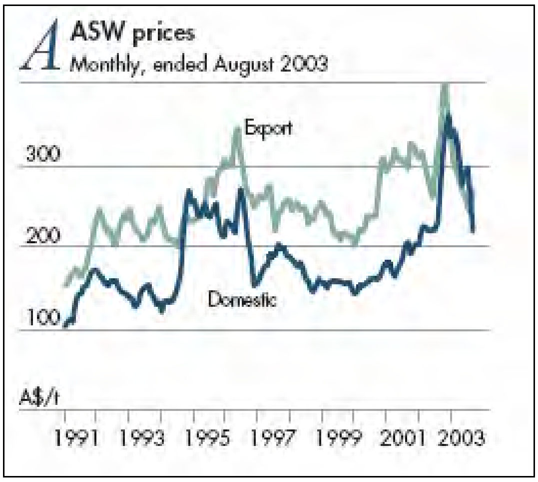
- When export parity price exceeds import parity price imports occur capping further price rises for feedgrains. Imported grain is processed at port side metropolitan areas and used primarily by the poultry and feedmilling industries. The imported grain then causes up country grain normally destined for export to be held up country and available for intensive livestock industries in those areas;

- One of the principal effects of drought has been constrained supply causing prices for winter and summer grains to increase as shown in following chart. However despite the high levels of grain prices supplies were available to intensive livestock feeders that had to make the decision to either continue feeding or scale down operations. This decision had different ramifications for pork operators compared to some feedlot operators on short feeding programs with cost of production economics relative to revenues being the deciding factor. Larger operators were able to negotiate some large parcel orders of grain. Smaller operators were able to access some supplies but at a premium ex storage for these deliveries;



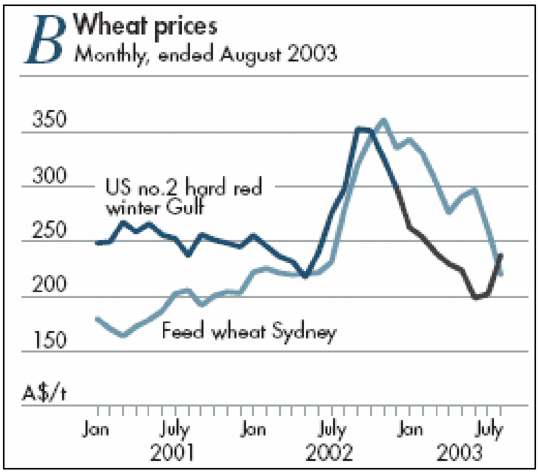
- Domestic and Export Pricing of Feed Wheat.

The current drought forced a closing of the traditional gap between export market price and domestic market price for feedgrains as shown in the following chart based on recent ABARE analysis. As the drought persisted the domestic price is some cases exceeded export parity price triggering the import of feedgrains from the USA and UK. A similar price trend and triggering of imports also occurred in the 1994-1995 drought. Imported grain however can only be used by poultry and feed compounding industry players and not by intensive livestock operators up country under existing AQIS protocols.




- Comparison of Australian and US Feedgrain Prices 2001-2003

Under existing AQIS import protocols grain can be sourced principally from the US and UK. The following chart from ABARE analysis shows the comparative price differentials between Feed wheat in Sydney and US No.2 hard red winter wheat ex Gulf ports. The extent of drought and constricted supply resulted in domestic feed wheat prices exceeding US grain prices for a short period before price declines occurred due to currency differentials and the impending delivery of new season stocks.



- Climate forecasting, and the understanding of the impact of climate on grain yields, has developed significantly in recent years. There has been significant work on integrating climate forecast models and crop production models especially by groups such as APSRU;

- ABARE has significantly revamped and upgraded its regional feedstuff supply demand model. This model can be linked to the APSRU climate based crop yield models to estimate feedstuff supply and location relative to intensive livestock industry demand drivers;

- Climate based seasonal prospect forecasts can be made with a reasonable level of accuracy in May and September each year. A these times it is realistic for both the grains and intensive livestock industries to update and revise the APSRU/ABARE model if there are concerns about feedstuff supply and demand;

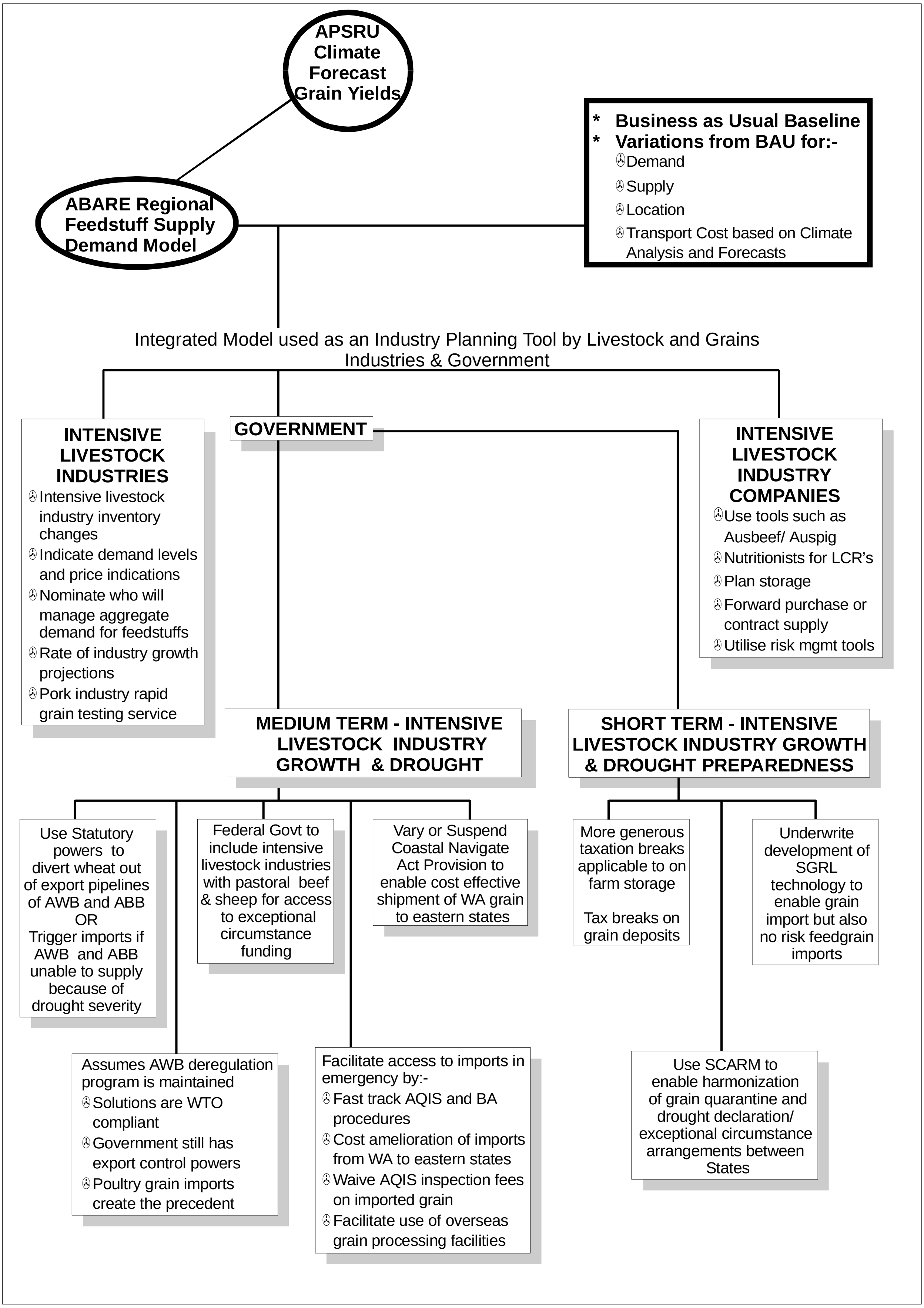
- Integrated modelling will enable the intensive livestock industries and the feedgrains industry to come together to examine likely feedgrain supply demand scenarios each year and then it is ultimately up to individual operators to make their own strategic and commercial decisions on feedgrain procurement and appropriate risk management. The integrated APSRU/ABARE model needs more work particularly in the area of stocks held on farm and in the central system as well as pricing information;

- The options chosen by individual operators will depend on the nature of their industry dynamics, geographic location, enterprise size, attitude to risk, level of on farm stocks, existing contract supply relationships and supply chain contract commitments;

- The options available to livestock end users during drought events are affected by the following factors:

  - Nutrition Science and Industry Practice
  - Regulatory
  - Efficient Infrastructure Utilisation
  - Contractual Commitments

- Future feedstuff security options can be divided into long term and short term measures. The longer term measures relate to drought preparedness, while the short term measures relate to emergency contingency items in times of severe supply demand deficits and are shown in the following chart:


APSRU Climate Forecast Grain Yields
ABARE Regional Feedstuff Supply Demand Model
* Business as Usual Baseline
* Variations from BAU for:-
Demand
Supply
Location
Transport Cost based on Climate Analysis and Forecasts
Integrated Model used as an Industry Planning Tool by Livestock and Grains Industries & Government
INTENSIVE LIVESTOCK INDUSTRIES
Intensive livestock industry inventory changes
Indicate demand levels and price indications
Nominate who will manage aggregate demand for feedstuffs
Rate of industry growth projections
Pork industry rapid grain testing service
GOVERNMENT
INTENSIVE LIVESTOCK INDUSTRY COMPANIES
Use tools such as Ausbeef/ Auspig
Nutritionists for LCR's
Plan storage
Forward purchase or contract supply
Utilise risk mgmt tools
MEDIUM TERM - INTENSIVE LIVESTOCK INDUSTRY GROWTH & DROUGHT
SHORT TERM - INTENSIVE LIVESTOCK INDUSTRY GROWTH & DROUGHT PREPAREDNESS
Use Statutory powers to divert wheat out of export pipelines of AWB and ABB OR Trigger imports if AWB and ABB unable to supply because of drought severity
Federal Govt to include intensive livestock industries with pastoral beef & sheep for access to exceptional circumstance funding
Vary or Suspend Coastal Navigate Act Provision to enable cost effective shipment of WA grain to eastern states
More generous taxation breaks applicable to on farm storage
Tax breaks on grain deposits
Underwrite development of SGRL technology to enable grain import but also no risk feedgrain imports
Assumes AWB deregulation program is maintained
Solutions are WTO compliant
Government still has export control powers
Poultry grain imports create the precedent
Facilitate access to imports in emergency by:-
Fast track AQIS and BA procedures
Cost amelioration of imports from WA to eastern states
Waive AQIS inspection fees on imported grain
Facilitate use of overseas grain processing facilities
Use SCARM to enable harmonization of grain quarantine and drought declaration/ exceptional circumstance arrangements between States

**Long Term Feedstuff Security Preparedness Measures:**

- Increased Grain and Fodder Storage on farm;
- Efficient Coastal Shipping;
- Improved Access to Imported Grain. This would primarily involve resourcing and managing the CSIRO work as a very high priority project with the potential, if successful, to solve the quarantine problem for inland end users;
- A new rapid grain testing service predicting the digestible energy of cereal grains for pigs using infrared spectroscopy (NIRS) calibrations has been released by Australian Pork Limited (APL), the Grains Research and Development Corporation and the South Australian Research and Development Corporation (SARDI);
- Ongoing Commitment to Feedgrain Research: GRDC has had a successful research and development program for feedgrains (Premium Feedgrain for Livestock Program). There have been a number of significant outcomes including identification of different feedgrain species suitability for intensive livestock species feeds development of some specialist feedgrain varieties; exploration of feed barley options for the northern agro-ecological region, development of NIR algorithms that may be used for value based grain trading. Given the projected growth in the Australian and international intensive livestock feeding markets and shortage in feedgrains supply it can be argued that there is a case for continuation of a feedgrain R&D program to develop varieties of feedgrains that have nutritional, yield, economic stress, and pest and disease resistance qualities that would make them a suitable grain crop of choice particularly in eastern Australian grain production areas. Adequate R&D needs to be undertaken to indicate the economic viability of grain producers moving away from the production of milling quality to specialised feed quality grains;
- Use of Drought Management Predictive Tool; and
- Tax measures such as the Xavier Martin Drought Grain Bond Proposal, and the proposed alignment of taxation concessions for grain storage with water storage concessions as drought preparedness assistance.

**Short Term Feedstuff Emergency Supply Security Measures:**

- Waive Import Inspection Fees;
- Allow international flag vessels for emergency charter to ship grain in coastal trade to eastern seaboard;
- Release Stocks held by Government owned or empowered Agencies; and
- Formation of a Peak Decision Making Body to initiate feed security options. Body to comprise of Chief Executives of key stakeholder groups with a focus on developing realistic action plans to address future feedstuff security supply constrictions.

**Exercise of those options will depend in large part on:**

- Government preparedness to develop contingency planning options to mitigate the cost of exceptional circumstance funding in extreme drought events;
- Intensive livestock feeding industries' ability to negotiate preferred changes in government policies, as summarised in the following schematic;
- Better engagement with the grain growing and marketing sectors to achieve mutually beneficial outcomes;
- The willingness for the intensive livestock feeding industries to secure feedstuff security on a contractual basis as opposed to being spot market buyers; and
- The development of better information programs to enable those players who want to utilise risk management tools depending on their enterprise size, nature of business and attitude to risk.

**Recommendations:**

Based on the preceding analysis the following table outlines the range of drought preparedness and drought impact mitigation measures that appear realistic in seeking to ensure adequate feedstuff security in the future.

The following table lists report recommendations for drought preparedness and response as well as our views on timeframe for actions to be implemented and delivery responsibility.

| Recommendations | Drought Preparedness | Drought Response | Timing | Responsibility to Progress |
|---|---|---|---|---|
| Further develop and refine the APSRU/ABARE predictive model to incorporate facilities for stocks and dynamic pricing | ✓ | | Immediate | FGAG/ ABARE |
| Undertake runs of the refined model to establish "what if" scenarios as a basis of feedgrain and intensive livestock industry contingency planning | ✓ | | Immediate | FGAG/ GRDC/ CVAP |
| Establish regular monitoring of national intensive livestock inventory | ✓ | | Mid term | FGAG/ ABARE |
| Establish regular monitoring program of grain and feedstuff stocks held on farm and in central system reserves | ✓ | | Mid term | FGAG/ ABARE |
| Underwrite development of SGRL technology to enable grain import but also no risk feedgrain imports | ✓ | | Immediate | FGAG/ AFFA |
| Use SCARM to enable harmonization of grain quarantine arrangements between States | ✓ | | Immediate | COAG |
| Review drought assistance and drought management decision making and resources used by State and Federal Government | ✓ | ✓ | Immediate/Medium Term | Industry Associations/ Government |
| More generous taxation breaks applicable to | ✓ | | Immediate/ Medium | Industry Associations |

| Recommendations | Drought Preparedness | Drought Response | Timing | Responsibility to Progress |
|---|---|---|---|---|
| on farm storage of grain and roughages | | | Term | |
| Trigger imports if AWB and ABB unable to supply because of drought severity<br>Assumes AWB deregulation continues<br>Solutions are WTO compliant<br>- Government still has export control powers<br>- Poultry grain imports create the precedent | | ✓ | When required in severe drought and market failure evident | Federal and State Government |
| Use Statutory powers to divert wheat out of export pipelines of AWB and ABB if market unable to import at competitive prices | | ✓ | When required in severe drought and market failure evident | Federal and State Government |
| Establish protocols to suspend Coastal Navigation Act Provisions to enable cost effective shipment of WA grain to eastern states on a permit basis | | ✓ | Medium Term | Federal Government/ Industry Associations |
| Facilitate access to imports in emergency by<br>- Fast track AQIS and BA permit appeals<br>- Waive AQIS inspection fees on imported grain | | ✓ | Immediate even if not utilised | AFFA/ Industry Bodies |
| Give highest possible priority to CSIRO Stored Grain Research Laboratory Project | ✓ | | Short/ Medium Term | Industry/ Federal Government |
| Initiate review and commercial assessment of Xavier Martin Drought Bonds proposal to establish commercial and policy efficacy | ✓ | | Mid term | Industry Bodies/ FGAG/ATO/AFFA |
| Formation of a Peak Decision Making Body to initiate feed security options. Body to comprise of Chief Executives of key stakeholder groups | ✓ | | Immediate | Industry Bodies and Companies |

# CONTENTS

**EXECUTIVE SUMMARY ........................................................ 3**

**1. INTRODUCTION ........................................................ 19**

**2. CURRENT AND FUTURE LIVESTOCK AND FEEDSTUFF SUPPLY / DEMAND IN CONTEXT ........................................ 21**

**2.1 Introduction ........................................................ 21**

**2.2 World in Context ........................................................ 21**

***2.2.1 Summary of World Livestock Issues ........................................ 21***

***2.2.2 Summary of World Grain Issues ........................................ 22***

***2.2.3 Implications for Australia ........................................ 24***

**2.3 Australia in Context ........................................................ 25**

***2.3.1 Australian Livestock Industry Growth Trends ........................ 25***

***2.3.2 Australian Livestock and Livestock Product Projection Trends27***

***2.3.3 Australian Feedstuffs Production Projections ........................ 28***

***2.3.4 Commercial Stockfeed Manufactures ........................................ 36***

***2.3.5 Adequacy of Feedgrain Supply for the Intensive Livestock Industries ........................................................ 37***

**3. FUTURE AUSTRALIAN FEEDSTUFF DEMAND ............ 38**

**3.1 Introduction ........................................................ 38**

**3.2 Australian Feed Demand by Livestock Feeding Sector ............ 40**

***3.2.1 Feedlot ........................................................ 40***

***3.2.2 Pigs ........................................................ 43***

***3.2.3 Poultry ........................................................ 45***

*3.2.4 Dairy ....................................................................................47*

*3.2.5 Sheep....................................................................................51*

**3.3 Overview of Key Australian Feedstuff Issues.............................54**

**3.4 Summary ....................................................................................56**

**4. AUSTRALIAN DROUGHT ..................................................58**

**4.1 Introduction ................................................................................58**

**4.2 Drought Frequency .....................................................................58**

*4.2.1 Definition of Drought...........................................................59*

*4.2.2 Relativity of the 2002-2003 Drought Event..................................61*

*4.2.3 Drought Impacts on Crop Yields................................................64*

*4.2.4 Drought Impacts in Intensive Livestock Production..................65*

*4.2.5 Drought Impacts on Feedgrain Prices.........................................70*

*4.2.6 Do Drought Induced Feedstuff Supply Demand Gaps Really Exist......................................................................................71*

*4.2.7 Prolonged Drought Impacts on the Pastoral Sheep and Cattle Industries .......................................................................73*

**5. POTENTIAL ROLE OF IMPORTS IN FEEDGRAIN SECURITY...........................................................................73**

**5.1 Background ................................................................................73**

**5.2 Current Access to Imported Product...........................................74**

**5.3 Australia's International Obligations on Quarantine Rules.......75**

**5.4 Quarantine Policy Making and Administration in Australia ......76**

**5.5 Currently Approved Conditions for Grain Imports.....................77**

**5.6 Experience to Date in Importing Feedstuffs ...............................79**

*5.6.1 Summary of 1994-1995 Imports of Whole Grain.........................79*

5.7 Effects of Quarantine Requirements ........................................85

5.8 Additional Sourcing Options within Current Technology .........86

5.9 Non-Grain Imports.....................................................................86

5.10 Interstate Movement of Grain...................................................86

5.11 New Import Access Opportunities............................................87

5.12 Acceptable Risk........................................................................88

*5.12.1 Future Objectives in Allocating Resources to Improve Access to Imported Feedstuffs.................................................................88*

6. MYTHS AND SACRED COWS ........................................88

7. FEEDSTUFF SUPPLY AND DEMAND INDUSTRY DYNAMICS.........................................................................90

7.1 Introduction ..............................................................................90

7.2 Feedgrains Industry ..................................................................90

7.3 The Intensive Livestock Feeding Industries ..............................93

7.4 Feedmill Industry.......................................................................93

*7.4.1 Summary of World Industrial Feedgrain Issues.........................93*

*7.4.2 The Australian Feedmilling Sector ............................................95*

7.5 Treatment and Technology Research and Supply Agencies ....96

7.6 AQIS / Biosecurity Australia.......................................................96

8. RISK MANAGEMENT OPTIONS IN THE INTENSIVE LIVESTOCK FEEDING INDUSTRIES...............................97

8.1 Introduction ...............................................................................97

8.2 Grain Price Risk Management Alternatives ...............................97

*8.2.1 Dairy .........................................................................................98*

*8.2.2 Pastoral - Beef / Sheep.............................................................98*

*8.2.3 Beef Feedlot and Pork Production.............................................98*

**9. FUTURE FEEDSTUFF SUPPLY SECURITY OPTIONS..........................................................................103**

**9.1 Factors Limiting Feedstuff Sourcing Options ..........................105**

**9.2 Management Options for Enhancing Feedstuff Security ........106**

**9.3 Feedstuff Security Options......................................................109**

*9.3.1 Long Term Measures ...............................................................109*

*9.3.2 Short Term Emergency Measures ............................................113*

**10. A PREDICTIVE TOOL ASSESS FEEDSTUFF SUPPLY ADEQUACY IN VARIABLE SEASONAL CONDITIONS 114**

**10.1 Introduction ..........................................................................114**

**10.2 Use Climate Based Feedgrain Yield Predictors.......................115**

**10.3 Outcomes of the Integrated APSRU and ABARE Model Assessment of the Severe Back to Back Continental Drought116**

**11. BIBLIOGRAPHY .........................................................118**

# 1. INTRODUCTION

This study has been commissioned by Meat and Livestock Australia, Australian Pork Limited, Dairy Australia and Australian Wool Innovation Limited. The project arises from concerns raised in the National Feedgrain Action Group about the ongoing feedstuff security for the target industries in the face of the current 2002-2003 drought induced feed shortages.

The issue of feedstuff security and growth of a feedgrains industry has been report rich. Throughout the 1990's a multitude of reports have been produced examining supply and demand, alternative feedstuffs, regional supply demand models, and State based examinations of feedstuff industries to underpin intensive livestock industries in those States.

There is an apparent and perceived inability of the agriculture sector to supply domestic intensive livestock feeding industries. This position has again raised the prospect of feedgrain imports to supply the feed supply gap as occurred in the 1994-1995 drought. This is despite the grain harvest particularly for wheat and barley in 2001-2002 being almost a quarter larger than that in the drought year of 1982-1983 from the same sown area.

At Grains Week 2003 the Chairman of GRDC indicated investment in grains R&D had achieved a three fold increase in the rate of wheat yields. Unfortunately the same can not be said for the coarse grains preferred by the intensive livestock industries who increasingly find that the massive increases in milling wheat yield overshadows the debate on the availability of feedgrains for the feedlot, pork, dairy and sheep sectors. The reality is that the Australian grains industry is primarily focused on the production and export of milling wheats with less focus on the feedgrain requirements of this growing sector in the Australian domestic market.

Equally the intensive livestock industries have been undergoing significant structural change with increasing consolidation and rationalisation. Despite the emergence of larger players with ongoing grain supply requirements there appears to be little resolution regarding the ongoing mitigation of feedstuff security. Clearly there is a need to bring together all the collective experience of the grains and intensive livestock industries to ensure feedstuff security now and into the future as the demand for feedgrains, especially in the Eastern States of Australia, continues to expand across all the target user industries.

The term grain security is widely used but needs clarification. Australia is a net exporter of grain in every year. In this general sense, grain is always available for domestic customers if a sufficiently high price is paid. However, supply of feedgrains for domestic users is more limited and variable than aggregate statistics suggest. To a significant extent feedgrain is owned by a few large companies eg AWB and ABB and substantial tonnage is committed to export customers. Freight costs from Western Australia to Eastern states where the shortages occur are inflated by coastal shipping regulations. In a developing drought event grain vendors will regard scarce stocks as appreciating assets. The problem for domestic customers becomes one of escalating prices, and difficulty in being able to purchase large parcels of grain.

While addressing the short term feed supply emergencies the project proponents have requested that Macarthur Agribusiness examine current and future feedgrain needs to derive options that will enable the intensive livestock industries to handle future drought emergencies and the growing needs of the expanding intensive livestock feeding sector.

This study is being carried out in parallel with an update of the Australian Bureau of Agricultural and Resource Economics (ABARE) feedgrain regional supply demand model and an Australian Bureau of Statistics (ABS) survey of feedgrain stocks held on farm as at 31 December, 2002.

Australia is the driest continent on earth and drought is a regular feature of the livestock and processing industry landscape. Despite this, the country has continued to develop growing domestic and export markets for grain fed beef and pork, milk and milk products, and wool and sheepmeat. The sustainability of these industries depends in part on continued access to feedstuffs in quantities and at world competitive prices.

This study examines global and Australian trends in feedgrain production and utilisation, impacts of drought and increasing intensive livestock industry demand and options that could be possible in filling feedstuff requirements in drought and intensive livestock industry growth scenarios. Initially the study was prompted by the severity of the 2002-2003 drought and the difficulties intensive livestock feeders were having in obtaining feedstuffs at economically acceptable prices to enable their operations to maintain profitability. As the drought has progressed and grain price has risen despite ongoing feedgrain exports from Australia, a number of other issues have emerged that impact on the feedgrain security issue. These issues include:

- The importation of feedgrains from the US and UK into eastern sea board ports with resultant domestic feedgrain price falls; grain equivalent cassava based feedstuffs and palm kernel meals imported from Indonesia and imported pelleted mill run and corn gluten feed pellets;

- The high cost of “internal grain imports” from WA and SA because of high Australian coastal shipping costs;

- Other initiatives of the Feedgrains Action Group including update and enhancement of the ABARE regional feedgrain supply demand model, and an ABS survey of grain and fodder stocks;

- The emergence of possible technology solutions for grain and fodder treatment of imported feedstuffs;

- The outcomes of the GRDC Premium Grains For Livestock Program including better nutritional profiling of feedgrain suitability to livestock performance characteristics and the projected pilot trial of NIR technology to enable feedgrains to be segregated to best livestock end use and a quantitative basis for feedgrain trading; and

- The emergence of further competition for available feedgrain supplies by the infant grain based fuel ethanol industry and increased grain feeding to dairy cattle.

Overall the feedgrain deficit imposed by drought to date has created a poor profitability situation for livestock feeders but access to feedstuffs has continued albeit with changes in normal ration composition. However, as the drought has progressed it has become evident that the current operations of the intensive livestock feeding industries could be significantly constrained by the continuation of the current drought. In the longer term there appears to be an increasing forecast supply demand deficit for feedstuffs that, unless addressed collectively by the grains and livestock industries, could cap the future growth potential of the intensive feeding industries.

This study examines:

- World and Australian feedstuff supply and demand trends;
- Current and forecast feedgrain production and use by the feedlot, pork, dairy and sheep sectors in Australia on a regional basis;
- The frequency and impact of drought on feedstuff production and availability;
- Key issues on feedstuff security seen by key intensive livestock feeders;
- Key issues impacting on the feedstuff security issue in Australia;
- Impediments to feedstuff access either through international imports or “internal imports” from other States of Australia; and
- Practical options to resolve feedstuff shortages in drought or intensive livestock industry growth scenarios.

# 2. Current and Future Livestock and Feedstuff Supply / Demand in Context

## 2.1 Introduction

This section examines the current status and trends in world and Australian intensive livestock industries and feedstuff production, developments in industrial feed manufacturing and analyses the adequacy or otherwise of feedstuff supply to meet current and forecast demand from the intensive livestock feeding industries in Australia.

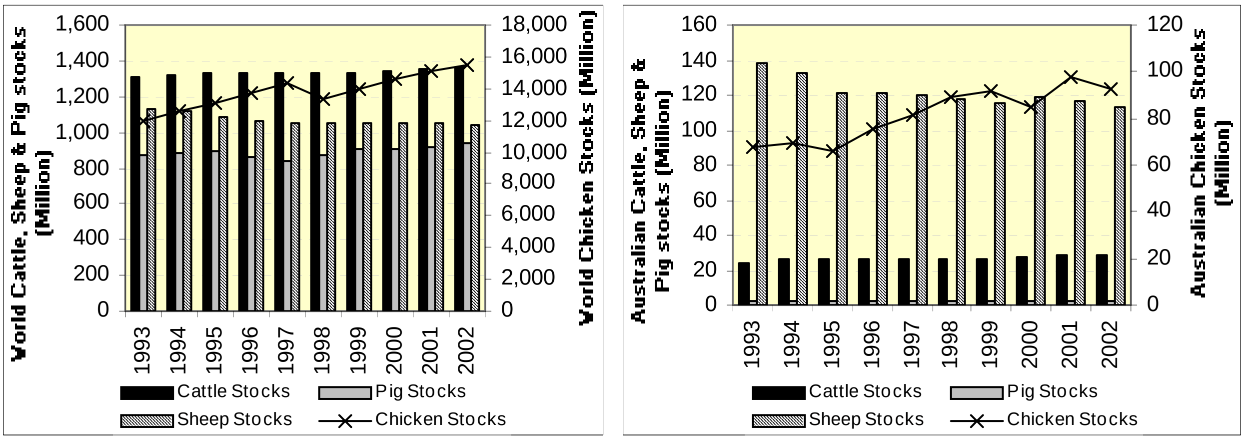
An examination of the literature indicates there is no one comprehensive set of data that reflects the changing dynamics in the feedstuff and intensive livestock feeding industries. Consequently we have utilised current production and forecasts from various agencies both within Australia and overseas. The databases analysed include those of Food and Agriculture Organisation (FAO), Food and Agriculture Policy Research Institute (FAPRI) USA, Meat and Livestock Australia (MLA), Australian Bureau of Agriculture and Resource Economics (ABARE) and USDA Foreign Agricultural Service (USDA, FAS). Much of this data is contained in the second volume of this report.

## 2.2 World in Context

### *2.2.1 Summary of World Livestock Issues*

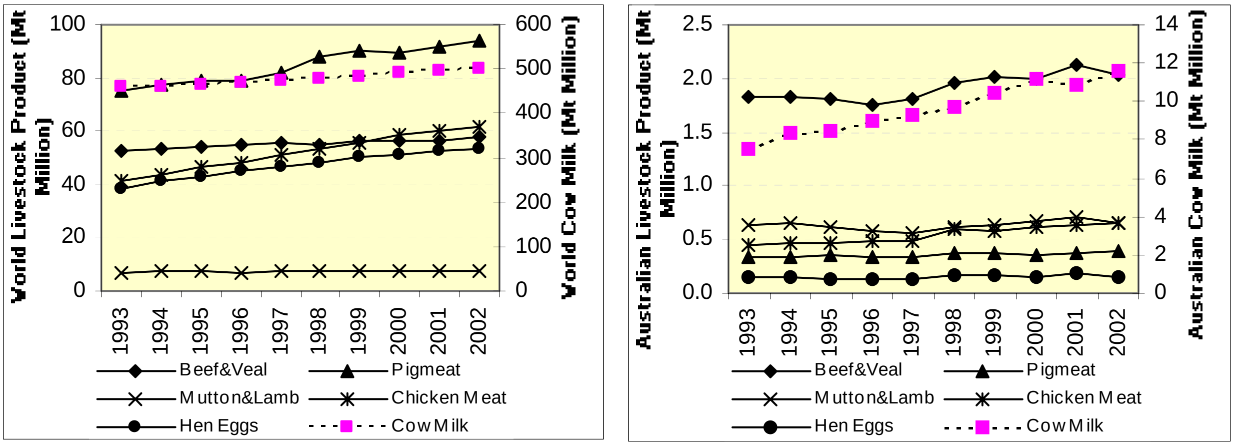
World livestock numbers and associated livestock product production have increased over the last 10 years and are projected to continue increasing (Figures 1 and 2). Human demand for animal meat and other products, particularly in developing countries, have been the main factor for the livestock number increase. The demand for efficiency from higher slaughter weights in developed countries and the urbanisation in developing countries forcing an intensification of livestock production are major factors in the increase in grain fed production systems. As livestock numbers continue to increase due an increasing demand for livestock products the amount of feedgrain required will increase. The question that remains is will feedgrain be available in sufficient quantities to satisfy the intensive livestock requirements both in Australia and worldwide irrespective of drought induced supply shortages on an affordable basis?

**Figure 1:** World and Australian Livestock Numbers




Source: FAO, 2003

**Figure 2:** World and Australian Livestock Product Production




*Source: FAO, 2003*

## 2.2.2 Summary of World Grain Issues

World feedgrain production is increasing, as is demand for feedgrains for the intensification of livestock industries, which is a world wide phenomenon (Figures 3 and 4). While some wheat is used for feedgrains it is generally down graded milling grains that are the feed source and hence supply is variable and dependant on climatic conditions. The narrowing supply demand gap for feedgrains is occurring against strong import demand from grain poor countries and the decrease in arable agriculture area sown to milling and feedgrains. It is important to have a perspective of the dynamics of the industrial feeds sector, which is the major supplier to the poultry, pork and dairy sectors, the largest users of industrial feeds.

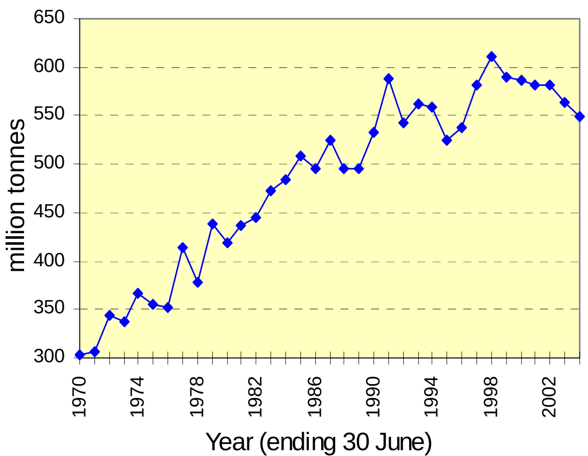
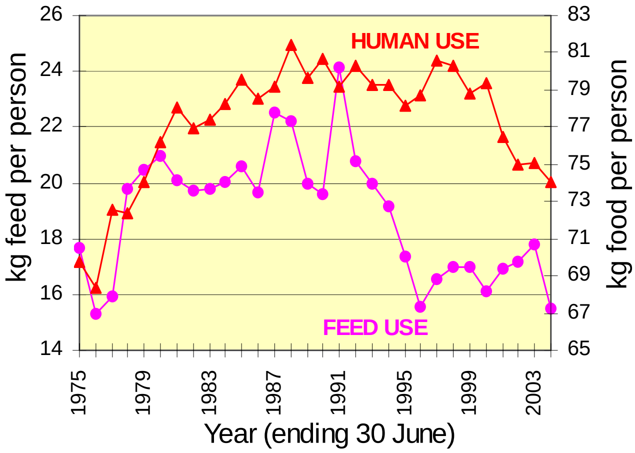
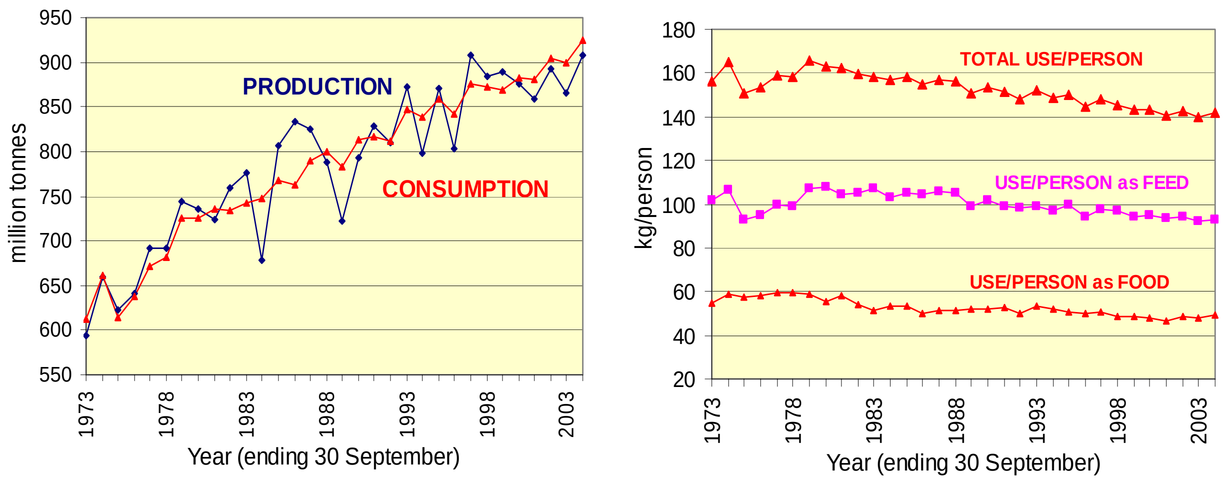



**Figure 3:** World Wheat Production, and Consumption per Person




Source: Analysing Agriculture, August 2003

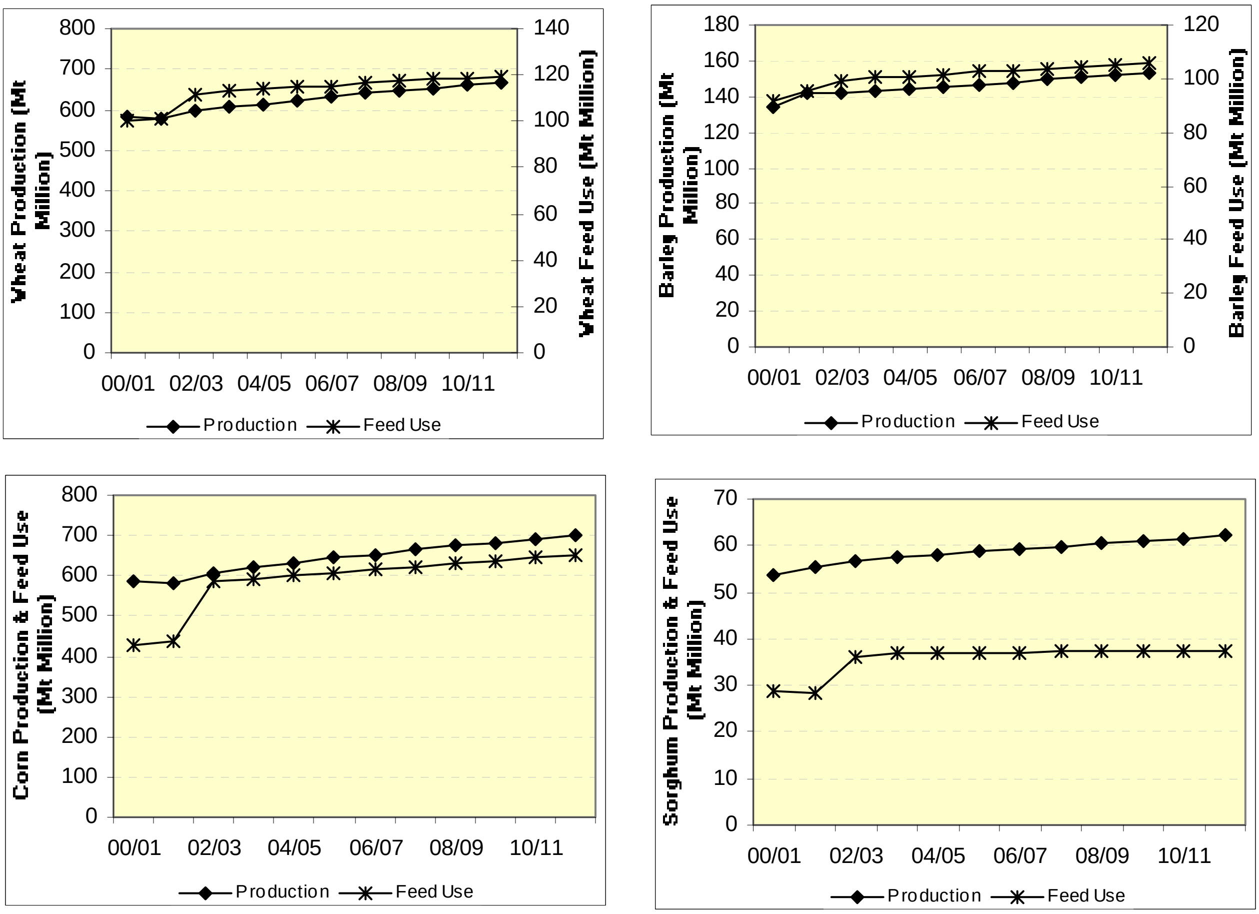
**Figure 4:** World Coarse Grain Production, Consumption and Consumption per Person




Source: Analysing Agriculture, July 2003

The Food and Agricultural Policy Research Institute (FAPRI) projects that wheat, barley, corn and sorghum production and feed use will increase to 2011 (Figure 5).

**Figure 5:** FAPRI Grain Production and Feed Use Projection




Source: FAPRI, 2002

The net result of the urbanisation of agriculture and increasing intensification in both developed and developing countries will increasingly put pressure on feedgrain supply surpluses.

### *2.2.3 Implications for Australia*

The growth in intensive livestock production, the narrowing demand supply gap for feedgrains, the relative value of the Australian dollar and Australia's role as a significant exporter of grains will place pressure on Australian based intensive livestock industries especially in times of feedgrain shortages such as drought.

The Australian grains industry is more focussed on grain exports and appears to not adequately recognise the emergence of the large intensive livestock industries and member companies. It is likely that the intensive livestock industries will increasingly need to revert to annual supply contracts with local grain growers to ensure supplies of feedgrains to enable the projected growth of these industries to occur. Grain imports do occur in Australia but are directed to the poultry industry whose geographic proximity to the seaboard with prevailing quarantine regulations preventing untreated grain from moving up country to pork and feedlot operations.

A key issue in determining the availability of feedstuffs for the intensive livestock industries depends on the projections of future growth for the feedlot, pork, poultry, dairy, and sheep industries. The future growth of these industries are explored in Section 2.3.2.

## 2.3 Australia in Context

### 2.3.1 Australian Livestock Industry Growth Trends

**Pastoral Beef Cattle**

Australian beef cattle numbers increased during the 1992 to 2002 period to reach 24,925,000 in 2002. Queensland has the majority of Australian beef cattle, 46% in 2001 (Table 1).

**Table 1:** Australian Beef Cattle Numbers 1992 - 2002

| | NSW | VIC | QLD | SA | WA | TAS | NT | ACT | Australia | % Change |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | '000 | | | | | | | | | |
| 1992 | 5,720 | 2,564 | 10,161 | 926 | 1,592 | 498 | 1,358 | 11 | 22,830 | |
| 1993 | 5,768 | 2,439 | 9,987 | 1,011 | 1,596 | 488 | 1,349 | 12 | 22,650 | -1% |
| 1994 | 6,127 | 2,604 | 9,656 | 1,056 | 1,683 | 507 | 1,434 | 13 | 23,080 | 2% |
| 1995 | 5,867 | 2,659 | 9,689 | 1,064 | 1,773 | 507 | 1,419 | 13 | 22,991 | 0% |
| 1996 | 6,019 | 2,714 | 9,928 | 1,069 | 1,803 | 521 | 1,502 | 13 | 23,569 | 3% |
| 1997 | 6,118 | 2,627 | 10,130 | 1,024 | 1,787 | 515 | 1,609 | 13 | 23,736 | 1% |
| 1998 | 5,922 | 2,306 | 10,562 | 1,051 | 1,848 | 510 | 1,566 | 10 | 23,776 | 0% |
| 1999 | 5,846 | 2,180 | 10,444 | 1,006 | 1,817 | 491 | 1,566 | 9 | 23,358 | -2% |
| 2000 | 5,531 | 2,371 | 11,503 | 995 | 2,059 | 411 | 1,570 | 10 | 24,448 | 5% |
| 2001 | 6,012 | 2,663 | 11,289 | 1,136 | 2,082 | 455 | 1,722 | 12 | 24,519 | 0% |
| 2002 | na | na | na | na | na | na | na | na | 24,925 | 2% |
| Source: ABARE, 2002 | | | | | | | | | | |

**Feedlot Cattle**

The Australian number of cattle on feed increased during the 1996 to 2002 period to reach 706,477 in December 2002 (Table 2). The average annual growth rate for the number of Australian cattle on feed for the 1995-2002 period was 7%.

**Table 2:** Australian Numbers of Cattle on Feed December 1995 - 2002

| | Dec-95 | Dec-96 | Dec-97 | Dec-98 | Dec-99 | Dec-00 | Dec-01 | Dec-02 |
|---|---|---|---|---|---|---|---|---|
| Numbers on Feed | 462,000 | 366,000 | 448,000 | 505,000 | 518,144 | 608,509 | 637,410 | 706,477 |
| % Change | | -21% | 22% | 13% | 3% | 17% | 5% | 11% |

Source: ALFA/MLA, 2002

The percentage reduction in the number of cattle on feed in 1996 is a direct negative impact of decreased herd size due to the 1994-1995 drought and inability to meet market demand, particularly in Japan, with Australia losing market share to USA. It was also the result of Australian production costs being higher than the USA as the US were not in drought and Australia was uncompetitive in the Japanese losing significant market share as a result.

Queensland is the predominant feedlot state having the majority of Australian cattle on feed, 48.6% in 2002 (Table 3). Queensland has the least security of feedgrain supply.

**Table 3:** Australian Numbers of Cattle on Feed by State for December 2002

| | NSW | VIC | QLD | SA | WA | Total |
|---|---|---|---|---|---|---|
| Dec-02 | 259,084 | 50,849 | 343,604 | 16,703 | 36,237 | 706,477 |

**Pigs**

Australian pig numbers achieved an average annual growth rate of 1.3% during the 1992-2002 period, reaching 2,881,000 head in 2002. NSW has the majority of Australian pigs, 28.3% in 2002 (Table 4). Growth in pig numbers has been fuelled by the growth in pork exports to SE Asia and Japan.

**Table 4:** Australian Pig and Breeding Sow and Gilt numbers 1995-2001

| | NSW | VIC | QLD | WA | SA | TAS | NT | ACT | Australia | % Change |
|---|---|---|---|---|---|---|---|---|---|---|
| | '000 | | | | | | | | | |
| 1992 | 805 | 457 | 568 | 320 | 424 | 45 | 3 | na | 2,621 | |
| 1993 | 823 | 434 | 622 | 307 | 438 | 45 | 3 | na | 2,673 | 2% |
| 1994 | 834 | 460 | 677 | 312 | 440 | 46 | 3 | na | 2,775 | 4% |
| 1995 | 791 | 439 | 644 | 316 | 423 | 38 | 3 | na | 2,653 | -4% |
| 1996 | 710 | 458 | 603 | 314 | 412 | 26 | 0 | na | 2,526 | -5% |
| 1997 | 729 | 485 | 600 | 297 | 417 | 24 | 2 | na | 2,555 | 1% |
| 1998 | 849 | 518 | 648 | 303 | 424 | 24 | 2 | na | 2,768 | 8% |
| 1999 | 778 | 521 | 621 | 277 | 406 | 22 | 2 | na | 2,626 | -5% |
| 2000 | 710 | 523 | 544 | 276 | 438 | 18 | 2 | na | 2,511 | -4% |
| 2001 | 845 | 557 | 597 | 286 | 438 | 22 | 2 | na | 2,748 | 9% |
| 2002 | 817 | 658 | 617 | 358 | 409 | 19 | 3 | na | 2,881 | 5% |

Source: ABARE , 2002

### Sheep

Australian sheep numbers declined during the 1992-2002 period to equal 103 Million head in 2002. NSW has the majority of Australian sheep, 36.9% in 2001 (Table 5). The decline in competitiveness of wool as a textile fibre, the move from wheat sheep farms to predominant grain farms or cotton in areas serviced with irrigation waters are some of the reasons behind the decline in the sheep population.

**Table 5:** Australian Sheep Numbers 1995-2002

| | NSW | VIC | QLD | SA | WA | TAS | NT | ACT | Australia | % Change |
|---|---|---|---|---|---|---|---|---|---|---|
| | Million | | | | | | | | | |
| 1992 | 54 | 26 | 15 | 16 | 34 | 4 | na | 0.1 | 151 | |
| 1993 | 49 | 24 | 13 | 16 | 33 | 4 | na | 0.1 | 141 | -6.9% |
| 1994 | 47 | 23 | 12 | 15 | 32 | 4 | na | 0.1 | 133 | -5.7% |
| 1995 | 40.5 | 21.4 | 11.6 | 13.3 | 30.3 | 3.9 | na | 0.1 | 120.9 | -8.8% |
| 1996 | 41.1 | 22.0 | 10.7 | 13.6 | 29.8 | 3.9 | na | 0.1 | 121.1 | 0.2% |
| 1997 | 42.4 | 22.3 | 10.5 | 13.1 | 27.8 | 4.0 | na | 0.1 | 120.2 | -0.7% |
| 1998 | 40.8 | 21.1 | 11.0 | 13.1 | 27.3 | 3.9 | na | 0.1 | 117.5 | -2.2% |
| 1999 | 40.6 | 20.9 | 10.6 | 13.1 | 28.4 | 3.8 | na | 0.1 | 115.5 | -1.7% |
| 2000 | 42.4 | 22.1 | 9.0 | 13.4 | 25.5 | 3.3 | na | 0.1 | 118.6 | 2.7% |
| 2001 | 41.0 | 23.0 | 9.1 | 13.1 | 23.8 | 3.3 | na | 0.1 | 110.9 | -6.5% |
| 2002 | na | na | na | na | na | na | na | na | 103.0 | -7.1% |

Source: ABARE, 2002

### Dairy Cattle

Australian dairy cow numbers increased overall during 1992-2002 to total 3,101,000 head in 2002. Victoria has the majority of Australian dairy cows, 64.5% in 2001 (Table 6). The dairy industry has been undergoing significant structural change with the departure of a large number of small players. Industry consolidation and rationalisation has seen the emergence of a number of large players and the trend to increasing concentrate feeding of dairy cows.

**Table 6:** Australian Total Dairy Cattle and Calves 1995 – 2002

| Year | NSW | VIC | QLD | SA | WA | TAS | NT | ACT | Australia | % Change |
|---|---|---|---|---|---|---|---|---|---|---|
| | '000 | | | | | | | | | |
| 1992 | 340 | 1472 | 280 | 139 | 113 | 154 | 2 | 0 | 2500 | |
| 1993 | 343 | 1484 | 282 | 143 | 117 | 161 | 2 | 0 | 2532 | 1% |
| 1994 | 364 | 1585 | 286 | 147 | 123 | 172 | 1 | 0 | 2678 | 6% |
| 1995 | 370 | 1,621 | 285 | 152 | 126 | 185 | 1 | 0 | 2,740 | 2% |
| 1996 | 371 | 1,682 | 286 | 150 | 121 | 197 | 1 | 0 | 2,808 | 2% |
| 1997 | 393 | 1,784 | 292 | 157 | 122 | 211 | 0 | 0 | 2,958 | 5% |
| 1998 | 429 | 1,836 | 305 | 162 | 124 | 218 | 1 | 0 | 3,076 | 4% |
| 1999 | 445 | 1,945 | 304 | 177 | 114 | 233 | 1 | 0 | 3,220 | 5% |
| 2000 | 440 | 1,893 | 305 | 189 | 106 | 206 | 1 | 0 | 3,140 | -2% |
| 2001 | 458 | 2,076 | 297 | 207 | 128 | 228 | 0 | 0 | 3,217 | 2% |
| 2002 | na | na | na | na | na | na | na | na | 3,101 | -4% |

Source: ABARE, 2002

**Poultry**

The Australian poultry industry is domestic market focussed and concentrated to a small number of large integrated companies. Australian poultry in 2000 totalled 87,029,000 head, chickens accounted for 98% of total poultry numbers. The number of Australian egg producing chickens in 2000 was 12,016,000, 14% of total chickens. Meat chickens accounted for 86% of total chickens (Table 7).

**Table 7:** Australian Poultry Numbers in 2000

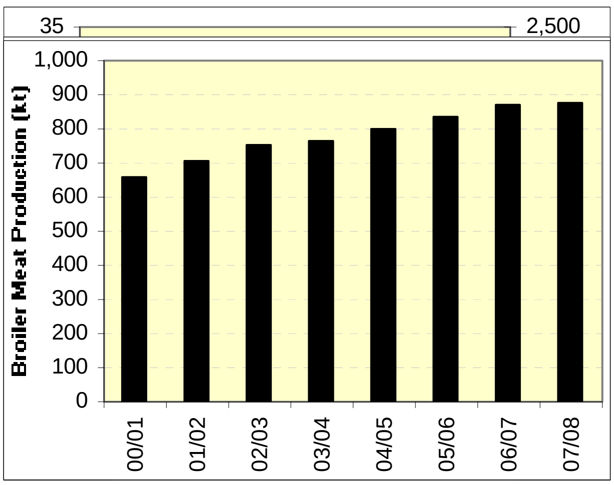
| Egg Chickens | Meat Chickens[c] | Ducks | Turkeys | Other poultry | Total all poultry |
|---|---|---|---|---|---|
| '000 | | | | | |
| 12,016 | 72,912 | 517 | 1,360 | 224 | 87,029 |

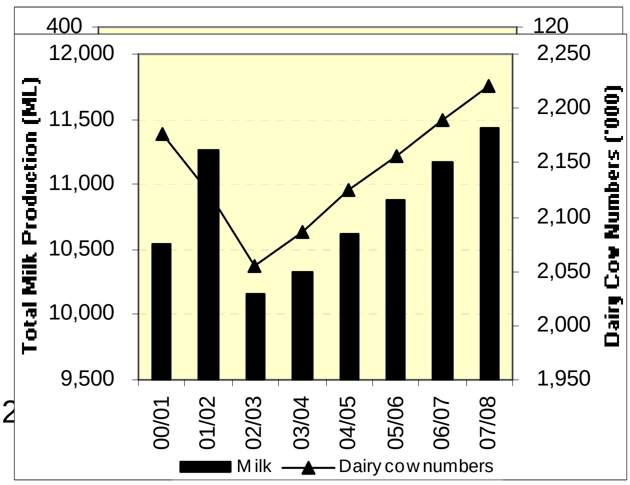
Source: ABS, 2003 (7215.0). Note: (a) Includes breeding stock; (b) Excludes turkeys in SA; and (c) Excludes meat strain chickens in TAS

## *2.3.2 Australian Livestock and Livestock Product Projection Trends*

An analysis of Australian livestock industry projection data obtained from ABARE, MLA, APL and FAPRI was undertaken to determine the best data source for projecting intensive livestock industry growth and subsequent feedstuff usage arising from those growth projections or otherwise. All sources exhibited similar trends to the ABARE analysis contained in their revision of the feedstuff regional supply demand model report. Consequently for all future analysis it was decided to utilise ABARE data albeit with variations as indicated in supplementary reports commissioned as part of this study into the feedlot, dairy, fodder and pastoral sheep and cattle industries. ABARE projects overall positive growth for all selected livestock and associated products between 2000-01 to 2007-08 period except for lamb and mutton which are projected to experience overall negative growth (Figure 6).

**Figure 6:** Australian Livestock Numbers and Production



Source: ABARE, 2003

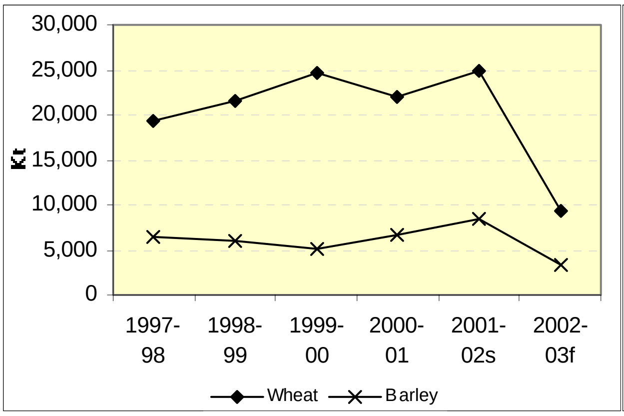
### 2.3.3 Australian Feedstuffs Production Projections

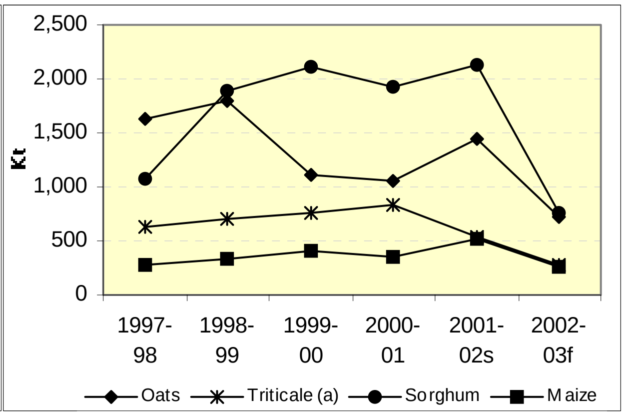
**Australian Grains**

The current 2002-2003 drought has impacted severely on Australian grain production. For example, ABARE forecasts Australian wheat production to equal 9,385 kt in 2002-2003, less than 50% of previous years. Reduced production of feedgrains, combined with poor pasture conditions forcing higher than normal use of wheat in livestock rations, has restricted grain exports to approximately 7 MT (less than half the previous years exports and the lowest level of exports in 24 years).

Despite the drought induced grain shortage there have still been exports of feedgrains particularly to the Middle East and Japan. USDA has forecast that Australia will ship 1.4 MT of barley and 100,000 tonnes of oats, both increases on the previous grain year. These exports have created significant tension between the grains and intensive livestock industries. Much of the tension arises from a lack of transparency in the quantum of grain stocks held, their location and price at import parity levels. The following section examines current and forecast Australian grain production and other feedstuff production, domestic use and exports relative to intensive livestock industry current and forecast demand.
The Australian grain, oilseed and pulse industries have grown over the past ten years. However, production growth has been greatly affected by drought occurrences such as the 1994-1995 drought and the recent 2002-2003 drought (Figure 7). Volume 2 of this report provides further Australian grain statistics.

**Figure 7:** Australian Grain Production




Source: ABARE, 18 February 2003,
Note: s= ABARE estimate, f = ABARE forecast; (a) = Excludes small quantities of triticale for export

- **Wheat:-** is the largest grain crop produced in Australia, production mostly occurring in NSW (33%) and Western Australia (32%). The majority of Australian wheat production is exported. In 2001-2002 21.8% of Australian wheat production was used domestically with only 10.9% of Australian wheat production utilised for feed (Figures 8 and 9).

- **Barley:-** Australia's second largest field crop is grown mainly in South Australia (34%) and Western Australia (27%). The majority of Australian barley production is exported. In 2001-2002, 35% of barley production was used domestically, with only 26.1% of Australian barley production utilised for feed.

- **Sorghum:-** Queensland accounts for the majority of sorghum production (63% in 2001-2002) followed by NSW (37% in 2001-2002). The majority of Australian sorghum production is used domestically with 80% of Australian sorghum production utilised for feed.

- **Oats:-** Australian oat production occurs principally in Queensland (39% in 2001-2002) and Victoria (24% in 2001-2002). The majority of Australian oat production is used domestically, with 75.7% of production utilised for feed.

- **Maize:** Australian maize production occurs mainly in NSW (63% in 2001-2002) and Queensland (34% in 2001-2002). The majority of Australian maize production is used domestically, with 70% of production utilised for feed.

- **Triticale:** Australian triticale production occurs mainly in NSW (70% in 2001-2002) and Victoria (44% in 2001-2002). The majority of Australian triticale production is used domestically with 98% of production utilised for feed.

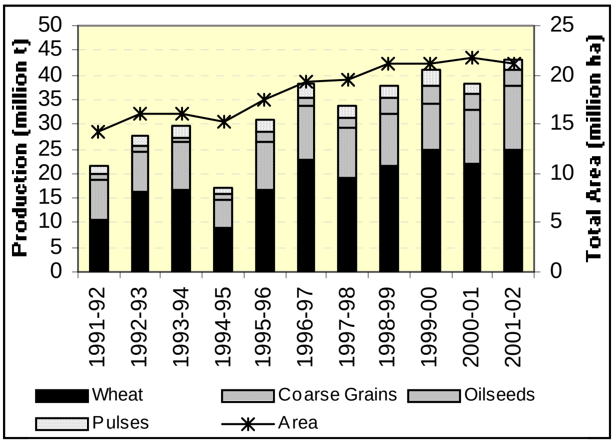
- **Canola:** The main oilseed grown in Australia. The majority of Australian canola production occurs in NSW (37% in 2001-2002) and Western Australia (23% in 2001-2002). The majority of Australian canola production is exported. In 2001-2002 only 22% of Australian canola production was utilised domestically.

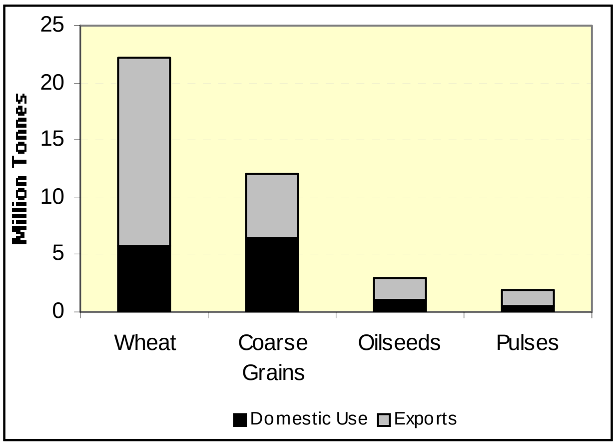
- **Other Oilseeds:** Cottonseed production mainly occurs in NSW (74% in 2001-2002) and Queensland (26% in 2001-2002). The majority of Australian linseed production occurs in Victoria (43% in 2001-2002) and NSW (26% in 2001-2002). Australian soybean production mainly occurs in NSW (70% in 2001-2002) and Queensland (27% in 2001-

2002). The majority of Australian oilseed production is exported with only 36% used domestically in 2001-2002 (Figure 8).

- **Pulses:** Lupins are the main pulse grown in Australia with the majority produced in Western Australia (74% in 2001-2002) and South Australia (13%). Australian field peas are mainly produced in South Australia (50%) and Victoria (31%). The majority of chickpeas are produced in NSW (63%) and Queensland (24%). The majority of pulses are exported with only 27% used domestically in 2001-2002 (Figure 8).

**Figure 8:** Australian Grain Production (1991-92-2001-02), Domestic Use and Exports (2001-02)

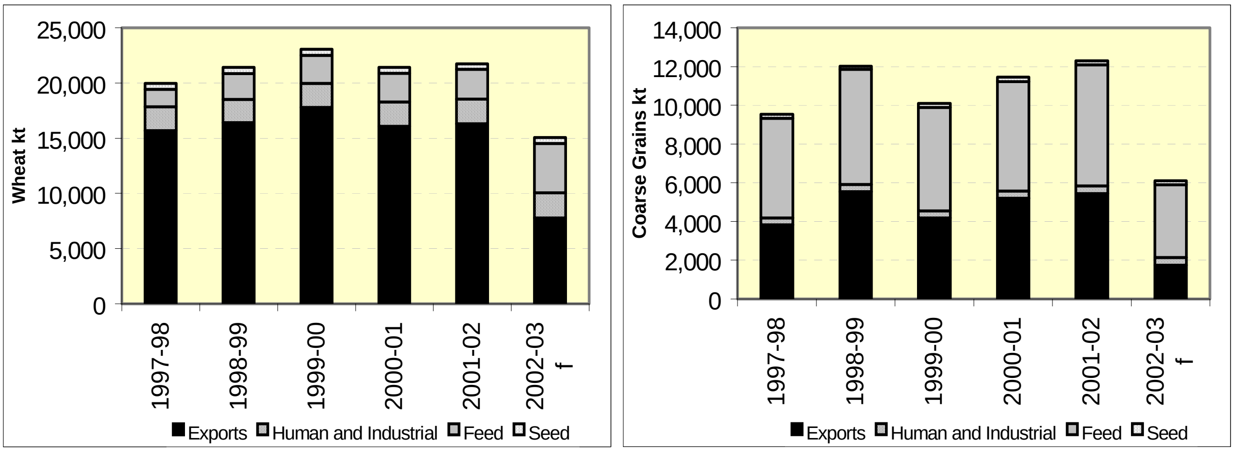



Source: ABARE 2002

Note: f = ABARE forecast; Pulses include lupins, field peas, chickpeas, faba beans, mung beans, navy beans, vetch and lentils; Oilseeds are comprised of canola, cottonseed, linola, linseed, peanuts, safflower seed, soybeans and sunflower seed; Coarse grains include barley, oats, sorghum, maize and triticale.

**Figure 9:** Wheat and Coarse Grain Exports and Domestic Use



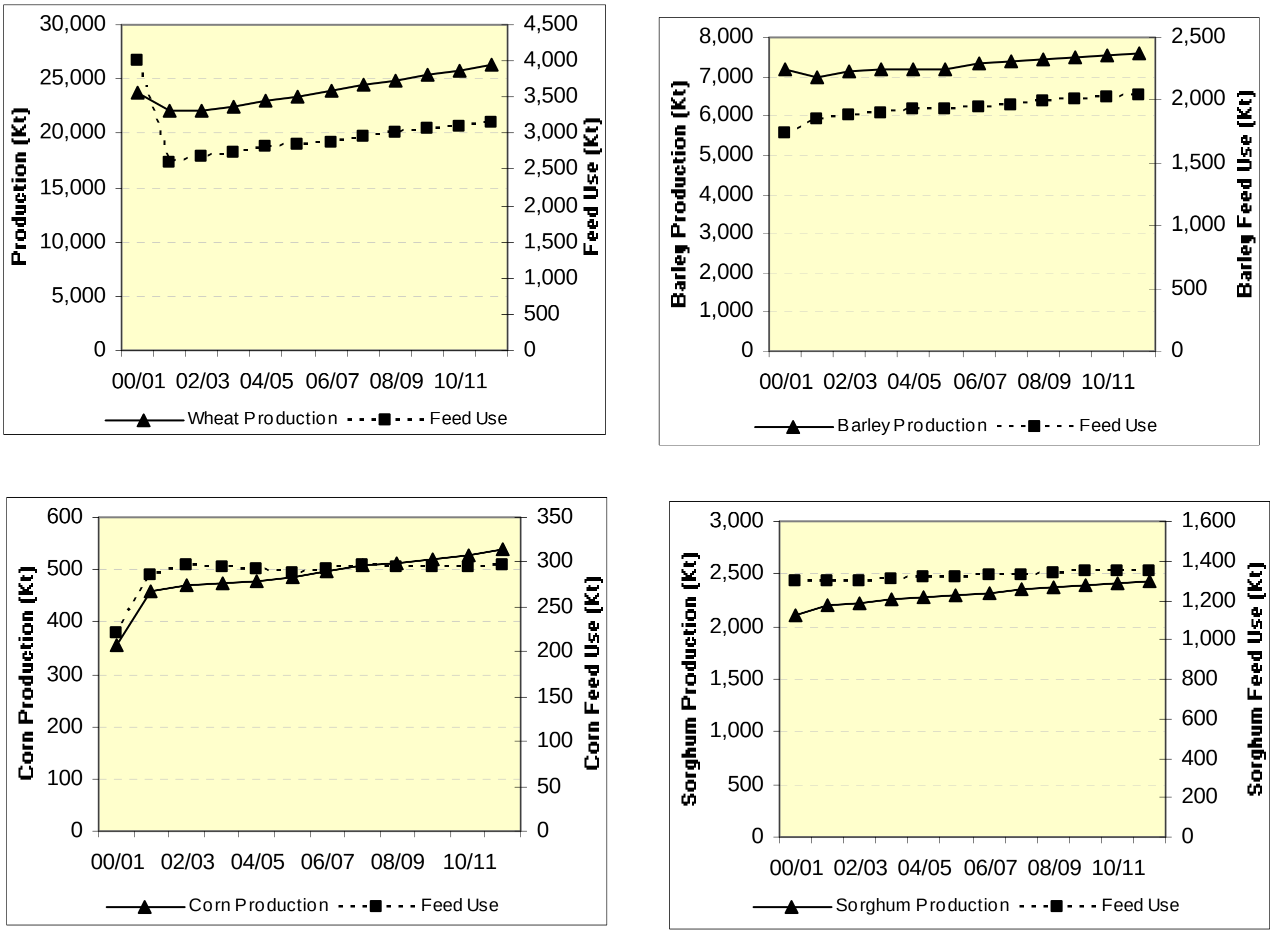

Source: ABARE 18th February 2003,

- As at the 28th of February 2003 the major Australian grain storage operators had 14,824,000 tonnes of grain in storage according to ABARE surveys, down on previous years. The majority of the grain stored was milling wheat followed by feed wheat. This probably accounts for the continued availability of small quantities of grains to the domestic market as the severity of the 2002-2003 drought worsened and crop yields declined compared to normal seasonal grain production.

- Australian grain production and feed use is projected to increase. FAPRI data indicates that production and feed use of all grains after 2000-2001 are projected to increase to 2010-2011 (Figure 10).

- By 2011-2012 FAPRI projects Australian wheat production to equal 26.33 MT and wheat feed use to equal 12% of Australian wheat production. Australian corn production is projected to equal 536.99 kt in 2011-2012, corn feed use to equal 55% of Australian corn production. Australian sorghum production is projected to equal 2.43 MT in 2011-2012, sorghum feed use to equal 55% of Australian sorghum production. FAPRI predicts that barley production will equal 7.61 MT in 2011-2012 and barley feed use to equal 27% of Australian barley production (Figure 10).

**Figure 10:** Australian Grain Production and Feed Use Projection




Source: FAPRI, 2002

### Australian Forage Crops

The characteristics of the Australian forage industry are as follows:-

- Australia produces approximately 5-6 MT of fodder per year, mostly for domestic use by livestock industries such as dairy, beef and horses. In 1999-2000 Australian hay production equalled 5,331,000 tonnes, a decline from the previous year (Figure 11). The majority of hay is produced from pastures, followed by cereal crops, lucerne, and non-cereal crops. In 1999-2000 Australian silage production equalled 2,981,000 tonnes, an increase from the previous year (Figure 11). *(Australian Bureau of Statistics (ABS), 2003).*

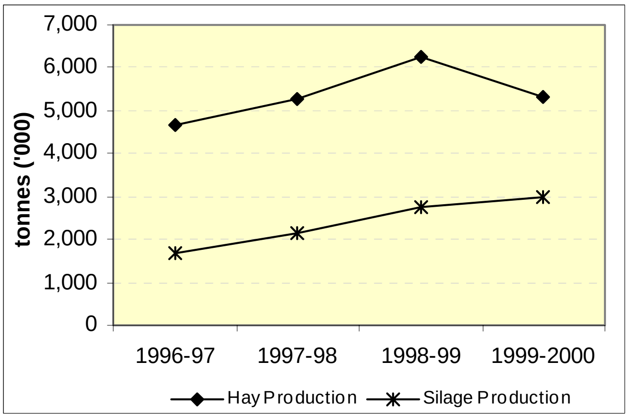
- The majority of Australian cereal crops cut for hay production occurs in Western Australia (40% in 1999-2000) and South Australia (23% in 1999-2000). Australian lucerne cut for hay is mainly produced in NSW (44% in 1999-2000), Victoria (22% 1999-2000) and Queensland (21% 1999-2000). The majority of other Australian pastures and grasses cut for hay are produced in Victoria (58% 1999-2000) and New South Wales (16% 1999-2000). *(ABS, 2003)*.

- The majority of forage crops are utilised domestically. According to RIRDC Approximately 80% of fodder production is used on-farm.

- Japan is Australia's most important export market. Japan imported 7,200 tonnes of lucerne hay, 8,900 tonnes of lucerne meal and pellets, and 211,000 tonnes of other hay and chaff in 1996-1997. There has been no recent data to identify the trends in export activity beyond 1997.

- The ABARE survey of on-farm grain and fodder stocks revealed that as at the 31st of December 2002 the following fodder sources were stored on farms in Australia 4,198 kt of hay 2,215 kt of silage, and 308 kt of straw. Persistent drought tends to limit irrigation water availability leading to a reduction in hay and silage production (Figure 11).

**Figure 11:** Australian Production of Hay and Silage




Source: ABS, 2003

A supplementary report titled "Fodder Supply and Demand Scenarios and Risk Management Options for the Livestock Industries", written by Colin Peace, Jumbuk Consulting Pty Ltd, was commissioned by Macarthur Agribusiness (the full report can be seen in Volume 2 of this report). In this report, using ABS hay and livestock statistics and Bureau of Meteorology rainfall data, four supply and demand scenarios for fodder are modelled.

The main findings of the report are:

- During a normal year of average rainfall, Australian annual fodder (hay and silage) supply and demand runs at a surplus (estimated to be 590,000 tonnes). In these years fodder producers are able to store hay and silage and carry stocks over to the next year.

- When rainfall is limited in the growing season, the reduced fodder production leads to higher hay prices a reduced demand and a rationing of supply. The model takes into account the various responses to these market changes to fodder.

- The dairy industry, particularly in Victoria shows up as a dominant consumer of fodder with relatively inelastic demand for lactating cows.

- In the most extreme drought scenario, the model used the ABARE survey figures of the anticipated changes in livestock numbers from June 30 2002 to June 30 2003. Despite the aggressive culling of stock, the fodder deficit for this model was 1.2 MT. In this instance, this is not a realistic outcome in the current farming practices, as supply and demand would not meet. As seen in recent ABS surveys, carryover stocks are insufficient to satisfy such a large nearby deficit. It does show however that if the livestock industry was to experience such a drought, the livestock numbers would need to fall below the levels indicated in the ABARE surveys of February 2003.

- One response to such domestic shortfalls of feeds has been to import stocks of feedgrains from international sources. This has occurred to a limited extent with fodder supplies. Alfalfa cubes and wheat bran pellets have been imported into Australia during recent droughts. They appear to have a good nutritional balance and despite some minor physical problems, they have been fed successfully to sheep and cattle.

- In the case of future droughts, reliance on these fodder substitutes appears a high-risk strategy. The production capacity of overseas mills is limited and the fibre-starved markets of north Asia also seek these feed supplements. While there may be some on-going potential for some livestock feeders to purchase these feeds, they will remain a risky and opportunistic option for the majority of livestock enterprises.

- There are many price risk management tools available now or able to be created should the need justify it. Spot purchases and forward contracting of the physical grain remain the key tools for all livestock feeds wishing to avoid grain price exposure (these tools are mentioned in more detail in section 8 of this report).

The following table summarises the four scenarios examined in the fodder report:

**Table 8:** Summary of Estimated Fodder Demand in all Scenarios Years (kt/yr)

| | Normal | | | Meteorological | | | Agricultural | | | Hydrological | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Demand | Supply | Surplus /Deficit | Demand | Supply | Surplus /Deficit | Demand | Supply | Surplus /Deficit | Demand | Supply | Surplus /Deficit |
| NSW | 1,414 | 1,276 | -138 | 1,531 | 1,007 | -524 | 1,249 | 692 | -557 | 796 | 417 | -379 |
| VIC | 2,709 | 3,325 | 616 | 2,958 | 3,068 | 110 | 2,789 | 2,145 | -644 | 2,039 | 1,145 | -894 |
| QLD | 1,067 | 837 | -230 | 1,148 | 707 | -442 | 987 | 676 | -311 | 742 | 642 | -101 |
| SA | 649 | 833 | 184 | 670 | 672 | 2 | 574 | 481 | -94 | 270 | 351 | 80 |
| WA | 911 | 1,071 | 159 | 948 | 923 | -25 | 795 | 688 | -108 | 398 | 566 | 167 |
| TAS | 329 | 399 | 70 | 361 | 329 | -32 | 337 | 232 | -105 | 248 | 180 | -68 |
| NT | 113 | 40 | -73 | 124 | 31 | -93 | 81 | 21 | -60 | 47 | 21 | -27 |
| ACT | 0 | 3 | 3 | 0 | 2 | 2 | 0 | 2 | 1 | .6 | 1 | .3 |
| Australia | 7,192 | 7,785 | 592 | 7,742 | 6,740 | -1,001 | 6,813 | 4,936 | -1,877 | 4,544 | 3,323 | -1,221 |

**Australian Alternative Feedstuffs**

Alternative feedstuffs are used by the intensive livestock industry and include fats and oils, molasses, white cotton seed, cassava, fibre crops, shrub legumes, rendered animal products and commercial feed wastes.

**Table 9:** Australian Alternative Feedstuffs

| | Australian Production (kt) | Exports (kt) | Domestic Use (kt) | Feed Use (kt) |
|---|---|---|---|---|
| Molasses[1] (2001) | 874.38 | 200.51 | 674.16 | 674.16 |
| Cassava[1] (2001) | na | na | 23.95(a) | 2.9=Food<br>21.1=Other Uses (b) |
| Copra Cake[1] (2001) | 0.004 | 0.013 | 11.75 | 11.75 |
| Palm Kernel Cake[1] (2001) | na | na | 20.1 (a) | 20.1 |
| Palm Oil[1] (2001) | na | 31.41 | 98.29 | 85.0 = Food<br>29.93 =Other Uses (b) |
| **Alternative Feedstuffs Used In Some Industries** | | | | |
| Meat & bone meal, poultry & feather meal (2000/01)[2] | 591.4 | 217 | • Other 29.4 | • Broiler & layer feeds = 190<br>• Pig feeds = 110(b)<br>• Pet food = 45 |
| Tallow (2000/01)[2] | 567.2 | 390 | • Edible usage = 66<br>• Soap & oleo chemical = 50<br>• Other 26.2 | • Intensive animal production = 5<br>• Pet food = 30 |

Sources: 1 = FAO, 2003; 2 = Australian Renderer's Association, 2002
Note: a = Supplied by Imports; (b) Cassava and Palm Oil Statistics don't go into feed use
Note: b = MBM has limited use and is not a substitute

The commercial reality is that there are limitations to the use of alternative feedstuffs either in terms of the quantity available, unit cost of energy or protein or anti-nutritional factors. There are, however, some regional players that consistently use alternative feedstuffs because of logistic economics or favourable supply arrangements or because the use is part of a vertically integrated operation. This is particularly the case with Northern Territory based operations sourcing SE Asian products from places such as Indonesia for live export cattle feeds en route to various SE Asian destinations. For products such as cassava there are mill processing capacity limitations to large volume supply to Australia as a grain substitute.

Moreover, beef produced in feedlots cannot be certified as grainfed unless the cattle are fed a predominantly grain based ration.

### *2.3.4 Commercial Stockfeed Manufactures*

According to Ridley Agriproducts (Australian Agribusiness Congress, 2002) there are approximately 4.9 MT of commercial stockfeed manufactured per annum, including integrated producers. In Australia there are currently 90-100 stockfeed mills. The manufacture of stockfeed in Australia mainly occurs in Victoria and NSW (Table 10) reflecting the predominance of the poultry, dairy and pork industries in those states.

**Table 10:** Commercial Stockfeed Manufacture by State

| State | % |
|---|---|
| VIC | 34 |
| NSW | 30 |
| QLD | 18 |
| WA | 9 |
| SA | 7 |
| TAS | 2 |
| NT | 0 |

Source: Robert Parkes - Ridley Agriproducts, 2002

More importantly it is these stockfeed mills, primarily located on the seaboard, that are expected to be used to process any imported grain into Australia. Discussion with stockfeed millers indicate that these mills under drought conditions are running at capacity with very little free capacity to process additional imported grain.

### 2.3.5 Adequacy of Feedgrain Supply for the Intensive Livestock Industries

The following table summarises Australian grain production and intensive livestock industry use. The analysis reveals that except in years where grain production is reduced through drought, there appears to be enough grains to supply animal feed demands. Assuming normal grain production occurs grain supply is assumed to be able to meet livestock demand even with livestock numbers growing at 10%. However, the critical issues are that if livestock growth continues uncertainty arises in abnormal years when grain production is reduced through events such as drought or pest and disease induced crop failure.

**Table 11:** Australian Feedgrain Supply and Demand

| | 1998/99 | 1999/00 | 2000/01 | 2001/02 | 2001/02 | 2002/03 | 2002/03 |
|---|---|---|---|---|---|---|---|
| | | | | 11-Mar | 10-Apr | 11-Mar | 10-Apr |
| **AUSTRALIAN WHEAT** | **‘000 tonnes** | | | | | | |
| Production | 21,465 | 24,757 | 22,108 | 24,854 | 24,854 | 9,500 | 9,500 |
| Exports | 16,104 | 17,124 | 16,682 | 16,494 | 16,494 | 9,000 | 9,000 |
| Consumption | 4,530 | 5,227 | 5,328 | 5,427 | 5,427 | 7,550 | 7,550 |
| **Available Surplus** | **831** | **2,406** | **98** | **2,933** | **2,933** | **-7,050** | **-7,050** |
| **@35% for Feedgrain use (ABARE)** | **291** | **842** | **34** | **1,027** | **1,027** | **-2,468** | **-2,468** |
| **AUSTRALIAN COARSE GRAIN** | | | | | | | |
| Production | 10,069 | 8,686 | 10,138 | 12,561 | 12,561 | 5,540 | 5,540 |
| Exports | 4,859 | 3,836 | 4,951 | 4,841 | 4,841 | 1,150 | 1,600 |
| **Available Surplus After Exports** | **5,210** | **4,850** | **5,187** | **7,720** | **7,720** | **4,390** | **3,940** |
| **Barley Consumption** | 2,130 | 2,560 | 2,181 | 4,008 | 3,200 | 3,200 | 3,200 |
| **Sorghum Consumption** | 1,400 | 1,300 | 1,300 | 1,746 | 1,705 | 1,025 | 1,000 |
| **Oats Consumption** | 1,548 | 982 | 965 | 1,363 | 1,363 | 675 | 625 |
| **Available Surplus After Consumption** | **132** | **8** | **741** | **603** | **1,452** | **(510)** | **(885)** |
| **AUSTRALIAN BARLEY** | | | | | | | |
| Production | 5,987 | 5,032 | 6,743 | 8,423 | 8,423 | 3,500 | 3,500 |
| Exports | 4,241 | 2,870 | 3,922 | 4,150 | 4,150 | 1,000 | 1,400 |
| Consumption | 2,130 | 2,560 | 2,181 | 4,008 | 3,200 | 3,200 | 3,200 |
| Ending Stocks | 465 | 387 | 983 | 1,098 | 1,906 | 398 | 806 |

| | 1998/99 | 1999/00 | 2000/01 | 2001/02 | 2001/02 | 2002/03 | 2002/03 |
|---|---|---|---|---|---|---|---|
| | | | | 11-Mar | 10-Apr | 11-Mar | 10-Apr |
| **Available Surplus** | **(384)** | **(398)** | **640** | **265** | **1,073** | **(700)** | **(1,100)** |
| **AUSTRALIAN SORGHUM** | | | | | | | |
| Production | 1,891 | 2,116 | 1,935 | 2,123 | 2,123 | 1,000 | 1,000 |
| Exports | 355 | 761 | 890 | 515 | 515 | 75 | 75 |
| Consumption | 1,400 | 1,300 | 1,300 | 1,746 | 1,705 | 1,025 | 1,000 |
| **Available Surplus** | **136** | **55** | **(255)** | **(138)** | **(97)** | **(100)** | **(75)** |
| **AUSTRALIAN OATS** | | | | | | | |
| Production | 1,798 | 1,118 | 1,050 | 1,439 | 1,439 | 725 | 725 |
| Exports | 241 | 158 | 86 | 133 | 133 | 50 | 100 |
| Consumption | 1,548 | 982 | 965 | 1,363 | 1,363 | 675 | 625 |
| Ending | 216 | 217 | 216 | 155 | 155 | 155 | 155 |
| **Available Surplus** | **9** | **(22)** | **(1)** | **(57)** | **(57)** | **0** | **0** |
| *Source USDA Trade Statistics, 2003* | | | | | | | |
| **Net Available Surplus for Intensive Industry Growth** | **52** | **477** | **418** | **1,097** | **1,946** | **(3,268)** | **(3,643)** |
| | | | | ***GOOD Years*** | ***GOOD Years*** | ***BAD Years*** | ***BAD Years*** |
| **Current Intensive Livestock Usage** | **2003** | **2007** | | | | | |
| Wheat | 2001 | 3236 | | | | | |
| Barley | 1291 | 1610 | | **Deficit/Surplus on Current Production** | | | |
| Sorghum | 1537 | 1549 | | **(469)** | **380** | **(4,834)** | **(5,209)** |
| | **4829** | **6395** | | | | | |
| **Feedgrain Demand Increase** | | **1566** | | | | | |

Source: Base Data = FAS, 2003, Macarthur Agribusiness Analysis, 2003

The Australian feedgrain supply industry will need to produce approximately a minimum of an additional 1.6 MT of feedgrains by 2007 to satisfy the growth projections of the intensive livestock industries. If this increase in feedgrain supply does not eventuate the intensive livestock industries will be forced to import feedgrains to satisfy their feedgrain requirements. This forced import need is not the preference of large Australian feedlot and pork industry players who would rather source locally or within Australia as long as they were able to have comparative feed supply costs to competitor industries in key export markets. The next sections of this report will examine the demand drivers in the Australian intensive livestock industries and explores some options to rectify any supply demand imbalance.

# 3. FUTURE AUSTRALIAN FEEDSTUFF DEMAND

## 3.1 Introduction

This section examines in more detail the future Australian feedstuff demand by livestock and feedstuff type. A number of analyses on the feedgrain industry have been undertaken by a range of agencies over the last 10 years.

The estimated demand for feedgrains including pulses and oilseeds for feeding was approximately 10 MT in 2002. The beef feedlot (25%) and poultry industries (24%) consume the most grain closely followed by pigs (20%) and the dairy industries (15%). By comparison in 2000 it was estimated that livestock sector demand would be 9.2 MT comprising: beef (2

MT), poultry (1.7 MT), egg industry (500 kt), pig industry (1.8 MT), dairy (2 MT), smaller industries- sheep, horses, pet food and aquaculture (~1.2 MT).

In most years Australian feedgrain production has enjoyed a surplus over and above domestic market requirements (43%) although this surplus can be reduced significantly during drought. Growth in the intensive livestock sector, fuelled by growth in response to domestic and export market demands for product consistency and supply reliability, is putting increasing pressure on the traditional feedgrain supply surplus particularly in the eastern States.

Indicative approximate usage rate of the various feedstuff groups by the intensive livestock industries are as follows:-

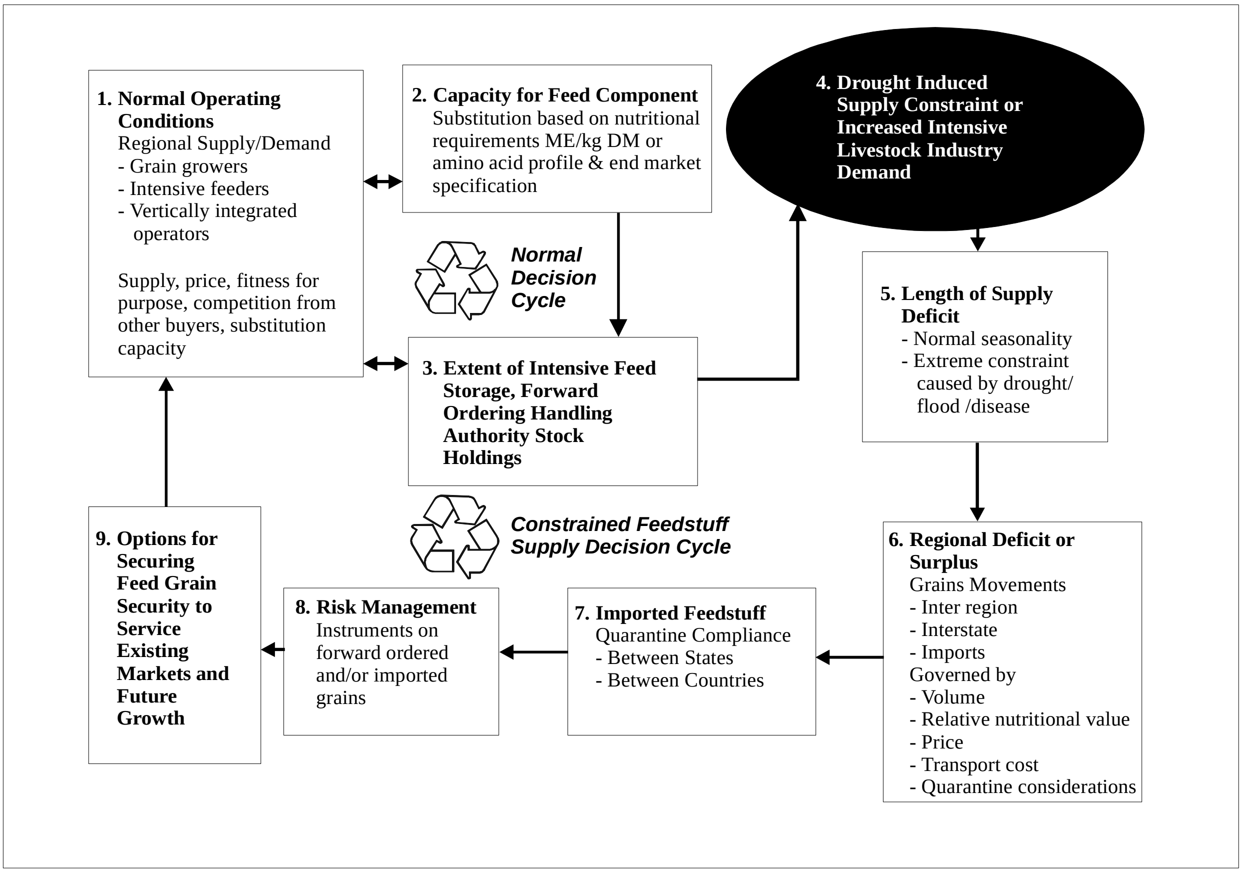
**Table 12:** Raw Material Usage by Intensive Livestock Industries

| Crop | % |
|---|---|
| Grains (wheat, barley, oats, maize, sorghum & triticale) | 76 |
| Oilseeds | 12 |
| By-products | 7 |
| Pulses | 5 |

Source: Robert Parkes - Ridley Agriproducts, 2002

The feed use profile has other dimensions which are governed by either drought or the need for continued industry growth and a decision cycle comes into play when there is restricted feedstuff supply in drought scenarios as shown in Figure 12.

**Figure 12:** The Intensive Livestock Industry Feedgrain Security Decision Cycles



This current study has been commissioned by Meat and Livestock Australia, Australian Pork Limited, Dairy Australia and Australian Wool Innovations Limited. FGAG and GRDC have commissioned an upgrade of ABARE's regional feedstuff supply demand model. After careful consideration it is Macarthur Agribusiness's opinion that there will be significant benefits in integrating the work of the respective studies to determine realistic options for future feedstuff security of the intensive livestock industries in Australia. Macarthur Agribusiness has examined the reworked ABARE model (November, 2003) and has undertaken an independent analysis and are comfortable with the efficacy of the ABARE data which will be used in this chapter. Any significant departures from ABARE estimates identified in supplementary industry sector reports commissioned as part of this report will be shared with ABARE to ensure the regional feed supply demand model is rigorous. A joint ABARE APSRU modelling exercise was commissioned by Macarthur Agribusiness to take into account the impact of drought on feed demand and supply in Australia. The results of this modelling can be seen in Chapter 10 of this report.

**ABARE Regional Feedstuff Supply Demand Model**

The ABARE data looks at current feedstuff demand (2003) and projects demand by intensive livestock industry type and region to 2007 in a Business As Usual scenario (BAU).

The intensive livestock industries considered are poultry broilers and layers, pigs, feedlot, dairy, sheep, grazing ruminants, and others including horses, aquaculture and various sunrise livestock industries.

Table 13 examines the intensive livestock industries total feed demand for cereals, pulses, oilseeds, oilseed meals, cereal by-products, roughages, animal proteins and other feed ingredients. The ABARE model projects a 15% total feed demand increase from 10,883 in 2003-2004 to 12,540 in 2007-2008.

**Table 13:** ABARE Model Australian Total Feed Demand in 2003-04 and 2007-08 (kt)

| Feed | QLD | NSW | VIC | SA | WA | AUST |
|---|---|---|---|---|---|---|
| Total Feed Demand (2003) | 2,555 | 3,309 | 3,293 | 886 | 840 | 10,883 |
| Total Feed Demand (2007) | 3,057 | 3,891 | 3,640 | 1,004 | 948 | 12,540 |
| Growth | 20% | 18% | 11% | 13% | 13% | 15% |

An important conclusion is that strongest demand growth is projected in Queensland and NSW, the States where supply shortages have been most acute.

## 3.2 Australian Feed Demand by Livestock Feeding Sector

This section examines specific livestock industry feedstuff requirements. A number of industry consultations were undertaken to gather information. ABARE BAU data is utilised in this section with additional summary information provided from specific industry reports, which were commissioned by Macarthur Agribusiness. Complete copies of these supplementary reports can be found in the accompanying Volume 2 of this report.

### *3.2.1 Feedlot*

The feedlot industry is the largest single user of feedgrains, accounting for 27% of the total. The types of grains used in lot feeding are predominantly barley and sorghum although wheat, and to a lesser extent maize, oats and triticale, play an important role.

Feedlot industry is continuing to consolidate with decline in the number of opportunity feeders. Feedlots are getting larger with more constant capacity utilisation requiring constant access to reliable supplies of feedgrains and roughages.

The feedlot industry has the following feed use profile:

| Feedstuff | % |
|---|---|
| Grain | 65 |
| Roughage & Additives | 17 (68% maize silage, 32 % industry by products) |
| Supplements & Protein Meals | 10 (molasses, meals, microelements and additives) |
| By Products | 8 |
| **Total** | **100** |

Source: MLA (FLOT.404), 2002

ALFA in a previous unpublished study had estimated the feedstuff requirements of the feedlot sector on a State by State basis (Table 14). This data is presented as a historical reference point and as a cross check on the data used in the recent ABARE regional supply demand model.

**Table 14:** ALFA Australian Commodity Usage by State (period 1/7/98 to 20/6/99) (tonnes)

| Commodity | NSW | Vic | QLD | SA | WA | AUST |
|---|---|---|---|---|---|---|
| **Grains** | | | | | | |
| Sorghum | 132,947 | - | 251,938 | - | - | 384,885 |
| Barley | 662,463 | 60,250 | 358,967 | 123,115 | 13,026 | 1,217,821 |
| Wheat | 104,546 | 3,100 | 109,251 | 480 | 7,959 | 225,336 |
| Other Grain | 20,213 | 5,794 | 44,895 | 8,725 | 25,655 | 105,282 |
| **Total Grain** | **920,169** | **69,144** | **765,051** | **132,320** | **46,640** | **1,933,324** |
| Molasses | 262,745 | 1,741 | 56,412 | - | 130 | 321,028 |
| Cottonseed | 12,752 | 2,300 | 63,197 | - | - | 78,249 |
| Silage | 104,636 | 8,000 | 118,205 | 53,766 | 5,922 | 290,529 |
| Hay/ Straw | 43,383 | 12,593 | 34,128 | 24,644 | 11,681 | 126,429 |
| Other Roughage | 126,565 | 4,650 | 93,160 | 878 | 3,697 | 228,950 |
| **Total Non Grain** | **550,081** | **29,284** | **365,102** | **79,288** | **21,430** | **1,045,185** |
| **Total** | **1,351,250** | **98,428** | **1,130,153** | **211,627** | **68,070** | **2,978,509** |

Source: ALFA

ABARE's revised feedstuff supply model examines feedlot requirements across the various feedstuffs on a State by State basis in 2003-2004 and 2007-2008 (Table 15). The estimates of feedstuff required is closely related to previous ALFA estimates of 2.9 MT. However, discussion with feedlot nutritionists cast doubt on the usage of oats at the levels indicated in this analysis. An independent feedlot supplementary report commissioned for this study indicated a preference for a mix of wheat, barley, triticale and sorghum grains depending on season and geographic locality.

**Table 15:** ABARE Model Australian Feedlot Feed Demand – BAU

| Feed | QLD | NSW | VIC | SA | WA | Total |
|---|---|---|---|---|---|---|
| | | | kt | | | |
| Wheat | 292 | 346 | 60 | 27 | 55 | 780 |
| Barley | 289 | 256 | 60 | 27 | 48 | 680 |
| Sorghum | 387 | 182 | 0 | 0 | 0 | 569 |
| Triticale | 0 | 81 | 30 | 14 | 0 | 125 |

| Feed | QLD | NSW | VIC | SA | WA | Total |
|---|---|---|---|---|---|---|
| | kt | | | | | |
| **Cereals** | **968** | **865** | **150** | **68** | **104** | **2,155** |
| Pulses | 0 | 0 | 0 | 0 | 0 | 0 |
| Oilseeds | 0 | 0 | 0 | 0 | 0 | 0 |
| Oilseed Meals | 0 | 0 | 0 | 0 | 0 | 0 |
| Cereal by-products | 26 | 23 | 4 | 2 | 3 | 57 |
| Roughages | 283 | 253 | 44 | 20 | 30 | 631 |
| Animal Proteins | 0 | 0 | 0 | 0 | 0 | 0 |
| Others | 14 | 12 | 2 | 1 | 1 | 30 |
| **Total (2003)** | **1,290** | **1,154** | **199** | **91** | **138** | **2,873** |
| **Total (2007)** | **1,659** | **1,483** | **256** | **117** | **178** | **3,693** |
| **Growth** | **29%** | **29%** | **29%** | **29%** | **29%** | **29%** |

Source: ABARE Model, 2003

The supplementary report titled “Review of Feedgrain Requirements for Feedlots” written by Mathew George - Nutrition Services Associates Pty Ltd, was commissioned by Macarthur Agribusiness (the full report can be seen in Volume 2 – Supplementary Reports). The report explores the requirements for feedgrains and possible utilisation of any alternate feedstuffs in normal and several droughts induced seasonal conditions.

The main findings of the report include:

- Australian feedlot production is dependent on the feeding of high energy feedstuffs. Domestic grains are the primary energy source used by feedlot cattle, the specifics of which are determined by feedlot region, available grain processing technology, and climatic conditions.

- Wheat and barley are the most widely utilised feedgrains under all seasonal conditions. Sorghum is widely utilised by the Queensland and Northern NSW feedlot industry, the extent of which is determined by seasonal availability and the relative price of other cereals.

    - In normal years, order of grain utilisation is wheat, barley, sorghum, triticale and corn.

    - During Low Winter crop periods, greater volumes of sorghum are used, with less wheat, barley and corn.

    - Following a Low Summer crop, greater volumes of wheat, barley and corn are used (as alternatives) versus sorghum.

- Total annual feedlot grain requirements are approximately 2.73 MT.

- Under increasingly severe Australian drought conditions, feedlot grain requirements increase from 2.73 MT to 2.83 MT because of reduced white cottonseed availability. Further defined are shifts to grain imported from Southern and Western States into Eastern cattle feeding regions.

- The maximum volume of alternative energy dense feedstuffs that could be used by the feedlot industry prior to significant reductions in feedlot cattle performance would be approximately 0.57 MT.

- There is an absence of suitable alternative energy dense feedstuffs in Australia. If available, maximum alternate feedstuff volumes would be 0.57 MT, and would reduce grain minimum annual requirement of 2.26 MT. Clearly a solution to provide economically viable energy dense feedstuffs is required. The minimum volume of grain in this ‘energy composite’ is 84% of 2.73 MT annual usage.

The following table is from Mathew George’s report and estimates the total grain consumption requirements by the Australian feedlot sector under different climatic scenarios.

**Table 16:** Grain Requirements and Maximum By-product Utilisation Capability by the Australian Feedlot Sector under Different Environmental Conditions

| | Grain or by-product requirements, Tonnes | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Season | Wheat | Barley | Triticale | Corn | Sorghum | Total Grain (undefined)* | Additional Non-Sorghum grain or byproducts** | Additional Sorghum grain or byproducts*** |
| **Normal year** | | | | | | | | |
| Apr - Sept | 558454 | 454409 | 58426 | 41492 | 249202 | | | |
| Oct - Feb | 612848 | 671169 | 81797 | | | | | |
| Total | 1171301 | 1125577 | 140224 | 41492 | 249202 | 2727796 | | |
| **Seasonal drought - Low Winter Crop** | | | | | | | | |
| Season | | | | | | | | |
| Apr - Sept | 548395 | 444350 | 58426 | 31433 | 283184 | | | |
| Oct - Feb | 552435 | 482379 | 81797 | | 249202 | | | |
| Total | 1100830 | 926729 | 140224 | 31433 | 532387 | 2731602 | | |
| **Seasonal drought - Low Summer Crop** | | | | | | | | |
| Season | | | | | | | | |
| Apr - Sept | 599946 | 495901 | 58426 | 82984 | 128377 | | | |
| Oct - Feb | 612848 | 671169 | 81797 | | | | | |
| Total | 1212793 | 1167069 | 140224 | 82984 | 128377 | 2731448 | | |
| **Multi-season drought** | | | | | | | | |
| Season | | | | | | | | |
| Apr - Sept | 435389 | 328088 | 61672 | | 590591 | | | |
| Oct - Feb | 541436 | 479578 | 61672 | | 333053 | | | |
| Total | 976825 | 807666 | 123345 | | 923644 | 2831480 | | |
| **Extreme ongoing continental drought** | | | | | | | | |
| Season | | | | | | | | |
| Apr - Sept | | | | | | 1132214 | 101690 | 182022 |
| Oct - Feb | | | | | | 1132214 | 101690 | 182022 |
| Total | | | | | | 2264428 | 203380 | 364043 |

* Total of all grains required. Grain type not specified during Extreme ongoing continental drought because of unknown supply

** Potential use of suitable energy dense by-products if available. If not, wheat, barley, triticale or corn would be anticipated to be the primary grain substituted

***Potential use of suitable energy dense by-products if available. If not, sorghum would be anticipated to be the primary grain substituted

## 3.2.2 Pigs

The Australian pork industry has long recognised the need to effectively manage feedstuff usage and secure feedgrains and/or pulses and protein meals at competitive prices to enable effective competition in domestic and export markets.

The major driver for the pig industry growth has been Singapore and Japan pork exports. This is likely to impact on the number of sows, which are expected to increase from approximately 300,000 sows to 450-500,000 sows in 5-7 years although the industry has doubts about this growth rate in sow numbers.

Tables 17 and 18 show estimated feedgrain demand for sows and slaughter pigs based on adjusted research and statistical information. These tables are to be used as a comparison tool against ABARE data.

**Table 17:** Australian Sows Feedgrain Demand (tonnes)

| | QLD | NSW | VIC | SA | WA | TAS | TOTAL |
|---|---|---|---|---|---|---|---|
| Wheat | 21,855 | 28,412 | 30,597 | 14,206 | 12,020 | 2,186 | 109,276 |
| Barley | 21,599 | 28,078 | 30,238 | 14,039 | 11,879 | 2,160 | 107,993 |
| Sorghum | 3,379 | 4,392 | 4,730 | 2,196 | 1,858 | 338 | 16,894 |
| Other coarse grains | 4,522 | 5,878 | 6,330 | 2,939 | 2,487 | 452 | 22,608 |
| **Total Cereals** | **51,355** | **66,760** | **71,895** | **33,380** | **28,244** | **5,136** | **256,771** |
| Pulses | 6,029 | 7,837 | 8,440 | 3,919 | 3,316 | 603 | 30,144 |
| Protein meal | 11,304 | 14,695 | 15,826 | 7,348 | 6,217 | 1,130 | 56,520 |
| Cotton seed | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mill mix | 6,673 | 8,675 | 9,342 | 4,337 | 3,670 | 667 | 33,365 |
| **Total Feedgrain** | **75,360** | **97,968** | **105,504** | **48,984** | **41,448** | **7,536** | **376,800** |

Source: Adjusted by Macarthur Agribusiness

**Table 18:** Australian Slaughter Pig Feedgrain Demand (tonnes)

| | QLD | NSW | VIC | SA | WA | TAS | TOTAL |
|---|---|---|---|---|---|---|---|
| Wheat | 109,033 | 171,292 | 86,899 | 78,129 | 57,283 | 4,629 | 507,265 |
| Barley | 107,752 | 169,281 | 85,879 | 77,212 | 56,610 | 4,574 | 501,309 |
| Sorghum | 16,856 | 26,482 | 13,434 | 12,079 | 8,856 | 716 | 78,423 |
| Other coarse grains | 22,558 | 35,438 | 17,978 | 16,164 | 11,851 | 958 | 104,947 |
| **Total Cereals** | **256,199** | **402,493** | **204,190** | **183,584** | **134,600** | **10,877** | **1,191,944** |
| Pulses | 30,077 | 47,251 | 23,971 | 21,552 | 15,802 | 1,277 | 139,930 |
| Protein meal | 56,394 | 88,596 | 44,946 | 40,410 | 29,628 | 2,394 | 262,368 |
| Cotton seed | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mill mix | 33,290 | 52,299 | 26,532 | 23,855 | 17,490 | 1,413 | 154,880 |
| **Total Feedgrain** | **375,960** | **590,640** | **299,640** | **269,400** | **197,520** | **15,960** | **1,749,120** |
| **Total Sows and Slaughter Pigs** | **451,320** | **688,608** | **405,144** | **318,384** | **238,968** | **23,496** | **2,125,920** |

Source: Adjusted by Macarthur Agribusiness

This estimate of 2.5 MT equates approximately with the ABARE model current estimates shown in Table 19.

**Table 19:** ABARE Model Australian Pig Feed Demand – BAU

| Feed | QLD | NSW | VIC | SA | WA | Total |
|---|---|---|---|---|---|---|
| | kt | | | | | |
| Wheat | 37 | 143 | 126 | 93 | 64 | 464 |
| Barley | 0 | 22 | 60 | 63 | 40 | 185 |
| Maize | 85 | 27 | 14 | 0 | 0 | 125 |

| Feed | QLD | NSW | VIC | SA | WA | Total |
|---|---|---|---|---|---|---|
| | kt | | | | | |
| Sorghum | 124 | 66 | 13 | 2 | 0 | 205 |
| Triticale | 2 | 92 | 53 | 41 | 12 | 199 |
| **Cereals** | **247** | **350** | **266** | **199** | **116** | **1,178** |
| Lupins | 31 | 27 | 28 | 35 | 39 | 159 |
| Peas | 0 | 0 | 0 | 0 | 2 | 2 |
| **Pulses** | **31** | **27** | **28** | **35** | **40** | **161** |
| Oilseeds | 0 | 0 | 0 | 0 | 0 | 0 |
| Canola meal | 2 | 3 | 0 | 1 | 1 | 7 |
| Soymeal | 0 | 0 | 0 | 0 | 4 | 5 |
| **Oilseed meals** | **2** | **3** | **0** | **1** | **5** | **12** |
| Cereal by-products | 69 | 79 | 80 | 35 | 33 | 297 |
| Roughages | 6 | 6 | 6 | 5 | 1 | 24 |
| Animal proteins | 0 | 0 | 0 | 0 | 0 | 0 |
| Others | 58 | 38 | 42 | 35 | 19 | 191 |
| **Total (2003)** | **414** | **504** | **421** | **310** | **214** | **1,863** |
| **Total (2007)** | **465** | **566** | **474** | **348** | **240** | **2,092** |
| **Growth** | **13%** | **12%** | **12%** | **12%** | **12%** | **12%** |

Source: ABARE Model, 2003

The extent of industry growth is subject to conjecture because of current drought impacts and volatility in export market prices. Some industry analysts expect sow numbers to grow by 25% over the next five years. An additional 400 kt of ingredient may be required by 2005. The pig industry was the largest user of pulses and legumes, with 40% of the total.

A supplementary report titled “Pork Industry Feedstuff Security Management Strategies” (Volume 2 – Supplementary Reports) delves into the management strategies which are currently being undertaken or need to be undertaken at both industry and farm level in relation to feedstuff security. The report acknowledges ingredient and nutrient constraints that impact on management strategies as well as current tools and support systems which are available such as PigStats, Auspig and FeedCheque. Australian Pork Limited’s policy position on feedgrains for the pork industry is contained in this report.

### *3.2.3 Poultry*

Table 20 shows estimated feedgrain demand for broilers based on adjusted research and statistical information for use as a comparison against ABARE data.

**Table 20:** Australian Broiler Feedgrain Demand (tonnes)

| | QLD | NSW | VIC | SA | WA | TAS | Total |
|---|---|---|---|---|---|---|---|
| Wheat | 118,060 | 261,458 | 180,988 | 71,718 | 55,167 | 11,034 | 698,425 |
| Barley | 27,367 | 60,608 | 41,954 | 16,625 | 12,788 | 2,558 | 161,899 |
| Sorghum | 24,855 | 55,044 | 38,103 | 15,099 | 11,614 | 2,323 | 147,037 |
| Other coarse grains | 15,534 | 34,402 | 23,814 | 9,437 | 7,259 | 1,452 | 91,898 |
| **Total Cereals** | **185,816** | **411,512** | **284,859** | **112,879** | **86,828** | **17,367** | **1,099,259** |
| Pulses | 23,626 | 52,323 | 36,219 | 14,352 | 11,040 | 2,208 | 139,769 |
| Protein meal | 91,201 | 201,976 | 139,813 | 55,402 | 42,616 | 8,523 | 539,531 |
| Cotton seed | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mill mix | 10,041 | 22,237 | 15,393 | 6,100 | 4,692 | 938 | 59,402 |
| **Total Feedgrain** | **310,684** | **688,048** | **476,284** | **188,732** | **145,176** | **29,036** | **1,837,960** |

Source: Adjusted by Macarthur Agribusiness

Table 21 shows estimated feed demand for Australian broilers for the 2003-2004 BAU scenario and projected 2007-2008 feed demand scenario.

**Table 21:** ABARE Model Australian Broiler Feed Demand - BAU

| Feed | QLD | NSW | VIC | SA | WA | Total |
|---|---|---|---|---|---|---|
| | kt | | | | | |
| Wheat | 67 | 259 | 198 | 87 | 62 | 673 |
| Barley | 0 | 0 | 0 | 0 | 42 | 42 |
| Maize | 16 | 51 | 33 | 4 | 4 | 107 |
| Sorghum | 96 | 298 | 62 | 0 | 4 | 459 |
| Triticale | 11 | 0 | 59 | 87 | 6 | 163 |
| **Cereals** | **189** | **607** | **353** | **178** | **117** | **1,444** |
| Peas | 6 | 20 | 13 | 6 | 47 | 93 |
| **Pulses** | **6** | **20** | **13** | **6** | **47** | **93** |
| Oilseeds | 0 | 0 | 0 | 0 | 0 | 0 |
| Canola meal | 27 | 52 | 47 | 4 | 4 | 134 |
| Soybean meal | 36 | 151 | 65 | 45 | 9 | 306 |
| **Oilseed meals** | **63** | **204** | **112** | **49** | **13** | **441** |
| Mill Mix | 25 | 81 | 53 | 23 | 0 | 182 |
| Rice Pollard | 0 | 0 | 53 | 2 | 0 | 55 |
| **Cereal by-products** | **25** | **81** | **105** | **25** | **0** | **237** |
| Roughages | 0 | 0 | 0 | 0 | 0 | 0 |
| Animal proteins | 18 | 41 | 45 | 15 | 20 | 140 |
| Others | 17 | 58 | 32 | 16 | 9 | 132 |
| **Total 2003** | **318** | **1,012** | **661** | **290** | **206** | **2,486** |
| **Total 2007** | **365** | **1,159** | **757** | **332** | **236** | **2,848** |
| **Growth** | **15%** | **15%** | **15%** | **15%** | **15%** | **15%** |

*Source: ABARE Model, 2003*

Table 22 shows estimated feedgrain demand for layers based on adjusted research and statistical information.

**Table 22:** Australian Layer Feedgrain Demand (tonnes)

| | QLD | NSW | VIC | SA | WA | TAS | TOTAL |
|---|---|---|---|---|---|---|---|
| Wheat | 30,096 | 64,944 | 44,352 | 9,504 | 12,672 | 3,168 | 164,736 |
| Barley | 7,524 | 16,236 | 11,088 | 2,376 | 3,168 | 792 | 41,184 |
| Sorghum | 10,868 | 23,452 | 16,016 | 3,432 | 4,576 | 1,144 | 59,488 |
| Other coarse grains | 4,180 | 9,020 | 6,160 | 1,320 | 1,760 | 440 | 22,880 |
| **Total Cereals** | **52,668** | **113,652** | **77,616** | **16,632** | **22,176** | **5,544** | **288,288** |
| Pulses | 4,180 | 9,020 | 6,160 | 1,320 | 1,760 | 440 | 22,880 |
| Protein meal | 22,572 | 48,708 | 33,264 | 7,128 | 9,504 | 2,376 | 123,552 |
| Cotton seed | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mill mix | 4,180 | 9,020 | 6,160 | 1,320 | 1,760 | 440 | 22,880 |
| **Total Feedgrain** | **83,600** | **180,400** | **123,200** | **26,400** | **35,200** | **8,800** | **457,600** |

Source: Adjusted by Macarthur Agribusiness

Table 23 shows the estimated feed demand for Australian layers for the 2003-2004 BAU scenario and 2007-2008 projected feed demand scenario.

**Table 23:** ABARE Model Australian Layer Feed Demand - BAU

| Feed | QLD | NSW | VIC | SA | WA | Total |
|---|---|---|---|---|---|---|
| | kt | | | | | |
| Wheat | 0 | 18 | 43 | 10 | 17 | 88 |
| Barley | 0 | 0 | 0 | 0 | 17 | 17 |
| Maize | 16 | 6 | 20 | 0 | 0 | 42 |
| Sorghum | 30 | 39 | 0 | 0 | 0 | 68 |
| Triticale | 0 | 0 | 0 | 6 | 0 | 6 |
| Cereals | 46 | 63 | 63 | 16 | 34 | 222 |
| Lupins | 0 | 0 | 1 | 0 | 6 | 6 |
| Peas | 2 | 3 | 3 | 1 | 2 | 11 |
| Pulses | 2 | 3 | 3 | 1 | 8 | 17 |
| Oilseeds | 0 | 0 | 0 | 0 | 0 | 0 |
| Canola Meal | 3 | 5 | 4 | 0 | 2 | 14 |
| Soybean Meal | 15 | 20 | 21 | 5 | 3 | 64 |
| Oilseed meals | 19 | 25 | 25 | 5 | 5 | 79 |
| Mill Mix | 20 | 27 | 28 | 7 | 0 | 82 |
| Rice Pollard | 0 | 0 | 3 | 0 | 0 | 3 |
| **Cereal by-products** | **20** | **27** | **32** | **7** | **0** | **85** |
| Roughages | 0 | 0 | 0 | 0 | 0 | 0 |
| Animal proteins | 0 | 0 | 0 | 0 | 3 | 3 |
| Others | 12 | 18 | 19 | 4 | 7 | 61 |
| **Total 2003** | **99** | **136** | **142** | **33** | **57** | **467** |
| **Total 2007** | **104** | **142** | **149** | **34** | **60** | **488** |
| **Growth** | **5%** | **5%** | **5%** | **5%** | **5%** | **5%** |

Source: ABARE Model, 2003

Ridley Agriproducts in 2002 estimated growth in the poultry industry and has come to the following conclusions- “Layers will have limited growth…whereas...Broilers should demonstrate an annual growth of 3-4%. An additional 400 kt of ingredient will be required by 2006….The poultry industry was the largest user of oilseed and oilseed meals with 64% of the total 2002 livestock consumption”.

### *3.2.4 Dairy*

Dairy industry growth has averaged 5% over the past decade and is forecast to continue at similar levels to 2004. The industry is predominantly pasture fed with an increasing amount of concentrates being used. The average composition of supplementary feeds is estimated to be 47% concentrates, 51% grains, and 2-4% by-products. Average consumption of supplementary feed has increased to 1.3 tonnes per cow per year that equates to annual consumption of 2.5-3.0 MT per annum increasing to 3.5 MT in 5-7 years.

Projected dairy industry growth will put pressure on fibre sources – the use of wheat milling by-product mill run (bran/pollard) will increase from current levels of 600,000 tonnes to greater than 800,000 tonnes. Based on Australian domestic flour requirements the level of mill run will not match this demand putting pressure on the availability of alternative fibre sources.

Table 24 shows estimated feedgrain demand for the Australian dairy industry based on adjusted research and statistical information. This table can be used for comparison purposes against ABARE data.

**Table 24:** Australian Dairy Feedgrain Demand (tonnes)

| | QLD | NSW | VIC | SA | WA | TAS | TOTAL |
|---|---|---|---|---|---|---|---|
| Wheat | 54,886 | 53,797 | 277,949 | 36,300 | 20,328 | 40,656 | 483,915 |
| Barley | 90,561 | 88,765 | 458,616 | 59,895 | 33,541 | 67,082 | 798,460 |
| Sorghum | 25,679 | 25,170 | 130,044 | 16,984 | 9,511 | 19,022 | 226,409 |
| Other coarse grains | 41,164 | 40,348 | 208,462 | 27,225 | 15,246 | 30,492 | 362,936 |
| Total Cereals | **212,290** | **208,080** | **1,075,071** | **140,404** | **78,626** | **157,252** | **1,871,720** |
| Pulses | 27,443 | 26,898 | 138,974 | 18,150 | 10,164 | 20,328 | 241,958 |
| Protein meal | 13,721 | 13,449 | 69,487 | 9,075 | 5,082 | 10,164 | 120,979 |
| Cotton seed | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mill mix | 20,973 | 20,557 | 106,213 | 13,871 | 7,768 | 15,536 | 184,919 |
| Total Feedgrain | **274,428** | **268,984** | **1,389,744** | **181,500** | **101,640** | **203,280** | **2,419,576** |

Source: Adjusted by Macarthur Agribusiness

Table 25 shows the estimated feed demand for the Australian dairy industry for the 2003-2004 BAU scenario and 2007-2008 projected feed demand scenario.

**Table 25:** ABARE Model Australian Dairy Feed Demand – BAU

| Feed | QLD | NSW | VIC | SA | WA | Total |
|---|---|---|---|---|---|---|
| | **kt** | | | | | |
| Wheat | 38 | 96 | 528 | 34 | 27 | 722 |
| Barley | 0 | 52 | 501 | 34 | 24 | 610 |
| Oats | 1 | 3 | 100 | 1 | 0 | 104 |
| Maize | 9 | 0 | 0 | 0 | 0 | 9 |
| Sorghum | 59 | 56 | 0 | 0 | 0 | 115 |
| **Cereals** | **107** | **207** | **1,128** | **68** | **51** | **1,561** |
| Lupins | 19 | 3 | 184 | 8 | 18 | 231 |
| **Pulses** | **19** | **3** | **184** | **8** | **18** | **231** |
| Oilseeds | 0 | 0 | 0 | 0 | 0 | 0 |
| Canola meal | 29 | 49 | 97 | 15 | 2 | 193 |
| **Oilseed meals** | **29** | **49** | **97** | **15** | **2** | **193** |
| Cereal by-products | 8 | 14 | 58 | 2 | 4 | 86 |
| Roughages | 20 | 33 | 176 | 11 | 9 | 248 |
| Animal proteins | 0 | 0 | 0 | 0 | 0 | 0 |
| Others | 13 | 21 | 115 | 7 | 6 | 163 |
| **Total 2003** | **195** | **327** | **1,759** | **112** | **89** | **2,482** |
| **Total 2007** | **210** | **351** | **1,888** | **120** | **95** | **2,664** |
| **Growth** | **7%** | **7%** | **7%** | **7%** | **7%** | **7%** |

Source: ABARE Model, 2003

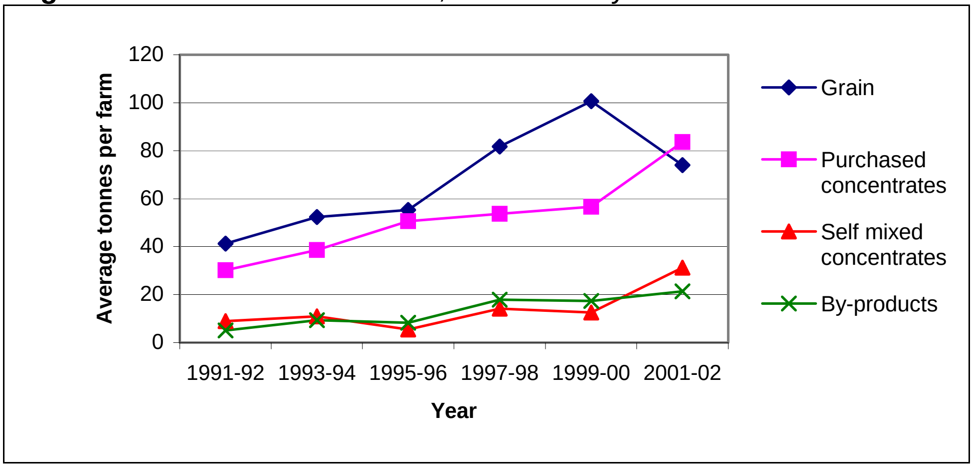
A report written by Rodriguez V., (2003) titled "Technology and Farm Management Practices in the Australian Dairy Industry" reveals results and analyses from the biennial surveys on the use of technology and farm management practices. These surveys have been conducted since 1991-1992 and indicate how Australian dairy farmers have continued to change their management practices and have adopted various technologies to improve performance.

Amongst the key findings from the report are as follows:

- Dairy farm numbers have consistently declined since 1974-1975. However, milk production has consistently increased. One contributing factor to this increase is the use of concentrate feeding.

- The percentage of dairy farms feeding concentrates or grain rose by almost 7 per cent since 1991-1992 to an estimated 87 per cent of Australian dairy farms in 2001-2002. Over the same period the average quantity of purchased concentrates used per farm rose by 53 tonnes to 83 tonnes. The quantity of grain fed decreased from 101 tonnes in 1999-2000 to 74 tonnes in 2001-2002 while the amount of self mixed concentrates more than doubled between the last two surveys period. The estimated amount of by-products fed more than quadrupled to 21 tonnes on average per farm in 2001-2002, with most of this increase occurring since 1995-1996 (Figure 13). Of all the states, Tasmania and Victoria had the lowest proportion of dairy farms feeding concentrates or grain, reflecting lower reliance on production of milk for the liquid milk market during periods of reduced seasonal pasture growth.

**Figure 13:** Use of Concentrates, Grain and By-Products




Source: Rodriguez, 2003

- The total quantity of hay cut increased from an average of 114 tonnes per farm in 1999-2000 to 152 tonnes in 2001-2002. In this same period, total silage cut rose by an average of 30 tonnes per farm to 172 tonnes in 2001-2002.

- Increases in hay and silage cut and stored on-farm reflect increased emphasis by owner managers on fodder conservation over the period 1991-1992 to 2001-2002. The percentage of farms that purchased hay or silage decreased considerably in the last survey year to 41 per cent of farms. The main reason for cutting or purchasing hay or silage was to continue normal practices. Other reasons, in order of priority, were to boost off-season production, reduce dependence on purchase feed or irrigation, and offset drought conditions and to apply pasture management measures.

- The following table reveals the percentage of farms feeding concentrates of grain by State.

**Table 26:** Feeding Regimes - Percentage of Farms Feeding Concentrates or Grain

| | | 1991-92 | 1993-94 | 1995-96 | 1997-98 | 1999-00 | 2001-02p |
|---|---|---|---|---|---|---|---|
| NSW | % | 98.3 (2) | 94.8 (3) | 99.1 (1) | 100.0 (0) | 99.0 (1) | 99.6 (0) |
| VIC | % | 72.6 (10) | 80.1 (5) | 83.3 (6) | 85.3 (6) | 89.5 (5) | 82.3 (5) |
| QLD | % | 100.0 (0) | 100.0 (0) | 98.7 (1) | 99.4 (1) | 99.2 (1) | 97.4 (3) |
| WA | % | 97.0 (3) | 98.5 (2) | 100.0 (0) | 100.0 (0) | 95.1 (4) | 100.0 (0) |
| SA | % | 81.0 (12) | 92.8 (4) | 97.5 (1) | 100.0 (0) | 96.4 (3) | 97.6 (2) |
| TAS | % | 53.5 (21) | 57.8 (22) | 82.6 (12) | 68.7 (16) | 65.0 (21) | 58.6 (15) |
| Australia | % | 80.5 (5) | 85.0 (3) | 89.0 (3) | 89.7 (4) | 91.3 (3) | 86.9 (3) |

Source: Rodriguez, 2003

A supplementary report titled "Feedgrains and the Australian Dairy Industry" written by Gordon Cleary and Steve Spencer was commissioned by Macarthur Agribusiness as part of this project (the full report can be seen in Volume 2 – Supplementary Reports). The report aims to describe the quantity of grain and fodder used by the Australian dairy industry and to describe some of the key economic and biological factors driving grain use. The report also discusses several contentious issues relating to supply and demand for feedgrains by the dairy industry.

This report found that:

- Purchased feedgrain and fodder are critical components in the feed base on most Australian dairy farms. An adequate supply of feedgrains, both cereals and proteins, is vital to milk production and the economics of the downstream milk processing sector, as the current drought has shown unequivocally. Despite the importance of the pasture base on which the dairy industry depends and the increasing use of co-products, any shortfall in feedgrains supply over the next decade will constrain milk production and limit both domestic milk product supply and the industry's export activities. Any such constraints will negatively impact on the financial performance of stakeholders within the dairy supply chain.

- It is estimated that the Australian dairy industry's requirement for feedgrains will grow by 24%, from 2,134 kt in 2000-2001 to 2,648 kt in 2006-2007. The cereal grain component is estimated to grow by 21% over this period, to 2,233 kt. The protein component, particularly lupins and canola meal, is estimated to grow by 47% over this period, to 415 kt (Table 27).

- Underpinning these grain supply numbers are a 21% increase in per cow feedgrain requirement from the current 0.94 t/cow to a projected 1.13 t/cow and a 2% increase in the national dairy herd. This takes account of the culling of herds in response to the drought. Assuming the availability of the required feedgrains and no further severe drought events, national milk production will rise 15% to 12.1 million litres and average per cow yield will rise 13% to 5,203 litres by 2006-2007.

**Table 27:** Projected Production and Feedgrain Requirements – Australian Dairy Industry

| | Base | Projected | Change |
|---|---|---|---|
| | 2000-01 | 2006-07 | (%) |
| Total Farms | 11,837 | 8,976 | -24.2% |
| Total Cows ('000) | 2,281 | 2,334 | 2.3% |
| Total Milk (ML) | 10,546 | 12,144 | 15.2% |

| | Base | Projected | Change |
|---|---|---|---|
| | **2000-01** | **2006-07** | **(%)** |
| Milk/Cow (L) | 4,624 | 5,203 | 12.6% |
| | | | |
| Total Cereals (kt) | 1,852 | 2,233 | 20.5% |
| Total Protein (kt) | 282 | 415 | 47.4% |
| Total Feedgrain (kt) | 2,134 | 2,648 | 24.1% |
| Feedgrain per Cow | 0.94 | 1.13 | 21.3% |

- The projected feedgrain supply and demand "push / pull" situation requires change by both grains industry and dairy industry stakeholders. Grain producers need the importance of high quality feedgrains to Australia's animal industries affirmed to them through both farmer education and commercial marketing initiatives. Likewise, dairy farmers (and many of their farm advisors) need better information on the merit of feedgrains in enhancing dairy profit, not just through filling short-term feed gaps but as a permanent daily ration component.

- The generic phrase "grain" needs to be stricken from the dairy industry's vocabulary and replaced with a grain's actual name, so that dairy farmers can associate merit or demerit more readily. For instance, dairy nutritionists know that oats does not provide the same level of nutrients as wheat and that white wheats tend to produce more milk than red wheats. Being descriptively specific is more informative to all. This labelling "sin" is a much under-rated barrier to rational use of the "right" feedgrains by dairy farmers.

- The milk processing sector needs to be pro-active in investigating and initiating robust bulk-buy and forward-commitment commercial arrangements for feedgrain supply to their milk supplier base. Since such moves will change the face of the feedgrains industry, not only dairy co-operatives, grain handlers and traders, and industry organisations but also the government and the finance sectors will have a key enabling role. By these means, the grain sector's ability to profitably grow enough of particular crops, within agronomic limits, to meet the dairy industry's requirements will be enhanced. Nonetheless, matching supply with demand for particular crops will continue to be an acute challenge to both industries.

### *3.2.5 Sheep*

The following table shows Australian sheep feed demand for a 2003-2004 BAU scenario and a projected 2007-2008 scenario.

**Table 28:** ABARE Model Australian Sheep Feed Demand - BAU (tonnes)

| Feed | QLD | NSW | VIC | SA | WA | Total |
|---|---|---|---|---|---|---|
| | kt | | | | | |
| Wheat | 0 | 0 | 0 | 5 | 16 | 22 |
| Barley | 0 | 0 | 5 | 0 | 0 | 5 |
| Oats | 0 | 0 | 5 | 5 | 0 | 10 |
| **Cereals** | **0** | **0** | **10** | **10** | **16** | **37** |
| Lupins | 0 | 0 | 0 | 0 | 25 | 25 |
| **Pulses** | **0** | **0** | **0** | **0** | **25** | **25** |
| Oilseeds | 0 | 0 | 0 | 0 | 0 | 0 |
| Oilseed meals | 0 | 0 | 0 | 0 | 0 | 0 |

| Feed | QLD | NSW | VIC | SA | WA | Total |
|---|---|---|---|---|---|---|
| | kt | | | | | |
| Cereal by-products | 0 | 0 | 0 | 0 | 3 | 4 |
| Roughages | 0 | 0 | 8 | 8 | 33 | 48 |
| Animal proteins | 0 | 0 | 0 | 0 | 0 | 0 |
| Others | 0 | 0 | 1 | 1 | 5 | 7 |
| **Total 2003** | **0** | **0** | **19** | **19** | **82** | **121** |
| **Total 2007** | **0** | **0** | **19** | **19** | **82** | **121** |
| Growth | 0% | 0% | 0% | 0% | 0% | 0% |

Source: ABARE Model, 2003

A supplementary report titled "Grain Demand and Economic Cost of Drought to the Grass Fed Ruminant Sector - Multivariable Model from a National Perspective" written by Dan Hogan – Keringal Pty Ltd, was commissioned by Macarthur Agribusiness as part of this project (the full report can be seen in Volume 2 – Supplementary Reports). The report is based on information from a multivariable model which was built to quantify the nature of grass fed ruminant feed demand during drought and is overlain with a weather probability curve to describe some of the logistical and economic impacts.

The following executive summary from the report summaries key findings:

- The drought event has impacted heavily on the grass fed ruminant sector (Ruminant sector). This is defined as all sheep and cattle that would normally gather their energy requirements from pastures. Due to widespread moisture deficits, pasture growth is less than ruminant demand and standing grass pasture is insufficient to maintain the energy requirements of the "flocks and herds".

- At this point the ruminant sector begins to move to existing pasture stocks, begins to consume fodder stocks (both grain and roughage), and/or loses body fat to maintain energy requirements. This process is well understood and functions continuously through existing markets in all seasons as pasture supply is geographically variable and the herd is transportable.

- The current drought situation is extreme in terms of the widespread nature and the magnitude of the pasture deficit, this necessitates a "significant and growing" reliance on fodder stocks as the drought lengthens and intensifies. This fodder demand spills out from the ruminant sector to the grains sector at and only when the grains supply is at a low level. The worse the weather the less grain and the higher the ruminant grain demand. The ruminant sector is dependent on the grains sector at these times to avoid long term economic damage.

- Information regarding the scale and distribution of this fodder demand is scarce and unreliable. It may be linked to the intermittent nature of this fodder demand that only arises in full force during major and widespread drought events. There is no reliable statistics that describe either the magnitude or the logistics of this demand.

- A multivariable model was constructed to quantify this demand and to consider the magnitude of the economic effects. This approach tries to model a complex and interrelated system that is currently experiencing a 1:100 severe drought event. As with all complex systems that are pushed out of normal operating parameters there runs a risk of system failure. The model allows one to change the assumptions about what is thought to be happening in the ruminant sector and to test what the probabilities of significant long term damage to each part of the system is. When areas of strategic weakness are identified the question still remains, what, if anything, can be done to mitigate these impacts?

- The author has chosen a set of assumptions that reflect his own subjective judgment on the matter and apologizes for all the inherent biases. What is assumed in this matter is, that as the drought continues in length and intensity the energy deficit grows, the fodder demand increases. That is, the end point of the drought is “unknown”. Therefore; a standard weather probability curve is used to estimate the probability of the “drought break” occurring. (Which for this discussion, is where the pasture growth can again supply the energy requirements of the ruminant sector and the fodder demand is at normal levels).

- As there are an infinitely variable set of future scenarios the worst 10% scenario was modelled to see where deficiencies in the system may lie. That is, if the current 2003 calendar season unfolds as a 1:10 dry year nationally. This scenario was estimated as having a 10% chance of eventuating. If so the ruminant sector will face another difficult year compounded by depleted resources on all fronts from the previous 1:100 dry year.

- Although not wishing this nightmare on man nor beast the point of good strategy is to be aware of possible difficult events arising and have appropriate contingency plans in place. Even if this season is in the dry 30% of years the compounding effect of the previous dry years will amplify the negative impacts relative to a similar series of dry years.

- What is clear from the exercise is that if the intensity of this drought continues into the future the fodder demand of the ruminant sector on the East Coast will be of sufficient magnitude to:

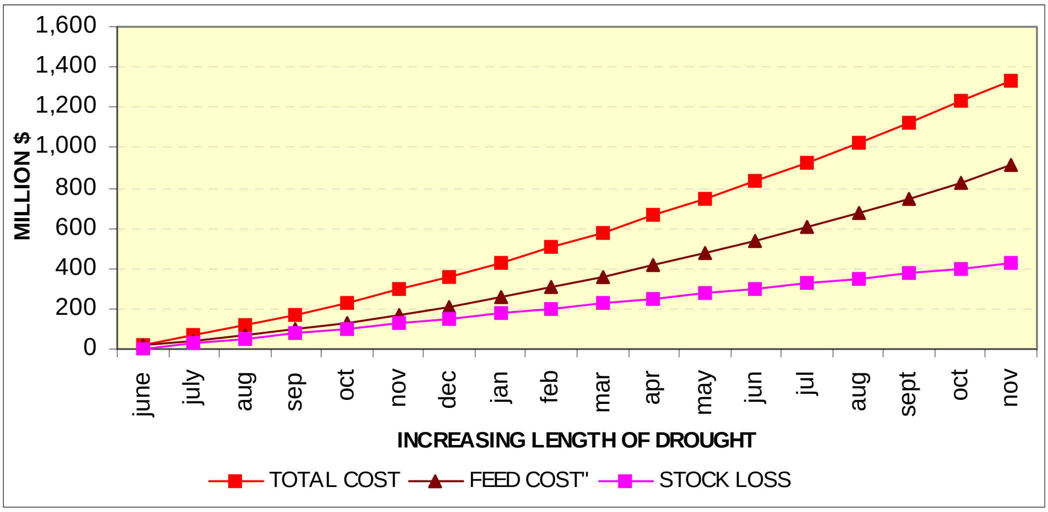
  1. Strain the supply chains logistics capacity to deliver grain and roughage from stocks held in South Australia and Western Australia.

  2. It will also test the ruminant sectors financial capacity to source capital to maintain production capacity.

  3. Will in the worst 10% of future seasons cause significant long term damage to the ruminant sector in terms of residual debt and reduced production capacity from stock losses.

- In the report an estimate of the quantum of the economic impact of the existing drought and the continuation scenario was undertaken (Figure 14). For sheep a stock loss estimate that begins at zero in June 2002 growing by 0.5% per month which equates to a 6% loss over the 12 month period from June 2002 to June 2003. These are paddock losses stock that are sold into the meat processing chain are not counted. Stock lost to production capacity are valued at $50/ head. The valuation is low as lost production capacity compounds the issue of excess processing capacity in this industry.

**Figure 14:** Drought Cost to Sheep Flock




## 3.3 Overview of Key Australian Feedstuff Issues

- Grains Council analysis in 1997 indicated that feedgrain production was not expected to keep pace with total demand. This conclusion assumed that feed barley domestic demand would increase, a move away from commodity cereal grains to higher value and more profitable food grains such as malting barley and chick peas; and the move to cotton production taking out former dryland grain growing acreage.

- Australian stockfeed requirements will reach 13-14 MT by 2010 with total feedgrain requirement to increase from 7.7 MT to around 10 MT by 2010.

- Australia is a net exporter of grain, vegetable and animal protein commodities. There is increasing pressure of the domestic availability of these products due to continued expansion of intensive livestock industries and the fickle nature of crop yields in the driest continent on earth.

- The inclusion of GMO crops in livestock feeds is becoming a significant issue especially for the lot feeding sector. This is especially the case with stockfeed ingredients derived from soybean meal imported from the US, cotton seed, cottonseed meal, canola meal imported from Canada, some amino acids, some feed enzymes, vitamins, canola seed, canola meal, maize and possibly field peas and lupins.

- Other drivers for increased grain use by the livestock industries include:

  - Increasing percentage of lot fed beef in domestic market consumption;

  - Live sheep and live cattle export growth requiring livestock feed industry support;

  - The pastoral sheep and cattle industries supplementary feedgrains but the extent of use is generally unknown;

- Increasing size of the aquaculture industry using grains as part of the feed ration;

- Recent drought has highlighted difficulties in "internal imports/ transfers" of feedgrains from WA and key grain export marketers competing in the market for feedgrains with intensive livestock feeder;

- Feedgrain production industry is a by-product of grain for human food industry and often sees feedgrains as a secondary commodity market;

- Feedgrains are now imported from the US and the UK for use by poultry feed compounders. Imported grain from the same sources are not available for pork, feedlot and dairy industries because of quarantine and biosecurity considerations as feeding sites are located greater than 100 km from port and imported grain can not be moved up country unless treated to AQIS protocols;

- In normal supply years Australia is an exporter of feed wheat, feed barley, lupins, sorghum, oats and oilseeds. Fodder crops are also exported eg lucerne cubes and hay. Domestic intensive livestock feeding industries see these exports as under valuing the commodity and placing the Australian based intensive livestock industries at risk through potential lack of supply.

• Previous studies by ABARE and GCA have also identified a number of other key issues facing the feedgrains industry including:

  - **Grain handling and storage infrastructure**: most grain storage and handling infrastructure has been designed and located to facilitate grain exports. This current infrastructure is not designed to handle frequent intra and inter regional transfers of feedgrains because of the wide diversity of ingredients and of quality characteristics;

  - **Transport**:- high cost of internal transport is an impediment to grain transfers between surplus and deficit regions;

  - **Lack of coordination between marketing organisations**:- the key decision is to decide whether to service traditional overseas markets (contractual obligations)of domestic markets that may have temporary feed deficits;

  - **Quarantine and biosecurity regulations limiting the availability of feedgrain imports**: drought and increased feed demand from growing intensive livestock feeding industries have focused debate on feedgrain imports. However, there are significant barriers to large scale grain imports although some feedgrain is imported for use by the poultry and feed manufacturing industries;

  - **Need to increase the total supply of feedgrains based on projected growth in the intensive livestock feeding industries;**

- **Improving internal grain flows to minimise supply demand shortfalls and meet domestic demand for feedgrains;**

- **Premium Grains for Livestock Program** Improving the management and pricing system for feedgrains enabling grain marketers and end users to develop pricing alternatives and risk management facilities for feedgrain producers and users. One possible tool is the development of a rapid and accurate tool to determine the nutritional value of grain.

• Ethanol Industry Based on Feedgrain Feedstock

The ethanol industry has been in existence for a period of time based primarily on ethanol produced from starch processing waste and sugar cane by-products. The move towards development of a bio-fuels industry has created a new potential competitor for feedgrain. Some Proposed projects for the newly emerging ethanol industry will be located in the grain belt and will provide direct competition for feedgrain that would be otherwise used by the intensive livestock feeding industries at those sites. Some players in this industry see that feedgrains could be a feedstock for ethanol production especially when a subsidy for industry establishment exists. The Australian Lot Feeders Association examined this issue following the release of a paper by APSRU that indicated the demand quantum risk that a feedgrain based ethanol industry could pose. The findings of the ALFA study were that:

- A new ethanol industry may develop in regional NSW and Queensland encouraged by Government policy initiatives including excise subsidies. The ethanol subsidy, if continued, beyond the 12 month sunset period, will significantly distort regional feedstuff markets; and

- Those same policy initiatives that encourage regional ethanol industry development may well destroy the intensive livestock industries that government has been looking to encourage to add value to Australian rural commodities, increase regional employment and increase export income.

## 3.4 Summary

Table 29 summarises the current and future growth trend drivers across the intensive livestock feeding industry sectors.

**Table 29:** Intensive Livestock Industry Growth Trend Drivers

| Industry | Trend Drivers | Impact on Feedstuff Usage | Comments |
|---|---|---|---|
| Feedlot Beef | ▪ Domestic market requirements for feedlot finishing.<br>▪ Quality Assurance.<br>▪ Drought grain assisted finishing.<br>▪ Live cattle export preparation.<br>▪ Export market certification requiring grain based rations. | ▪ Feed costs are 88% of total costs.<br>▪ Grains comprise 65-70 % of total costs or 80% of feed costs.<br>▪ Feed usage dependent on availability and price. | ▪ Concentration in feedlot sector and decline in number of opportunity feedlots.<br>▪ Capacity utilisation remaining high.<br>▪ Grain demand outstripping supply growth.<br>▪ Drought scenarios impose deficit conditions.<br>▪ Alternative feedstuffs extensively studied. |

| Industry | Trend Drivers | Impact on Feedstuff Usage | Comments |
|---|---|---|---|
| Pastoral Beef | ▪ Supplementary feeding increasing.<br>▪ Cattle being turned off younger and significant numbers finished in feedlots.<br>▪ Live export market increasing. | ▪ Unknown quantities of feedgrains used in pastoral beef sector.<br>▪ Extensive use of molasses, pasture and cereal hays and silage in feed deficit scenarios.<br>▪ Cattle being introduced to starter rations in Australia. | ▪ Drought feeding qualifies for exceptional circumstance funding. |
| Pork | ▪ Domestic focus with growing export sector to Singapore and Japan.<br>▪ Import competition from Denmark and Canada.<br>▪ Increasing concentration and vertical integration.<br>▪ Increasing focus on fresh chilled pork in the domestic market. | ▪ Uses estimated 1.8MT of feedgrains annually and 120Kt of oilseed meals.<br>▪ Wheat (500kt) and barley (500kt) use is predominate. Sorghum (205kt) use is also significant in N.NSW and S. Qld. | ▪ Pork producers fight to qualify for exceptional circumstance funding in drought situations.<br>▪ Smaller players are at mercy of vagaries of the market whereas larger players are better able to manage risk.<br>▪ State drought assistance provides a double penalty as subsidies drive up feedgrain prices further at cost to pig producers. |
| Dairy | ▪ Increasing concentrate feeding especially in Victoria.<br>▪ feedgrain requirement from the current 0.94 t/cow<br>▪ Some feedlot dairy emergence. | ▪ Estimated usage 2MT.<br>▪ Barley the predominant grain at 31%, wheat 15% sorghum 9%, other coarse grains 22%. | ▪ Concentrate feeding only practiced by top end performance players.<br>▪ Grain feeding used to even out variations in annual pasture curve and sustain milk yields year round. |
| Sheep | ▪ Predominantly drought feeding and live export trade. | ▪ Estimated usage is 440,000 tonnes with 80,000 tones to live sheep export trade. | ▪ Prime requirements are up country availability in severe drought events as normal supplementation occurs from on farm stocks. |
| Poultry | ▪ Poultry meat sector growing as domestic demand grows. Egg sector static.<br>▪ Two major companies account for 70-75% of industry turnoff.<br>▪ Most grain purchased from merchants, marketing authorities and traders. | ▪ Uses approximately 2.2 million tonnes in 2000- poultry meat 1.7MT and egg production 0.5MT.<br>▪ % use is: wheat 38%, barley 10%, sorghum 9%, coarse grains 12%, soya bean meal and canola meal account for 19% of rations.<br>▪ Poultry meat sector expansion. | ▪ Poultry producers also source from feed compounders.<br>▪ Grain imports have occurred and grain processed portside for distribution in pelleted form to operators within 100km of port. |
| Other industries eg pet food, aquaculture, horses, and deer. | ▪ Increasing usage as livestock industries diversify and providing competition for feedstuffs for traditional intensive livestock industries. | ▪ Estimated usage 1.2 MT. | ▪ Predominantly supplied by specialist feed compounders with limited on site preparation. |

# 4. AUSTRALIAN DROUGHT

## 4.1 Introduction

In normal seasons there has been a traditional surplus of feedstuff supply over demand. However, pressure on the supply demand dynamic comes in particularly severe drought situations. The following section examines the impacts of drought on crop yields and intensive livestock industry feed supply. The objective is to incorporate the recent changes in thinking in drought forecasting, climate based yield estimation and linkage to supply demand modelling for intensive livestock industry feedstuffs to provide a mechanism for managing feedstuff supplies in future extreme drought situations.

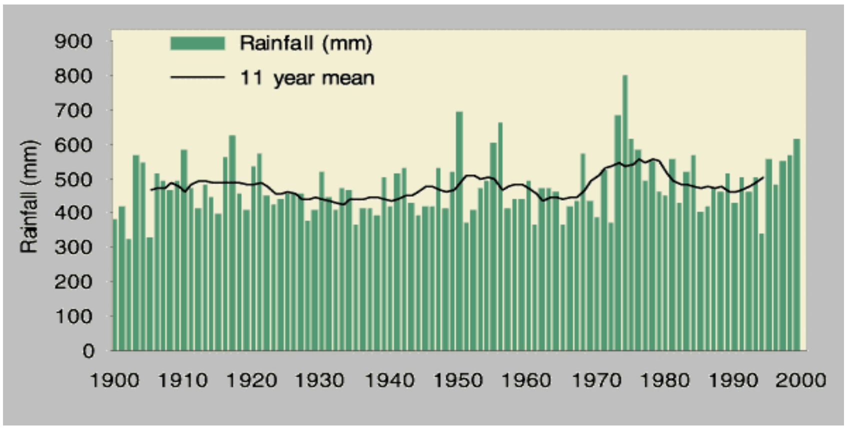
## 4.2 Drought Frequency

Australia is one of the driest continents on earth with very few years where rainfall exceeds long term averages (Figure 15). In some areas drought is the normal state of affairs with drought expected 5-6 years out of 10.

In April 2003 a National Drought Summit was held in Brisbane, Queensland. Some of the outcomes of that summit are crucial to the definition of drought, the relativity of the 2002-2003 drought events, an understanding of drought and its impact on crop yields, animal production and drought induced feedstuff supply demand gaps. Some key outcomes of the Summit were that:

- Over the period 1900 to 2000 median rainfall across Australia was increasing;
- Droughts were not becoming more frequent;
- Some droughts were occurring in La Nina years;
- Drought periods were becoming hotter with higher evaporation rates;
- The word drought is emotive and rainfall deficiencies are a better term;
- It is difficult to be precise when a drought occurs and even more difficult to determine when a drought ends; and
- The concept of rainfall deficiency needs to be considered in terms of a continuum of meteorological drought, agricultural drought and hydrological drought.

**Figure 15:** Australian Long Term Rainfall




Source: Bureau of Meteorology, 2003

### *4.2.1 Definition of Drought*

- There are many definitions of the term "drought'. At the recent National Drought Summit in Brisbane (April, 2003) the issue of drought and its definition was considered in depth. Mike Couglan from the Commonwealth Bureau of Meteorology's National Climate Centre developed the following definition of drought that handles the issue of increasing severity or relief from drought based on the availability of water……"Simplest to consider drought to be a problem of supply, ie. drought occurs when the availability of water from natural sources falls below some expected level for an extended period. Other, more complex definitions consider it to be as much a demand problem as a supply problem, in which case, drought might be said to occur when the actual demand exceeds the expected supply, again usually for an extended period.

- While there is no "rule' per se regarding the minimum spatial extent over which a drought can be said to occur, it is generally accepted that the area has to be sufficiently large for there to be economic, social or environmental impacts. We need to distinguish between "drought" and "aridity".

  - **Drought** is a shortfall in rainfall for an extended period below an arbitrarily set threshold that is well below normal expectations; and

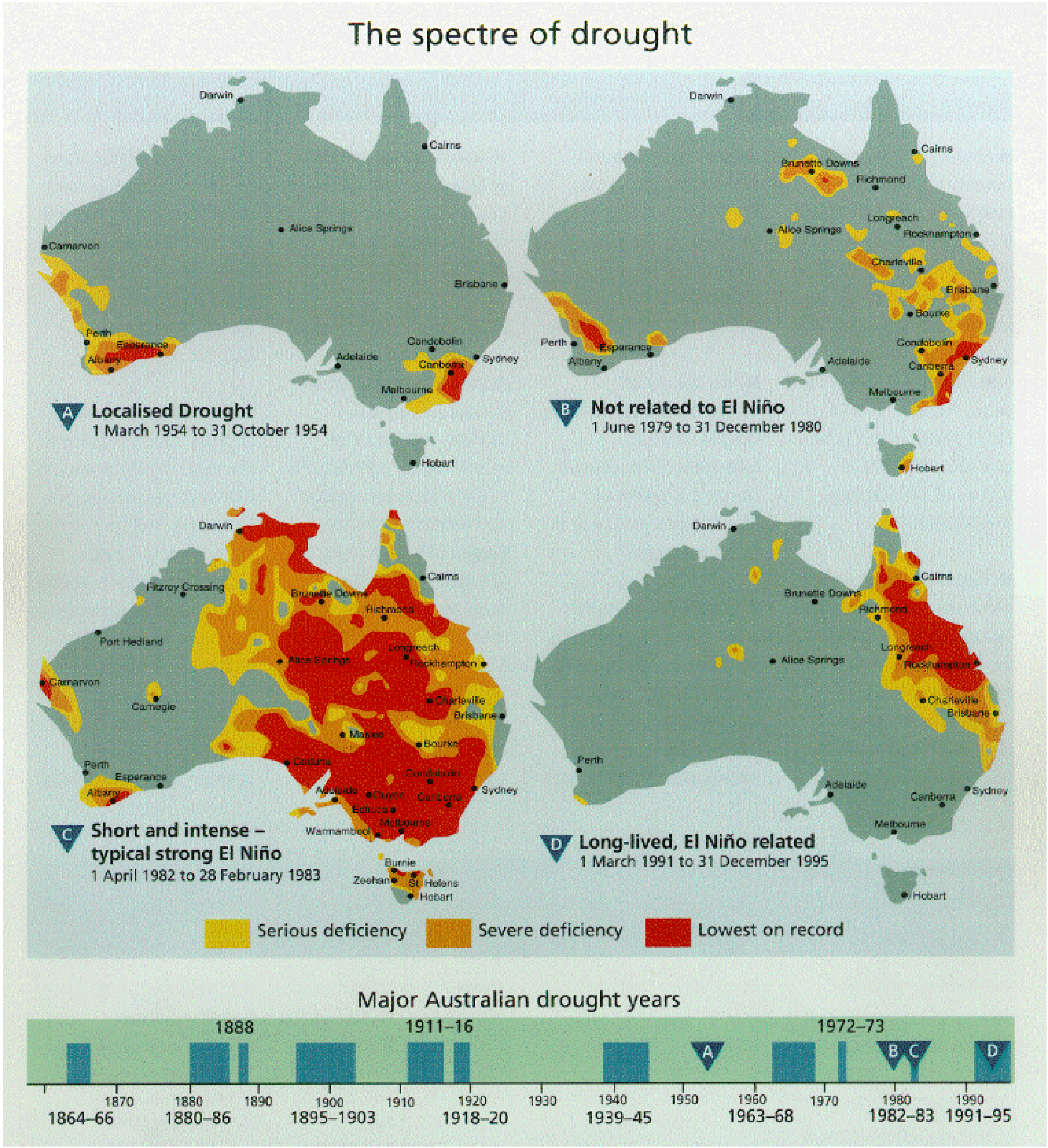
  - **Aridity** is the continuous occurrence of rainfall below an arbitrary but very low threshold (NB: Aridity can be seasonal, e.g. northern Australian 'dry season'.

- Natural sources of water relevant to the drought problem include, in a somewhat temporal, hierarchical order:

(1) Precipitation, including rain and snow
(2) Groundwater, including snow pack
(3) Water courses (roofs and down pipes, creeks, rivers etc.)
(4) Water storages (tanks, ponds, lakes, major dams, reservoirs)
(5) Deep, freshwater aquifers

- Reduction of supply in 1 can lead to **'meteorological' drought**, adding 2 and 3 leads to '**agricultural' drought,** and 2, 3, 4 and 5 to **'hydrological' drought**."

- Elsewhere in this report we have used the concept of meteorological, agricultural and hydrological drought to examine feedstuff constrained supply and the intensive livestock industries response to those phases of drought.




The Bureau of Meteorology has analysed the various forms of drought. The following graphic above highlights:

(a) a localised drought;
(b) short drought not related to an El Nino event;
(c) short and intense drought which characterises an El Nino drought event; and
(d) a long lived El Nino related drought.

The graphic also show the incidence of major drought events over time .A Bureau of Meteorology synopsis of the effects of those major drought events is:

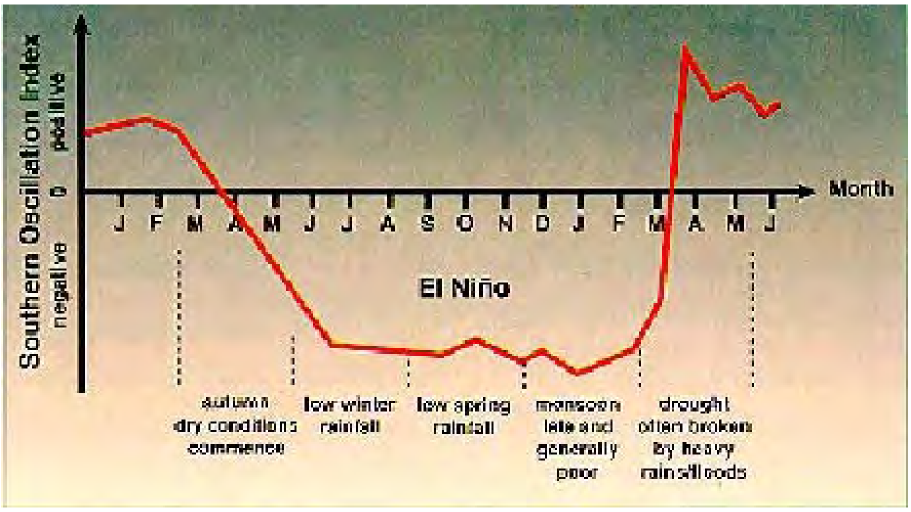
| Year | Drought Extent and Impact |
|---|---|
| 1864-1866 | All States affected except Tasmania |
| 1880-1886 | Southern and eastern States affected |
| 1888 | All States except WA affected |
| 1895-1903 | Sheep numbers halved and more than 40% loss of cattle. Most devastating drought in terms of stock losses |
| 1911-1916 | Loss of 19 million sheep and 2 million cattle |
| 1918-1920 | Only parts of WA free from drought |
| 1939-1945 | Loss of nearly 30 million sheep between 1942 and 1945 |
| 1963-1968 | Widespread drought. Also longest drought in arid Australia: 1958-67. The last two years saw a 40% drop in the wheat harvest, a loss of 20 million sheep and a decrease in farm income of $300-500 million |
| 1972-1973 | Mainly in eastern Australia |
| 1982-1983 | Total losses estimated in excess of $3000 million. Most intense drought in terms of areas affected |
| 1991-1995 | Average production by rural industries fell by about 10% resulting in a possible $5billion cost to the Australian economy. $590 million drought relief provided by the Commonwealth Government between September 1992 and December 1995. |

While the table shows the quantified impacts of drought what is less apparent is the human and psychological cost of drought; the cash flow drought that occurs long after the drought has ended as producers rebuild their businesses and the loss of market share by players in export oriented intensive livestock industries resulting from an inability to supply because of feedstuff supply constraints, resultant price increases and water shortages.

### *4.2.2 Relativity of the 2002-2003 Drought Event*

- The 2002-2003 drought commenced with the onset of another El Nino weather phenomenon. The typical El Nino seems to start in late summer and breaks in mid Autumn (see below).

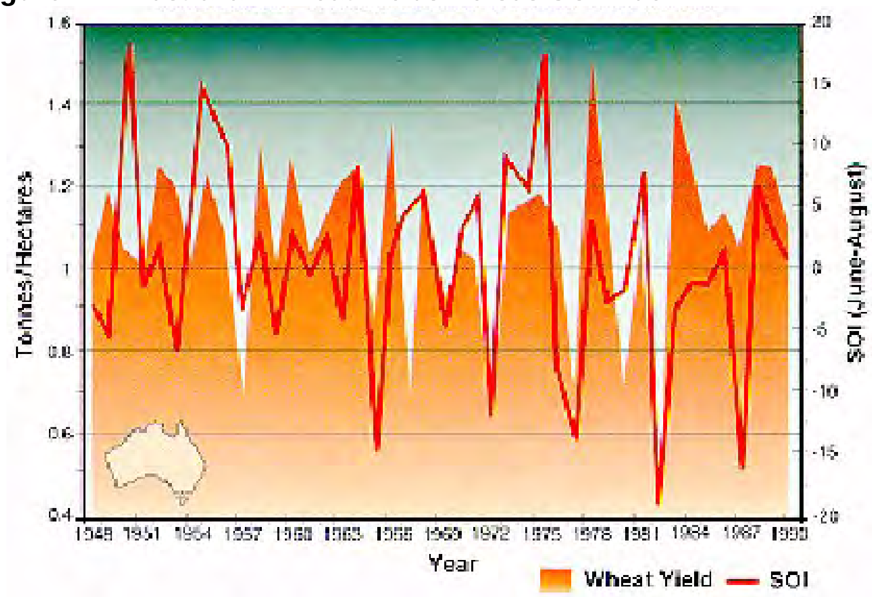
**Figure 16:** Typical Pattern of Eastern and Northern Australian Rainfall and the SOI during an El Nino Period




Source: Bureau of Meteorology, 2003

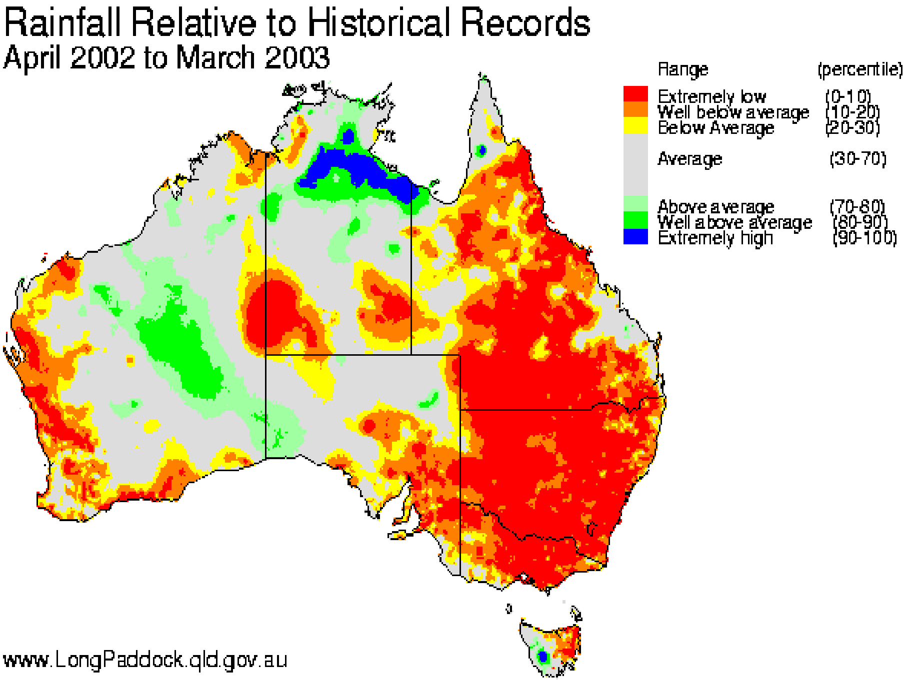
- The following graph shows strong correlation between wheat yields and SOI index:

**Figure 17:** Australian Wheat Yields Versus SOI Index



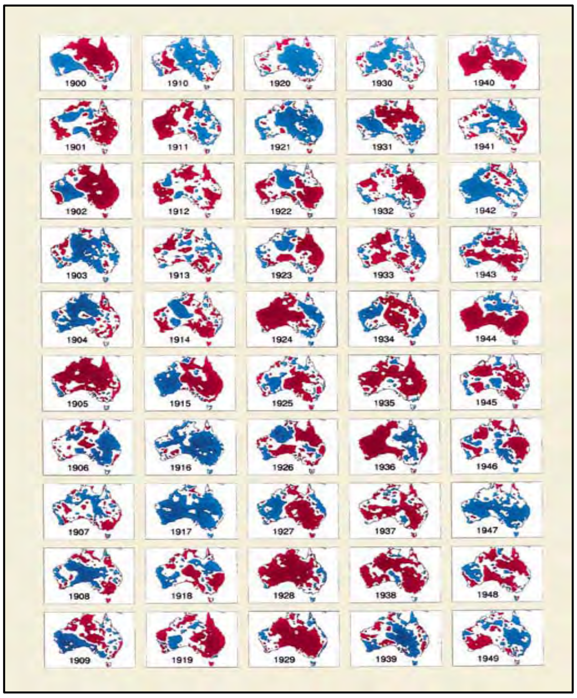

Source: Bureau of Meteorology, 2003

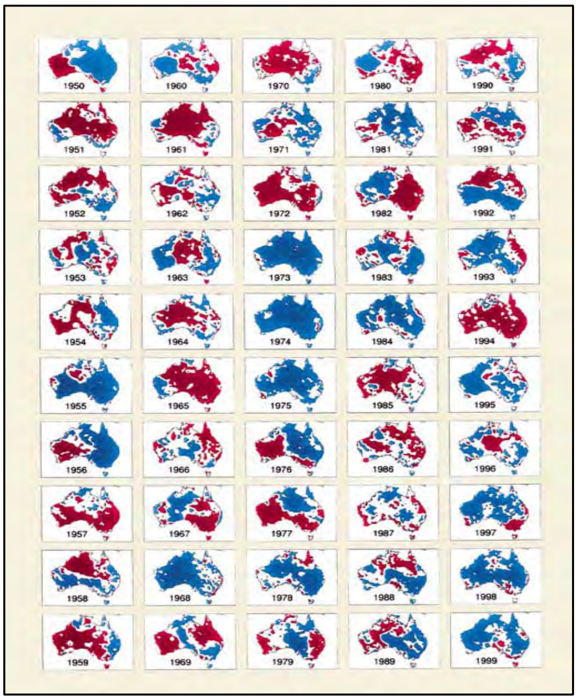
- The current 2002-2003 drought is extensive as shown below and covers the major crop areas and those grain belt regions in the Eastern States that are the locations of the intensive livestock industries.




- The Bureau of Meteorology estimates that "severe drought affects some part of Australia about once every 18 years. This does not mean that severe drought regularly and predictably recurs every 18 years; intervals between severe droughts have varied from 4 to 38 years".

- Australian is a drought prone country where drought is more the norm than the exception. Perhaps this can be best illustrated by the following chart based on Bureau of Meteorology analysis showing below average rainfall in each year from 1900 to 1999.



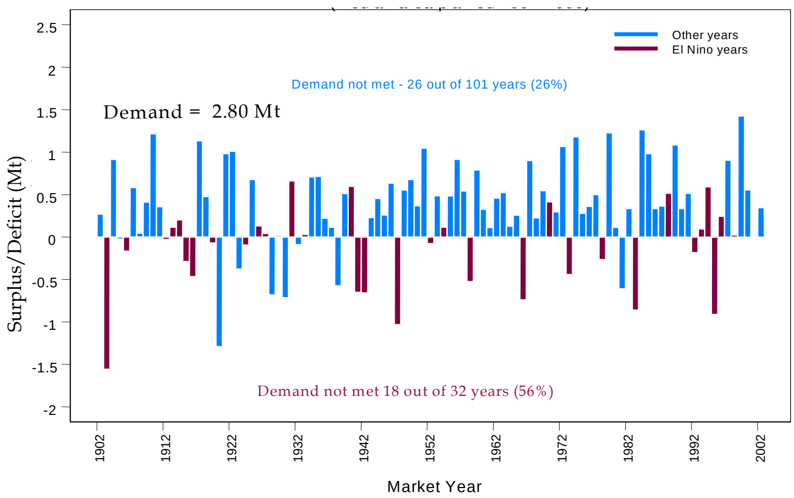


- While the 2002–2003 drought is severe it is generally regarded by climate experts as not being the most severe. The following table is chronology of major drought events in Australia.

### 4.2.3 Drought Impacts on Crop Yields

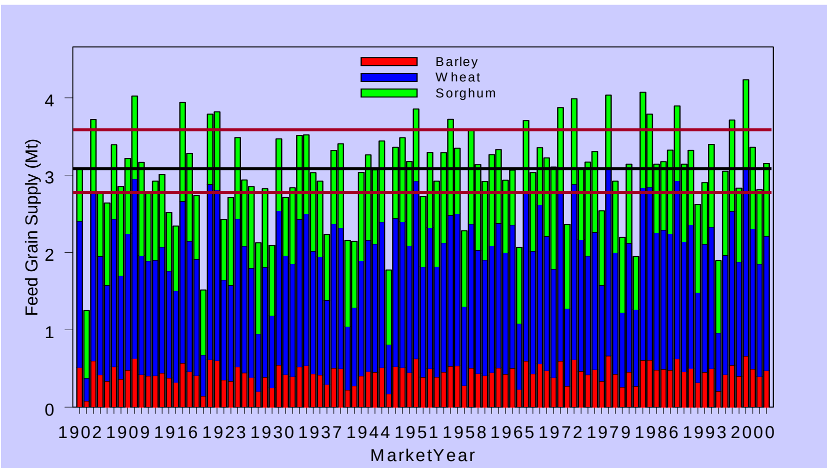
Drought impacts on crop yields and subsequent availability of feedgrains available to the intensive livestock industries. APSRU has undertaken extensive analysis of the impact of drought on crop yields particularly in the Northern agro-ecological region ie. the northern grain belt between Dubbo in NSW and Central Queensland. This analysis (Figure 18) shows that in non El Nino years demand is not met (from local sources) in 26% of years while in El Nino years is not met in 56% of years.

**Figure 18:** Deviation of Annual Feedgrain Surplus from Current Demand for QLD & NNSW (median area planted 1992-2002)




Source: Hammer GL., Potgieter A., Strahan R., 2003

**Figure 19:** Feedgrain Availability




Source: Hammer GL., Potgieter A., Strahan R., 2003

### *4.2.4 Drought Impacts in Intensive Livestock Production*

The following analysis examines the onset and development of drought events across the meteorological, agricultural and hydrological drought continuum described above and impact and response of the intensive livestock sectors.

Seasonal Rainfall Drought Events ↔ **Normal Season** ↔ **Meteorological Drought** ↔ **Agricultural Drought** ↔ **Hydrological Drought** ↔ **Return to Normal Season** ↔ **Normal Season** ↔ **Intensive Livestock Risk Mgmt Tools**

| **Seasonal Rainfall Drought Events** | **Normal Season** | **Meteorological Drought** | **Agricultural Drought** | **Hydrological Drought** | **Return to Normal Season** | **Normal Season** | Intensive Livestock **Risk Mgmt Tools** |
|---|---|---|---|---|---|---|---|
| Rainfall Characteristic | Average to above average rainfall | ?% Below average rainfall | ?% Severe Below average rainfall | Severe prolonged below average rainfall | Prolonged average to above average rainfall | Average to above average rainfall | Use of climate forecast tools |
| Livestock Water Availability | Adequate surface and ground water supplies | Surface water supply below average | Surface water supply limited | Surface & ground water supply limited | Surface water replenished, aquifer recharge | Adequate surface and ground water supplies | Investment in water access & supply |
| Grain Production Response | Normal crop area; focus on milling grains some feedgrains | Normal crop area; reduced yields; some regional crop failure | Reduction in sown area; signif. reduced yields; regional and inter-regional crop failure | Winter and summer crops not planted in regions crop failure across states | Signif. increase in milling grain plantings to ensure cash flow | Normal crop area; Focus on milling grains some feedgrains | Short term grain storage, contract supply; access to internal and external imports |
| Roughage Production Response | Normal crop area and production of pasture and cereal hays, silage and crop by products | Normal crop area; reduced yields; some regional crop failure; some alternate by products | Reduction in sown area; signif. reduced yields; regional and inter-regional crop failure; increased use of some by products | Winter and summer crops not planted in regions crop failure across states; significant use of alternate feedstuffs | Signif. increase in replenishment of fodder reserves and additional harvest | Normal crop area and production of pasture and cereal hays, silage and crop by products | Contract roughage and by product supply and drought reserve storage on site |

Seasonal Rainfall Drought Events ⟷ **Normal Season** ⟷ **Meteorological Drought** ⟷ **Agricultural Drought** ⟷ **Hydrological Drought** ⟷ **Return to Normal Season** ⟷ **Normal Season** ⟷ **Intensive Livestock Risk Mgmt Tools**

| **Seasonal Rainfall Drought Events** | **Normal Season** | **Meteorological Drought** | **Agricultural Drought** | **Hydrological Drought** | **Return to Normal Season** | **Normal Season** | Intensive Livestock **Risk Mgmt Tools** |
|---|---|---|---|---|---|---|---|
| **Intensive Livestock Industry Response** | | | | | | | |
| Beef | Herd size responds to market outlook; pastoral cattle supplementary fed; feedlot throughput about 1.3M head, principal feedstuffs sourced locally with harvest purchase & then top up as required; investment in feedlot capacity and refurbishment | As in normal seasons, feedstuffs sourced within and adjacent regions, increased turnoff to feedlots. Some local drought declarations; agistment or the long paddock the preferred option | Signif. increased turnoff of females, young cattle finished with supplementary feeding & feedlots. Increased use of alternative feedstuffs eg molasses. Drought reserves run down. Pastoral exceptional circumstances funding mobilised | Ongoing sell down of herd, limited supplementary feeding as feedstuffs increase in price, water the main issue, feedlot capacity strained and then deceases as supply is constricted. Pressure for grain imports. Some alternative feedstuff use | Increased optimism, cash flow shortages, in arable areas grain crops grown, cattle withdrawn from sale; price escalates in competition with meat processors; herd rebuilding commences; some players leave industry due to financial circumstances | Herd size responds to market outlook; pastoral cattle supplementary fed; feedlot throughput about 1.3M head, principal feedstuffs sourced locally with harvest purchase & then top up as required; investment in feedlot capacity as available capacity fully utilised | Effective drought plans. Feedstuff supply contracts; access to feedlot for custom feeding; futures use by some players; in most cases it is better to sell stock than to drought feed |

Seasonal Rainfall Drought Events ↔ **Normal Season** ↔ **Meteorological Drought** ↔ **Agricultural Drought** ↔ **Hydrological Drought** ↔ **Return to Normal Season** ↔ **Normal Season** ↔ **Intensive Livestock Risk Mgmt Tools**

| **Seasonal Rainfall Drought Events** | **Normal Season** | **Meteorological Drought** | **Agricultural Drought** | **Hydrological Drought** | **Return to Normal Season** | **Normal Season** | Intensive Livestock **Risk Mgmt Tools** |
|---|---|---|---|---|---|---|---|
| **Intensive Livestock Industry Response** | | | | | | | |
| Pork | Herd builds in response to export demand; small players leave industry; large players write local feedstuff supply contacts; increasing supply chain alignment with meat processors; retailers; feedstuffs predominantly locally sourced | Grain price builds contingent on national feedstock inventory, some feedstuff sourcing from adjacent regions but least cost rations maintained. Pork prices could increase but moderated by imports | Grain price continues to build, some small players cut production by not joining sows; larger players source grains and protein meals from farther a-field, least cost rations reformulated. Imports to plug pork supply gaps; | Grain supply demand gaps; Internal import esp. barley from SA. Further exits by smaller pork producers; increased de-stocking as family farms exit; large producers margins are further squeezed; exceptional circumstance funding use increases; larger players maintain sow numbers but operate at loss because of high grain price; significant forward buying | Industry rationalisation as smaller player financial reserves exhausted, feedstuff sourcing returns to regional basis; onsite storage of principal feedstuffs at harvest time as producers average down feedstuff costs | Herd builds in response to market outcomes; small players leave the industry; large players write local feedstuff supply contacts; increasing supply chain alignment with meat processors; feedstuffs predominantly locally sourced | Local feedstuff supply contracts at prices in excess of export pool pricing; contract supply or vertical integration with processors; larger producers look to risk management for both inputs and outputs |

Seasonal Rainfall Drought Events ⟷ **Normal Season** ⟷ **Meteorological Drought** ⟷ **Agricultural Drought** ⟷ **Hydrological Drought** ⟷ **Return to Normal Season** ⟷ **Normal Season** ⟷ **Intensive Livestock Risk Mgmt Tools**

| **Seasonal Rainfall Drought Events** | **Normal Season** | **Meteorological Drought** | **Agricultural Drought** | **Hydrological Drought** | **Return to Normal Season** | **Normal Season** | Intensive Livestock **Risk Mgmt Tools** |
|---|---|---|---|---|---|---|---|
| Dairy | Predominant feed source is pasture with increasing levels of concentrate feeding by top end players. The objective is to even out the pasture curve throughout the year | Same as in a normal season with some increased hay or silage feeding to bolster any pasture shortfalls | Herd size starts to reduce, and concentrate and forage feeding increases mainly from own on farm stocks. As grain feeding levels increase the requirement for protein sources also increases predominantly from lupins | Herd size reduces further with milk supply constrained although operators will increase concentrate feeding while benefit cost is positive. Grain is imported from within Australia as farms are mainly up country in Victoria and southern NSW | | As rainfall returns to normal patterns and pasture growth returns to normal the level of concentrate feeding reduces to accommodate increased low cost nutrient balance supplied by pasture sources | Level of industry fragmentation within industry has precluded grain purchase risk management or aggregated buying on contract supply. As benefits become aware of concentrate feeding impacts on milk yield and grain use increases there is likelihood that supply contracts will be developed |
| Sheep | Most production from pasture; some growers have buffer drought stocks stored on farm; in wheat sheep belt local supply from gain handlers assured | As condition dry off lambs sold into the market as stores as well as older ewes; some drought feeding of breeding stock; utilisation of on farm drought buffer stocks | As drought declarations are issued exceptional circumstance provisions invoked; further livestock sell offs; increased supplementary feeding of ewes; some alternative feedstuffs used | Drought buffer stocks exhausted, most livestock sold off apart from nucleus ewe flock; grains and other feedstuffs sourced State-wide; remaining ewes sold off | First move is to sow grain crops to generate cash flow in sheep wheat belt After rains move to restock with ewes and progressive return to normal operations; on farm drought buffer stocks replenished | Most production from pasture; some growers have buffer drought stocks stored on farm; in wheat sheep belt local supply from gain handlers assured | On farm drought buffer stocks; need for local access to drought feeds in grain handling system, exceptional circumstance access speed; drought stock sell down plans |

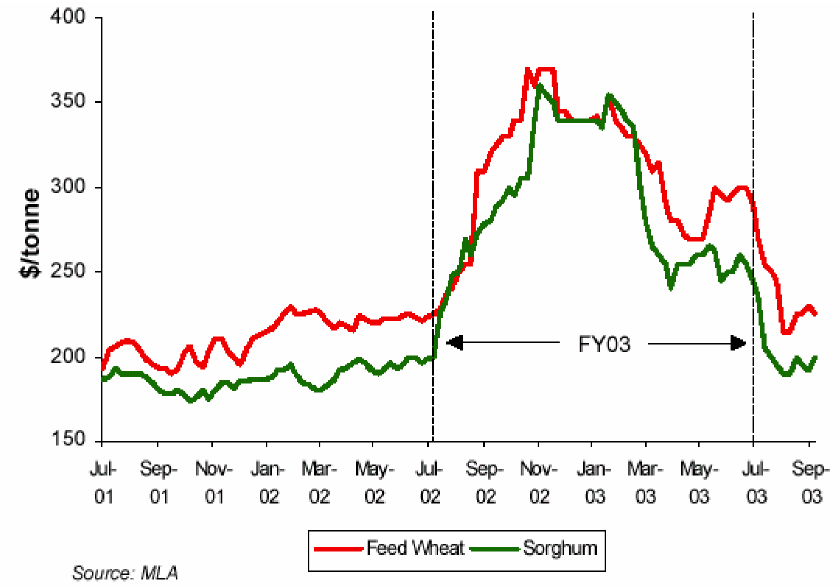
| Seasonal Rainfall Drought Events | **Normal Season** | **Meteorological Drought** | **Agricultural Drought** | **Hydrological Drought** | **Return to Normal Season** | **Normal Season** | **Intensive Livestock Risk Mgmt Tools** |
|---|---|---|---|---|---|---|---|

| **Seasonal Rainfall Drought Events** | **Normal Season** | **Meteorological Drought** | **Agricultural Drought** | **Hydrological Drought** | **Return to Normal Season** | **Normal Season** | Intensive Livestock **Risk Mgmt Tools** |
|---|---|---|---|---|---|---|---|
| Grain Supply Industry | Mainly export focus with some farm based supply of feedgrains to intensive livestock feeding industries. Generally adequate feedgrains from new season and stocks to satisfy demand. Some contract supply and storage to larger operators | Still export focused especially with regional or seasonal drought scenarios. Supply transfers from outside immediate region and interstate. Pricing starts to increase based on anticipated future supply pricing is export parity plus freight to up country sites | Increased supply from other regions and states. Pricing formula starts to change to import parity plus transfer price up country. Some imports of lower cost grain arbitraged against exports of higher value and quality feedgrains to export customers. Stocks continue to be reduced | Grain supplies transferred from SA and WA to eastern states and increased imports. Import pricing puts a cap on domestic market price increases. Stocks continue to be reduced and future strategies decided by June/ July each year as winter crop prospects firm up | Return to normal season slows imports; new season stocks received and import velocity resumes, remaining old season stocks cleared | System returns to situation where supply generally exceeds demand except for intensive livestock industry growth in eastern States | Mainstream system provides procurement, storage and pricing risk tools for larger players. Reality is larger players will spread supply sourcing between two or more players. Smaller player can access grain futures or local supply contracts priced at a margin over export parity to divert grain out of the export pipeline. Limited use of output commodity price risk management by forward supply contracts or futures |

### 4.2.5 Drought Impacts on Feedgrain Prices

A major expense incurred by intensive livestock industries is the purchase of feedgrains. During times of drought the rise in feedgrain prices can detrimentally affect the economic viability of these enterprises. The following chart reveals the Australian feedgrain price trend for the July 2001 to September 2003 period. During this period feed wheat and sorghum prices increased as the drought intensified, peaking in late 2002 to early 2003. The first cargo of imported feedgrain to Australia for seven years occurred in January of 2003 contributing to the decline in feedgrain price (Figure 20).

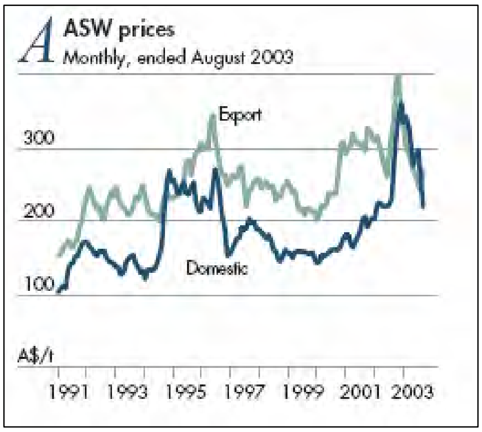
**Figure 20:** Australian Feedgrain Prices




**Domestic and Export Pricing of Feed Wheat**

This analysis highlights the highs and lows of the drought induced feedgrain price effect. The market does not operate in isolation and Australia has forward grain supply contract commitments with export customers. The following chart by ABARE shows the variation between export and domestic stocks for ASW (feed wheat over the period 1991-2003). In normal seasons there is a pricing differential between domestic market and export prices. However when supply becomes constrained domestic market price increases to export parity price as can be seen for the price indications in 2003.

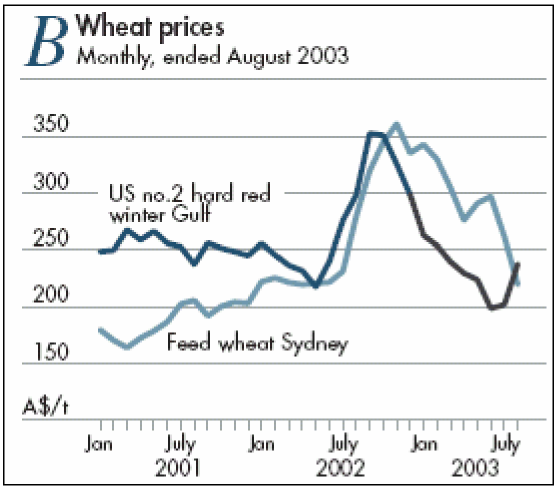
**Figure 21:** Domestic and Export Pricing of Feed Wheat



**Comparison of Australian and US Feedgrain Prices 2001-2002**

The following chart from ABARE shows the difference between US No. 2 hard red winter wheat ex Gulf ports USA versus feed wheat Sydney over the course of the current drought. This chart has been included to demonstrate the relativity of feedgrain pricing between domestic market and US export sourced product. It shows that in a normal season and at the entry into a drought event domestic grain is priced below US grain given the USA is a likely source of imports when the Australian domestic market has a supply deficit. As domestic market prices rise, US sourced product becomes a more attractive commercial proposition until domestic price fall triggered by either the arrival of new season grains or sufficient imports to cap further domestic price rises. ABARE analysis indicates that US hard red winter wheat price peaked in September- October 2002 at approximately A$352 per tonne while Australian feed what price peaked at A$ 361 per tonne. From November 2002 to July 2003 both Australian and US price trended downwards with the Australian price maintaining a premium to the US price. However, in August 2003 this premium had eroded as the US price increased and Australian prices continued to fall.

**Figure 22:** Comparison of Australian and ES Feedgrain Prices 2001-2002




## *4.2.6 Do Drought Induced Feedstuff Supply Demand Gaps Really Exist*

- The current 2002-2003 drought, despite its duration and severity, has not exhausted feedstuff supply because of reduced economic activity, on farm grain storage, some grain and feedstuff imports and market pricing releasing feedgrains to the Australian domestic market instead of the usual export pathway. The most significant impact has been price increases in feedgrains which reflects what has occurred in previous droughts as shown below.

- However, while there is a strong correlation between El Nino induced drought events and winter wheat yields, summer crop yields are also impacted; the 1994-1995 drought was a long lived one which culminated in the acute 1994-1995 and 1995-1996 domestic grain shortages, with huge price increases.

- The following feedgrain prices (quoted in ABARE Commodity Statistics) are indicative:

| Comments | Year | Sorghum Bulk Delivered Sydney $/tonne | Feed Wheat Bulk Delivered Sydney $/tonne |
|---|---|---|---|
| | 1973-1974 | 63.7 | 71.0 |
| | 1974-1975 | 70.6 | 80.4 |
| | 1975-1976 | 78.5 | 99.3 |
| | 1976-1977 | 83.6 | 105.4 |
| | 1977-1978 | 84.8 | 111.6 |
| | 1979-1980 | 103.3 | 140.5 |
| | 1980-1981 | 135.3 | 151.37 |
| Drought in grain growing areas | 1981-1982 | 112.95 | 149.8 |
| Severe drought | 1982-1983 | n/a | 184.1 |
| | 1983-1984 | 127.8 | 175.2 |
| | 1984-1985 | 131.7 | 204.4 |
| | 1985-1986 | 126.7 | 193.8 |
| | 1986-1987 | 111.4 | 170.1 |
| | 1987-1988 | 129.0 | 189.5 |
| | 1988-1989 | 152.1 | 211.8 |
| | 1989-1990 | 152.8 | 171.0 |
| | 1990-1991 | 136.8 | 135.8 |
| | 1991-1992 | 172.8 | 159.7 |
| | 1992-1993 | 148.9 | 143.5 |
| | 1993-1994 | 168.6 | 137.6 |
| Drought in grain growing regions | 1994-1995 | 215.7 | 232.8 |
| | 1995-1996 | 223.7 | 234.7 |
| | 1996-1997 | 174.8 | 188.4 |
| | 1997-1998 | 182.4 | 185.9 |
| | 1998-1999 | 141.6 | 155.4 |
| | 1999-2000 | 130.6 | 153.6 |
| | 2002-2003 | 238 | n/a |

The above suggests that drought (ie. within the last decade) now pushes prices up much more sharply than previously. This may be due to the following factors:

(a) Cattle lot feeding began to grow significantly in the early 1990's and the export expansion of the pig meat industry has occurred over the last few years.

(b) Barley production has not increased to the extent of wheat production. Between the early 1990's and the early part of this century Australia production of wheat has increased from a 'good crop' of around 16 MT to 22-25 MT. Over the same period, barley production has edged up from the 6-7 MT level to about 8 MT (ABARE is forecasting around 6-6.5 MT over the next few years).

(c) Sorghum yield tends to fluctuate a lot with the climate (ranging from 1.8-3.0 tonnes per hectare in Queensland over the mid to late 1990's); area planted has trended up slightly with increases in NSW partially offset by Queensland downward pressures. ABARE forecasts a plateauing out of sorghum production over the next few years as part of an expected switch back to wool while cotton production is expected to be limited by irrigated water availability, as distinct from demand.

The reality of the current 2002-2003 drought is that despite severe price rises and supply constraints the supply of Australian produced feedstuffs has been generally adequate for the intensive livestock industries to continue operation albeit with significantly reduced profit margin. There have been imports of some grain and feedmilling ingredients destined primarily for the poultry and companion animal manufactured feed industries. The net effect of imports has been a decrease in local grain prices, a (lessening of exports and a decrease in movements of grain in the central system from up country to export port. The next section examines the issues associated with grain imports.

### 4.2.7 Prolonged Drought Impacts on the Pastoral Sheep and Cattle Industries

Previous droughts have decimated sheep and cattle populations:

- The 1895-1903 drought halved sheep numbers and decreased cattle populations by 40 per cent;
- The 1911-1916 drought resulted in a loss of 19million sheep and 2 million cattle;
- The 1939-1945 drought resulted in a loss of nearly 30 million sheep between 1942 and 1945; and
- In more recent times the 1963-1968 drought saw a loss of 20 million sheep and drought losses were extensive in 1982-1983 and 1991-95.

Before those losses occur the pastoral sheep and beef and dairy cattle industries will invariably drought feed cattle and simultaneously decrease herd and flock numbers. Initially drought feeding comes from on farm reserves but then resorts to bought in drought feedstuffs. The extent and quantum of on farm drought feeding is unknown. One of the supplementary reports commissioned in this study estimated that in a prolonged severe drought monthly feedstuff demand would be in the vicinity of 740,000 tonnes per month.

Since the severe historical droughts there have been a number of significant changes that will help to mitigate drought effects including the feedlot industry, a more extensive meat processing industry better livestock transport systems and better drought feeding understanding, practice and technology. Despite these significant gains a prolonged multi year drought in pastoral areas is likely to place significant demands on feedstuff supply possibly necessitating imports of feedstuffs. If such a situation occurred the hidden cost will be the decline in livestock breeding populations and turnoff significantly constraining live stock supply for intensive animal feeders well after the drought has finished.

# 5. POTENTIAL ROLE OF IMPORTS IN FEEDGRAIN SECURITY

## 5.1 Background

Access to internationally traded product is the normal mechanism for ensuring that domestically produced product is not priced above the price at which equivalent imported product can be purchased.

The domestic feedgrain market lacks such full price discipline due to the effects of quarantine. This differentiates the price behaviour of domestic feedgrains from the international disciplines applying to the outputs of the meat and wool industries. In the absence of full access to imported feedstuffs, domestic feedgrain prices have risen above export parity during severe drought events.

The price impact is accentuated by the increased difficulties experienced in accessing large parcels of feedgrains during a worsening drought event; anecdotal evidence suggests that a small number of export focussed agencies may control a larger than normal share of uncommitted feedgrain stocks, and forward contracted individual growers are not able to fulfil commitments at those times.

Quarantine conditions applying to imported feedgrains are extensive, and are attributable to the high quarantine risks associated with the grains proposed for importation as feedgrain. Large volumes of processed foods are imported by Australia, some requiring government regulation; grain is a biologically active product capable of reproduction and of harbouring some serious pest and disease risks that may negatively impact on Australia's broad acre industries. Quarantine rules are intended to minimise those risks, which are the germination of spilt grain; release of weeds; release of pathogens; release of insects.

The quarantine restrictions that apply are intended to manage quarantine risks to an "acceptable" level. The pest risk analysis involves scientific judgement about the probability of pests and diseases being introduced into Australia. The issue of what constitutes an acceptable level of risk is determined by the Commonwealth Government. Australia general has a very low acceptable level of risk and on an issue such as grain imports where the consequences of risks being realised are very high quarantine requirements are necessarily very strict.

The current AQIS protocols for the import of various feedgrains from USA and the UK are located in Volume 2 of this report.

## 5.2 Current Access to Imported Product

Access to imported product under current rules can be summarised as follows (see later explanatory details):

**Table 30:** Access to Import Product under Current Quarantine Rules

| **Location** | **Access to imported product under current quarantine rules (a)** | | | **Assumed additional eligible supplying countries/products based on IRA requirements and export availability** |
|---|---|---|---|---|
| | **Processed or devitalised feedgrains** | **Unprocessed feedgrains** | **Current Eligible Supplying countries** | |
| Metropolitan areas (metropolitan post code zones and Newcastle/ Sydney/ Port Kembla transport areas | Yes | Under strict conditions from approved supplying countries/ regions (UK, Canada, USA) | No formal list exists; but approvals have been granted for unprocessed feedgrains from United Kingdom and regions of the USA | Unprocessed feedgrains<br>- Canada (barley)<br>- Finland (barley)<br>Processed feedstuffs<br>All sources providing certain conditions are met; other countries e.g. Russia have been assessed but judged by Biosecurity Australia to be too high risk. |

| Location | Access to imported product under current quarantine rules (a) | | | Assumed additional eligible supplying countries/products based on IRA requirements and export availability |
|---|---|---|---|---|
| | Processed or devitalised feedgrains | Unprocessed feedgrains | Current Eligible Supplying countries | |
| Inland areas (areas outside metropolitans areas) | Yes | No | Above | Above |

(a) The rules are reassessed each crop year.

## 5.3 Australia's International Obligations on Quarantine Rules

The use of measures to restrict the movement of potential quarantine pests, both into Australia and within Australia, due to the quarantine risks they pose must conform to international treaties.

At the conclusion of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) in 1994, member nations decided that specific agreements were necessary to stop countries erecting unjustified technical barriers to trade to compensate for the proposed removal of tariffs. Australia, as a member of the Cairns group, was a strong proponent of this initiative. One of these agreements, the Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS agreement), includes measures to protect human, animal or plant life or health from risks arising from quarantine pests. The SPS agreement recognises the International Plant Protection Convention of 1951 (IPPC), which deals specifically with plant quarantine issues.

The SPS agreement came into force for developed countries with the formation of the World Trade Organisation (WTO) on 1 January 1995. This agreement was motivated by a concern that unless clear rules were made in the area of phytosanitary measures, gains achieved in the negotiations concerning agricultural trade would be eroded by the imposition of additional restrictions in the form of sanitary and phytosanitary barriers.

The SPS agreement imposes disciplines on the actions taken by national governments to regulate the importation of plants and plant products. A fundamental requirement of the SPS Agreement is that Members ensure that SPS measures are based on an assessment as appropriate to the circumstances of the risks to human, animal or plant health taking into account risk assessment techniques developed by the relevant international organisations. These actions have to be based on scientifically assessed pest risks. The SPS decision processes must be transparent (that is, clearly stated and open to external scrutiny if requested).

The SPS agreement also requires WTO members to base SPS measures on "international standards, guidelines or recommendations". The International Plant Protection Commission (IPPC) Secretariat has been recognised by the WTO as the body responsible for coordinating phytosanitary standards development. Biosecurity Australia, and its predecessors, have been an active participants in the development of international standards and considers that its decision making process is consistent with the developing standards.

## 5.4 Quarantine Policy Making and Administration in Australia

Biosecurity Australia is responsible for developing quarantine policy, in Australia, in line with Australia's international obligations and Commonwealth Government policies. It does this by assessing quarantine risks associated with imports of both plants and animals. Australia is a member of the World Trade Organisation (WTO) and Biosecurity Australia assesses the pest risks associated with trade using international standards. Biosecurity Australia uses the International Plant Protection Convention (IPPC) guidelines for Pest Risk Analysis (PRA) frameworks for determining quarantine pest concerns associated with imports.

Once quarantine policies are adopted the implementation will be the responsibility of the Australian Quarantine and Inspection Service (AQIS). AQIS regulates quarantine at the international border and performs this task under the *Quarantine Act 1908*. AQIS is empowered to regulate the importation of all types of material into Australia. The act does not differentiate between end usages.

The following diagram shows how the approval process operates (Table 31):

**Table 31:** Approval Process

| Application to AQIS | Biosecurity Australia Policy Advice | New Protocol drawn up, or existing one amended | AQIS permit approval |
|---|---|---|---|
| Product/ supplying country covered by existing protocol specifying quarantine management conditions | → | → | ✓ |
| Proposal involves new commodity/country combinations, new technologies, and drawing up, or amendment of, protocol | Biosecurity/ AQIS typically collaborate | ✓ | ✓ or ✗ |

If AQIS judges that an import application requires Biosecurity Australia (BA) advice, it is referred to BA for advice by AQIS; about 500 such requests for policy advice are received each year. An understanding of this process is critical to an assessment of the potential for the gas fumigation treatment now being developed by CSIRO to gain BA approval.

Risk is assessed on a <u>systems</u> basis, ie. the likely level of risk with the transport handling, treatment and storage systems taken as a whole.

## 5.5 Currently Approved Conditions for Grain Imports

Quarantine policy parameters for imported feedgrains accessible within current conditions are as follows:

| | Bulk Maize from United States of America for processing | Bulk Sorghum from USA for Processing | Bulk Wheat from UK for Processing | Bulk Wheat for UK for Milling |
|---|---|---|---|---|
| **Storage/ Processing Plan** | Metropolitan postcode districts plus narrow area defined as transport axis from Sydney to Port Kembla and Newcastle | As per maize | As per maize | As per maize |
| **Approved Eligible Supplying Countries/ Regions** | USA from:<br>Iowa<br>Minnesota<br>South Dakota<br>North Dakota<br>Wisconsin | USA from:<br>South Dakota<br>Kansas<br>Nebraska<br>Missouri<br>Illinois | Grown and sourced in UK | Grown and sourced in UK |
| **Processing Requirements** | ▪ Under AQIS supervision product to be steam pelletised at pressure at 88°C-100°C for 10-20 seconds<br>▪ Then mill etc to be cleaned and inspected by AQIS | As per maize | As per maize | ▪ Grain must be milled to the extent that no whole grain or other seeds are present<br>▪ By products for animal food to be steam pelletised. |

Note: (a) Cereal rye from Canada and Denmark is subject to similar conditions.

| | Bulk Maize from United States of America for processing | Bulk Sorghum from USA for Processing | Bulk Wheat from UK for Processing | Bulk Wheat for UK for Milling |
|---|---|---|---|---|
| **Quarantine Approval Pathway** | <u>Before purchase from USA exporter</u>:<br>▪ Importer must notify AQIS of:<br>- Vessel's name and provide copy of vessel cleanliness certificate<br>- Prior 6 cargoes with all details to be notified<br>- Port of discharge in Australia and ETA to be notified<br>- Provide AQIS with contingency plan<br><u>In USA</u><br>▪ Transported directly to Pacific NW ports or to gulf ports (excl Texas via river system)<br>▪ Be accompanied by disease free certification from USA Grain Inspection and Stockyard Packers Association (GIPSA) including cleaning of transportation units<br>▪ <u>Also</u> accompanied by International Phytosanitary Certificate declaring free of all species of genus 'Trogoderma'<br>▪ Certification by GIPSA (or approved equivalent) that maize is US Grade1 or Grade 2 with no admixture or bleaching and was loaded under GIPSA supervision.<br><u>On arrival at Port</u><br>▪ Importer provides AQIS with gas free certificate from a licensed fumigator or industrial chemist prior to AQIS inspection.<br>▪ AQIS inspection prior to discharge.<br>▪ Grain to be sampled in a laboratory for testing.<br><u>Movement from Port to Storage</u><br>▪ If shipment clean, discharge to approved storage or approved processing premises.<br>▪ Discharge must be at AQIS approved berths<br>▪ Any dust extracted to be buried/incinerated under AQIS rules<br>▪ Contingency plan to handle spillage to be approved by AQIS<br>▪ Only AQIS approved truck/rail wagons to be used; must be cleaned before moving from wharf area<br>▪ Transport routes to be AQIS approved<br><u>After Storage</u><br>▪ After discharge all trucks/wagons to be AQIS inspected<br>▪ Wharf equipment and wharf to be cleaned after each day<br><u>Movement from Storage to Processing</u><br>▪ Trucks/wagons to be cleaned<br>▪ Route to processing facility to be AQIS approved<br>▪ AQIS inspection of trucks/wagons prior to leaving premises<br>▪ All trucks/wagons to be cleaned upon completion of last load and AQIS inspected | As per maize | As per maize<br>Similar to maize with approved third party certifier instead of GIPSA<br>Similar to maize with additional pest/disease listed<br>Maximum of 1% foreign matter specified<br>As per maize<br>As per maize<br>As per maize | Similar to requirements for bulk wheat for processing |

## 5.6 Experience to Date in Importing Feedstuffs

The first major test of the quarantine response to applications to import grain for inland usage occurred during the regional drought of the early to mid 1990's. To meet the shortfall of grain, attributable to the prevailing drought conditions at that time, the Australian Quarantine and Inspection Service (AQIS) received a number of requests for the development of a Quarantine Protocol for the importation of bulk grain.

In response, AQIS commissioned the Bureau of Resource Sciences (BRS) to undertake a pest risk analysis (PRA) to assess the risks of introducing exotic pests, diseases and weeds into Australia with the importation of barley, wheat, maize and sorghum from the USA and Canada.

AQIS subsequently drafted 3 protocol options within which imports might be allowed, ie:

(1) Steam treatment of grain at the point of entry; this product then could move to any destination, and is the basis on which AQIS approved grain imports for inland usage.

(2) Cracking of grain in metropolitan/ port areas and subsequent movement to metropolitan and rural end users on a case by case basis:

- This was subsequently further refined to require pelletising following hammer milling as an approved import process.
- Prior to this, AQIS would allow movement of some cracked grains under approved transportation conditions to approved inland areas (eg Tamworth).

(3) Movement of unprocessed grain to rural areas:

- This was rejected as too high a risk, although the trial was not completed prior to AQIS inspectors being withdrawn.

By June 1995, AQIS had approved the importation of approximately 500,000 tonnes of grain (including stockfeed pellets) of which all but a very small quantity were approved under protocol 1 above.

The following is a summary provided by AQIS of feedstuff imports that occurred in the 1994-95 drought.

### *5.6.1 Summary of 1994-1995 Imports of Whole Grain*

- The Imported Grain Task Force (IGTF) was established by the Minister for Primary Industry and Energy in October 1994 to actively progress risk assessment processes and assess applications to import whole cereal grain as a result of prevailing drought conditions.
- The first application for imported whole grain directly resulting from the drought conditions was received in August 1994.

- A total of 440,506 tonnes of grain was imported and landed between August 1994 and 30 September 1995.

- Break-up of total arrivals by grain type in tonnes:

  - Rye – 4,300 tonnes
  - Barley – 65,860 tonnes
  - Maize – 89,131 tonnes
  - Sorghum – 281,215 tonnes

- Break-up of totals by Port of landing:

  - Brisbane – 146,860 tonnes
  - Melbourne – 46,200 tonnes
  - Newcastle – 174,516 tonnes
  - Port Kembla – 47,930 tonnes
  - Geelong – 25,000 tonnes

- Break-up of totals by Country of Origin:

  - Finland – 40,860 tonnes
  - Canada – 29,300 tonnes
  - USA – 370,346 tonnes

- Approved applications to import grain have been classified into 3 major categories shown in the table below:

| Human consumption | Stockfeed | Pet food |
|---|---|---|
| • grain for puffing into cereal multigrain recipes<br>• barley for malting<br>• hard wheats for making pasta<br>• grain for 'milling' | • horse feed<br>• poultry feed<br>• stockfeed<br>• feed barley | • bird seed<br>• kibble for pet food<br>• other cereal components of dog food |

- Break-up of totals by End Use:

  - Human consumption – 29,300 tonnes
  - Stockfeed – 396,474 tonnes
  - Pet food – 14,732 tonnes

- In practice, the utilisation of a heat treatment facility (protocol 1) underwritten by a consortium of feedlot operators, and built/ managed by Grainco was not successful. Feedlot end users reported a variety of problems including some loss of nutritional value; low per hour throughput; and problems with stones etc mixed with the US maize. The treatment at this facility was reported to add an extra $40 per tonne to overall costs for feedlot end users, taking account of the cost of heat treatment ($8-$10 per tonne) and the loss of performance from the final grain product.

- Since the mid 1990's drought, quarantine conditions for imported feedgrains have solidified and are built around the following core elements:

  - Vessel by vessel approval

- Low risk countries/internal regions to be the source of supply
- Low risk grains from the above
- Reliance on detailed certification from internationally accepted certifiers
- Detailed and stringent transportation, storage and processing requirements to be met overseas and in Australia
- The imported grain to be confined to metropolitan areas and a narrow transport axis prior to processing
- Milling and heat treatment as the basis for processing
- Following processing, the imported product is free to be used anywhere in Australia

• Imports during the 2002-2003 drought have been confined to grain from the United States, United Kingdom, Canada and Demark for metropolitan processing, since as documented earlier those countries are approved suppliers within existing protocols.

• In a postscript to the 2002-2003 feedstuff import activity on 11 July 2003 AQIS and grain industry representatives announced "that is was unlikely Australia will import any further feedgrain in the foreseeable future. The Australian Quarantine and Inspection Service (AQIS) reports that no further imports have been ordered. Grains Council of Australia President Keith Perrett said there would be no more imports since it took 6-8 weeks to bring shipments in and the first new crop wheat varieties from the 2003-2004 winter crop will be harvested in 8-10 weeks. There will be a tight supply period over the next couple of months. But there should be grain there… Australia imported 48,000 tonnes of maize, 285,000 tonnes of wheat, 17,300 tonnes of stockfeed and 126,600 tonnes of stockfeed ingredients for total imports of 476,900 tonnes in 2003… This is less than the 600,000 tonnes of feed what which AQIS had earlier expected."(Reuters News 11/07/2003). More detailed breakdown of feedstuff imports that have occurred over the 2002-2003 drought is shown in the following data supplied by AQIS:

• The Imported Grains Operations Response (IGOR) group was established in October 2002 to actively progress imported grain operational processes and maintain quarantine integrity.

• The establishment of IGOR was in response to applications and enquiries from importers acting on behalf of the livestock production industries that faced a shortage of domestic product within Australia.

• Operational systems were implemented on 2 January 2003 for system and documentation checks. The first shipment of imported grain occurred on 9 January 2003.

• A total of 430,431 tonnes of grain has been imported and landed between January 2003 and June 2003.

- Break-up of total arrivals by grain type in tonnes:

  - Rye – 10,468 tonnes
  - Maize – 48,249 tonnes
  - Feed wheat – 271,887
  - Milling wheat – 26,670 tonnes
  - Soybeans – 73,157 tonnes

- Break-up of totals by Port of landing:

  - Brisbane – 44,950 tonnes
  - Melbourne – 206,307 tonnes
  - Newcastle – 179,174 tonnes

- Break-up of totals by Country of Origin:

  - UK – 298,557 tonnes
  - USA – 121,406 tonnes
  - Denmark – 10,468 tonnes

- Break-up of totals by End Use:

  - Milling – 37,138 tonnes
  - Stockfeed – 320,136 tonnes
  - Oil – 73,157 tonnes

**Eastern Seaboard Feedmill Processing Capacity**

However the reality is that there is limited grain processing capacity available (estimated at 1.04 MT) in eastern seaboard ports. Australian Wool Innovation Ltd (AWI) in a recent analysis identified the processing capacity as shown in the following table. This capacity is generally fully committed to the vertically integrated feedmillers or poultry feed manufacturers.

**Table 32:** Ability to Process Imported Grains[1]

| Port | Mills | Supply Sector | Total Grain Use Tonnes/annum |
|---|---|---|---|
| Brisbane | Ingham<br>Bartter<br>Riverina | Integrated Broiler<br>Integrated Broiler<br>Commercial | 215,000 |
| Newcastle/Sydney | Ingham<br>Bartter<br>Weston<br>Vella<br>Premier | Integrated Broiler & Commercial Dairy<br>Integrated Broiler<br>Commercial<br>Commercial<br>Commercial | 375,000 |
| Melbourne | Ingham<br>Bartter<br>Ridley | Integrated Broiler & Commercial Dairy<br>Integrated Broiler<br>Commercial | 450,000 |
| Port Kembla | No mills | | |
| TOTAL | | | 1,040,000 |

Source: AWI, December 2002

[1] Source: AWI Consulting team's calculations based on metropolitan stockfeed plant capacities

AWI assessment of the surplus feedmill process capacity situation was as follows:

- "*The metropolitan feedmills do not have significant spare manufacturing capacity and their ability to supply pelleted grain or feed for supply to inland locations is very limited.*"

  The other option is transhipment transfers of feedgrains from WA and SA. This issue was also analysed by AWI with the following outcomes:-

- **Current Shipping Costs**

Trade sources have indicated that shipments of grain are being arranged from South Australia where an estimated 150,000 tonnes of feed barley will be shipped from SA ports to Qld and NSW ports. It is also expected that some 200,000 of barley will also be moved by rail from SA silos to destinations in Victoria and NSW. These estimates are based on information available in mid-December 2002.

**Table 33:** Estimated Shipping costs from WA and SA[2]

| Cost Component- AUD per tonne | SA to East Coast Ports | WA to East Coast Ports |
|---|---|---|
| Sea Freight* | $23-25 | $25-30 |
| Discharge | $17-18 | $17-18 |
| Cartage | $3-4 | $3-4 |
| Total Costs | $43-47 | $45-52 |

Source: AWI, December 2002
* Shipping costs are based on the use of non-Australian flag vessels that would require a single voyage permit. Shipping companies advise that suitable bulk cargo Australian flag vessels are not available to undertake interstate voyages. Shipping costs are dependent on availability; tonnage capacity and rates also vary according to changes in the sea freight market. The shipping rates also assume that a vessel is not being repositioned.

Total costs estimated for the shipment of grain from SA to Brisbane and Newcastle range between AUD 43-47 per tonne when grain is purchased on a Free on Board (FOB) basis. Total cost from WA to Brisbane and Newcastle range between AUD 45-52 per tonne.

- **Rail Transport**

The grain trade is investigating the possibility of transporting grain from BHC sites situated South Australia such as Crystal Brook that are on the main interstate line to places in NSW such as Parkes and Narrabri. The rates from Crystal Brook to Parkes range between $42-45 per tonne based on a 2,000 tonne train load. Unloading and outturn charges at Parkes and Narrabri would range between $8-9 per tonne.

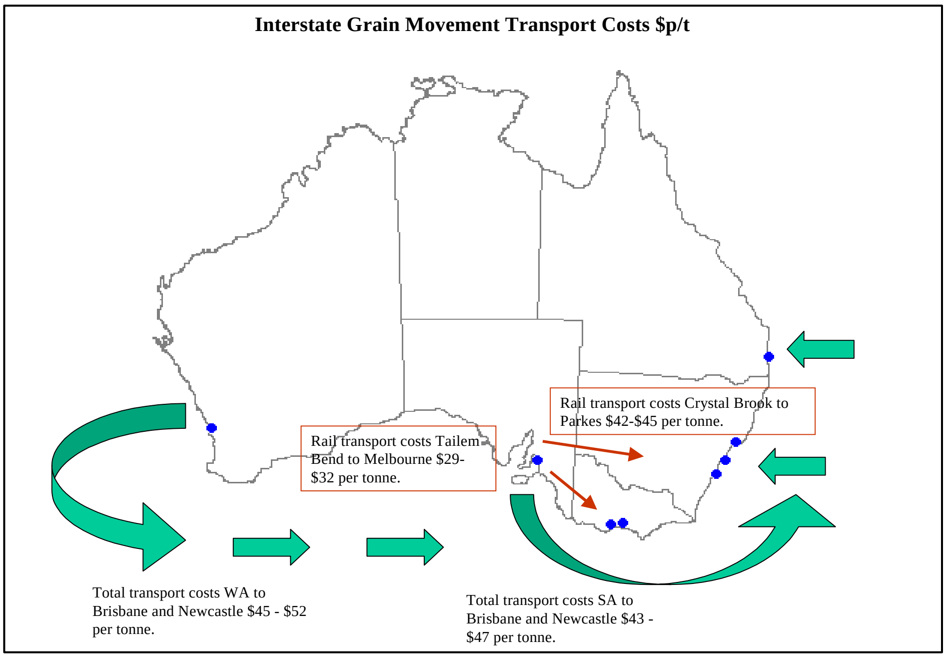
As indicated above large tonnages of South Australian grain is likely to be transferred interstate from South Australia into Victoria. Freight rates from Tailem Bend in South Australia to the Melbourne market range between $29-32 per tonne, based on a 2000 tonne trainload. The rate from Tailem Bend to Parkes ranges between $48-52 per tonne, when grain is moved to Parkes through the Victorian rail system.

[2] Consulting team research based on a rammage of information obtained from shipping companies and grain traders

- **Road Transport**

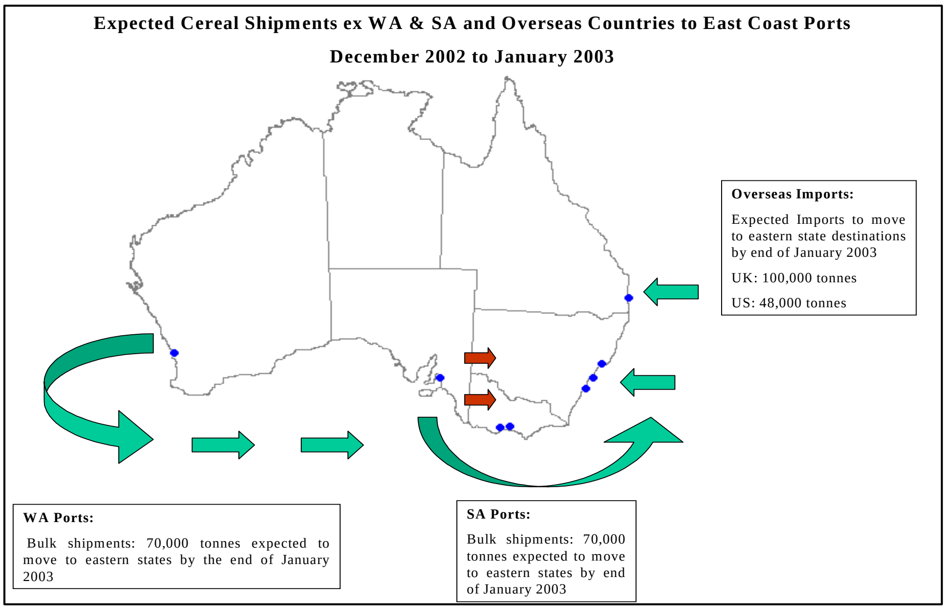
Road transport cannot normally compete with rail when grain is transported interstate unless back loading can be arranged. However, there is anecdotal evidence that tonnages of grain are now being transported by road into Victoria and NSW from SA and to a lesser extent WA. Road transport rates currently range between 6 and 7 cents per tonne/kilometre.

**Figure 23:** Transport Costs




Source: AWI, December 2002

**Figure 24:** Expected Shipments




Source: AWI, December 2002

Figure 24 above shows the expected shipments that will be shipped to east coast ports during the December 2002 and January 2003 period.

## 5.7 Effects of Quarantine Requirements

The current approval conditions for imported grains have the following consequences:

(1) At certain times, import parity has been below the equivalent domestic price (for example, the 2001-2002 annual report of the Australian Barley Board referred to domestic feedgrain prices during that year as being the most expensive in the world).

There is a significant economic cost born by inland end users relative to international competitors who are far less susceptible to recurrent droughts, and therefore have more stable access to domestic feedgrains.

(2) The effect of metropolitan processing only is to allow only some feedgrain users, eg maltsters, flour millers and chicken meat producers, to utilise existing on site processing facilities.

Inland end users currently require access to metropolitan processing facilities, and also must fund the added costs of moving processed product from the metropolitan zone for rural use.

During the 2002-2003 drought metropolitan processing facilities were fully stretched and capacity was not available for rural end users. The capacity of metropolitan mills to process imported grains has been assessed by a separate report commissioned by AWI Ltd (Drought Feed Strategies for the Australian Wool Industry 1 December 2002) to be 1,040,000 tonnes per annum. This report concluded that “the metropolitan feedmills do not have significant spare manufacturing capacity (i.e. during a severe drought event) and their ability to supply pelleted grain or feed for supply to inland locations is very limited.”

The costs attributable to metropolitan processing and AQIS are estimated by the previously quoted AWI report to be \$6.00 per tonne for transport to processing; \$27.50 per tonne for processing charges and \$3.50 per tonne for AQIS charges. These costs and complexities make grain importation for rural customers a costly and “last resort” option.

AQIS site accreditation for processing of imported grain has to be renewed every year, and the costs are high.

(3) In any event, commercial piggeries/feedlots mainly purchase whole grain for <u>on site</u> processing. ‘Wet processing’ is commonly utilised by larger operators including reconstitution, and steam rolling/flaking. These nutrition related processing requirements are at odds with the current quarantine rules requiring pelletising in metropolitan areas.

Consequently, certain meat producers (chicken meat producers in particular) have a greater capacity to manage through a drought than others.

This is not to say that import access for metropolitan processors does not have beneficial effects in alleviating feedgrain shortages. It does, but in uneven ways across industries depending upon geographic location.

(4) However, while there remains a vessel by vessel application and approval process, the rules are much better defined now than in the mid 1990's drought.

## 5.8 Additional Sourcing Options within Current Technology

While specific conditions have been approved for the previous products, earlier BRS/AQIS scientific analysis and previous experience would suggest that the following products would probably be regarded as acceptable for entry by Biosecurity Australia:

- Barley from Canada
  - Based on AQIS documentation dated March 1995 and approved imports of cereal rye.
- Barley from Finland was utilised in the manufacture of stockfeed in 1995 ie it was previously approved for importation for seaboard processing.
- Cereal Rye from Demark has been imported; the assumption is that other cereals from Denmark would be acceptable if subject to similar conditions.

## 5.9 Non-Grain Imports

Non grain imports are currently permitted provided processing eliminates the risk of quarantine pests/diseases surviving. Such treatment can be off shore (providing the process has been previously approved and appropriate checking mechanisms have been developed for on arrival verification and/or sampling), or in metropolitan locations in Australia, provided that AQIS inspection, and related product sampling, can take place.

## 5.10 Interstate Movement of Grain

Australian livestock industries are handicapped by the internationally high costs involved in internal movements of grains.

In September 2002 ProFarmer published the following cost comparison between moving sorghum into Sydney from United States gulf ports relative to sourcing wheat from Western Australia:

| | **Price per tonne** | |
|---|---|---|
| | **US Sorghum** | **Wheat Ex Western Australia** |
| Offer price ex Gulf<br><br>Freight to Sydney | US$131<br><br>US$25 | A$280<br>F.O.B costs $A17<br>A$25 |
| **Landed Sydney** | **US$156 = A$290** | **=A322** |
| Unloading and handling<br>Freight to processing<br>Incidentals | $A16<br>A$15<br>A$10 | A$16<br>A$15<br>A$10 |
| **Total** | **A$330** | **A$363** |

The previously mentioned AWI commissioned report contains cost calculations consistent with the above.

The high coastal shipping costs in Australia are believed to be largely attributable to regulations requiring the use of Australian registered vessels on the coastal trade.

There are restrictions on the entry of lupin imports from Western Australia into Victoria, in particular, due to anthracnose. These restrictions are not standardized across each state as the risk profile varies with the extent of lupin production in the respective states.

## 5.11 New Import Access Opportunities

The best opportunity to improve access to imported grains lies in the research being carried out by CSIRO to test the efficacy of gas fumigation through a project funded by a consortium of livestock industries including ALFA and APL through MLA Ltd.

This new technology offers the following <u>potential</u> benefits:

- By eliminating mill/ best treatment processing it would allow inland movement of whole imported grain for on site usage.
- The fumigant uses naturally occurring chemicals with no significant residue risks.
- Secure metropolitan storage facilities can be utilised prior to inland shipment.

To date, varying levels of fumigation have shown the capacity to partially kill weeds, pathogens and devitalise grains, with indications that increasing moisture content substantially improves efficacy.

This work is now to be continued through an MLA administered contract to the stage where capacity to achieve complete kill/ devitalisation is to be demonstrated.

However, the technology still has to meet the following tests before it is commercially available to livestock end users:

- Manufacture of the gas is currently confined to one plant in China, and its ongoing availability in Australia is not yet assured. (A positive factor is the commitment by CSIRO to secure adequate supply, particularly since it offers good potential in applications for wood etc).
- AVMPA (formerly NRA) has yet to approve commercial application in Australia.
- The capacity of the gas fumigant to achieve complete weed/ pathogen kill and full devitalisation, while promising, is not yet proven.
- AQIS/ Biosecurity Australia will probably require a series of commercial scale trials before acceptance of efficacy with 100% kill/ devitalisation <u>if</u> complete reliance is to be placed on fumigation.
- If such trials are successful, the existing protocol defining metropolitan processing requirements would be modified.

## 5.12 Acceptable Risk

A critical issue is the degree of kill/ devitalisation required by AQIS/ Biosecurity Australia. It is likely that near 100% kill/ distribution <u>for each commercial shipment</u> will be required, as measured by per shipment sampling by an AQIS inspector (consistent with existing protocols).

However, quarantine risk is assessed on a systems basis, ie taking into account the ability of the supply chain to reduce risk. Consequently, it is possible that, even if the fumigant does not achieve 100% efficacy, it may do so to such a substantial extent that, taken with approved transport handling and storage arrangements which provide greater than usual leakage security, the system as a whole could be approved.

### *5.12.1 Future Objectives in Allocating Resources to Improve Access to Imported Feedstuffs*

We suggest following objectives should govern future livestock industry efforts to facilitate access to imported feedstuff:

(1) The emphasis should be on grains, for reasons outlined in this report.

(2) The primary goal is for an approved (ie within an AQIS protocol) methodology for movement and utilisation inland of unprocessed grains from more than one supplying country.

(3) This must allow the insertion in the domestic feedgrain pricing structure of a permanent import parity benchmark, with the market perceiving that end users can access <u>large scale imported grains at any time</u>.

(4) The best opportunity for delivery of this goal is to ensure adequate funding and management rigour for the CSIRO (Stored Grains Research Laboratory) work underway into gas treatment of imported grains.

(5) Through the Steering Committee which is to be set up to oversight the future progression of the project the potential for gas fumigation to achieve objective (3), even if 100% kill/ devitalisation is not achieved, through a systems risk minimization process should be kept in mind.

# 6. MYTHS AND SACRED COWS

There are a number of intensive livestock industry and feedgrain industry myths and sacred cows that were identified in this study. We have attempted to catalogue them and provide the facts in an attempt to remove some of the confusion and misinformation that clouds the public debate on this issue.

**Figure 25:** Intensive Livestock Industry and Feedgrain Industry Myths and Sacred Cows

| Intensive Livestock Industry | |
|---|---|
| **Myth or Sacred Cow** | **Facts** |
| ▪ Most cereal grains are interchangeable | ▪ The GRDC Premium Feedgrains Program has identified that grains can have different nutrition responses across the intensively fed livestock species. They are instigating NIR trials in 2003 to segregate grain and develop a value based marketing system for feedgrain based on objective measurement. |
| ▪ There will always be plenty of feedgrain for our intensive feeding businesses | ▪ Several analyses have shown that Australia is following world trends with feedgrain demand outstripping capacity to supply. This position is aggravated in the Northern grain region by highly variable grain yields with demand expectation not met one year in 3. This position could be further aggravated by grain based ethanol production proposals |
| Feedgrain Industry | |
| **Myth or Sacred Cow** | **Facts** |
| ▪ Queensland and Northern NSW have an equal opportunity for summer and winter crops | ▪ This may be so in some years. Recent QDPI research indicates there is likely to be supply/ demand failure 1 year in 3 ie crop failure is frequent and normal. |
| ▪ There is always plenty of feedgrain in Australia | ▪ Feedgrain production is relatively flat. The only variations occur where there is a large wheat harvest with significant down grades to feedgrain status. However in most years there is sufficient feedgrains but the location of that grain and price often precludes economic use |
| ▪ Grains R&D will ensure there are always adequate feedgrain supplies | ▪ Barley, sorghum and maize production ($ per annum) receive only a fraction of R&D funding going into milling wheat ($ per annum) |
| ▪ All feedgrains are interchangeable and this is why the grains industry does not take the intensive livestock industry seriously and they are opportunistic buyers | ▪ The GRDC Premium Feedgrain program has identified that some grains are better suited to some livestock species and others. The same grain fed to different species can have different outcomes in terms of MJ/ kg DM, CP and digestibility eg sorghum apart from waxy sorghum should not be the grain of choice for pork |
| Federal and State Government | |
| **Myth or Sacred Cow** | **Facts** |
| ▪ The pork industry is a fragmented small industry comprised of opportunistic feeders. | ▪ There has been significant consolidation and rationalisation in the pork industry leading to significant supply chain integration. The key players are large agribusinesses focused on domestic and export markets. |
| ▪ The wheat industry needs a single desk arrangement to trade effectively in world markets and such an arrangement benefits all growers | ▪ Several studies have shown single desk operations confer little if any benefit to stakeholders. AWB uses regulated monopoly powers to distort local markets. |
| ▪ Australia needs to be a net exporter of feedgrain to service existing export market clients | ▪ There is increasingly a demand supply gap occurring between the feedgrain production and intensive livestock industries worldwide. Except in superior production years attempts should be made to ensure the intensive livestock industries have access to feedgrain supplies at export parity prices. In low production years feedgrain supply should not exceed import parity. |
| ▪ Australia always has adequate feedgrains for the intensive and extensive in drought times livestock industries | ▪ In situations where there is a need to import feedstuffs the IRA process is too long and susceptible to protracted delays through consultation, instead of a more proactive approach |

| | |
|---|---|
| | to helping identify how the strategic problem of lack of and access to unprocessed grain can be addressed by government/ industry partnership. Quarantine authorities have agreed to such a partnership process. |
| ▪ Australia always has adequate feedgrains for the livestock industries | ▪ This perception exists when all feedgrains are bulked together. When wheat is isolated then there are deficits in some feedgrains notably barley, sorghum and maize. This position is confounded by high internal freight costs caused by adherence to Australian coastal shipping regulations forcing grain users to look to the US and import grain rather than seek to import from WA as the first choice. |
| ▪ The grain handling and procurement process managed by the regulated grain marketing organisations is efficient | ▪ Both AWB and ABB are export focused. They are loathe to use their infrastructure to import grain on behalf of Australian domestic clients although they hold global positions in grain at prices less than domestic offer price ex silo. |

The bottom line is that there has been an emergence of a professional feedgrain user industry that creates significant market opportunities for grain growers particularly in the Eastern States. There is a need for both the supply and user industries to work together for mutual advantage with debates based on fact rather than traditional inter sectoral rhetoric. The issue of feedgrain security has been researched to death but there has not been a satisfactory resolution of the communication impasse despite the existence of such groups as the Feedgrain Action Group which is supposed to be forums where such issues are resolved.

The 2003 drought has proved that the intensive industries have worked effectively together, there is sufficient feedstuff to supply the user industries and the market works in getting the feedstuff to user location albeit at significantly increased prices in times of severe supply shortages; there will be some imports but those will be processed at port side and directed towards the metropolitan based intensive livestock industries; and that despite the existence of a number of risk management instruments these tend to be used more by the supply side than the demand side of the industry with usage being contingent based on individuals players attitude to risk.

# 7. FEEDSTUFF SUPPLY AND DEMAND INDUSTRY DYNAMICS

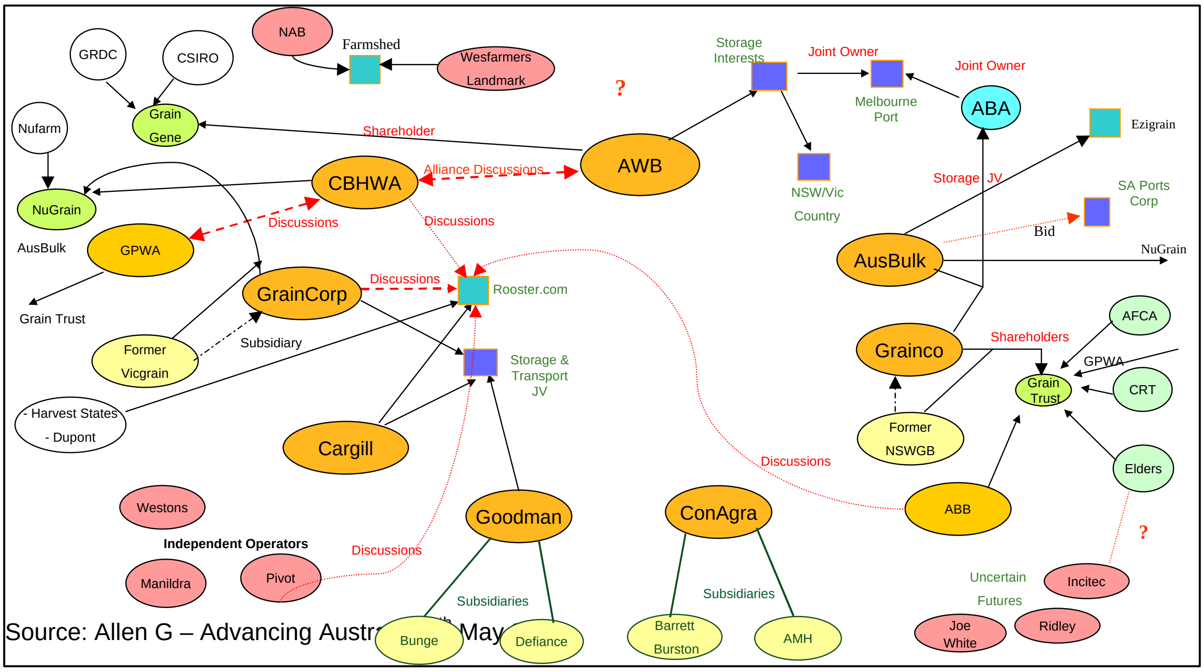
## 7.1 Introduction

This section highlights some of the key issues that arose from the consultation phase of this project highlighting particularly some of the impediments to change but also some of the positive drivers to a more professional feedgrain user and supply industry.

## 7.2 Feedgrains Industry

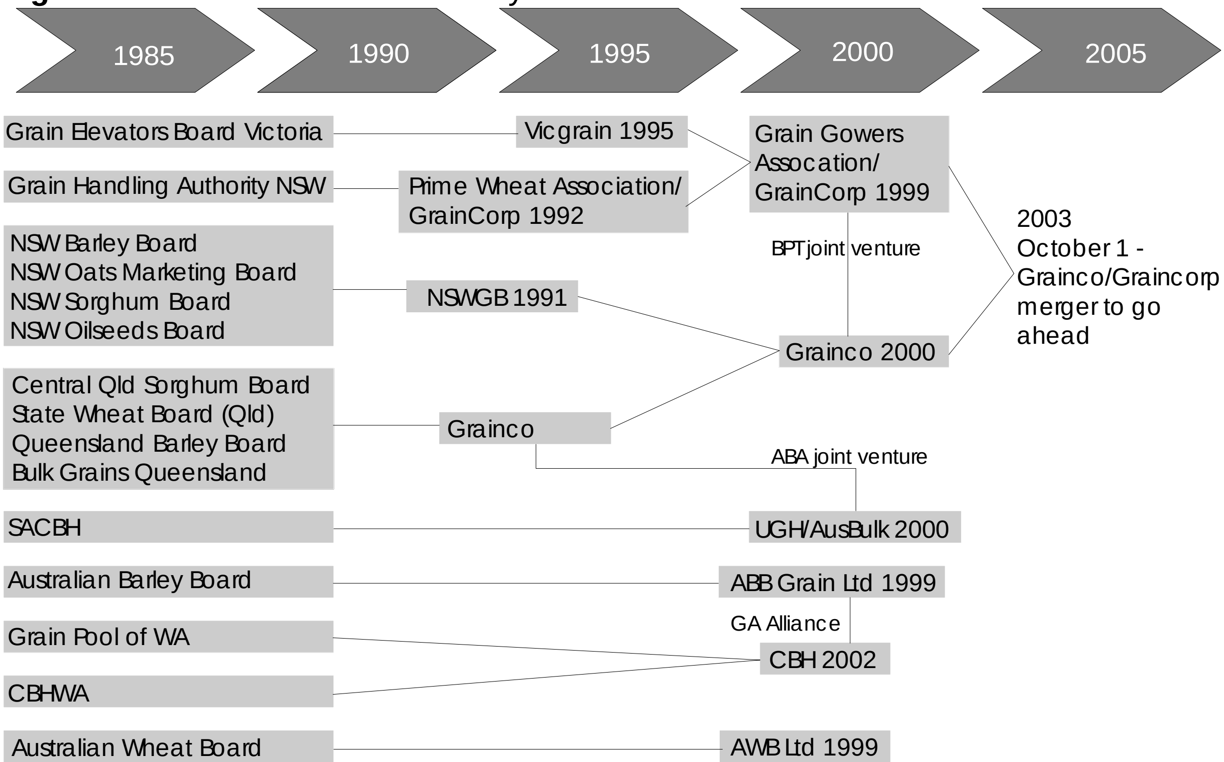
The grains industry has become consolidated over the years (Figure 27). Figure 26 shows the web of interrelationships among players in the central system and the private sector players operating predominantly in the domestic market. There has been significant criticism of the monopoly players in the central system especially the Australian Wheat Board and the Australian Barley Board. Examination of their monopoly powers has been undertaken in a number of reports recently including a May, 2003 report into the Wheat Export Authority. In this report we do not propose to go over this debate. However, we need to say that when there is an extreme back to back drought scenario which constrains supply some commentators contend there is an arguable case for government to intervene to ensure drought mitigation supplies of grains are available to the intensive livestock feeding industries.

**Figure 26:** Australian Grain Industry Linkages




Source: Allen G – Advancing Austr... May

**Figure 27:** Australian Grain Industry Consolidation




- **Grainco (subsidiaries):** Agriculture Market Services (ARMS), PlantTech, GrainCo Australia Country Link, MarketLink (joint venture with ConAgra Trade Group), Container Link, Bulk Terminals Australia (BTA is a joint venture with GrainCorp), Globex, Graintrust
- **AWB Ltd (subsidiaries):** AWB International, Landmark, 15pc stake in Elders
- **Ausbulk (subsidiaries):** AusMalt (along with Joe White Maltings), The Lentil Company (TLC), Southern Wharf Services, NuGrain (a joint venture with NuFarm, Wesfarmers Landmark and Graincorp), ABA Alliance
- **CBH (subsidiaries):** Grain Pool Pty Ltd (including AgraCorp), Bulk West (including BulkWest Engineering and BulkWest Logistics), CBH investment Ltd
- **GrainCorp (joint ventures):** Allied Mills Australia (joint venture with Cargill), BTA Australia, Australian Grain Accumulation Services, SunPrime Seeds, NuGrain, Advanced Trading Australia
- **ABB (subsidiary):** Jossco, (GA Alliance with CBH)

*Source: Queensland Country Life, September 25, 2003 p.26*

Table 34 shows the single desk commodity marketers that have significant buying powers and infrastructure storage positions in the total grain supply demand equation. These same players also undertake significant activity in the domestic market along with private traders and accumulators as well as offering risk management vehicles for the larger intensive livestock industry players. The smaller feedlot, pork and dairy operators are the players who do not have sufficient order quantities to come onto the radar screen of these large grain export organisations. Large and small players divert grain out of the export pipeline by offering local prices at a margin over export parity to secure supplies.

**Table 34:** Single Desk Commodity Marketers

| Commodity | Value | Region | Manager | Corporate Structure |
|---|---|---|---|---|
| Wheat | $4b | National | AWB | Listed company |
| Barley | $1b | SA<br>WA<br>NSW | ABB Grain<br>Grain Pool<br>Grainco Australia | Listed Company<br>Subsidiary of grower co-op CBH group<br>Public company trading on an exempt market |
| Canola | $500m | WA<br>NSW | Grain Pool<br>Grainco Australia | Subsidiary of grower co-op CBH group<br>Subsidiary of grower co-op CBH group |

| Commodity | Value | Region | Manager | Corporate Structure |
|---|---|---|---|---|
| Lupins | $150m | WA | Grain Pool | Subsidiary of grower co-op CBH group |
| Sorghum | $50m | NSW | Grainco Australia | Subsidiary of grower co-op CBH group |
| Sugar | $1b | Qld | Queensland Sugar | Company limited by guarantee owned by growers and mills |
| Rice | $800m | NSW | Sunrice/Ricegrowers | Grower Co-op |

Source: AFR page 15, 9 May 2003 "Wheat monopoly under fire" Cathy Bolt and Simon Strutt

## 7.3 The Intensive Livestock Feeding Industries

Essentially the feedgrain user industries want to undertake grain trades with the following parameters:

- Some operators entering into (a) local supply contracts for 40-90% of supply based on forward sale of fixed tonnage / fixed price (b) hectare contracts with estimated tonnages at indicator prices splitting any price movement 50/50; (c) cash sales ex header or farm storage.
- Deferred delivery contracts @$2 /month after 2 months.
- Prompt payments deferred delivery contracts with all payments 30 days from delivery to NACMA receival standards with completed commodity vendor declarations.
- A need to access feedgrains at world competitive prices.

The nature and intensity of the current drought made the players from the feedlot, pork, dairy and sheep sectors reluctant to talk about their strategies for feedstuff procurement for fear of losing those particular supply sources that would ensure their capacity to maintain operations albeit on a reduced scale until the drought was over. The larger players had contractual arrangements with local grain growers at purchase prices above export parity less freight to seaboard at harvest. Those purchase contracts included an arrangement for these growers to hold on property and deliver through the year. The other supply source was large contract purchases with grain handlers in the central system with typical order quantities of around 50,000 tonnes.

## 7.4 Feedmill Industry

### *7.4.1 Summary of World Industrial Feedgrain Issues*

Feed International Journal in January 2003 examined the world industrial feed industry and highlighted the following key issues:

- Total global industrial or manufactured feed output exceeds 606 MT on 96 kg per person per year.
- The top ten producers of industrial or manufactured feed in 2002 were the USA which produced 143.4 MT, China, Brazil, Japan, France, Canada, Mexico, Germany, Spain and the Netherlands. By comparison Australia produced 8.1 MT in 2002. China is the emerging powerhouse in industrial feed manufacture. China

is the world's second largest poultry producer dependant on industrial feed and is the largest pig meat producer (not yet dependent on industrial feed).

- Expansion in Brazil and Mexico over 2002 continued to give a 5 year average growth rate of 8%.

- Growth is based on solid population growth and urbanisation in developing countries.

- Fewer than 3,500 feedmills manufacture more than 80% of the world's industrial feed.

- Intensive livestock usage of industrial feeds is poultry (37%), pigs (32%), dairy cattle (17%), beef cattle (8%), fin fish and shellfish (3%) and other species (3%).

- Vertically integrated food companies are now involved in most farmed livestock.

- Outside EU (where wheat is the cereal grain of choice as in Australia and China) yellow maize and soybean meal account for the vast majority of feedstuffs for mono gastric feeds. Sorghum is a popular substitute for corn. Soybean meal accounts for 75% of all protein used in industrial feeds.

- Feed safety is now a key issue following dioxin contamination in Belgium poultry feeds, BSE scares in Europe and Japan and GMO grain inclusion in livestock diets.

- There has been development of:- the European Food Safety Authority; Draft Code of Practice for Good Animal Feeding within Codex Alimentarius; and food chain qualified suppliers and quality assurance programs that affect feed manufacturers.

- Increasing focus on feed ingredient and product traceability, feed hygiene and animal to product identification.

- Increased direct regulatory action to control pollution from animals.

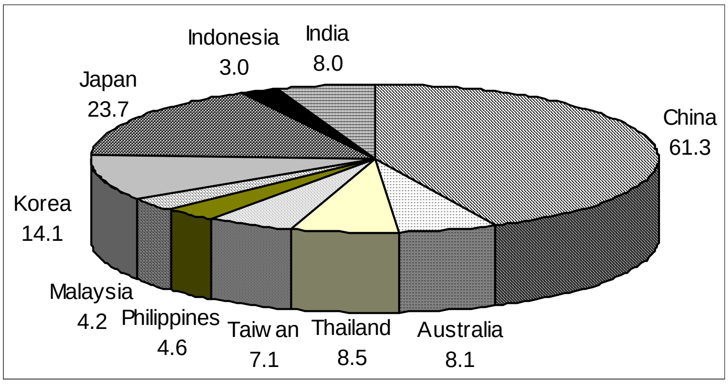
- The introduction of new husbandry practices to improve animal welfare in poultry and pork industries.

- Species and feed companies are under pressure to be like the integrators or seek out special niches.

- Feed labelling is a rapidly emerging issue with respect to country of origin, GMO or biotech free statements.

- Mid range FAO projection forecast a global population of 7.8 billion in 2025. Projecting per capita feed use to continue at 96kg/ per person per year puts total global feed output at 750 MT in 2025.

**Figure 28:** Asia-Pacific Industrial Feed Production 2002 (million metric tons)




Source: Feed International, January 2003

The intensive livestock enterprises incur high costs associated with feeding, especially in the intensive chicken industry (broiler and layer) where feed costs can account for up to 70-80% of total costs (Table 35).

**Table 35:** Animal Production Times and Feed Component Costs

| | % feed in total cost | Production Cycle |
|---|---|---|
| Broiler | 70-80% | 30-50 days |
| Layer | 70-80% | Continuous |
| Pigs | 50-70% | 4-6 months |
| Cattle (grainfed) | 20-30% | > 60 days |

Source: Rabobank International, 2002

### 7.4.2 The Australian Feedmilling Sector

As part of the consultations undertaken for this report we held discussions with the Australian Stock Feed Manufacturers Association (SFMAA). The outcome of those discussions was that:

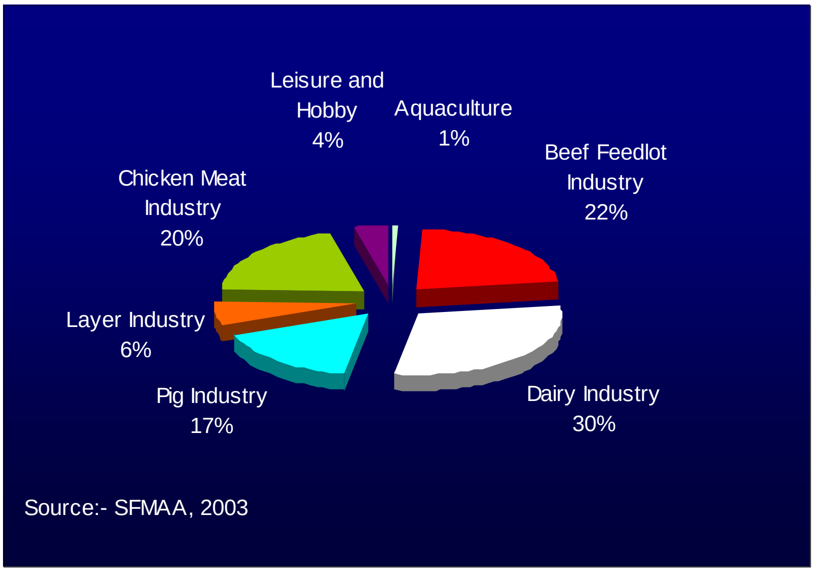
- SFMAA members operate 91 feedmilling sites located in all States of Australia. The number of mills and volume of feed processed represents 90% of all commercial feed sold in Australia;
- SFMAA estimates that over 10 MT of stockfeed is consumed annually in Australia. This volume excludes pasture grazing silage and hay and does not account for spikes in consumption due to droughts;
- The members of the Association processed approximately 4.0 MT annually;
- There is insufficient milling capacity to process an additional import level of 100,000 tonnes of feedgrains per month given existing processing commitments to industrial feedmilling clients;
- The existing feedmillers are generally but not always part of vertically integrated poultry operations or processors of specialist feeds for the companion animal industries or aquaculture industries;

- Most feedmills are located on the seaboard or close to metropolitan city areas where they have the capacity to import grains and process under existing AQIS protocols in constrained supply situations;

- The trends identified in 1.2.1 of this section also apply to the Australian feedmilling sector;

- Figure 29 shows the estimated usage of feedstuffs by intensive livestock sector in Australia.

**Figure 29:** Feed Use by the Australian Intensive Livestock Sector




## 7.5 Treatment and Technology Research and Supply Agencies

CSIRO's Stored Grain Research Laboratory (SGRL) is a world leader in grain storage and treatment of grains that meet Australia's strict quarantine standards and the market standards of export markets for Australian grain. SGRL believes it has much to offer the grain user industries to improve grain storage and minimise grain waste of spoilage and is actively used by many of the larger intensive livestock industry players. SGRL constantly explores the frontiers to identify better grain fumigation technologies and in the process of this research has identified a fumigation treatment that may be able to treat grains to kill insect pests, grain borne disease, pathogens and also sterilise grains. If this technology can be commercialised it may assist in ensuring that there is another tool in the arsenal to enable feedgrains to be imported if Australia if severe back to back droughts create significant supply demand imbalances. The intensive livestock feeding industries principally Meat and Livestock Australia and Australian Pork Limited are funding research and development to see if this technology is applicable under Australian conditions.

## 7.6 AQIS / Biosecurity Australia

All players agree that Australia's high quality quarantine status should be maintained. The risk analysis undertaken by Biosecurity Australia is fundamental to the protocols that AQIS puts in place to maintain quarantine integrity. Currently there are protocols for the import of maize from the USA and wheat and barley from the UK.

The feedgrain user industries are critical of the length of time that is takes to undertake the risk assessment to enable feedgrains to be imported into Australia. This concern is based on the likely prospect that intensive livestock industry demand growth allied with drought events is likely to place increasing pressure on the need for feedgrain imports in the future.

# 8. RISK MANAGEMENT OPTIONS IN THE INTENSIVE LIVESTOCK FEEDING INDUSTRIES

## 8.1 Introduction

The study proponents called for an overview of grain supply and price risk management options that are, or could be, available to the intensive livestock feeding sector. Consultation with industry stakeholders during the course of this study indicated that:

- Use of current risk instruments was highly variable depending on seasonal conditions;
- Players attitude to risk;
- The unwillingness or inability of players to separate grain supply security and price risk issues;
- There is tendency among intensive livestock industry feeders to be production driven rather than market pulled. By that we mean they will tend to decide to feed animals, buy feed, produce to market conditions and then think about managing risk once the production process is underway. More experienced and professional operators will secure a market end price, lock in risk management instruments and then go about sourcing materials that allows them to deliver product to a market within their pricing forecast range; and
- The supply side of the feedgrain industry was more mature in its attitude to the use of risk instruments than the demand side of the industry.

Macarthur Agribusiness commissioned Jumbuk Consulting Pty Ltd, Melbourne, to undertake a short review study of the availability of risk instrument availability, current usage. The findings of that report follow.

## 8.2 Grain Price Risk Management Alternatives

In a drought scenario, price risk management of feeds is an important factor. Once livestock businesses have considered the price risk management of the animal output (eg. milk, meat or wool), consideration can be given to the management of the input costs such as grain. As the grain market is more liquid and sophisticated, there are more price risk management alternatives for feedgrains than hay.

Assuming that livestock feeders are not able to grow some or all of their grain requirements, there are a number of tools that are available to manage the price risk of grain. Many analysts say that some price management tools are more applicable to others and not all buyers' requirements are best locked into one particular strategy.

Factors influencing price risk management for each of the major livestock sectors can be considered.

### 8.2.1 Dairy

The acceptance and proven benefits of grain feeding in the dairy industry are wide spread. This enables dairy farmers to predict their grain demand forward and use relevant price risk management tools. Grain demand will increase during periods of reduced pasture production. As droughts become progressively worse, grain demand will continue to increase until the price of grain becomes prohibitive and culling of stock numbers commences.

During Hydrological droughts the production of irrigated pasture will fall. In this case, hay and silage price risk management will be an important factor. Lactating dairy cows require long straw fibre for milk production and unlike the sheep and cattle in the pastoral industry, must maintain a higher level of fibre in the ration. The most appropriate strategy in this case is the long-term storage of hay or silage.

### 8.2.2 Pastoral - Beef / Sheep

This sector of the livestock industry does not intend to routinely feedgrain. This changes the price risk management needs of the sector considerably. In times of drought, this sector often purchases grain in preference to hay and silage. This happens for three reasons:

- In drought times, hay is very difficult to source in the local area.
- During drought the price of hay and silage is often prohibitively expensive particularly when road freight is taken into account.
- Unlike grain, hay is not a dense source of metabolisable energy. Previous droughts have proven that sheep and cattle can be maintained on grain diets alone.

### 8.2.3 Beef Feedlot and Pork Production

These sectors have one of the more predictable requirements for grain demand. Managers of beef feedlots and piggeries who have a regular and predictable numbers of animals on feed are able to employ more price risk management tools than the other sectors.

Depending on the individual businesses size and appetite for risk, the following strategies may be used in varying combinations. These factors are taken into account in the adjoining Table 37.

**Prompt Purchases**

Prompt pricing of grain can involve high levels of price risk but also provide some good opportunistic buying as well.

*Flat Price Physical Delivered Farm*

The most common form of grain purchasing is the contract that buys grain to the consumption point when it’s needed and payment occurs as the grain is being processed.

*Grain Tenders*

Some farmer co-operatives and traders offer grain for sale in a tender. These tenders can be for a forward or nearby delivery. Nearby delivery tenders are offered to larger tonne buyers (2,000 tonnes plus) through the AWB Weekly Tenders. Few trades have been conducted through the system.

**Forward Contracting**

If a livestock producer has a predictable demand pattern for feedgrain in a liquid market, forward contracting is an ideal way to meet future requirements. By purchasing grain deliveries well before delivery, a grain buyer has the opportunity to make an informed marketing decision. Many questions arise when buying grain forward such as who to buy from, what portion of total demand, what quality, when and what price. The variety of risk management profiles that exist under this buying strategy will cover all consumers in all cases.

In comparison to nearby purchases, forward contracting can lead to higher counterparty risk. Care needs to be taken in selecting a reliable supplier who will deliver despite changes to the price and quality of grain available in the market place.

Increasingly the dairy farmers are buying a portion of their demand for two and three years forward.

*Flat Price Physical Grain Contracts Delivered Farm*

This is the most common and straightforward way to forward purchase grain. The drought markets will provide grain traders with opportunities to tranship grain from interstate and offer to livestock feeders.

*Flat Price Physical Delivered to a Related Market in Australia*

Often grain markets may be inactive in the drawing arc of supply to a demand point. Markets in other more distant areas may be trading when the market in the source area is not.

In this case a less common price risk management strategy is to buy physical grain in another area. This will cover the majority of the price risks yet leave a small basis risk between the two markets. This works well for companies who are buying grain for multiple consumption points across Australia. If good buying opportunities present themselves in some areas and equitable arrangements can be put into place, stock swaps can be conducted with national grain marketers so grain can be exchanged for stocks close to the preferred delivery point. Dairy farmers who lease grain-growing properties have used this strategy. In some seasons it has been a cheaper option to sell grain that is contract grown for them and purchase cheaper grain delivered to their farms.

*Multi Delivery Point Sales at Buyer's Option*

In a similar vein, large grain uses with many delivery points across the country can buy grain delivered to many points at buyer's option. This can then be used to advantage through arbitrage by opting to take delivery in the highest priced market and separately buying in other grain in the less expensive markets.

*Contracting Grain for Several Years Forward*

Depending on their confidence in the livestock, milk or wool markets, farmers may be able to take advantage of long term contracts. By taking a fixed price for a fixed tonnage over two or three years, there can be an overall improvement in a good average price over that period. Dairy farmers are considering these more often according to grain brokers in Victoria. Dairy farmers are increasingly considering a strategy involving:

- Forward contracting a third of grain requirements at least 12 months in advance;
- Covering a third of grain requirements at harvest; and
- Buying the remaining third of requirements on the prompt market through the year.

**Feed Bank**

As proposed by Xavier Martin and the NSW Farmers Federation, there are concerns that despite managing grain price risks, there is also an issue of access to physical grain during severe droughts.

Under a scheme proposed in early 2003, a primary producer would deliver or buy feedgrain in store, managed by a professional bulk storage operator. The storage operator would issue a feedgrain warrant to the primary producer, stating the type of grain and tonnage. The producer would declare a value for the warrant at the date of warrant issue for tax purposes.

This value would be fully tax deductible for the producer in the year of issue and taxable in the year of withdrawal. The storage operator would manage the turnover of stocks by type from season to season within the region. Storage fees would be payable by the producer on invoice and be 150% tax deductible. The feedgrain would be eligible for withdrawal once appropriate drought severity criteria are met. If the grain were withdrawn outside this period, accumulated tax concessions would be repayable.

It would need to be determined if producers are prepared to pay for stocks of grain that they may not have access to until a third party says they do. Also, in the instance of an extended drought-free period, the issue of grain stock disposal would need to be resolved. With accumulated tax deductions payable, any withdrawal of grain from the Feed Bank in a good season would prove to be very costly. It is yet to be seen if these complexities of the scheme can be overcome.

**Futures Contracts**

Futures contracts enable grain buyers to flat price purchase their grain needs in a market that is parallel to their own. The objective is to cover the price exposure at a time when it is not possible to purchase the physical grain.

*CBOT corn and wheat*

The largest agricultural futures markets of the US can provide a hedging mechanism for some grain buyers. It is usual for Australian sorghum prices to follow the US corn prices and likewise Australian wheat to follow US wheat. The difference between the two markets can be large particularly when Australia is suffering a drought. This difference is the basis, which has its own set of associated risks.

*ASX futures*

Despite the Sydney Stock Exchange delisting their grain futures contracts in June 2001, the Australian Stock Exchange has recently established futures contracts for feed wheat, feed barley, sorghum and canola. An Australian exchange with the three feedgrains will bring reduced basis and exchange rate risk for livestock feeders. The liquidity or volume of trading in the contracts is still small although trades are expected to increase with the new season's grain harvest in November 2003.

*Basis Contracts*

These contracts are offered to grain buyers as a contract price with a premium or discount to a nominated futures market. The contracts involve a settlement where the grain buyer exchanges futures and usually a small premium for the physical grain from the seller.

Basis contracts are currently written using US futures on the Chicago Board of Trade. With the advent of the ASX feedgrain futures contracts, basis contracts may be written as a premium or discount to an Australian market. The reduction of risk with ASX basis contracts will be significant as exchange rate risk is eliminated and basis risk (between the local market and ASX futures) will be much less that the CBOT basis contracts.

**Options Contracts**

These are commonly done in all high volume international agricultural commodity exchanges. From an Australian grain buyer's perspective the barriers to these types of contracts are:

- Exchange rate risk
- Basis risk
- Inability to freely trade in and out of the contracts during Australian business hours
- Margin calls

For grain buyers, options offer a chance to cap the maximum level grain prices may reach while maintaining the advantage on the downside if prices were to become cheaper with time. With the payment of a premium buyers can ensure that the futures grain price will not exceed a certain level during a specified period and advantage can be taken if markets move lower.

These contracts are available on the US exchanges. The ASX may offer these corresponding option markets on the Exchange for the three feedgrains if the liquidity is deemed sufficient.

**Tailored Products**

Some special over the counter contracts have been devised so that a financial instrument is able to deliver a price risk management role without the involvement of the physical commodity.

Major grain traders or banks will arrange some product for a client if the tonnage can justify the trouble for designing the risk management tool. Generally these companies would require a client to be using in excess of 15,000 tonnes/yr to warrant a specific tool for a client.

The National Australia Bank offers several strategies that are currently used by grain producers and wheat millers. Some of these strategies may also be useful for feedgrain buyers.

*Swaps*

Swaps are an instrument that locks in a price for grain for future delivery. Swaps have been packaged so that the grain futures contract relies on a cash settlement on expiry. They are based on either Chicago or Kansas City Boards of Trade futures contracts in US cents/bushel. These contract prices are converted to AUD/tonne. Swaps are able to account for the exchange rate fluctuations; brokerage and margin calls associated with foreign futures contracts. Swaps do however leave participants fully exposed to the domestic basis.

In most cases, grain growers use Swaps to manage the price risk of selling grain. In some circumstances, Swaps could be a useful tool for grain buyers. In a case where US futures prices are low and the AUD/USD exchange rate is high, a low price could be achieved for the purchase of grain extending out for up to three years. Cash earned on settlement of the contract can then offset the costs of buying grain on the domestic market.

*Caps*

Grain buyers can use a Cap strategy to limit the upside of their price exposure. These contracts do not lock in the price but give the grain buyer a right but not an obligation to buy grain at a certain price.

By using US call options and exchange rates, the NAB charges payment of a premium for the grain buyer to ensure that the grain price will not exceed a particular level.

*Collar*

This financial instrument enables a grain buyer to cap the maximum price of the futures contract while giving up some of the advantage on the downside. The premiums for these contracts are cheaper and they set a range for the pricing of a futures contract.

**Table 36:** Risk Management Tools and Recommended Adoption by Livestock Industries

| Risk Management tool | Dairy | | | Beef / Sheep Pastoral | | | Beef Feedlot and Piggeries | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Small** | **Medium** | **Large** | **Small** | **Medium** | **Large** | **Small** | **Medium** | **Large** |
| **1 Prompt Purchases** | | | | | | | | | |
| 1.1 Flat Price physical | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1.2 Grain Tenders | | | ✓ | | | | | ✓ | ✓ |
| **2 Forward Contracting** | | | | | | | | | |
| 2.1 Flat Price Delivered Farm | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2.2 Flat price Delivered elsewhere | | | ✓ | | | ✓ | | | ✓ |

| **Risk Management tool** | **Dairy** | | | **Beef / Sheep Pastoral** | | | **Beef Feedlot and Piggeries** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Small** | **Medium** | **Large** | **Small** | **Medium** | **Large** | **Small** | **Medium** | **Large** |
| 2.3 Multi-delivery Point | | | | | | ✓ | | | ✓ |
| 2.4 Contracting years forward | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ |
| **3. Feed Bank** | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ |
| **4. Futures Contracts** | | | | | | | | | |
| 4.1 CBOT corn and wheat | | | ✓ | | | | | ✓ | ✓ |
| 4.2 ASX futures | | ✓ | ✓ | | | | | ✓ | ✓ |
| 4.3 Basis Contracts | | | ✓ | | | | | | ✓ |
| | **Dairy** | | | **Pastoral Beef / Sheep** | | | **Beef Feedlot and Piggeries** | | |
| | **Small** | **Medium** | **Large** | **Small** | **Medium** | **Large** | **Small** | **Medium** | **Large** |
| **5 Options Contracts** | | | | ✓ | | | | ✓ | ✓ |
| **6. Tailored Products** | | | | | | | | | |
| 6.1 Swaps | | ✓ | | ✓ | | | | ✓ | ✓ |
| 6.2 Caps | | ✓ | | ✓ | | | | ✓ | ✓ |
| 6.3 Collars | | | | ✓ | | | | | ✓ |

Not all of these options suit all livestock feeders of all sizes. The predicability of grain demand has a big impact on the price risk exposure of each operator and correspondingly the strategies that would relate to that exposure. In this instance, livestock producers normally dependent on grazing will be less suited to any on-going price risk management programs.

There is always some downtime from farming activities to undertake the training to learn some specific price risk management tools. The time and expense of this training is best spread over a larger income base that exists within the larger operators of each livestock sector.

The varying predictability of demand between livestock producers will alter the adoption of these price risk management tools. For instance, graziers, who would only buy grain in during drought periods, are not exposed to the grain price risk on a regular or predictable basis.

# 9. FUTURE FEEDSTUFF SUPPLY SECURITY OPTIONS

The preceding analysis has clearly shown the following:

- The intensive livestock industries are growing and will require increase quantities of feedstuffs in the future in line with international trends;

- The principal feedstuffs required will be primarily cereal grains, pulses and some roughages;

- Alternative feedstuffs are unlikely to be used in quantity because of limited availability, nutritional constraints, possible anti nutrition factors, export clarification issues, real cost per MJ/kg DM energy and some concerns about possible contamination or residue levels;

- The Eastern States, where the majority of intensive livestock industries are located, will form the greater part of the domestic market for feedgrains and it is likely that there will be increasingly fewer exports of feedgrains from these States in the future;

- The grains industry is beginning to recognize the growing importance of the intensive livestock industries especially in the Eastern States;

- Drought is a key component of cyclical grain and feedstuff shortages in Australia. The severity of droughts is not consistent across Australia and in most years there are sufficient supplies of feedgrains at current usage rates;

- In severe back to back continental droughts the need for imports arise when export parity price exceeds domestic price and import parity price. When imports occur the price rises for feedgrains are capped, imported grain is processed in port side metropolitan areas and used primarily by the poultry and feedmilling industries. This usage then causes up country grain normally destined for export to be held up country and available for intensive livestock industries in those areas;

- Climate forecasting and the understanding of climate on grain yields has developed significantly in recent years. There has been significant work on integrating climate forecast models and crop production models especially by groups such as APSRU;

- ABARE has significantly revamped its regional feedstuff supply demand model. This model can be linked to the APSRU climate based crop yield models to estimate feedstuff supply and location relative to intensive livestock industry demand drivers;

- Climate based seasonal prospect forecasts can be made with a reasonable level of accuracy in May and September each year;

- Integrated modelling will enable the intensive livestock industries and the feedgrains industry to come together to examine likely feedgrain supply demand scenarios each year and then it is ultimately up to individual operators to make their own decisions on feedgrain procurement and risk management;

- The options chosen by individual operators will depend on the nature of their industry dynamics, geographic location, enterprise size, attitude to risk, level of on farm stocks, existing contract supply relationships and supply chain contract commitments.

The result of all of the above is that there are a number of options to ensure feedstuff supply security in the future. Those options fall into immediate shot term emergency measures, medium term measures and long term measures as follows:-

## 9.1 Factors Limiting Feedstuff Sourcing Options

The options available to livestock end users during drought events are effected by the following factors:

**(1) Nutrition Science and Industry Practice**

The relationship between carcase yields, meat quality attributes and feeding regimes are now quite finely tuned. There are strict limits to the extent to which grain based rations can be diluted by other feedstuffs such as pelletised lucerne, processed tapioca and molasses. Varying the ration mix can cause unintended problems of changed meat quality, daily live weight gain and livestock management. The supplementary reports for the feedlot and dairy sector (Volume 2 of this report) indicate the extent of inter-changeability of grains and the usage limits of alternative feedstuffs.

Livestock feeders are reluctant to use predominantly non grain based feeds, even in exceptional circumstances, due to the possibility of unintended, and unforeseeable, nutritional, and even animal health, consequences.

**(2) Regulatory**

(a) Current and planned export rules for beef derived from feedlots specify that for the product to be certified as grainfed for export the cattle must be fed a predominantly grainfed ration with minimum defined energy content. This certification is seen as an important product differentiation from grass fed, or grain finished, beef with associated marketing advantages. There are no equivalent regulatory linkages between livestock rations and product labelling in the pork, chicken or wool industries.

(b) Current quarantine rules (see earlier in this report) limit grain imports to either processed product that is devitalized, and therefore able to move inland; or to utilisation of whole grain from approved sources for metropolitan processing so as to, in turn, eliminate subsequent quarantine risk.

**(3) Efficient Infrastructure Utilisation**

Infrastructure and related technologies/ trained personnel in the intensive feeding industries, in particular, are based on the storage, processing and handling of feedgrain inputs. Grain feeding involves varying degrees of processing such as roller, milling, steam flaking and reconstitution.

Those facilities are already in place, along with grain storage silos/ bunkers and there is a natural imperative to use the facilities and people available.

**(4) Contractual Commitments**

The cattle feedlot industry in both Australia and USA had its origins in the value adding of readily available local low priced grain.

The export led expansion of the pork industry has been based on the ongoing availability of domestic grain; the export dependent expansion of dairying in Australian over the past decade has relied, in large part, on the availability of grain for supplementary cow feeding to help stabilize milk production across seasons.

In essence, livestock industries have outsourced grain supply storage to Australian graingrowers and the grains industry infrastructure on the assumption that their needs would always be met.

This has led to a growing network of contracts between end users and either grain growers, or grain accumulation and marketing companies. These contractual linkages, including forward contracting and involving both sell and buy commitments in the interests of grain supply stability, contribute to a trading environment in which purchase of feedstuffs other than grain as the primary component of the normal feeding ration is only contemplated during a severe and protracted, drought event, and as a last resort only.

A further aspect of forward contracting is the contractual commitments entered into by meat companies to supply grain fed product; these commitments have the effect of committing operators in the supply chain to the ongoing feeding of livestock through grain shortages.

The preceding factors mean that domestic grain shortages result in the progressive escalation of feedgrain prices as committed buyers bid for scarcer supplies <u>without</u> necessarily a corresponding substitution into non-grain feedstuffs. Instead, the industry response to such conditions appears to be to scale back activity, or margins, depending upon economic variables such as exchange rate settings, international prices and other input costs. However when domestic prices for feedgrains reach a level where grain traders can arbitrage between export and import grain supplies then imported grains arrive to cap domestic market price and drive price back towards export parity.

The conclusion is that domestic feedgrain shortages tend to threaten end user activity levels, or viability, instead of triggering large scale feedstuff substitution. However, in most circumstances the market seems to be a sufficiently effective mechanism to source and supply feedgrains except in severe back to back drought events. When this occurs then there may be some justification for government assistance or intervention to sustain the viability of the intensive livestock feeding industries.

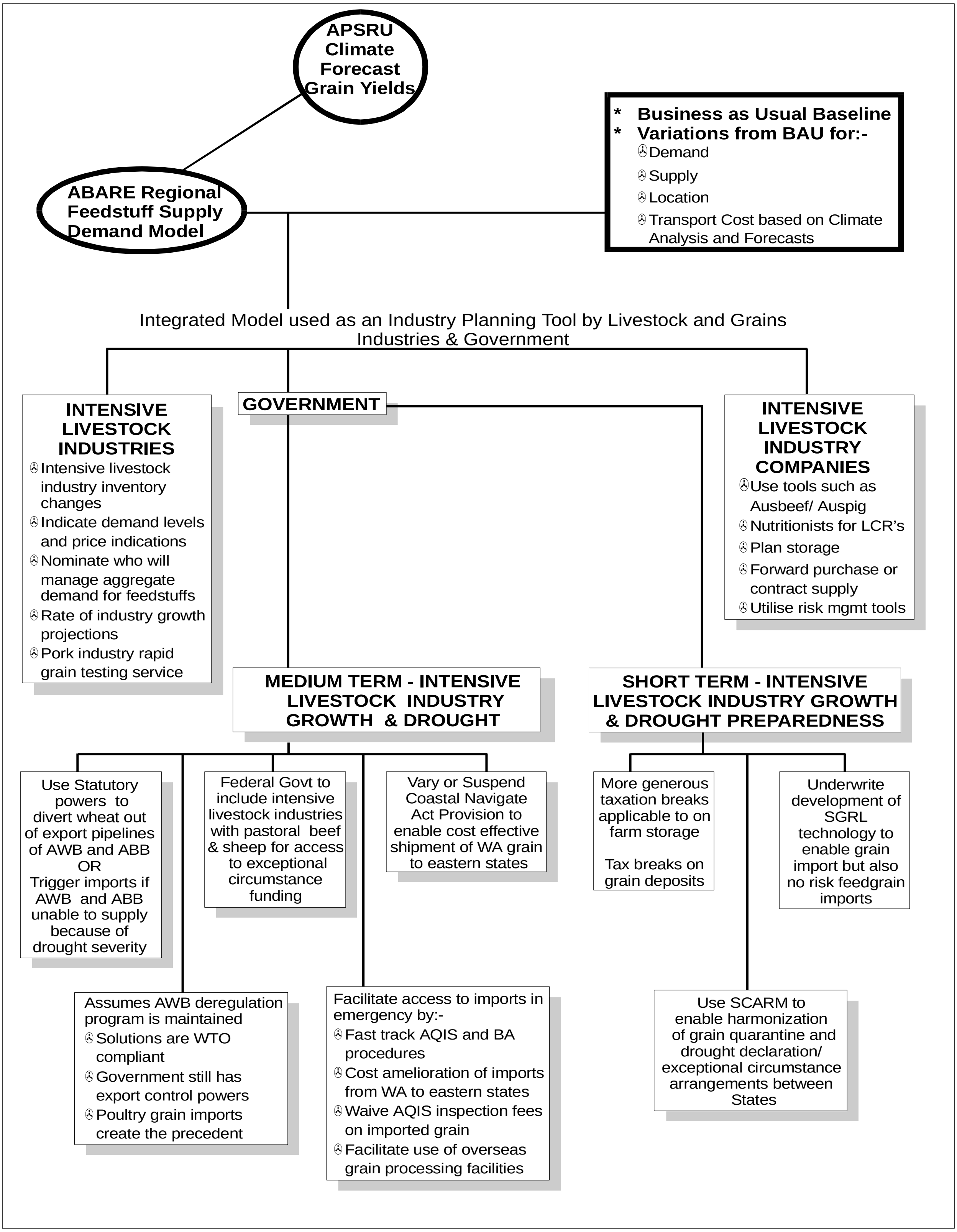
Feedgrain security issues are therefore of critical importance to the future growth potential of the livestock industries covered by this study especially in the eastern States of Australia and particularly in the traditional grain poor Sates of Victoria and Queensland.

## 9.2 Management Options for Enhancing Feedstuff Security

The management options to enhance feedstuff security we recommend to industry bodies and operators fall within two categories, ie. responding to an immediate drought emergency (ie. short run), or putting in place longer term strategies to prepare for such extreme drought emergencies ie. long run management options.

Capacities to exercise those options will depend in large part on:

- Government preparedness to develop contingency planning options to mitigate the cost of exceptional circumstance funding in extreme drought events;
- Intensive livestock feeding industries' ability to negotiate preferred changes in government policies, as summarised in the following schematic;
- Better engagement with the grain growing and marketing sectors to achieve mutually beneficial outcomes;
- The willingness for the intensive livestock feeding industries to secure feedstuff security on a contractual basis as opposed to being spot market buyers; and
- The development of better information programs to enable those players who want to utilise risk management tools depending on their enterprise size, nature of business and attitude to risk.


APSRU Climate Forecast Grain Yields
ABARE Regional Feedstuff Supply Demand Model
* Business as Usual Baseline
* Variations from BAU for:-
Demand
Supply
Location
Transport Cost based on Climate Analysis and Forecasts
Integrated Model used as an Industry Planning Tool by Livestock and Grains Industries & Government
INTENSIVE LIVESTOCK INDUSTRIES
Intensive livestock industry inventory changes
Indicate demand levels and price indications
Nominate who will manage aggregate demand for feedstuffs
Rate of industry growth projections
Pork industry rapid grain testing service
GOVERNMENT
INTENSIVE LIVESTOCK INDUSTRY COMPANIES
Use tools such as Ausbeef/ Auspig
Nutritionists for LCR's
Plan storage
Forward purchase or contract supply
Utilise risk mgmt tools
MEDIUM TERM - INTENSIVE LIVESTOCK INDUSTRY GROWTH & DROUGHT
SHORT TERM - INTENSIVE LIVESTOCK INDUSTRY GROWTH & DROUGHT PREPAREDNESS
Use Statutory powers to divert wheat out of export pipelines of AWB and ABB OR Trigger imports if AWB and ABB unable to supply because of drought severity
Federal Govt to include intensive livestock industries with pastoral beef & sheep for access to exceptional circumstance funding
Vary or Suspend Coastal Navigate Act Provision to enable cost effective shipment of WA grain to eastern states
More generous taxation breaks applicable to on farm storage
Tax breaks on grain deposits
Underwrite development of SGRL technology to enable grain import but also no risk feedgrain imports
Assumes AWB deregulation program is maintained
Solutions are WTO compliant
Government still has export control powers
Poultry grain imports create the precedent
Facilitate access to imports in emergency by:-
Fast track AQIS and BA procedures
Cost amelioration of imports from WA to eastern states
Waive AQIS inspection fees on imported grain
Facilitate use of overseas grain processing facilities
Use SCARM to enable harmonization of grain quarantine and drought declaration/ exceptional circumstance arrangements between States

## 9.3 Feedstuff Security Options

The ABARE analysis commissioned for this study (Section 10) found that a severe and persistent multi year drought, as occurred 1911-1915 would, if yield impacts were similar, result in a requirement at drought peak for the shipment of over 2 MT of grain in one year into eastern states.

The model that the bulk of this would flow from Western Australia to Victoria and Queensland, while imports of 318,000 tonnes would be needed that year.

As the drought recovery proceeds, Queensland would still require net imports of 730,000 tonnes for a year, with the cumulative net import requirement of Queensland over a simulated five year period amounting to 2 MT.

It is clear that Queensland is the State most vulnerable to drought impacts.

It follows that the proposed drought preparedness measures would have particular application to reducing Queensland's vulnerability to feedgrain shortages.

### *9.3.1 Long Term Measures*

**(1) Increased Grain and Fodder Storage**

Greater on site grain storage is obviously one means of individuals/companies improving their capacity to manage through a grain supply crisis, whether it is caused by crop disease, regional drought/ floods, or a major continental event. It would be analogous to other drought preparedness means such as water storage to increase the stock/ consumption ratio. This involves added storage costs, estimated at $2-3 per tonne stored per month.

To do so may involve a reversal of livestock industry trends, with anecdotal information that end users have been increasingly outsourcing grain storage to growers, and companies in the feedstuff supply chain. While this makes good sense from a short run company management perspective, it necessarily increases dependency upon downstream grain supplies. Increased 'in house' grain storage, with the effect of increasing the national stock/annual domestic consumption ratio, would be, in effect, an added weapon in national drought preparedness. Similarly fodder supply storage could be considered especially in areas where fodder use is paramount to the maintenance of livestock productivity such as the Victorian dairy industry.

To date, government incentives for drought preparedness have largely focussed on on-farm water storage, and farm reticulation measures, as well as income smoothing provisions to smooth out the taxation incidence on fluctuations in actual income.

Such provisions aim to lessen the consequences of drought in the national interest, but are skewed towards extensive agriculture and irrigation operations through both increasing their capacity to hold and distribute on site water supplies, and to put aside financial reserves in good times.

However, drought preparedness in current and forecast agriculture involves much more than water and finance provisions. It is clear that drought impacts on grain and roughage stocks, and that physical shortages, and limited emergency supply options, given current quarantine restrictions, accentuate drought impacts.

The current Commonwealth government taxation regime is uneven in the incentives it provides for drought purposes (Table 37).

**Table 37:** Current Commonwealth Government Taxation Regime

| Drought Preparedness Measure | Current Taxation Regime |
|---|---|
| Farm water storage and farm reticulation systems. | 3 year accelerated write off |
| Grain storage | 20-66 2/0 years depreciation provision (effective life) (see notes on previous drought investment allowance below) |
| Residential buildings | 33-50 year depreciation provision (effective life) |
| Abnormal income from forced sale of livestock | Can spend profit over 5 years |
| Tax averaging | Even out income over 5 year maximum |
| Farm Management Deposits Scheme | Deductible in the year in which they are made (subject to certain criteria) |
| Drought freight subsidies | State level; partial subsidies on fodder and livestock transport |

Increased taxation incentives to increase on site grain storage capacity can legitimately be argued as a drought preparedness measure in the same way as increased water storage is.

Moreover, investing in grain storage, or ‘deposits’ in good years to help offset bad years is analogous to the intent of the FMD scheme. ‘Depositing’ grain, by grain dependent operators, has the same intent as depositing money and may, in fact, be a better management option since history has shown, and our modelling confirms, that in a severe drought event grain is scarcer than money (ie the former has physical supply limitations, and the price can escalate above import parity while access to credit is subject to ongoing lending criteria). The practicalities of this proposed widening of the FMD scheme would need to be carefully explored.

There is ample precedence for taxation provisions to be employed to achieve national resource management and environmental objectives. Such examples include:

- The deductibility in equal instalments over 3 years of capital expenditure incurred on water storage and farm reticulation systems.
- Landcare and water facility tax offsets of 30 cents in the dollar.
- Special provisions for vineyard establishment.
- FMD Scheme.

Specific taxation incentives for drought mitigation purposes for grain storage were limited to the drought investment allowance which provided for a deduction of 10% of capital expenditure incurred on buying or building new items of drought mitigation property, including a structure used exclusively to store grain, hay or fodder. However, the expenditure on each item must have been incurred or the construction commenced after 23 March 1995 and before 1 July 2000. Moreover, the deductions were limited to $5,000 for any one year.

Consequently, the provision is of little relevance to the issue of increasing the grain stock/ annual consumption relationship, and its termination has, in a small way, further reduced the incentives for increased on site storage.

There are strong reasons for extending taxation concessions, within the purposes of drought preparedness, for added grain and fodder storage.

**(2) Efficient Coastal Shipping**

The Navigation Act 1912 is, in effect, a protective instrument for Australian manned coastal vessels, and adds significantly to the cost of shipping grain from Western Australia/ South Australia to the eastern seaboard. In fact, the AWB estimates that it is cheaper to ship grain from the west coast of USA to Brisbane that to ship grain from Western Australia to Brisbane.

These added costs are particularly significant since our information is that the order of preference for grain sourcing for livestock end users is as follows:

| Preference Order | Source |
|---|---|
| 1 | Grain available within the region (to minimise transport costs) |
| 2 | Grain from SA/WA |
| 3 | Imported grain |

The regulation of coastal shipping therefore is disadvantageous to the efficient movement of grain from Western Australia during an eastern states drought.

Such interstate grain movement is required during regional, as distinct from continental, droughts. Such regional droughts have occurred more frequently in Queensland/NSW rather than Western Australia/South Australia/Victoria where winter rainfall has historically been less erratic than winter and summer rainfall in those states.

Livestock industries have strong grounds to press for the deregulation of the coastal shipping industry.

**(3) Improved Access to Imported Grain**

Access to imported grains occurs through quarantine approval of individual shipments that are sourced from countries/ regions, and through transport, handling and storage processes, that conform to protocols.

Grain import access is currently limited to metropolitan processing, to ensure cargo devitalisation; inland end users cannot source imported grains in unprocessed form.

Metropolitan (ie. within the post code zone of the capital cities and a defined corridor between Newcastle/ Sydney/ Port Kembla) processing adds substantially (estimated $50/ tonne) to the costs of imported grain to inland user. The currently required heat treatment/ roller milling in metropolitan area is also incompatible with the efficient utilisation of on site grain storage and processing for inland consumers and the nutrition strategies in place in those operations.

Access to imported grain has two dimensions, i.e. the capacity to add, at short notice, to the supply of feedgrains in Australia (i.e. drought response) and the ongoing domestic price discipline inherent in easier access to imported grains (i.e. drought preparedness).

CSIRO is developing a new gas fumigation process that offers the prospect of completely devitalizing imported grain, enabling unprocessed usage inland. This technology is as yet unproven, and livestock industry groups have undertaken to fund further research to establish the efficiency of gas fumigation in devitalizing grain on a commercial basis.

If efficacy is established, the degree of devitalisation of grain, and weed/ pathogen kill will need to be negotiated with Biosecurity Australia as the basis for an import protocol. Issues of registration and production of the fumigant will also need to be addressed.

The progression of this technology should be a very high priority.

**(4) Ongoing Commitment to Feedgrain Research**

GRDC has had a successful research and development program for feedgrains (Premium Grain For Livestock Program). There have been a number of significant outcomes including identification of different feedgrain suitability as intensive livestock species feeds; development of some specialist feedgrain varieties; exploration of feed barley options for the northern agro-ecological region, development of NIR algorithms that may be used for value based grain trading.

Given the projected growth in the Australian and international intensive livestock feeding markets and shortage in feedgrains supply it can be argued that there is a case for continuation of a feedgrain R&D program to develop varieties of feedgrains that have nutritional, yield, economic and pest and disease resistance qualities that would make them a suitable grain crop of choice particularly in eastern Australian grain production areas.

There are proposal for a feedgrain CRC which will further advance the R&D effort in feedgrains over the life of the CRC if approved and funded.

**(5) Use of Drought Management Predictive Tool**

This report models the projected impacts of defined drought events, including a worst case scenario of a ‘back to back’ continental drought, similar to 1944-1945.

This scenario modelling integrates climatic forecasting with forecast consequences for grain availability, prices and livestock industry activity.

The maintenance of this model would enable industry policy makers, and individual managers, to make better informed decisions as to how best to manage industry, and company, business as meteorological data unfolds as to the likely magnitude of a drought event.

This model should be maintained to a base extent so that it can input ongoing data such as grain stocks, crop estimates and readily available livestock industry data. This way the database and model maintenance capabilities are retained for expanded use in an emergency.

Integral to the above is the proposed regular collecting of stock data by ABS to enable a picture to be progressively built up of relationships between crop output, consumption and stocks held, down to regional levels.

**(6) Xavier Martin Drought Grain Bond Proposal**

The Xavier Martin proposal for a series of drought grain bonds has received significant publicity. It is envisaged that the drought grain bonds would work in a similar way to the farm deposit scheme whereby grain is committed the central system in good years to be retrieved in poor years. Taxation commitments would be invoked when grain is retrieved from the central system. Macarthur Agribusiness has discussed the proposal with Mr Martin and it appears that while there has been significant publicity the proposal is still the concept stages.

We have also discussed the proposal objective with existing grain suppliers to the domestic market whose view was that Xavier Martin proposal is unlikely to be viable as it is reversion to previous government intervention policy of keeping drought reserve grain up country. The key failure point appears to be the payment of storage costs of approximately $3 /tonne per month plus carry cost of the capital tied up in grain. However if the market is failing to get appropriately priced grain to the right location in time of severe drought the proposal may have some merit but obviously needs significant further assessment.

### *9.3.2 Short Term Emergency Measures*

**Waive Import Inspection Fees**

Since grain imports are an emergency measure, it would be helpful if the Commonwealth government could waive the inspection fees involved in approving and monitoring the import emergency permit process.

**Coastal Shipping**

Allow international flag vessels for emergency charter to ship grain in coastal trade to eastern seaboard.

**Release Stocks held by Government Related Agencies**

A feature of the domestic feedgrains markets is the dominant position in the storage system of vertically integrated grain marketing bodies which have some degree of government empowerment. While this empowerment does not necessarily mean that their operations can be directly dictated by governments, it does mean that they have a public responsibility, as an offset to empowerment, to play a supportive role in responding to drought events.

The setting up of a strategic national grain stockpile, similar in purpose to the United States strategic oil reserve, would involve substantial ongoing costs, and is not necessary given stock levels held in this country and storage costs. However, stocks held by agencies such as AWA, ABB and Grain Pool of WA represent a de-facto strategic reserve. There should be an obligation on those agencies to regularly disclose to government (on a confidential basis) levels of uncommitted grain stocks, and location so that there is a core ongoing level of knowledge about the national capacity to manage drought.

Such disclosure could be exercised through the proposed (see comments on predictive modelling) ongoing ABS survey of grain stock holdings.

In addition, governments should have the capacity, if necessary through the exercise of export approval powers, to require the release of uncommitted stocks in accordance with PIMC approved drought strategy. The emphasis on ensuring that Australian grain growers exercise whatever market power is available in global markets through single desk selling should not be allowed to create knock on problems for domestic end users.

***Formation of a Peak Decision Making Body***

The Feedgrain Action Group has been effective in highlighting the issues concerning feedstuff security for the intensive livestock industries. However now is the time to get commercial application with commitment to various options that will secure supply in the future. Consistent with a market driven approach it is recommended that a peak decision making body be formed comprising chairman/chief executives of the major intensive livestock industries, the grain production marketing industries and appropriate government agency representation. The focus of the new organisation should be to proactively achieve effective contingency plans to avert feedstuff supply deficits before the next major drought event comes.

| Recommendations | Drought Preparedness | Drought Response | Timing | Responsibility to Progress |
|---|---|---|---|---|
| Further develop and refine the APSRU/ABARE predictive model to incorporate facilities for stocks and dynamic pricing | ✓ | | Immediate | FGAG/ ABARE |
| Undertake runs of the refined model to establish “what if” scenarios as a basis of feedgrain and intensive livestock industry contingency planning | ✓ | | Immediate | FGAG/ GRDC/ CVAP |
| Establish regular monitoring of national intensive livestock inventory | ✓ | | Mid term | FGAG/ ABARE |
| Establish regular monitoring program of grain and feedstuff stocks held on farm and in central system reserves | ✓ | | Mid term | FGAG/ ABARE |
| Underwrite development of SGRL technology to enable grain import but also no risk feedgrain imports | ✓ | | Immediate | FGAG/ AFFA |
| Use SCARM to enable harmonization of grain quarantine arrangements between States | ✓ | | Immediate | COAG |
| Review drought assistance and drought management decision making and resources used by State and Federal Government | ✓ | ✓ | Immediate/Medium Term | Industry Associations/ Government |
| More generous taxation breaks applicable to on farm storage of grain and roughages | ✓ | | Immediate/ Medium Term | Industry Associations |
| Trigger imports if AWB and ABB unable to supply because of drought severity<br>Assumes AWB deregulation continues<br>Solutions are WTO compliant<br>- Government still has export control powers<br>- Poultry grain imports create the precedent | | ✓ | When required in severe drought and market failure evident | Federal and State Government |
| Use Statutory powers to divert wheat out of export pipelines of AWB and ABB if market unable to import at competitive prices | | ✓ | When required in severe drought and market failure evident | Federal and State Government |
| Establish protocols to suspend Coastal Navigation Act Provisions to enable cost effective shipment of WA grain to eastern states on a permit basis | | ✓ | Medium Term | Federal Government/ Industry Associations |

| Recommendations | Drought Preparedness | Drought Response | Timing | Responsibility to Progress |
|---|---|---|---|---|
| Facilitate access to imports in emergency by<br>- Fast track AQIS and BA permit appeals<br>- Waive AQIS inspection fees on imported grain | | ✓ | Immediate even if not utilised | AFFA/ Industry Bodies |
| Give highest possible priority to CSIRO Stored Grain Research Laboratory Project | ✓ | | Short/ Medium Term | Industry/ Federal Government |
| Initiate review and commercial assessment of Xavier Martin Drought Bonds proposal to establish commercial and policy efficacy | ✓ | | Mid term | Industry Bodies/ FGAG/ATO/AFFA |
| Formation of a Peak Decision Making Body to initiate feed security options. Body to comprise of Chief Executives of key stakeholder groups | ✓ | | Immediate | Industry Bodies and Companies |

# 10. A PREDICTIVE TOOL ASSESS FEEDSTUFF SUPPLY ADEQUACY IN VARIABLE SEASONAL CONDITIONS

## 10.1 Introduction

The preceding chapters have clearly highlighted the following:

- A growing domestic market for feedstuffs fuelled by the growth in intensive livestock industries;
- Limits on production in the eastern States relative to projected feedstuff demand in normal seasonal conditions;
- Year on year production surpluses in both SA and WA;
- Growing supply/demand shortfalls in most countries of the world;
- Significant fluctuations in feedstuff production and availability in drought events such as the El Nino;
- Except in severe supply shortages such as the 2002-2003 drought there are sufficient grains to satisfy intensive livestock feeding industry demand and the market works to distribute grains albeit at increased cost;
- Price fluctuates between import and export parity and domestic price builds in times of supply shortages until import parity is reached, imports occur and further price rises are capped;
- Most intensive livestock industry players have not tended to use risk management instruments to manage supply and price risk preferring to spot purchase a percentage grain at harvest at margins above export parity and then make additional purchases throughout the feeding year;
- Imported grains are subject to strict AQIS quarantine protocols with imported grain limited to portside processing and distribution to metropolitan feedmills and use by the domestic poultry, feedmill and metropolitan companion animal industries;
- There are no silver bullet solutions to resolution of the problem of feedstuff security by imports but there are some technological developments that may assist resolution of the matter in the future;
- However, despite the existence of groups such as the Feedgrain Action Group (FGAG) there is a wealth of rhetoric and little debate based on factual data to enable industries and stakeholder players to make strategic decisions when impending seasonal conditions indicate the likelihood of a climate induced feedstuff shortage;
- This report has attempted to draw together all the current activity and overview the level of knowledge with respect to feedstuff security. As the project unfolded we became increasingly convinced of the potential to pull together some existing work

that would enable both the grain and intensive livestock industries to asses the relative supply demand conditions based on seasonal trends as determined by climate forecasts. This chapter examines the development of a climate based interactive predictive model that utilises the climate history grain yield data of APSRU and ABARE's regional feedgrain supply demand model.

## 10.2 Use Climate Based Feedgrain Yield Predictors

The Project Team commissioned APSRU to examine over 100 years of climate history and identify a range of seasonal climatic conditions that covered a winter or summer seasonal drought through to a back to back year on year drought. APSRU was also asked to estimate wheat and sorghum yield on an index basis relative to 1.00 being a normal season across a 5 year times series that reflected the emergence of drought and subsequent recovery.

APSRU has implemented a modelling system for crop yield at shire level for wheat and sorghum. This system underpins crop forecasts for these crops throughout the Australian grain belt (see http:/www.dpi.qld.gov.au/climate/). The modelling system incorporates an agro-climatic stress index model that has been calibrated to predict yield per unit area at shire scale (Stephens, 1995; Hammer et al., 1996). It was agreed that a study focussed on crop yield indices for wheat and sorghum for specific known drought periods during the 20th century would be sufficient for MA needs. This could be done by adapting the existing modelling system, conducting long-term simulations and aggregating resultant indices at shire scale to suit the larger supply zones used in the ABARE model.

Further detail of the APSRU analysis and report can be found in Volume 2.of this report.

The range of climate events APSRU was asked to cover and the representative years data sets of those season events were as follows:

- Severe Winter Drought:- 1991-1995
- Severe Summer Drought:- 1901-1905
- Severe Summer and Winter Drought:- 1981-1985 includes the continental drought
- Severe Back to Back Year on Year Drought:- 1911-1915

APSRU had previously and continues to work with ABARE in annual crop yield estimations. The first step in the process was to align the APSRU and ABARE shire databases for grain yield so that the ABARE supply and demand regions in the feedstuff model mirrored those in the APSRU data. That process was achieved.

Budget and time constraints have not enabled us to examine each of these climatic positions. Instead we have examined the Severe Back to Back Drought Scenario and compared that position with ABARE's business as usual case. The rationale of this approach was that by examining a severe back to back continental drought it was expected that issues such as interstate transfers, utilisation of alternative feedstuffs and possible imports would be brought into play. At the same time as this analysis was being undertaken GRDC was utilising the ABARE model to examine variations on the business as usual case for such matters as increased utilisation of waxy sorghum and decreased transport costs.

It should be noted that in both our analysis and GRDC analysis runs the ABARE model had not been amended for drought pricing and stock levels which we understand ABARE is considering in later iterations of the feedstuff supply demand model.

The intent of this approach has been to assess whether or not the ABARE model can be made more interactive with dynamic assessments of feedstuff supply and demand arising from changes in climatic conditions. If this is possible then the grain supply and user industries will be then able to use this dynamic tool to assess the climatic position prior to each winter and summer crop and make appropriate company and industry strategies based on the model outcomes.

## 10.3 Outcomes of the Integrated APSRU and ABARE Model Assessment of the Severe Back to Back Continental Drought

The following tables show the movements in major feedstuffs by State in the severe drought scenario using the 1911-1915 crop yield data estimates compared to a baseline 2003-2004 business as usual case reflecting the supply demand mass balances in a back to back drought year.

| State | Main Feed Production | Livestock Demand | Surplus | Inflows from other States | Outflows to Other States | Exports O'seas | Imports from O'seas |
|---|---|---|---|---|---|---|---|
| **BAU - BASELINE (kt)** | | | | | | | |
| QLD | 1,734 | 1,988 | -254 | 866 | 0 | 611 | 0 |
| NSW | 4,751 | 2,678 | 2,073 | 92 | 1,113 | 1,072 | 20 |
| VIC | 3,373 | 2,698 | 675 | 635 | 67 | 1,269 | 27 |
| SA | 3,513 | 713 | 2,800 | 74 | 0 | 2,876 | 2 |
| WA | 8,148 | 665 | 7,483 | 0 | 486 | 6,997 | 0 |
| **Total** | **21,518** | **8,742** | **12,776** | **1,666** | **1,666** | **12,825** | **49** |
| **1 - INITIAL DROUGHT IMPACTS (kt)** | | | | | | | |
| QLD | 2,032 | 1,990 | 42 | 882 | 0 | 924 | 0 |
| NSW | 4,972 | 2,692 | 2,280 | 97 | 1,209 | 1,177 | 10 |
| VIC | 3,332 | 2,699 | 633 | 714 | 88 | 1,286 | 27 |
| SA | 3,339 | 717 | 2,622 | 93 | 0 | 2,717 | 2 |
| WA | 7,078 | 665 | 6,413 | 0 | 489 | 5,924 | 0 |
| **Total** | **20,752** | **8,762** | **11,990** | **1,786** | **1,786** | **12,028** | **39** |
| **2 – INITIAL LOW LEVEL DROUGHT CONTINUES (kt)** | | | | | | | |
| QLD | 1,339 | 1,982 | -643 | 905 | 0 | 262 | 0 |
| NSW | 4,401 | 2,671 | 1,730 | 116 | 993 | 877 | 24 |
| VIC | 3,286 | 2,688 | 598 | 593 | 50 | 1,174 | 33 |
| SA | 3,417 | 712 | 2,706 | 71 | 0 | 2,779 | 2 |
| WA | 7,906 | 664 | 7,242 | 0 | 642 | 6,600 | 0 |
| **Total** | **20,350** | **8,717** | **11,633** | **1,685** | **1,685** | **11,692** | **59** |
| **3 – CONTINUED DROUGHT (kt)** | | | | | | | |
| QLD | 1,710 | 1,983 | -273 | 852 | 0 | 579 | 0 |
| NSW | 4,167 | 2,671 | 1,497 | 127 | 853 | 792 | 21 |
| VIC | 3,223 | 2,690 | 534 | 572 | 60 | 1,077 | 31 |
| SA | 2,958 | 714 | 2,244 | 95 | 0 | 2,341 | 2 |
| WA | 8,036 | 665 | 7,371 | 0 | 733 | 6,638 | 0 |
| **Total** | **20,095** | **8,724** | **11,372** | **1,646** | **1,646** | **11,426** | **54** |
| **4 – SEVERE DROUGHT (kt)** | | | | | | | |
| QLD | 1,553 | 1,972 | -420 | 783 | 0 | 451 | 88 |

| State | Main Feed Production | Livestock Demand | Surplus | Inflows from other States | Outflows to Other States | Exports O'seas | Imports from O'seas |
|---|---|---|---|---|---|---|---|
| NSW | 3,252 | 2,646 | 606 | 89 | 480 | 242 | 28 |
| VIC | 1,328 | 2,671 | -1,343 | 1,267 | 26 | 35 | 137 |
| SA | 1,555 | 729 | 826 | 55 | 628 | 310 | 59 |
| WA | 5,891 | 664 | 5,226 | 0 | 1,059 | 4,173 | 6 |
| **Total** | **13,578** | **8,683** | **4,895** | **2,193** | **2,193** | **5,212** | **318** |
| **5 – RECOVERY (kt)** | | | | | | | |
| QLD | 1,252 | 1,982 | -730 | 977 | 0 | 248 | 0 |
| NSW | 4,511 | 2,672 | 1,839 | 120 | 1,010 | 970 | 21 |
| VIC | 3,637 | 2,695 | 942 | 571 | 58 | 1,483 | 28 |
| SA | 4,044 | 720 | 3,324 | 57 | 0 | 3,382 | 2 |
| WA | 9,119 | 666 | 8,454 | 0 | 657 | 7,797 | 0 |
| **Total** | **22,563** | **8,734** | **13,829** | **1,725** | **1,725** | **13,880** | **51** |

Some highlights of the integrated model development and this analysis are that:

- The model approximates and simulates the realities of the operation of the feedstuff supply and export industries, the intensive livestock industry demand profiles and the obvious need for all players in these industries to adjust their positions based on emerging data on supply / demand relativities. Importantly the existing model is dynamic and can be adapted to become a powerful planning tool for the stakeholders in the intensive livestock feeding market;

- Despite the severity of the drought scenario there will always be grain produced somewhere in Australia;

- Previous analysis has shown that even without drought there will be increasing pressure on feedstuff demand driven by growth in the intensive livestock feeding industries;

- Irrespective of drought there will be grain available for export;

- There is a dynamic domestic market grain trading market that will intensify as drought induced windfall profits from scarce grain holdings can be realised, but only to the point where price will rise to import parity, as at this point grain price is capped by imports from overseas;

- Queensland will have supply deficit in most years while Victoria are likely to have a grain supply demand deficit in years where there is a continuation of winter drought conditions;

- The eastern States are likely to have their grain production consumed by the domestic demand industries that includes the intensive livestock feeding industries seeking grain forcing transfers from either WA or SA;

- The supply/demand mass balance quantum is contingent on the quantity of grains produced in the preceding years to the severe drought event year reflecting the importance of stocks either held in the central system or on farm;

- There will be imports of feedgrains between export parity and import parity pricing levels. This imported grain will go to the metropolitan poultry and feedmilling industries having the effect of keeping grain that was formally designated for export or available for use by metropolitan poultry and feed milling industries being held up country. Only in a severe drought event will there be significant imports of feedgrains with principal destination being Victoria;

- Initially grain demand increases as the drought intensifies and then demand decreases as the economics of grain feeding becomes unfavourable. This is relevant when you look at drought in the very short run, monthly or seasonal. The ABARE analysis uses an annual time frame.

This integrated APSRU/ABARE model still needs further enhancements that are beyond the scope of this study. These enhancements include more work on the demand driver quantum as shown in the supplementary reports to this report, more detailing of stocks held in the central system, by grain traders and on farm and pricing relativities.

The supply and demand industries would benefit from sitting down once a year when the climate assessments are shaped to use this modelling work as a planning tool to undertake a minimum annual run of this model to establish likely supply / demand situations. The outcomes of these model runs would enable respective industries to shape recommendations to their constituents to enable them to develop risk management and feedstuff procurement strategies. It is incumbent on the demand industries to do more work on improving demand estimates and the level of livestock inventories within each sector also indicating estimated movements in demand growth.

However this is not the only activity that needs to be undertaken to resolve feedstuff supply demand imbalances. Concurrent with use of the model as a planning tool are the development of the raft of infrastructure and policy changes suggested in Chapter 9 of this report.

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# Review Options to Reduce Feedstuff Supply Variability in Australia

*Volume 2: Statistical Compendium and Supplementary Reports*

**Project number FLOT.123**
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Feedlots

# INTRODUCTION

This study has been commissioned by the Australian feedlot, pork, dairy and sheep industries. The project arises from concerns raised in the National Feed Grain Action Group about the ongoing feedstuff security for the target industries in the face of the current 2002-2003 drought induced feed shortages.

This report is a supplementary document to Report 1. It contains a statistical compendium, supplementary reports which were commissioned by Macarthur Agribusiness, pork management strategies and AQIS reports on the import conditions for various grains.

The statistical compendium provides information on the current status and future projected trends in world and Australian intensive livestock industries and feedstuff production, as well as statistical information on the industrial feed manufacturing industry.

The supplementary reports, commissioned by Macarthur Agribusiness, are referred to in report 1 and are provided in full in this report. The supplementary reports provide valuable information regarding the feedstuff requirements of the main intensive livestock industries under normal and drought conditions as well as reports on feedstuff and fodder supply under normal and drought conditions.

The pork management strategies report delves into the management strategies which are currently being undertaken or need to be undertaken at both industry and farm level. The report acknowledges ingredient and nutrient constraints which impact on management strategies as well as current tools and support systems which are available such as PigStats, Auspig and Feed Cheque.

The AQIS reports which are referred to in report 1 reveal the various conditions required for the import of various grain, these reports are shown in full in this report.

# STATISTICAL COMPENDIUM

Note: This paper was prepared by Macarthur Agribusiness. The intent of the paper is to ascertain the relative supply demand situation for feedstuff supply relative to intensive livestock feed demand in world and Australian context. The nature of statistical data collection and analysis often varies making the assessment of precise supply and demand profiles difficult suffice to say that the relative order of quantums from various statistical sources appears to be similar.

## 1. WORLD AND AUSTRALIAN LIVESTOCK NUMBERS

The trends in the Australian intensive livestock industries need to be put into a global context. While Australia is a minnow in absolute livestock numbers and production terms (Figures 1 and 2) it is one of the largest exporters of beef and sheep meat in the world.

World and Australian cattle, pig and chicken numbers increased over the 1993 to 2002 period, however, world and Australian sheep numbers declined during 1993-2002 period (Figure 1).

**Figure 1:** World Livestock Numbers, Top Five Countries in 2002 and Australia (1993-2002)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cattle Stocks** | **Head (Million)** | | | | | | | | | |
| **World** | **1,305.4** | **1,318.1** | **1,332.1** | **1,333.4** | **1,326.4** | **1,328.4** | **1,330.9** | **1,347.2** | **1,354.2** | **1,360.5** |
| ***Growth (%)*** | | ***1.0%*** | ***1.1%*** | ***0.1%*** | ***-0.5%*** | ***0.1%*** | ***0.2%*** | ***1.2%*** | ***0.5%*** | ***0.5%*** |
| India | 205.7 | 206.5 | 207.5 | 208.5 | 209.5 | 212.1 | 214.9 | 218.8 | 219.6 | 219.6 |
| Brazil | 155.1 | 158.2 | 161.2 | 158.3 | 161.4 | 163.2 | 164.6 | 169.9 | 171.8 | 176.0 |
| China | 85.8 | 90.9 | 100.6 | 99.5 | 90.8 | 99.4 | 101.9 | 104.6 | 106.1 | 106.2 |
| USA | 99.2 | 101.0 | 102.8 | 103.5 | 101.7 | 99.7 | 99.1 | 98.2 | 97.3 | 96.7 |
| EU (15) | 84.9 | 84.0 | 84.3 | 85.0 | 84.7 | 83.2 | 83.1 | 83.2 | 82.2 | 81.6 |
| Argentina | 52.7 | 53.2 | 52.6 | 50.9 | 50.1 | 48.0 | 49.1 | 48.7 | 50.2 | 50.4 |
| **Australia** | **24.1** | **25.8** | **25.7** | **26.4** | **26.8** | **26.9** | **26.6** | **27.6** | **28.8** | **28.8** |
| ***Growth (%)*** | | ***7.0%*** | ***-0.1%*** | ***2.5%*** | ***1.5%*** | ***0.3%*** | ***-1.0%*** | ***3.8%*** | ***4.3%*** | ***0.0%*** |
| **Pig Stocks** | **Head (Million)** | | | | | | | | | |
| **World** | **876.6** | **882.4** | **900.6** | **861.6** | **835.5** | **876.0** | **905.2** | **910.9** | **921.7** | **939.3** |
| ***Growth (%)*** | | ***0.7%*** | ***2.1%*** | ***-4.3%*** | ***-3.0%*** | ***4.8%*** | ***3.3%*** | ***0.6%*** | ***1.2%*** | ***1.9%*** |
| China | 394.1 | 402.9 | 424.8 | 398.6 | 373.6 | 408.4 | 429.2 | 437.5 | 454.4 | 464.7 |
| EU (15) | 118.8 | 119.9 | 119.0 | 117.0 | 119.4 | 120.6 | 123.4 | 122.1 | 121.5 | 123.1 |
| USA | 58.2 | 57.9 | 59.7 | 58.2 | 56.1 | 61.2 | 62.2 | 59.3 | 59.1 | 59.1 |
| Brazil | 34.2 | 35.1 | 36.1 | 29.2 | 29.6 | 30.0 | 30.8 | 31.6 | 29.4 | 30.0 |
| Vietnam | 14.9 | 15.6 | 16.3 | 16.9 | 17.6 | 18.1 | 18.9 | 20.2 | 21.7 | 21.7 |
| **Australia** | **2.6** | **2.8** | **2.7** | **2.5** | **2.6** | **2.8** | **2.6** | **2.4** | **2.8** | **2.8** |
| ***Growth (%)*** | | ***4.9%*** | ***-4.4%*** | ***-4.8%*** | ***1.1%*** | ***8.3%*** | ***-5.1%*** | ***-7.3%*** | ***13.6%*** | ***0.0%*** |
| **Sheep Stocks** | **Head (Million)** | | | | | | | | | |
| **World** | **1,128.4** | **1,117.1** | **1,082.5** | **1,066.6** | **1,051.6** | **1,052.9** | **1,053.8** | **1,057.1** | **1,046.4** | **1,044.0** |
| ***Growth(%)*** | | ***-1.0%*** | ***-3.1%*** | ***-1.5%*** | ***-1.4%*** | ***0.1%*** | ***0.1%*** | ***0.3%*** | ***-1.0%*** | ***-0.2%*** |
| China | 109.7 | 111.7 | 117.4 | 127.6 | 114.1 | 121.0 | 127.4 | 131.1 | 133.2 | 137.0 |
| **Australia** | **138.1** | **132.6** | **120.9** | **121.1** | **120.2** | **117.5** | **115.5** | **118.6** | **116.2** | **113.0** |
| ***Growth (%)*** | | ***-4.0%*** | ***-8.8%*** | ***0.2%*** | ***-0.7%*** | ***-2.3%*** | ***-1.7%*** | ***2.7%*** | ***-2.0%*** | ***-2.8%*** |
| EU (15) | 115.6 | 115.2 | 112.5 | 109.6 | 113.9 | 115.8 | 115.3 | 111.3 | 106.5 | 102.2 |
| India | 51.9 | 53.0 | 54.1 | 55.3 | 56.5 | 57.1 | 57.6 | 57.9 | 58.2 | 58.2 |
| Iran, Islamic Rep | 49.7 | 50.3 | 50.9 | 51.5 | 52.1 | 53.2 | 53.9 | 53.9 | 53.9 | 53.9 |
| **Chicken Stocks** | **(Million)** | | | | | | | | | |
| **World** | **11,944** | **12,608** | **13,033** | **13,727** | **14,305** | **13,333** | **13,972** | **14,651** | **15,091** | **15,420** |

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Growth (%)*** | | ***5.6%*** | ***3.4%*** | ***5.3%*** | ***4.2%*** | ***-6.8%*** | ***4.8%*** | ***4.9%*** | ***3.0%*** | ***2.2%*** |
| China | 2,692.2 | 2,996.7 | 3,137.4 | 3,474.5 | 3,984.0 | 3,121.1 | 3,424.1 | 3,625.0 | 3,771.5 | 3,923.6 |
| USA | 1,498.0 | 1,558.0 | 1,611.0 | 1,661.0 | 1,706.0 | 1,726.0 | 1,785.0 | 1,816.0 | 1,830.0 | 1,830.0 |
| Brazil | 654.2 | 681.1 | 729.5 | 728.1 | 760.6 | 765.2 | 804.6 | 842.7 | 1,006.0 | 1,050.0 |
| EU (15) | 923.5 | 935.4 | 934.8 | 1,009.3 | 970.7 | 998.4 | 997.0 | 1,010.0 | 1,004.4 | 1,014.7 |
| Indonesia | 805.8 | 929.6 | 1,008.4 | 1,095.4 | 972.8 | 645.5 | 622.5 | 859.5 | 853.8 | 870.0 |
| **Australia** | **68.1** | **69.2** | **66.0** | **75.7** | **81.4** | **89.5** | **91.5** | **85.0** | **98.0** | **93.0** |
| ***Growth (%)*** | | ***1.6%*** | ***-4.6%*** | ***14.8%*** | ***7.5%*** | ***10.0%*** | ***2.2%*** | ***-7.1%*** | ***15.3%*** | ***-5.1%*** |

Source: FAO, 2003.

# 2. WORLD AND AUSTRALIAN LIVESTOCK PRODUCT PRODUCTION

World and Australian beef and veal, pigmeat, mutton and lamb, chicken meat, fresh whole cow milk and hen egg production increased during 1993-2002 with a slight decline occurring for Australian beef and veal, lamb and mutton and hen egg production in 2002 (Figure 2).

**Figure 2:** World Livestock Product Production, Top Five Producers in 2002 & Australia (1993-2002)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Beef and Veal** | **Mt (Million)** | | | | | | | | | |
| **World** | **52.5** | **53.2** | **54.2** | **54.7** | **55.4** | **55.2** | **56.2** | **56.7** | **56.3** | **57.7** |
| ***Growth (%)*** | | ***1.5%*** | ***1.7%*** | ***1.0%*** | ***1.2%*** | ***-0.4%*** | ***2.0%*** | ***0.8%*** | ***-0.7%*** | ***2.6%*** |
| USA | 10.6 | 11.2 | 11.6 | 11.7 | 11.7 | 11.8 | 12.1 | 12.3 | 12.0 | 12.4 |
| EU (15) | 8.2 | 7.9 | 8.0 | 8.0 | 7.9 | 7.7 | 7.7 | 7.4 | 7.4 | 7.5 |
| Brazil | 4.8 | 5.1 | 5.7 | 6.2 | 5.9 | 5.8 | 6.4 | 6.5 | 6.7 | 7.1 |
| China | 2.1 | 2.5 | 3.3 | 3.3 | 4.1 | 4.5 | 4.7 | 5.0 | 5.1 | 5.2 |
| Argentina | 2.8 | 2.8 | 2.7 | 2.7 | 2.7 | 2.5 | 2.7 | 2.7 | 2.6 | 2.7 |
| **Australia** | **1.8** | **1.8** | **1.8** | **1.7** | **1.8** | **2.0** | **2.0** | **2.0** | **2.1** | **2.0** |
| ***Growth (%)*** | | ***-0.1%*** | ***-1.2%*** | ***-3.3%*** | ***3.8%*** | ***8.0%*** | ***2.8%*** | ***-1.1%*** | ***6.6%*** | ***-4.0%*** |
| **Cow Milk, Whole, Fresh** | **Mt (Million)** | | | | | | | | | |
| **World** | **460.3** | **461.4** | **463.9** | **469.5** | **471.8** | **478.8** | **484.8** | **490.4** | **495.4** | **499.1** |
| ***Growth (%)*** | | ***0.2%*** | ***0.5%*** | ***1.2%*** | ***0.5%*** | ***1.5%*** | ***1.3%*** | ***1.1%*** | ***1.0%*** | ***0.8%*** |
| EU (15) | 120.6 | 120.6 | 122.7 | 122.3 | 121.7 | 121.7 | 122.7 | 122.1 | 120.5 | 121.1 |
| USA | 68.3 | 69.7 | 70.4 | 69.9 | 70.8 | 71.4 | 73.8 | 76.1 | 75.0 | 75.0 |
| India | 25.4 | 26.1 | 26.1 | 27.3 | 29.6 | 31.4 | 32.8 | 34.0 | 35.0 | 35.0 |
| Russian Federation | 46.3 | 42.0 | 39.1 | 35.5 | 33.8 | 33.0 | 32.0 | 32.0 | 32.6 | 32.7 |
| Brazil | 16.1 | 16.3 | 17.0 | 19.1 | 19.2 | 19.3 | 19.7 | 20.4 | 22.6 | 23.3 |
| **Australia** | **7.6** | **8.3** | **8.5** | **9.0** | **9.3** | **9.7** | **10.5** | **11.2** | **10.9** | **11.6** |
| ***Growth (%)*** | | ***10.2%*** | ***1.6%*** | ***6.2%*** | ***3.5%*** | ***4.5%*** | ***7.9%*** | ***6.6%*** | ***-2.8%*** | ***6.9%*** |
| **Pigmeat** | **Mt (Million)** | | | | | | | | | |
| **World** | **75.2** | **77.7** | **78.7** | **78.6** | **82.3** | **87.8** | **89.9** | **89.7** | **91.5** | **93.6** |
| ***Growth (%)*** | | ***3.4%*** | ***1.2%*** | ***-0.1%*** | ***4.7%*** | ***6.6%*** | ***2.4%*** | ***-0.2%*** | ***2.0%*** | ***2.3%*** |
| China | 29.8 | 32.6 | 33.4 | 33.0 | 37.2 | 39.9 | 41.0 | 41.4 | 43.0 | 44.3 |
| EU (15) | 16.1 | 16.2 | 16.1 | 16.5 | 16.4 | 17.8 | 18.1 | 17.7 | 17.7 | 17.6 |
| USA | 7.8 | 8.0 | 8.1 | 7.8 | 7.8 | 8.6 | 8.8 | 8.6 | 8.7 | 9.0 |
| Brazil | 1.3 | 1.3 | 1.4 | 1.6 | 1.5 | 1.7 | 1.7 | 1.9 | 2.0 | 2.0 |
| Poland | 1.9 | 1.7 | 2.0 | 2.1 | 1.9 | 2.0 | 2.0 | 1.9 | 1.8 | 1.9 |
| **Australia** | **0.3** | **0.3** | **0.4** | **0.3** | **0.3** | **0.4** | **0.4** | **0.4** | **0.4** | **0.4** |
| ***Growth (%)*** | | ***4.9%*** | ***2.0%*** | ***-4.9%*** | ***0.5%*** | ***9.1%*** | ***1.0%*** | ***-1.9%*** | ***0.6%*** | ***8.2%*** |
| **Mutton and Lamb** | **Mt (Million)** | | | | | | | | | |
| **World** | **7.1** | **7.2** | **7.3** | **7.1** | **7.2** | **7.4** | **7.4** | **7.6** | **7.6** | **7.7** |
| ***Growth (%)*** | | ***1.8%*** | ***0.1%*** | ***-2.1%*** | ***1.7%*** | ***1.9%*** | ***0.7%*** | ***2.6%*** | ***0.2%*** | ***0.6%*** |
| China | 0.7 | 0.8 | 0.9 | 1.0 | 1.2 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 |

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|---|---|---|---|---|---|---|---|---|---|---|
| EU (15) | 1.1 | 1.1 | 1.1 | 1.1 | 1.0 | 1.1 | 1.1 | 1.1 | 0.9 | 1.0 |
| **Australia** | **0.6** | **0.6** | **0.6** | **0.6** | **0.6** | **0.6** | **0.6** | **0.7** | **0.7** | **0.6** |
| ***Growth (%)*** | | ***0.6%*** | ***-4.0%*** | ***-7.6%*** | ***-1.4%*** | ***8.8%*** | ***2.0%*** | ***8.2%*** | ***5.1%*** | ***-9.7%*** |
| New Zealand | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.5 |
| Iran, Islamic Rep of | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 |
| **Chicken Meat** | **Mt (Million)** | | | | | | | | | |
| **World** | **41.4** | **43.8** | **46.6** | **47.9** | **50.9** | **53.1** | **56.0** | **58.5** | **60.3** | **61.9** |
| ***Growth (%)*** | | ***5.7%*** | ***6.6%*** | ***2.7%*** | ***6.3%*** | ***4.3%*** | ***5.4%*** | ***4.6%*** | ***3.0%*** | ***2.7%*** |
| USA | 10.2 | 11.0 | 11.5 | 12.1 | 12.5 | 12.8 | 13.6 | 13.9 | 14.3 | 14.8 |
| China | 4.6 | 5.2 | 6.1 | 6.2 | 7.2 | 8.0 | 8.4 | 9.0 | 9.3 | 9.5 |
| EU (15) | 5.6 | 6.0 | 6.1 | 6.4 | 6.5 | 6.8 | 6.7 | 6.7 | 6.8 | 6.7 |
| Brazil | 3.1 | 3.4 | 4.1 | 4.1 | 4.5 | 4.9 | 5.5 | 6.0 | 6.2 | 6.7 |
| Mexico | 1.0 | 1.1 | 1.3 | 1.3 | 1.4 | 1.6 | 1.7 | 1.8 | 1.9 | 1.9 |
| **Australia** | **0.4** | **0.5** | **0.5** | **0.5** | **0.5** | **0.6** | **0.6** | **0.6** | **0.6** | **0.7** |
| ***Growth (%)*** | | ***6.3%*** | ***-0.5%*** | ***3.0%*** | ***1.5%*** | ***23.4%*** | ***-4.5%*** | ***6.1%*** | ***3.3%*** | ***4.8%*** |
| **Hen Eggs** | **Mt (Million)** | | | | | | | | | |
| **World** | **38.4** | **41.3** | **43.0** | **45.3** | **46.5** | **48.2** | **50.0** | **51.4** | **52.8** | **53.5** |
| ***Growth (%)*** | | ***7.5%*** | ***4.0%*** | ***5.3%*** | ***2.8%*** | ***3.5%*** | ***3.9%*** | ***2.8%*** | ***2.6%*** | ***1.4%*** |
| China | 9.7 | 12.1 | 13.7 | 15.9 | 16.5 | 17.5 | 18.5 | 19.4 | 20.2 | 20.6 |
| EU (15) | 5.2 | 5.3 | 5.4 | 5.3 | 5.3 | 5.4 | 5.4 | 5.2 | 5.3 | 5.2 |
| USA | 4.3 | 4.4 | 4.4 | 4.5 | 4.6 | 4.7 | 4.9 | 5.0 | 5.1 | 5.1 |
| Japan | 2.6 | 2.6 | 2.5 | 2.6 | 2.6 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| Russian Federation | 2.2 | 2.1 | 1.9 | 1.8 | 1.8 | 1.8 | 1.8 | 1.9 | 2.0 | 2.1 |
| **Australia** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.2** | **0.2** | **0.1** | **0.2** | **0.1** |
| ***Growth (%)*** | | ***0.1%*** | ***-2.6%*** | ***-1.8%*** | ***1.9%*** | ***26.4%*** | ***-0.8%*** | ***-17.5%*** | ***25.9%*** | ***-19.0%*** |

Source: FAO, 2003.

# 3. WORLD PROJECTED LIVESTOCK NUMBERS

World livestock numbers are projected to increase. FAO figures were utilised as a basis for annual growth projection in the 2003-2007 period (Figure 3).

**Figure 3:** Projected World Livestock Numbers

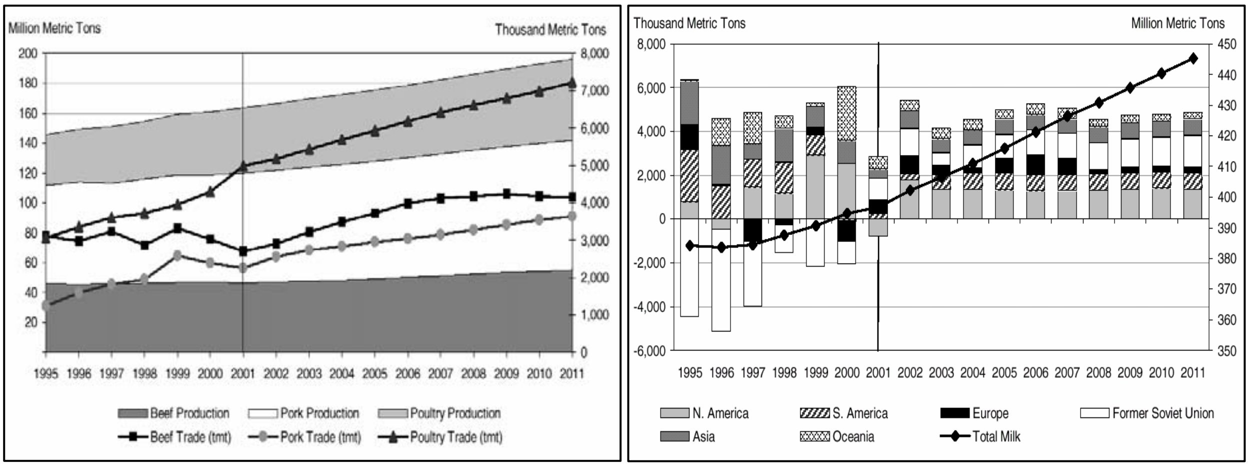
| | **Ave. Annual Growth Rate 1993-2002** | **Projection (Million head)** | | | | |
|---|---|---|---|---|---|---|
| | | **2003** | **2004** | **2005** | **2006** | **2007** |
| Cattle Stocks | *0.5%* | 1,366.76 | 1,373.07 | 1,379.41 | 1,385.78 | 1,392.17 |
| Pig Stocks | *0.8%* | 939.32 | 946.91 | 954.56 | 962.27 | 970.05 |
| Sheep Stocks | *-0.9%* | 1,035.13 | 1,026.29 | 1,017.52 | 1,008.83 | 1,000.21 |
| Chicken Stocks | *2.9%* | 158.74 | 163.42 | 168.23 | 173.18 | 178.28 |

Source: FAO, 2003 Adjusted by Macarthur Agribusiness

The US Food and Agricultural Policy Research Institute (FAPRI) projects that beef, pork and poultry production and trade will continue to increase until 2011, with beef trade stabilising in 2009 (Figure 4) confirming the trends shown in the FAO data. FAPRI projects that world milk production will continue to increase to 2011, growth occurring in all countries especially the former Soviet Union (Figure 4).

# 4. WORLD PROJECTED LIVESTOCK PRODUCTS AND TRADE

**Figure 4:** FAPRI Projections for World Meat Production and Trade and Milk Production




Source: FAPRI, 2002

# 5. WORLD AND AUSTRALIAN LIVESTOCK PRODUCT TRADE

World beef and veal exports are forecast to equal 6,518,000 Mt in 2003, the average growth rate for the 1998-2003 period equals 4.0% (Figure 5). The top five exporters in 2002 were Australia, which exported 1,420,000 Mt, Brazil, Canada, EU-15 and New Zealand. World beef and veal imports are forecast to equal 5,522,000 Mt in 2003, the top five importers in 2002 were Japan, Russian Federation, EU-15, Mexico and the Republic of Korea (Figure 5).

World pork exports are forecast to equal 3,921,000 Mt in 2003, the average growth rate for the 1998-2003 period equals 7.1% (Figure 5). The top five exporters of pork in 2002 were the EU-15 which exported 1,300,000 Mt, Canada, Brazil, China and Hungary. In comparison Australia exported 83,000 Mt in 2002. World pork imports are forecast to equal 3,652,000 Mt, the top five importers of pork in 2002 were Japan, Russian Federation, Mexico, Hong Kong and the Republic of Korea (Figure 5).

World broiler exports are forecast to equal 5,556,000 Mt in 2003, the average growth rate for the 1998-2003 period equals 6.0% (Figure 5). The top five exporters of broiler meat in 2002 were Brazil which exported 1,425,000 Mt, EU-15, Thailand, China and Canada. In comparison Australia exported 15,000 Mt in 2002. World broiler imports are forecast to equal 4,486,000 Mt in 2003, the top five importers of broiler meat in 2002 were the Russian Federation, Japan, EU-15, Saudi Arabia and China (Figure 5).

World mutton and lamb exports equalled 854,391 Mt in 2001, the average growth rate for the 1997-2001 period was 0.7% (Figure 5). The top five exporters of mutton and lamb in 2001 were New Zealand which exported 345,475 Mt, Australia which exported 295,924 Mt, EU-15, Uruguay and Namibia. World mutton and lamb imports equalled 821,896 Mt in 2001, the top five importers in 2001 were EU-15, China, Mexico, Saudi Arabia and United States of America (Figure 5).

World hen egg exports equalled 976,575 Mt in 2001, the average growth rate for the 1997-2001 period was 2.9% (Figure 5). The top five exporters of hen eggs in 2001 were EU-15 which exported 575,655 Mt, Malaysia, USA, China and Belarus. In comparison Australia exported 96 Mt in 2001. World hen egg imports in 2001 equalled 886,408 Mt, the top five importers in 2001 were EU-15, Hong Kong, Canada, Singapore, Switzerland (Figure 5).

World fresh whole cow milk exports equalled 4,459,919 Mt in 2001, the average growth rate for the 1997-2001 period was 1.9% (Figure 5). The top five exporters of fresh whole cow milk in 2001 were EU-15 which exported 3,972,050 Mt, Australia which exported 59,235 Mt, Hungary, Slovenia and Uruguay. World fresh whole cow milk imports equalled 4,635,408 Mt in 2001, the top five importers in 2001 were EU-15, Brazil, Hong Kong, Croatia and the Philippines (Figure 5).

**Figure 5:** World Livestock Product Exports and Imports, Top Five Exporters and Importers in 2002 & Australia (1998-2003)

| Product | 1998 | 1999 | 2000 | 2001 | 2002p | 2003f |
|---|---|---|---|---|---|---|
| **Beef & Veal Exports** | **Mt ('000) Carcass Weight Equivalent** | | | | | |
| **World** | **5,370** | **5,779** | **5,938** | **5,818** | **6,227** | **6,518** |
| ***Growth (%)*** | | ***7.6%*** | ***2.8%*** | ***-2.0%*** | ***7.0%*** | ***4.7%*** |
| **Australia** | **1,268** | **1,270** | **1,338** | **1,395** | **1,420** | **1,500** |
| ***Growth (%)*** | | ***0.2%*** | ***5.4%*** | ***4.3%*** | ***1.8%*** | ***5.6%*** |
| Brazil | 306 | 464 | 492 | 748 | 838 | 925 |
| Canada | 428 | 492 | 523 | 574 | 625 | 600 |
| EU 1/ | 678 | 854 | 645 | 572 | 530 | 570 |
| New Zealand | 488 | 442 | 485 | 500 | 510 | 530 |
| **Beef & Veal Imports** | **Mt ('000) Carcass Weight Equivalent** | | | | | |
| **World** | **4,573** | **5,084** | **5,074** | **4,963** | **5,190** | **5,522** |
| ***Growth (%)*** | | ***11.2%*** | ***-0.2%*** | ***-2.2%*** | ***4.6%*** | ***6.4%*** |
| Japan | 943 | 959 | 1016 | 955 | 700 | 860 |
| Russian Federation | 684 | 838 | 478 | 653 | 700 | 740 |
| EU 1/ | 326 | 351 | 448 | 413 | 500 | 530 |
| Mexico | 307 | 358 | 420 | 426 | 440 | 445 |
| Korea, Rep | 125 | 242 | 342 | 246 | 390 | 420 |
| **Pork Exports** | **Mt ('000) Carcass Weight Equivalent** | | | | | |
| **World** | **2,800** | **3,310** | **3,411** | **3,552** | **3,825** | **3,921** |
| ***Growth (%)*** | | ***18.2%*** | ***3.1%*** | ***4.1%*** | ***7.7%*** | ***2.5%*** |
| EU 1/ | 1,004 | 1,390 | 1,470 | 1,235 | 1,300 | 1,325 |
| Canada | 432 | 554 | 658 | 727 | 800 | 815 |
| Brazil | 105 | 109 | 163 | 337 | 400 | 430 |
| China | 143 | 75 | 73 | 139 | 225 | 200 |
| Hungary | 109 | 131 | 143 | 118 | 120 | 110 |
| **Australia** | **17** | **37** | **49** | **66** | **79** | **83** |
| ***Growth (%)*** | | ***117.6%*** | ***32.4%*** | ***34.7%*** | ***19.7%*** | ***5.1%*** |
| **Pork Imports** | **Mt ('000) Carcass Weight Equivalent** | | | | | |
| **World** | **2,661** | **3,160** | **3,122** | **3,197** | **3,553** | **3,652** |
| ***Growth (%)*** | | ***18.8%*** | ***-1.2%*** | ***2.4%*** | ***11.1%*** | ***2.8%*** |
| Japan | 777 | 919 | 995 | 1,068 | 1,125 | 1,150 |
| Russian Federation | 710 | 832 | 520 | 560 | 700 | 710 |
| Mexico | 114 | 190 | 276 | 294 | 300 | 310 |
| Hong Kong | 207 | 217 | 247 | 260 | 285 | 300 |
| Korea, Rep | 66 | 156 | 174 | 123 | 145 | 150 |
| **Broiler Exports** | **Mt ('000) Ready to Cook Equivalent 1/** | | | | | |
| **World** | **4,196** | **4,462** | **4,868** | **5,607** | **5,334** | **5,556** |
| ***Growth (%)*** | | ***6.3%*** | ***9.1%*** | ***15.2%*** | ***-4.9%*** | ***4.2%*** |
| Brazil | 594 | 750 | 893 | 1,241 | 1,425 | 1,325 |
| EU 1/ | 788 | 764 | 762 | 718 | 670 | 695 |

| Product | 1998 | 1999 | 2000 | 2001 | 2002p | 2003f |
|---|---|---|---|---|---|---|
| Thailand | 274 | 288 | 328 | 425 | 415 | 435 |
| China | 323 | 375 | 464 | 489 | 400 | 400 |
| Canada | 53 | 47 | 55 | 69 | 75 | 80 |
| **Australia** | **13** | **12** | **14** | **19** | **15** | **15** |
| ***Growth (%)*** | | ***-7.7%*** | ***16.7%*** | ***35.7%*** | ***-21.1%*** | ***0.0%*** |
| **Broiler Imports** | **Mt ('000) Ready to Cook Equivalent 1/** | | | | | |
| **World** | **3,555** | **3,986** | **4,029** | **4,391** | **4,389** | **4,486** |
| ***Growth (%)*** | | ***12.1%*** | ***1.1%*** | ***9.0%*** | ***0.0%*** | ***2.2%*** |
| Russian Federation | 1,020 | 930 | 943 | 1,281 | 1,220 | 1,300 |
| Japan | 590 | 667 | 721 | 710 | 750 | 700 |
| EU 1/ | 167 | 198 | 299 | 418 | 550 | 600 |
| Saudi Arabia | 287 | 364 | 348 | 399 | 390 | 385 |
| China | 427 | 591 | 608 | 473 | 380 | 350 |

Source: FAS, 2003

Note 1/ = As of 1997, chicken feet/paws are not included in trade data

Note: EU 1/ = EU – pre 2000 are partial EU data; 2000 and later is total EU-15.

| | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|
| **Mutton & Lamb Exports** | **Mt ('000)** | | | | |
| **World** | **837.5** | **853.2** | **882.7** | **938.0** | **854.4** |
| ***Growth (%)*** | | ***1.9%*** | ***3.4%*** | ***6.3%*** | ***-8.9%*** |
| New Zealand | 355.3 | 351.3 | 347.2 | 379.1 | 345.5 |
| **Australia** | **234.1** | **249.8** | **266.2** | **300.1** | **295.9** |
| ***Growth (%)*** | | ***6.7%*** | ***6.6%*** | ***12.7%*** | ***-1.4%*** |
| European Union (15) | 181.2 | 193.2 | 213.6 | 196.3 | 159.5 |
| Uruguay | 16.0 | 16.8 | 11.9 | 16.5 | 9.0 |
| Namibia | 0.0 | 0.0 | 0.0 | 1.8 | 6.6 |
| **Mutton & Lamb Imports** | **Mt ('000)** | | | | |
| **World** | **815.4** | **856.8** | **836.8** | **921.7** | **821.9** |
| ***Growth (%)*** | | ***5.1%*** | ***-2.3%*** | ***10.1%*** | ***-10.8%*** |
| European Union (15) | 405.5 | 413.5 | 426.5 | 431.5 | 372.6 |
| China | 20.5 | 25.1 | 28.4 | 34.1 | 42.7 |
| Mexico | 21.5 | 27.1 | 33.8 | 44.4 | 48.8 |
| Saudi Arabia | 45.3 | 45.0 | 40.0 | 55.3 | 44.5 |
| United States of America | 34.6 | 47.2 | 47.2 | 54.8 | 61.0 |
| **Hen Egg Exports** | **Mt ('000)** | | | | |
| **World** | **871.8** | **905.3** | **945.1** | **957.2** | **976.6** |
| ***Growth (%)*** | | ***3.8%*** | ***4.4%*** | ***1.3%*** | ***2.0%*** |
| European Union (15) | 548.6 | 565.8 | 620.7 | 569.6 | 575.7 |
| Malaysia | 36.0 | 28.4 | 46.3 | 55.6 | 75.9 |
| United States of America | 68.1 | 69.9 | 57.9 | 64.6 | 62.6 |
| China | 60.7 | 56.1 | 44.5 | 65.0 | 58.1 |
| Belarus | 16.5 | 33.1 | 53.5 | 50.9 | 37.3 |
| **Australia** | **0.4** | **0.6** | **0.6** | **0.1** | **0.1** |
| ***Growth (%)*** | | ***55.8%*** | ***-12.6%*** | ***-77.1%*** | ***-25.6%*** |
| **Hen Egg Imports** | **Mt ('000)** | | | | |
| **World** | **866.4** | **907.9** | **864.3** | **897.3** | **886.4** |
| ***Growth (%)*** | | ***4.8%*** | ***-4.8%*** | ***3.8%*** | ***-1.2%*** |
| European Union (15) | 478.5 | 479.0 | 475.4 | 513.0 | 493.0 |
| China, Hong Kong SAR | 83.1 | 83.8 | 82.8 | 81.0 | 83.0 |
| Canada | 27.1 | 37.9 | 25.9 | 23.3 | 38.4 |
| Singapore | 38.3 | 39.7 | 41.8 | 40.3 | 38.0 |
| Switzerland | 22.7 | 22.6 | 23.3 | 23.6 | 25.4 |
| **Cow Milk, Whole, Fresh Exports** | **Mt ('000)** | | | | |
| **World** | **4,177.3** | **4,564.7** | **4,795.5** | **4,851.3** | **4,459.9** |
| ***% Growth*** | | ***9.3%*** | ***5.1%*** | ***1.2%*** | ***-8.1%*** |
| European Union (15) | 3,711.7 | 4,074.9 | 4,375.4 | 4,380.6 | 3,972.1 |

| | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|
| **Australia** | **52.7** | **54.2** | **63.8** | **67.6** | **59.2** |
| ***% Growth*** | | ***2.7%*** | ***17.8%*** | ***5.9%*** | ***-12.4%*** |
| Hungary | 26.4 | 34.5 | 22.9 | 65.2 | 78.6 |
| | **1997** | **1998** | **1999** | **2000** | **2001** |
| Slovenia | 49.0 | 51.1 | 31.0 | 16.7 | 57.4 |
| Uruguay | 89.7 | 109.3 | 83.4 | 81.7 | 48.9 |
| **Cow Milk, Whole, Fresh Imports** | **Mt ('000)** | | | | |
| **World** | **4,288.4** | **4,660.1** | **4,987.7** | **5,050.5** | **4,635.4** |
| ***% Growth*** | | ***8.7%*** | ***7.0%*** | ***1.3%*** | ***-8.2%*** |
| European Union (15) | 3,702.4 | 4,091.5 | 4,465.3 | 4,489.4 | 4,175.8 |
| Brazil | 113.4 | 126.3 | 116.1 | 89.9 | 36.1 |
| China, Hong Kong SAR | 49.8 | 51.5 | 52.3 | 50.4 | 49.1 |
| Croatia | 46.5 | 42.3 | 51.4 | 76.9 | 67.5 |
| Philippines | 21.6 | 22.2 | 16.7 | 21.3 | 36.7 |

Source: FAO, 2003

The reality of the above data is that there is an increasing intensification and growth of agriculture particularly in the livestock and related industries. These intensive industries require a constant and reliable supply of feedstuffs to maintain production intensity.

# 6. WORLD GRAIN PRODUCTION, TRADE AND FEED USE

## 6.1 Wheat

World wheat production, yields and feed use increased overall between 1993-1994 – 2002-2003 whilst area of wheat harvested declined. In 2002-2003 world wheat production equalled 566,900,000 Mt of which approximately 17-20% was utilised for feed use (Figure 6).

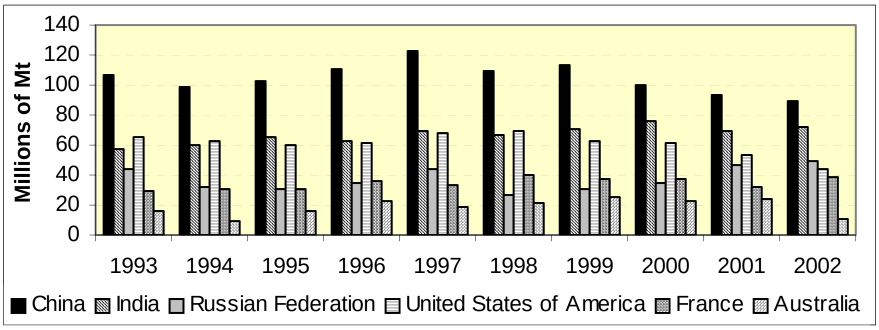
According to FAO, the top five wheat producing countries in 2002 were China (16% of world wheat production), India (13%), the Russian Federation (9%), USA (8%) and France (7%). By comparison Australia produced 2%, of the world wheat production in 2002. In past years Australia has produced up to 4% of world wheat production. Whilst Australia is a small producer globally, it is ranked in the top five wheat exporters.

**Figure 6:** World Wheat Supply and Demand

| | Area Harvested | Yield | Product. | World Trade | Feed Use | Feed Use % of Product | Total Use | Ending Stocks | Stock as% of Cons. |
|---|---|---|---|---|---|---|---|---|---|
| **MILLIONS OF METRIC TONS/HECTARES** | | | | | | | | | |
| 1993/94 | 222.1 | 2.51 | 558.1 | 101.7 | 108.3 | 19.4% | 553.4 | 180.5 | 32.6 |
| 1994/95 | 214.5 | 2.44 | 523.8 | 101.5 | 99.6 | 19.0% | 544.1 | 160.2 | 29.4 |
| 1995/96 | 218.5 | 2.46 | 538.1 | 99.3 | 90.7 | 16.8% | 545.0 | 153.3 | 28.1 |
| 1996/97 | 229.8 | 2.53 | 581.9 | 100.4 | 97.7 | 16.8% | 570.5 | 164.7 | 28.9 |
| 1997/98 | 228.0 | 2.68 | 610.1 | 104.4 | 101.8 | 16.7% | 579.4 | 195.4 | 33.7 |
| 1998/99 | 225.0 | 2.62 | 589.7 | 102.1 | 103.5 | 17.6% | 579.0 | 206.1 | 35.6 |
| 1999/00 | 216.6 | 2.71 | 586.1 | 112.9 | 99.3 | 17.0% | 585.1 | 207.0 | 35.4 |
| 2000/01 | 219.3 | 2.65 | 582.1 | 103.6 | 105.6 | 18.1% | 584.8 | 204.3 | 34.9 |
| 2001/02 | 214.5 | 2.70 | 579.8 | 110.1 | 108.1 | 18.6% | 582.8 | 201.3 | 34.6 |
| 2002/03 | 212.5 | 2.67 | 566.9 | 104.8 | 117.8 | 20.8% | 595.4 | 172.8 | 29.0 |

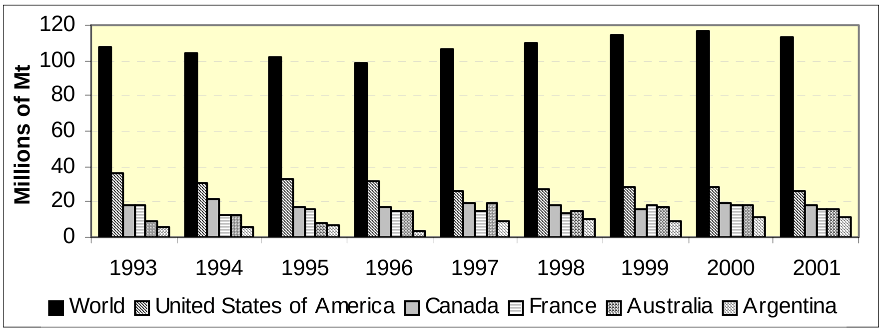
Source: Foreign Agricultural Service, 2003.
Note: Trade statistics exclude intra-EU15 trade.

**Figure 7:** Top Five Wheat Producing Countries in 2002 and Australia from 1993-2002



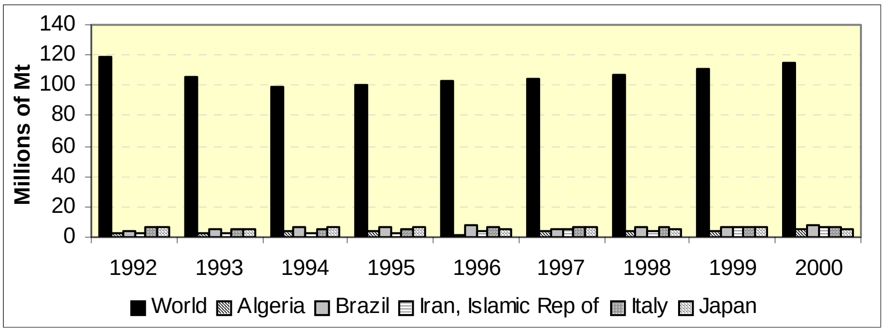

Source: FAO, 2003

**Figure 8:** World Wheat Exports and Top Five Wheat Exporters in 2002 from 1993-2002




Source: FAO, 2003

**Figure 9:** World Wheat Imports and Top Five Wheat Importers in 2002 from 1993-2002




Source: FAO, 2003

## 6.2 Coarse Grains

World coarse grain production, yields and feed use increased overall between 1993/94 - 2002-2003 period, with coarse grain feed use peaking in 2001-2002 and declining slightly in 2002-2003. The area of coarse grains harvested declined during this period. In 2002-2003 world coarse grain production equalled 861,600,000 Mt of which approximately 68% was utilised for feed use (Figure 10).

According to USDA FAS, the top five coarse grain producers for the 2002/2003 year were the United States which produced 28% of world coarse grain production, China (15%), the EU (12%), Brazil (4%) and Mexico (3%). Australia produced 1% of world coarse grain production. While Australia is a small producer on a global scale, it is a major exporter. In 2002-2003 Australia exported 1,150,000 Mt of coarse grains, despite significant drought effects. In 2000-2001 Australia exported 4,951,000 Mt of coarse grains and was amongst the top five exporters.

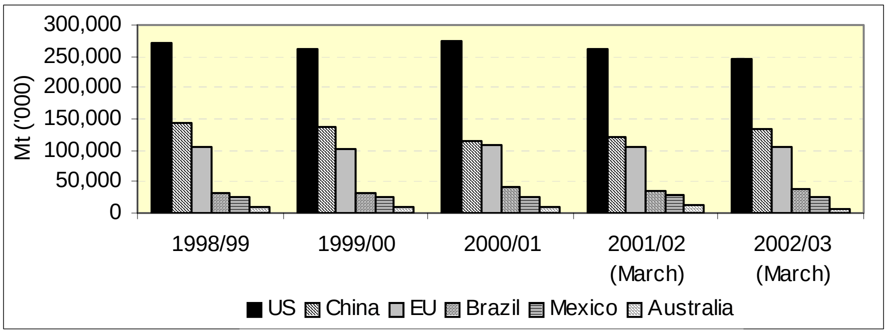
**Figure 10:** World Coarse Grain Supply and Demand

| | Area Harvested | Yield | Product. | World Trade | Feed Use | Feed Use % of Product. | Total Use | Ending Stocks | Stock as% of Cons. |
|---|---|---|---|---|---|---|---|---|---|
| **MILLIONS OF METRIC TONS/HECTARES** | | | | | | | | | |
| 1993/94 | 319.6 | 2.50 | 799.1 | 86.6 | 545.7 | 68.3% | 839.0 | 179.1 | 21.4 |
| 1994/95 | 324.1 | 2.69 | 870.8 | 98.6 | 570.1 | 65.5% | 859.2 | 190.7 | 22.2 |
| 1995/96 | 313.8 | 2.56 | 802.4 | 88.1 | 548.2 | 68.3% | 841.5 | 151.7 | 18.0 |
| 1996/97 | 322.9 | 2.81 | 908.4 | 94.3 | 575.4 | 63.3% | 874.8 | 185.3 | 21.2 |
| 1997/98 | 311.1 | 2.84 | 883.0 | 85.7 | 581.7 | 65.9% | 872.2 | 196.1 | 22.5 |
| 1998/99 | 307.6 | 2.89 | 889.9 | 96.7 | 574.2 | 64.5% | 870.3 | 215.7 | 24.8 |
| 1999/00 | 299.8 | 2.93 | 877.3 | 104.8 | 584.5 | 66.6% | 883.1 | 209.9 | 23.8 |
| 2000/01 | 296.6 | 2.90 | 859.7 | 104.4 | 586.3 | 68.2% | 880.3 | 189.3 | 21.5 |
| 2001/02 | 299.5 | 2.98 | 891.2 | 101.9 | 601.2 | 67.5% | 902.9 | 177.6 | 19.7 |
| 2002/03 | 291.2 | 2.96 | 861.6 | 101.7 | 587.9 | 68.2% | 888.0 | 151.1 | 17.0 |

Source: Foreign Agricultural Service, 2003.

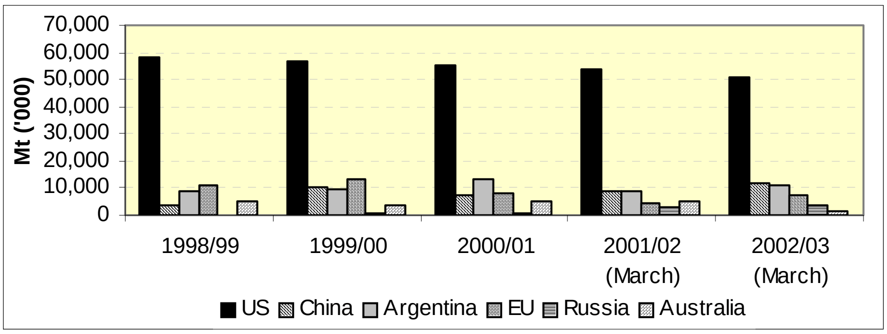
Notes: Coarse grains data are on an Oct/Sept trade year. "Stocks as a Percent of Consumption" represents the ratio of marketing year ending stocks to total consumption. Trade statistics exclude intra-EU15 trade.

**Figure 11:** Top Five World Coarse Grain Producers



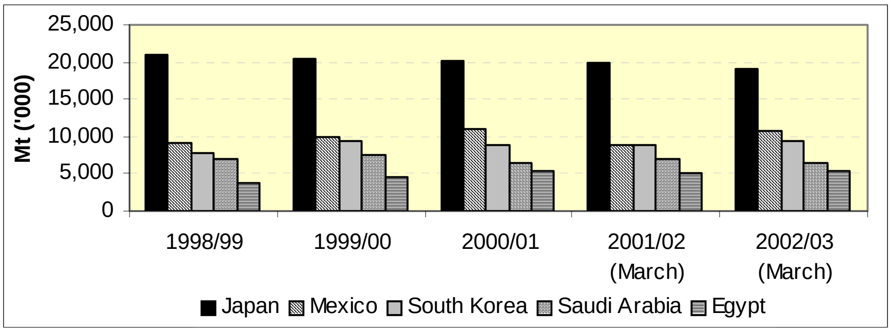

Source: FAS, 2003

**Figure 12:** Top Five World Coarse Grain Exporters




Source: FAS, 2003

**Figure 13:** Top Five World Coarse Grain Importers




Source: FAS, 2003

## 6.3 World Grain Projections

FAPRI projects world wheat production to increase to reach 669,078,000 Mt in 2011-2012, the average growth rate for the 2000/01 to 2011/12 period is projected to be 1.3% varying from –0.7% to 3.2%. FAPRI projects feed use to increase to 119,320,000 Mt, the average growth rate for the 2000/01 to 2011/12 period is projected to be 1.6%, higher than the average growth rate of wheat production. The proportion of wheat production utilised for feed use is projected vary between 17.3% to 18.7%, on average for the 2000-2001 to 2011-2012 period it is projected to equal 18.1%.

**Figure 14:** FAPRI World Wheat Projection

| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 | 08/09 | 09/10 | 10/11 | 11/12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **World Wheat** | **(Thousand Metric Tons)** | | | | | | | | | | | |
| **Production** | **582,220** | **578,451** | **597,717** | **605,570** | **613,822** | **624,250** | **630,466** | **639,536** | **645,781** | **653,486** | **660,358** | **669,078** |
| *% Growth* | | *-0.7%* | *3.2%* | *1.3%* | *1.3%* | *1.7%* | *1.0%* | *1.4%* | *1.0%* | *1.2%* | *1.0%* | *1.3%* |
| **Feed Use** | **100,498** | **101,363** | **111,373** | **113,086** | **113,891** | **114,956** | **115,108** | **116,491** | **117,182** | **118,394** | **118,344** | **119,320** |
| *% Growth* | | *0.9%* | *9.9%* | *1.5%* | *0.7%* | *0.9%* | *0.1%* | *1.2%* | *0.6%* | *1.0%* | *0.0%* | *0.8%* |
| *% Feed Use/Production* | *17.3%* | *17.5%* | *18.6%* | *18.7%* | *18.6%* | *18.4%* | *18.3%* | *18.2%* | *18.1%* | *18.1%* | *17.9%* | *17.8%* |

Source: FAPRI, 2002

FAPRI projects world corn production to increase to reach 700,912,000 Mt in 2011-2012, the average growth rate for the 2000/01 to 2011/12 period is projected to be 1.7% varying from –0.3% to 4.0%. FAPRI projects feed use to increase to 653,035,000 Mt, the average growth rate for the 2000/01 to 2011/12 period is projected to be 4.4%, higher than the average growth rate of corn production. The proportion of corn production utilised for feed use is projected vary between 72.6% to 96.5%, on average for the 2000-2001 to 2011-2012 period it is projected to equal 90.7%.

**Figure 15:** FAPRI World Corn Projection

| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 | 08/09 | 09/10 | 10/11 | 11/12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **World Corn** | **(Thousand Metric Tons)** | | | | | | | | | | | |
| **Production** | **585,413** | **583,402** | **606,940** | **621,690** | **632,622** | **643,943** | **653,369** | **663,547** | **674,196** | **682,359** | **692,253** | **700,912** |
| *% Growth* | | *-0.3%* | *4.0%* | *2.4%* | *1.8%* | *1.8%* | *1.5%* | *1.6%* | *1.6%* | *1.2%* | *1.4%* | *1.3%* |
| **Feed Use** | **425,102** | **435,515** | **585,487** | **590,673** | **599,459** | **606,379** | **614,136** | **621,867** | **630,842** | **637,765** | **646,169** | **653,035** |
| *% Growth* | | *2.4%* | *34.4%* | *0.9%* | *1.5%* | *1.2%* | *1.3%* | *1.3%* | *1.4%* | *1.1%* | *1.3%* | *1.1%* |
| *% Feed Use/Production* | *72.6%* | *74.7%* | *96.5%* | *95.0%* | *94.8%* | *94.2%* | *94.0%* | *93.7%* | *93.6%* | *93.5%* | *93.3%* | *93.2%* |

Source: FAPRI, 2002

FAPRI projects world barley production to increase to reach 153,180,000 Mt in 2011-202012, the average growth rate for the 2000/01 to 2011/12 period is projected to be 1.2% varying from –0.2% to 6.0%. FAPRI projects feed use to increase to 105,781,000 Mt, the average growth rate for the 2000/01 to 2011/12 period is projected to be 1.3%, higher than the average growth rate of barely production. The proportion of corn production utilised for feed use is projected vary between 66.9% to 70.3%, on average for the 2000-2001 to 2011-2012 period it is projected to equal 69.3%.

**Figure 16:** FARPI World Barley Projection

| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 | 08/09 | 09/10 | 10/11 | 11/12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **World Barley** | **(Thousand Metric Tons)** | | | | | | | | | | | |
| **Production** | **133,997** | **142,086** | **141,842** | **142,759** | **144,042** | **145,328** | **146,852** | **147,804** | **149,577** | **150,622** | **151,920** | **153,180** |
| *% Growth* | | *6.0%* | *-0.2%* | *0.6%* | *0.9%* | *0.9%* | *1.0%* | *0.6%* | *1.2%* | *0.7%* | *0.9%* | *0.8%* |
| **Feed Use** | **91,768** | **95,080** | **99,079** | **100,295** | **100,846** | **101,454** | **102,507** | **102,910** | **103,669** | **104,408** | **105,143** | **105,781** |
| *% Growth* | | *3.6%* | *4.2%* | *1.2%* | *0.5%* | *0.6%* | *1.0%* | *0.4%* | *0.7%* | *0.7%* | *0.7%* | *0.6%* |
| *% Feed Use/Production* | *68.5%* | *66.9%* | *69.9%* | *70.3%* | *70.0%* | *69.8%* | *69.8%* | *69.6%* | *69.3%* | *69.3%* | *69.2%* | *69.1%* |

Source: FAPRI, 2002

FAPRI projects world barley production to increase to reach 62,163,000 Mt in 2011-2012, the average growth rate for the 2000/01 to 2011/12 period is projected to be 1.3% varying from 0.7% to 2.9%. FAPRI projects feed use to increase to 37,474,000 Mt, the average growth rate for the 2000/01 to 2011/12 period is projected to be 2.7%, higher than the average growth rate of sorghum production. The proportion of sorghum production utilised for feed use is projected vary between 51.1% to 64.0%, on average for the 2000-2001 to 2011-2012 period it is projected to equal 60.5%.

**Figure 17:** FAPRI World Sorghum Projection

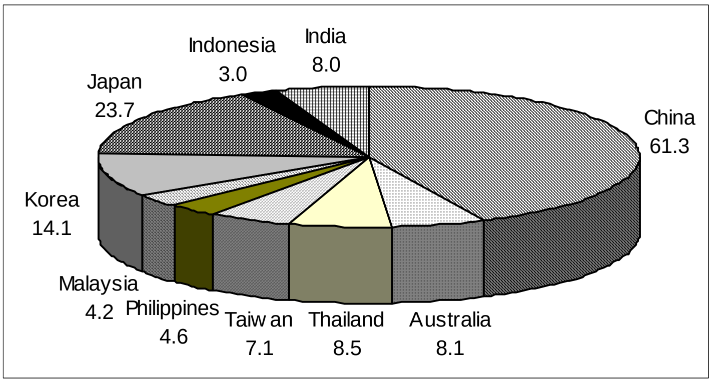
| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 | 08/09 | 09/10 | 10/11 | 11/12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **World Sorghum** | **(Thousand Metric Tons)** | | | | | | | | | | | |
| **Production** | **53,698** | **55,274** | **56,657** | **57,688** | **58,081** | **58,757** | **59,368** | **59,895** | **60,502** | **61,030** | **61,611** | **62,163** |
| *% Growth* | | *2.9%* | *2.5%* | *1.8%* | *0.7%* | *1.2%* | *1.0%* | *0.9%* | *1.0%* | *0.9%* | *1.0%* | *0.9%* |
| **Feed Use** | **28,818** | **28,232** | **35,924** | **36,908** | **36,791** | **36,971** | **37,147** | **37,162** | **37,197** | **37,262** | **37,370** | **37,474** |
| *% Growth* | | *-2.0%* | *27.2%* | *2.7%* | *-0.3%* | *0.5%* | *0.5%* | *0.0%* | *0.1%* | *0.2%* | *0.3%* | *0.3%* |
| *% Feed Use/Production* | *53.7%* | *51.1%* | *63.4%* | *64.0%* | *63.3%* | *62.9%* | *62.6%* | *62.0%* | *61.5%* | *61.1%* | *60.7%* | *60.3%* |

Source: FAPRI, 2002

## 6.4 World Industrial Feed Production

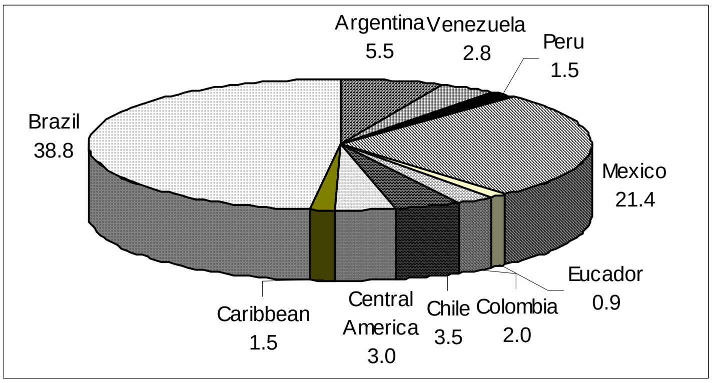
The following charts reveal Industrial Feed Production in each country for each region.

**Figure 18:** Asia-Pacific Industrial Feed Production 2002 (millions metric tons)



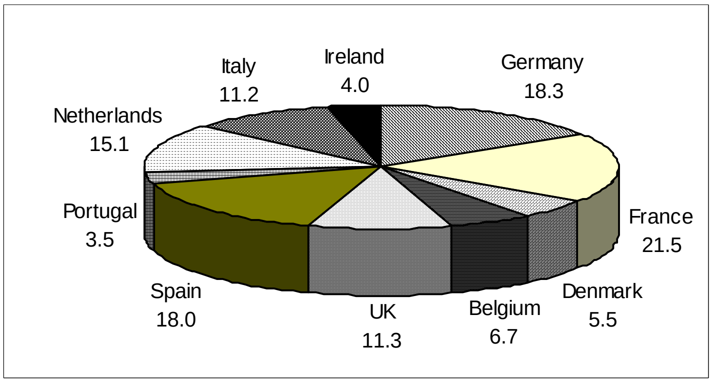

Source: Feed International, January 2003

**Figure 19:** Latin America Industrial Feed Production 2002 (millions metric tons)



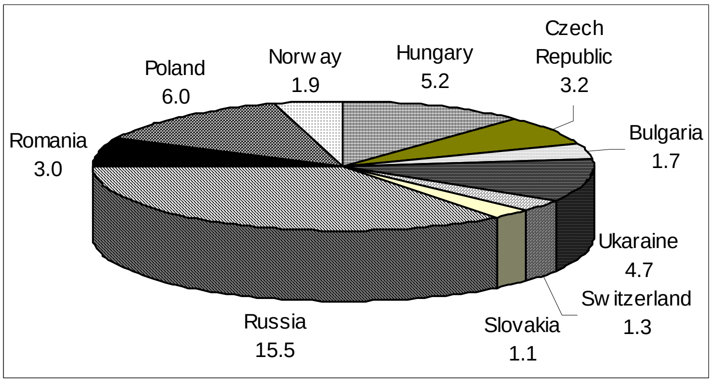

Source: Feed International, January 2003

**Figure 20:** European Union Industrial Feed Production 2002 (millions metric tons)



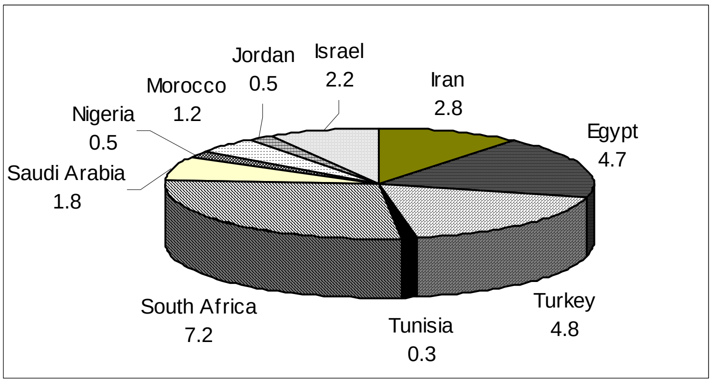

Source: Feed International, January 2003

**Figure 21:** Non-EU Europe Industrial Feed Production 2002 (millions metric tons)



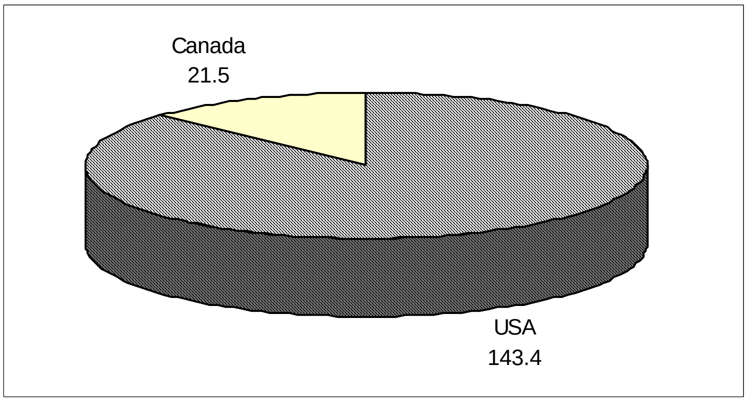

Source: Feed International, January 2003

**Figure 22:** Middle East & Africa Industrial Feed Production 2002 (millions metric tons)




Source: Feed International, January 2003

**Figure 23:** North America Industrial Feed Production 2002 (millions metric tons)




Source: Feed International, January 2003

# 7. AUSTRALIAN LIVESTOCK AND LIVESTOCK PRODUCT SITUATION AND OUTLOOK

Figures 24 and 25show comparative projections for the Australian Cattle Industry by MLA, ABARE and FAPRI.

**Figure 24:** MLA Situation and Outlook for the Australian Cattle Industry

| | 1998 | 1999 | 2000 | 2001 | 2002 | *2003* | *2004* | *2005* | *2006* | *2007* |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cattle numbers ('000)*** | 26,851 | 26,850 | 27,100 | 27,721 | 28,000 | *26,900* | *27,500* | *28,400* | *29,200* | *29,800* |
| percentage change | -0.2% | 0.0% | 0.9% | 2.3% | 1.0% | *-3.9%* | *2.2%* | *3.3%* | *2.8%* | *2.1%* |
| **Slaugtherings ('000 head)** | | | | | | | | | | |
| cattle | 8,100 | 7,653 | 7,578 | 7,779 | 7,960 | *7,380* | *7,200* | *7,500* | *7,900* | *8,300* |
| calves | 1,224 | 1,113 | 1,080 | 956 | 1,070 | *950* | *935* | *1,030* | *1,130* | *1,180* |
| total | 9,324 | 8,766 | 8,658 | 8,735 | 9,030 | *8,330* | *8,135* | *8,530* | *9,030* | *9,480* |
| **Avg carcase weight (kg)** | 240 | 257 | 262 | 262 | 258 | *258* | *265* | *267* | *269* | *270* |
| **Production ('000 tonnes carcase weight)** | | | | | | | | | | |
| total beef and veal | 1,989 | 2,004 | 2,023 | 2,072 | 2,090 | *1,935* | *1,935* | *2,060* | *2,170* | *2,280* |
| **Cattle exports ** ('000 head)** | 621 | 844 | 896 | 822 | 978 | *945* | *920* | *950* | *1,000* | *1,100* |
| **Beef exports** ('000 tonnes)** | | | | | | | | | | |
| total, carcase weight | 1,282 | 1,272 | 1,335 | 1,407 | 1,362 | *1,295* | *1,300* | *1,375* | *1,365* | *1,545* |
| total, shipped weight | 856 | 868 | 902 | 947 | 920 | *875* | *880* | *930* | *990* | *1,070* |
| **Domestic utilisation ('000 tonnes c/c weight)** | | | | | | | | | | |
| imports | 5 | 5 | 5 | 2 | 2 | *2* | *2* | *2* | *2* | *2* |
| total, carcase weight | 689 | 725 | 684 | 655 | 725 | *635* | *630* | *660* | *700* | *730* |
| kg/head | 37.2 | 38.2 | 35.7 | 34.2 | 38.2 | *33.5* | *32.0* | *33.0* | *34.7* | *36.0* |

Source: MLA, 2003

Note: * As at 31 March until 1999, 30 June from 2000; ** excl. canned/misc, shipped weight. Figures in italics indicated forecasts

**Figure 25:** FARPI and ABARE Projections for Australian Cattle Industry

| **FARPI Projection** | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Million Head** | | | | | | | | | | |
| Cattle Inventories (start) | 27.1 | 27.9 | 28.9 | 29.9 | 30.9 | 31.8 | 32.4 | 32.8 | 33.1 | 32.8 | 32.1 |
| *% change* | | *3.0%* | *3.5%* | *3.5%* | *3.2%* | *3.1%* | *1.8%* | *1.3%* | *0.6%* | *-0.7%* | *-2.1%* |
| | **Thousand Metric Tonnes** | | | | | | | | | | |
| Beef Production | 2,000 | 2,038 | 2,099 | 2,165 | 2,188 | 2,255 | 2,260 | 2,233 | 2,221 | 2,208 | 2,179 |
| *% change* | | *1.9%* | *3.0%* | *3.1%* | *1.1%* | *3.0%* | *0.2%* | *-1.2%* | *-0.6%* | *-0.6%* | *-1.3%* |

Source: FAPRI, 2002

| **ABARE Outlook** | 2000-01 | 2001-02 | 2002-03 | 2003-04 | 2004-05 | 2005-06 | 2006-07 | 2007-08 |
|---|---|---|---|---|---|---|---|---|
| | **Million** | | | | | | | |
| Cattle Numbers | 27.7 | 28.5 | 27.2 | 27 | 27.6 | 28.2 | 28.6 | 28.9 |
| Beef Numbers | 24.5 | 25.4 | 24.2 | 23.9 | 24.5 | 25 | 25.4 | 25.7 |
| *% change* | | *3.7%* | *-4.7%* | *-1.2%* | *2.5%* | *2.0%* | *1.6%* | *1.2%* |
| | **KT** | | | | | | | |
| Production | 2080 | 2034 | 2104 | 1740 | 1816 | 2048 | 2141 | 2196 |
| *% change* | | *-2.2%* | *3.4%* | *-17.3%* | *4.4%* | *12.8%* | *4.5%* | *2.6%* |

Source: ABARE, March 2003

Figures 26, 27 and 28 show Australian Pig Industry projections by FAPRI, ABARE and APL.

**Figure 26:** FAPRI, and ABARE Australian Pig Projections

| **FARPI Projection** | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **(Million Head)** | | | | | | | | | | |
| Hog Inventories (Start.) | 2.5 | 2.6 | 3.0 | 3.0 | 3.1 | 3.2 | 3.2 | 3.3 | 3.4 | 3.5 | 3.6 |
| *% Change* | | *4.7%* | *13.7%* | *2.6%* | *2.1%* | *3.3%* | *0.6%* | *2.8%* | *3.5%* | *1.6%* | *2.2%* |
| | **(Thousand Metric Tons)** | | | | | | | | | | |
| Production | 366 | 374 | 383 | 387 | 388 | 395 | 401 | 404 | 409 | 412 | 417 |
| *% Change* | | *2.3%* | *2.2%* | *1.1%* | *0.4%* | *1.8%* | *1.5%* | *0.8%* | *1.1%* | *0.9%* | *1.1%* |

Source: FAPRI, 2002

| ABARE Pig Outlook | 2000/01 | 2001/02 | 2002/03 | 2003/04 | 2004/05 | 2005/06 | 2006/07 | 2007/08 |
|---|---|---|---|---|---|---|---|---|
| | ('000) | | | | | | | |
| Breeding sows | 332 | 340 | 335 | 358 | 380 | 396 | 404 | 408 |
| *% Change* | | *2.4%* | *-1.5%* | *6.9%* | *6.1%* | *4.2%* | *2.0%* | *1.0%* |
| | kt | | | | | | | |
| Production | 365 | 396 | 393 | 361 | 441 | 438 | 476 | 479 |
| *% Change* | | *8.5%* | *-0.8%* | *-8.1%* | *22.2%* | *-0.7%* | *8.7%* | *0.6%* |

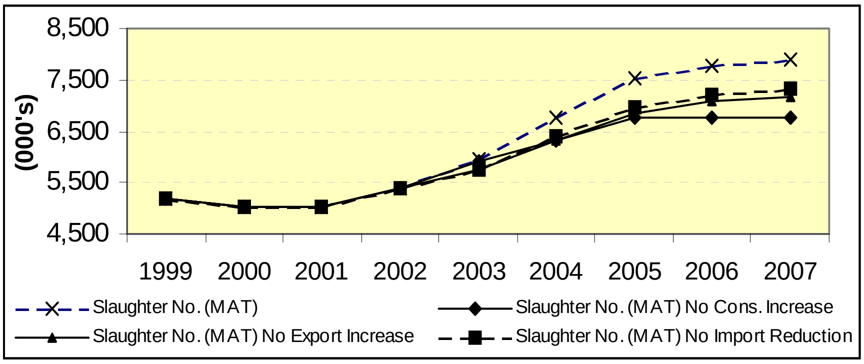
Source: ABARE, 2003

**Figure 27:** APL Australian Pig Projections

| | Aver Slaughter Weight | Imports Volume (/.56) MAT | Farmed Exports (/.8) MAT | Slaughter Numbers | Production as per ABS 12 month total | Consumption using Prod ABS | |
|---|---|---|---|---|---|---|---|
| | Kgs | Kgs CWE | Kgs CWE | MAT | tonnes | MAT | |
| Jun-99 | 73.8 | 28,255,191 | 19,863,748 | 5,176 | 369,863 | 378,254,443 | 19.97 |
| Jun-00 | 74.3 | 65,216,552 | 48,203,360 | 5,025 | 362,854 | 379,867,192 | 19.83 |
| Jun-01 | 74.2 | 46,475,964 | 55,457,390 | 5,016 | 365,167 | 356,185,574 | 18.37 |
| Jun-02 | 74.0 | 79,010,312 | 74,128,698 | 5,402 | 395,534 | 400,415,614 | 20.41 |
| Jun-03 | 74.0 | 65,841,927 | 93,009,650 | 5,958 | 440,925 | 413,756,818 | 21.05 |
| Jun-04 | 74.0 | 52,673,542 | 111,890,603 | 6,779 | 501,650 | 442,433,033 | 22.51 |
| Jun-05 | 74.0 | 39,505,156 | 130,771,555 | 7,544 | 558,279 | 467,012,646 | 23.76 |
| Jun-06 | 74.0 | 39,505,156 | 130,771,555 | 7,766 | 574,665 | 483,399,055 | 24.59 |
| Jun-07 | 74.0 | 39,505,156 | 130,771,555 | 7,876 | 582,859 | 491,592,259 | 25.01 |

Source: APL, 2003

**Figure 28:** APL Australian Pig Slaughter Projection




Source: APL, 2003
Note: Cons. = Consumption

Figures 29 and 30 show Australian Sheep Industry projections by MLA, FAPRI and ABARE.

**Figure 29:** MLA Situation and Outlook for the Australian Sheep Industry

| | 1998 | 1999 | 2000 | 2001 | 2002 | *2003* | *2004* | *2005* | *2006* | *2007* |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sheep & Lamb numbers*('000)** | | | | | | | | | | |
| at Jun 30 | 117,491 | 115,456 | 118,550 | 110,928 | 107,000 | *101,000* | *98,500* | *99,300* | *100,600* | *102,300* |
| % change | -2.3% | -1.7% | 2.7% | -6.4% | -3.5% | *-5.6%* | *-2.5%* | *0.8%* | *1.3%* | *1.7%* |
| **Slaugtherings ('000 head)** | | | | | | | | | | |
| sheep | 15,588 | 15,457 | 16,358 | 15,815 | 14,875 | *12,150* | *11,150* | *10,650* | *10,850* | *11,250* |
| lamb | 15,605 | 16,392 | 18,456 | 17,911 | 17,100 | *16,200* | *17,150* | *19,300* | *20,150* | *20,600* |
| **Avg carcases weight (kg)** | | | | | | | | | | |
| sheep | 20.6 | 21.0 | 21.2 | 20.6 | 20.0 | *21.0* | *21.0* | *21.0* | *21.0* | *21.0* |
| lamb | 19.2 | 19.5 | 20.0 | 19.7 | 19.8 | *20.2* | *20.5* | *20.7* | *20.9* | *21.0* |

| | 1998 | 1999 | 2000 | 2001 | 2002 | *2003* | *2004* | *2005* | *2006* | *2007* |
|---|---|---|---|---|---|---|---|---|---|---|
| **Production ('000 tonnes carcase weight)** | | | | | | | | | | |
| mutton | 322 | 325 | 345 | 326 | 297 | *255* | *235* | *225* | *227* | *235* |
| lamb | 300 | 318 | 367 | 353 | 340 | *327* | *350* | *400* | *420* | *433* |
| **Sheep exports ('000 head)** | 4,980 | 5,026 | 5,421 | 6,812 | 6,155 | *5,700* | *5,600* | *5,700* | *5,800* | *5,900* |
| **Exports ('000 tonnes shipped weight)** | | | | | | | | | | |
| mutton | 157 | 159 | 179 | 175 | 165 | *139* | *122* | *114* | *116* | *121* |
| lamb | 78 | 89 | 112 | 110 | 101 | *95* | *107* | *125* | *133* | *138* |
| **Domestic utilisation ('000 tonnes carcase weight)** | | | | | | | | | | |
| mutton | 112 | 115 | 109 | 101 | 79 | *72* | *72* | *72* | *73* | *76* |
| kg/head | 6.0 | 6.1 | 5.7 | 5.2 | 4.1 | *3.6* | *3.6* | *3.6* | *3.6* | *3.7* |
| lamb | 213 | 218 | 243 | 228 | 224 | *220* | *229* | *255* | *270* | *276* |
| kg/head | 11.4 | 11.4 | 12.7 | 11.8 | 11.5 | *11.2* | *11.2* | *11.5* | *13.2* | *13.5* |

Source: MLA, 2003

Note: * As at 31 March until 1999, 30 June from 2000; Figures in italics indicated forecasts S

**Figure 30:** FAPRI and ABARE Projections for the Australian Sheep Industry

| **FARPI** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sheep Numbers** | **(Million Head)** | | | | | | | | | | |
| Inventories (Beg.) | 118.3 | 119.5 | 121.6 | 122.5 | 122.1 | 120.9 | 118.2 | 115.3 | 112.1 | 108.1 | 103.5 |
| *% change* | | *1.0%* | *1.7%* | *0.8%* | *-0.3%* | *-1.0%* | *-2.2%* | *-2.5%* | *-2.8%* | *-3.5%* | *-4.2%* |
| **Production** | **(Thousand Metric Tons)** | | | | | | | | | | |
| Lamb and Mutton | 639 | 646 | 648 | 644 | 632 | 621 | 606 | 586 | 564 | 541 | 519 |
| *% change* | | *1.0%* | *0.3%* | *-0.5%* | *-1.8%* | *-1.7%* | *-2.4%* | *-3.4%* | *-3.8%* | *-4.0%* | *-4.1%* |
| *Source: FAPRI, 2003* | | | | | | | | | | | |
| **ABARE** | **2000-01** | **2001-02** | **2002-03** | **2003-04** | **2004-05** | **2005-06** | **2006-07** | **2007-08** | | | |
| **Numbers** | ***Million*** | | | | | | | | | | |
| Sheep | 111 | 103 | 97 | 103 | 104 | 108 | 111 | 115 | | | |
| *% change* | | *-7.2%* | *-5.8%* | *6.2%* | *1.0%* | *3.8%* | *2.8%* | *3.6%* | | | |
| **Production** | **kt** | | | | | | | | | | |
| Mutton | 348 | 282 | 312 | 237 | 292 | 292 | 288 | 305 | | | |
| *% change* | | *-19%* | *10.6%* | *-24%* | *23.2%* | *0.0%* | *-1.4%* | *5.9%* | | | |
| Lamb | 367 | 349 | 340 | 320 | 330 | 343 | 348 | 357 | | | |
| *% change* | | *-4.9%* | *-2.6%* | *-5.9%* | *3.1%* | *3.9%* | *1.5%* | *2.6%* | | | |

Source: ABARE, March 2003

Figure 31 shows Australian Dairy Industry Projections by FAPRI and ABARE.

**Figure 31:** Australian Dairy Industry Projections

| **FAPRI** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Numbers** | **(Thousand Head)** | | | | | | | | | | |
| Milk Cow | 2,206 | 2,215 | 2,220 | 2,217 | 2,207 | 2,203 | 2,201 | 2,193 | 2,186 | 2,179 | 2,173 |
| *% Change* | | *0.4%* | *0.2%* | *-0.1%* | *-0.5%* | *-0.2%* | *-0.1%* | *-0.4%* | *-0.3%* | *-0.3%* | *-0.3%* |
| **Production** | **(Thousand Metric Tons)** | | | | | | | | | | |
| Milk | 10,865 | 11,102 | 11,261 | 11,374 | 11,463 | 11,660 | 11,827 | 11,930 | 12,063 | 12,195 | 12,349 |
| *% Change* | | *2.2%* | *1.4%* | *1.0%* | *0.8%* | *1.7%* | *1.4%* | *0.9%* | *1.1%* | *1.1%* | *1.3%* |
| Butter | 175 | 182 | 182 | 180 | 179 | 182 | 184 | 183 | 184 | 184 | 186 |
| *% Change* | | *4.0%* | *0.0%* | *-1.1%* | *-0.6%* | *1.7%* | *1.1%* | *-0.5%* | *0.5%* | *0.0%* | *1.1%* |
| Cheese | 350 | 363 | 376 | 389 | 401 | 413 | 425 | 437 | 449 | 461 | 473 |
| *% Change* | | *3.7%* | *3.6%* | *3.5%* | *3.1%* | *3.0%* | *2.9%* | *2.8%* | *2.7%* | *2.7%* | *2.6%* |

Source: FARPI, 2002

| ABARE Outlook | 2000/ 01 | 2001/ 02 | 2002/ 03 | 2003/ 04 | 2004/ 05 | 2005/ 06 | 2006/ 07 | 2007/ 08 |
|---|---|---|---|---|---|---|---|---|
| **Numbers** | **000** | | | | | | | |
| Cow | 2,176 | 2,123 | 2,055 | 2,086 | 2,125 | 2,157 | 2,189 | 2,220 |
| *% Change* | | *-2.4%* | *-3.2%* | *1.5%* | *1.9%* | *1.5%* | *1.5%* | *1.4%* |
| | **ML** | | | | | | | |
| **Production** | | | | | | | | |
| Total Milk | 10,545 | 11,271 | 10,160 | 10,333 | 10,624 | 10,883 | 11,167 | 11,436 |
| *% Change* | | *6.9%* | *-9.9%* | *1.7%* | *2.8%* | *2.4%* | *2.6%* | *2.4%* |
| | **kt** | | | | | | | |
| Butter | 151 | 164 | 149 | 146 | 157 | 155 | 159 | 163 |
| *% Change* | | *8.6%* | *-9.1%* | *-2.0%* | *7.5%* | *-1.3%* | *2.6%* | *2.5%* |
| Cheese | 376 | 431 | 396 | 361 | 354 | 374 | 382 | 391 |
| *% Change* | | *14.6%* | *-8.1%* | *-8.8%* | *-1.9%* | *5.6%* | *2.1%* | *2.4%* |

Source: ABARE, March 2003.

Note: Butter includes the butter equivalence of butter oil, butter concentrate, ghee and dry butter fat

Figure 32 shows projections for the Australian Broiler Industry by FAPRI and ABARE.

**Figure 32:** Australian Broiler Projection

| FAPRI Projection | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Production** | **(Thousand Metric Tons)** | | | | | | | | | | | |
| Broiler | 566 | 589 | 597 | 607 | 614 | 620 | 635 | 644 | 648 | 658 | 668 | 679 |
| *% Change* | | 4.1% | 1.4% | 1.7% | 1.2% | 1.0% | 2.3% | 1.4% | 0.7% | 1.5% | 1.5% | 1.7% |

Source: FAPRI, 2002

| ABARE Outlook | 2000/01 | 2001/02 | 2002/03 | 2003/04 | 2004/05 | 2005/06 | 2006/07 | 2007/08 |
|---|---|---|---|---|---|---|---|---|
| **Production** | **kt** | | | | | | | |
| Broiler | 657 | 704 | 752 | 766 | 800 | 833 | 868 | 877 |
| *% Change* | | 7.2% | 6.8% | 1.9% | 4.4% | 4.1% | 4.2% | 1.0% |

Source: ABARE, March 2003

# 8. AUSTRALIAN GRAIN PRODUCTION AND USE

The following figures show Australian grain production, use, stock on hand and projection statistics.

**Figure 33:** Australian Grain Production by State 2001/2002

| | NSW | VIC | QLD | WA | SA | TAS | Australia |
|---|---|---|---|---|---|---|---|
| Wheat (kt) | 8,257 | 2,812 | 929 | 7,931 | 4,897 | 27 | 24,854 |
| Barley (kt) | 1,389 | 1,692 | 184 | 2,243 | 2,891 | 25 | 8,423 |
| Oats (kt) | 331 | 352 | 6 | 567 | 171 | 12 | 1,439 |
| Sorghum (kt) | 785 | 6 | 1,331 | 0 | 0 | 0 | 2,129 |
| Maize (kt) | 330 | 7 | 175 | 9 | 0 | 0 | 521 |
| Triticale (kt) | 373 | 235 | 5 | 35 | 109 | 6 | 532 |

Source: ABARE, 2002

Note: Australian totals may not be equal as a result of rounding and the inclusion of data for the Australian Capital Territory.

**Figure 34:** Australian Production and Grain Use

| Component | Australian Production (kt) | Exports (kt) | Domestic Use (kt) | Feed Use (kt) | % of Production Feed use |
|---|---|---|---|---|---|
| | **2001/2002** | | | | |
| Wheat[1] | 24,854 | 16,304 | 5,427 | 2,700 | 10.9% |
| Barley[1] | 8,423 | 4,998 | 2,500 | 2,200 | 26.1% |
| Sorghum[1] | 2,123 | 426 | 1,702 | 1,699 | 80.0% |
| Maize[1] | 521 | 75 | 467 | 365 | 70.1% |
| Oats[1] | 1,439 | 190 | 1,249 | 1090 | 75.7% |
| Triticale[b1] | 532 | | 532 | 519 | 97.6% |
| | **2000** | | | | |
| Millets[2] | 56.8 | 24.2 | 32.6 | | |

Sources: 1 = ABARE, 18 February 2003 Australian Crop Report; 2=FAOSTAT, 2003
Note: a = Calculated as a residual: production less exports less other domestic uses less change in stocks
b = Includes small quantities of triticale for export

**Figure 35:** Australian Protein Meals, Oilseeds and Pulses

| Component | Australian Production (kt) | Exports (kt) | Domestic Use (kt) | Imports (kt)[2] |
|---|---|---|---|---|
| | | **2001/02** | | |
| Canola[1] | 1,797 | 1,380 | 395 | • Oilseeds = 0.092<br>• Oils = 3.282 |
| Cottonseed[2] | 979.8 | • Oilseeds = 593.64<br>• Oils = 2.49<br>• Oilseed meal = 31.92(a) | n/a | • Oils = 0.64 |
| Linseed[2] | 9.1 | • Oilseed = 0.03<br>• Oil = 0.30<br>• Oilseed meal =0.74 | n/a | • Oilseeds = 1.04<br>• Oils = 2.43 |
| Soybeans[2] | 70.4 | • Oilseed = 5.42<br>• Oil = 2.21<br>• Oilseed meal = 1.78 | n/a | • Oilseed = 0.31<br>• Oil = 10.89<br>• Oilseed meal = 258.76 |
| Lupins[1] | 1,220 | 713 | 391 (b) | n/a |
| Field Peas[1] | 416 | 432 (c) | 75 (b) | n/a |
| Chickpeas[1] | 258 | 283 (c) | 46 (b) | n/a |

Sources: 1 = ABARE, 18 February 2003 Australian Crop Report; 2 = ABARE, 2002
Notes: a = includes sunflower seed oilseed meal exports; b = calculated as a residual: production less exports less other domestic uses less change in stocks; c = Production may not equal the sum of apparent domestic use and exports in any one year due to reductions or increases in stock levels

**Figure 36:** ABARE Stocks of Grain on Hand for Major Grain Storage Operators - Australia

| | 31 Dec 2002 (kt) | 31 Jan 2003 (kt) | 28 Feb 2003 kt |
|---|---|---|---|
| **Wheat (In storage & handling)** | | | |
| Milling | 9,634 | 9,061 | 8,317 |
| Feed | 2,555 | 2,373 | 2,163 |
| On-Farm | 1,241 | na | na |
| **Total** | **13,430** | **11,434** | **10,480** |
| **Barley (in storage & handling)** | | | |
| Malting | 1,838 | 1,683 | 1,484 |
| Feed | 1,633 | 1,488 | 1,370 |
| On-Farm | 772 | na | na |
| **Total** | **4,242** | **3,170** | **2,854** |
| **Oats** | | | |
| In storage and handling | 128 | 137 | 143 |
| On-Farm | 993 | na | na |
| **Triticale** | | | |
| In storage & handling | 46 | 48 | 48 |

| | 31 Dec 2002 (kt) | 31 Jan 2003 (kt) | 28 Feb 2003 kt |
|---|---|---|---|
| On-Farm | 168 | na | na |
| **All Grains** | | | |
| In storage & handling | 17,297 | 16,214 | 14,824 |
| On-Farm | 3,731 | na | na |
| **Total** | **21,028** | **16,214** | **14,824** |

Source: ABARE, 2003

**Figure 37:** Australian FAPRI and ABARE Grains Projection

| FAPRI | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 | 08/09 | 09/10 | 10/11 | 11/12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Production (Thousand Metric Tons) | | | | | | | | | | | |
| Wheat | 23,766 | 22,000 | 22,164 | 22,520 | 22,941 | 23,404 | 23,890 | 24,424 | 24,858 | 25,346 | 25,810 | 26,328 |
| *% Change* | | *-7.4%* | *0.7%* | *1.6%* | *1.9%* | *2.0%* | *2.1%* | *2.2%* | *1.8%* | *2.0%* | *1.8%* | *2.0%* |
| Corn | 355 | 460 | 469 | 475 | 479 | 486 | 497 | 508 | 511 | 519 | 526 | 537 |
| *% Change* | | *29.6%* | *2.0%* | *1.4%* | *0.8%* | *1.4%* | *2.2%* | *2.1%* | *0.7%* | *1.6%* | *1.4%* | *2.0%* |
| Sorghum | 2,109 | 2,200 | 2,219 | 2,254 | 2,275 | 2,299 | 2,323 | 2,346 | 2,367 | 2,389 | 2,412 | 2,435 |
| *% Change* | | *4.3%* | *0.9%* | *1.6%* | *0.9%* | *1.0%* | *1.1%* | *1.0%* | *0.9%* | *0.9%* | *1.0%* | *1.0%* |
| Barley | 7,196 | 7,000 | 7,158 | 7,174 | 7,201 | 7,207 | 7,329 | 7,391 | 7,427 | 7,466 | 7,531 | 7,606 |
| *% Change* | | *-2.7%* | *2.3%* | *0.2%* | *0.4%* | *0.1%* | *1.7%* | *0.8%* | *0.5%* | *0.5%* | *0.9%* | *1.0%* |

Source: FAPRI, 2002

| ABARE | 00-01 | 01-02 | 02-03 | 03-04 | 04-05 | 05-06 | 06-07 | 07-08 | na | na | na | na |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Production (kt) | | | | | | | | | | | |
| Wheat | 22,108 | 24,854 | 9,385 | 24,305 | 24,001 | 23,756 | 23,514 | 23,274 | | | | |
| *% Change* | | *12.4%* | *-62%* | *159%* | *-1.3%* | *-1.0%* | *-1.0%* | *-1.0%* | | | | |
| Barley | 6,743 | 8,423 | 3,268 | 6,635 | 6,311 | 6,299 | 6,339 | 6,396 | | | | |
| *% Change* | | *24.9%* | *-61%* | *103%* | *-4.9%* | *-0.2%* | *0.6%* | *0.9%* | | | | |
| Oats | 1,050 | 1,439 | 725 | 1,317 | 1,267 | 1,270 | 1,276 | 1,247 | | | | |
| *% Change* | | *37.0%* | *-50%* | *81.7%* | *-3.8%* | *0.2%* | *0.5%* | *-2.3%* | | | | |
| Triticale | 841 | 532 | 269 | 527 | 473 | 466 | 462 | 467 | | | | |
| *% Change* | | *-37%* | *-49%* | *95.9%* | *-10%* | *-1.5%* | *-0.9%* | *1.1%* | | | | |
| Sorghum | 1,935 | 2,123 | 755 | 2,048 | 2,054 | 2,044 | 2,033 | 2,064 | | | | |
| *% Change* | | *9.7%* | *-64%* | *171%* | *0.3%* | *-0.5%* | *-0.5%* | *1.5%* | | | | |
| Maize | 345 | 521 | 259 | 456 | 450 | 449 | 444 | 436 | | | | |
| *% Change* | | *51.0%* | *-50%* | *76.1%* | *-1.3%* | *-0.2%* | *-1.1%* | *-1.8%* | | | | |

Source: ABARE, March 2003

**Figure 38:** Australian Oilseed and Protein Meal Production by State

| | NSW | VIC | QLD | WA | SA | TAS |
|---|---|---|---|---|---|---|
| | kt | | | | | |
| Canola | 716 | 355 | 1 | 439 | 409 | 1 |
| Cottonseed | 720.6 | 0 | 259.3 | 0 | 0 | 0 |
| Linseed | 2.4 | 4 | 1 | 1.3 | 0.5 | 0 |
| Soybeans | 50 | 2 | 19 | 0 | 0 | 0 |
| Lupins | 125 | 42 | 0 | 896 | 156 | 0 |
| Field Peas | 33 | 130 | 0 | 45 | 208.4 | 0 |
| Chickpeas | 161.5 | 23.5 | 61 | 11 | 1 | 0 |

Source: ABARE, 2002

**Figure 39:** Australian Hay Production by State 1999

| | NSW | VIC | QLD | SA | WA | TAS |
|---|---|---|---|---|---|---|
| Cereal crops cut for hay | 410 | 362 | 86 | 418 | 539 | 10 |
| Lucerne cut for hay | 406 | 199 | 196 | 86 | 16 | 11 |
| Other Pastures and grasses cut for hay | 527 | 1,925 | 47 | 242 | 365 | 239 |

Source: ABS, 2003

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# 9. REVIEW OF FEED GRAIN REQUIREMENTS FOR FEEDLOTS

Prepared by: Matthew H. George, BVSc, MS, PhD - Nutrition Services Associates Pty Ltd, 2003.

Nutrition Service Associates (NSA) is an Australian subsidiary of an international feedlot nutrition consultancy group based in Hereford, Texas (USA). NSA has a presence consulting to approximately 35% of the US feed beef production and is privileged with a similar presence in the Australian feedlot industry. Since 1989, NSA has been actively providing feedlot nutritional and animal performance consultancy support to feedyards located in Queensland, New South Wales and Victoria.

# CONTENTS

**INTRODUCTION .......... 2**

**STATISTICAL COMPENDIUM .......... 3**

**1. EXECUTIVE SUMMARY .......... 27**

**2. AUSPICES .......... 27**

**2.1 Cattle Feeding Region and Occupancy .......... 28**

**2.2 Feedlot grain processing technology .......... 28**

**2.3 Grain Purchasing Criteria .......... 29**

**2.4 Feedlot Grain Utilisation patterns in varying Climatic Conditions .......... 29**

***2.4.1 Normal year with Dual Australian Continental Summer and Winter crops .......... 29***

***2.4.2 Seasonal drought with low winter crop .......... 30***

***2.4.3 Seasonal drought with low summer crop .......... 31***

***2.4.4 Multiseason drought .......... 31***

***2.4.5 Extreme ongoing continental drought .......... 32***

**2.5 Secondary Issues to Feedstuff Supply Under Multiseason and Extreme Continental Drought Conditions .......... 33**

***2.5.1 Water .......... 33***

***2.5.2 Roughage .......... 34***

**2.6 Utilisation Potential of Alternative Feedstuffs in Australian Feedlots .......... 34**

**2.7 Estimates of Total Grain Consumption Requirements by the Australian Feedlot Sector .......... 37**

**3. CONCLUSION....................................................................38**

**GRAIN DEMAND AND ECONOMIC COST OF DROUGHT TO THE GRASS FED RUMINANT SECTOR MULTIVARIABLE MODEL FROM A NATIONAL PERSPECTIVE ........................40**

**FEED GRAINS AND THE AUSTRALIAN DAIRY INDUSTRY 54**

**PORK INDUSTRY FEEDSTUFF SECURITY MANAGEMENT STRATEGIES...............................................................................87**

**FODDER SUPPLY AND DEMAND SCENARIOS AND RISK MANAGEMENT OPTIONS FOR THE LIVESTOCK INDUSTRIES...............................................................................94**

**FODDER SUPPLY AND DEMAND .........................................95**

**VARIABILITY IN SUPPLY OF FEED GRAINS ASSOCIATED WITH CLIMATIC VARIABILITY IN AUSTRALIA ..................122**

**AQIS CONDITIONS FOR THE IMPORT OF VARIOUS GRAINS.............................................................................134**

# 1. EXECUTIVE SUMMARY

Australian feedlot production is dependent on the feeding of high energy feedstuffs. Domestic grains are the primary energy source used by feedlot cattle, the specifics of which are determined by feedlot region, available grain processing technology, and climatic conditions. Wheat and barley are the most widely utilized feed grains under all seasonal conditions. Sorghum is widely utilized by the Queensland and Northern NSW feedlot industry, the extent of which is determined by seasonal availability and the relative price of other cereals. Under increasingly severe Australian drought conditions, feedlot grain requirements increase from 2.73 Million Tonnes to 2.83 Million Tonnes because of reduced white cottonseed availability. Further defined are shifts to grain imported from Southern and Western States into Eastern cattle feeding regions. Suitable alternative energy dense feedstuffs are limited in availability in Australia. If suitable supplies were available, maximum utilization by the feedlot industry would be 0.57 Million Tonnes, prior to reductions in feedlot cattle performance. Absolute annual feedlot grain requirements under maximum alternate feedstuff availability remain at 2.26 Million Tonnes.

# 2. AUSPICES

Intensive feeding of cattle (feedlotting) developed as a methodology to rapidly and cost effectively grow cattle under an array of seasonal climatic conditions to a desired degree of finish (fat composition) to meet predetermined market specifications. When the energy content of a diet fed to cattle does not limit growth, the empty body contains an ever increasingly smaller percentage of protein (muscle) and increasing proportion of fat.

The success of feedlotting is dependent of the cost of energy and other nutritional inputs expressed on a cost of live weight gain basis, relative to achieving a desired carcass composition.

Feed intake by ruminants is largely related to the dietary energy concentration, with the concept that consumption of less digestible, low energy (higher fibre) diets is regulated by physical factors such as rumen fill and rate of digesta passage, whereas, in contrast consumption of high-energy (usually low-fibre) diets is controlled by the animals energy demands and metabolic factors (NRC, 1987). Feeding of higher energy (lower roughage) diets will tend to maximize animal growth, with fewer physical limitations.

Therefore, Australian (and global) feedlot production is dependent on the feeding of high energy feedstuffs.

On the basis of suitability, bulk handling characteristics, freight, and lack of suitable alternatives, grains (wheat, barley, triticale, corn and sorghum) are the primary source of energy used in intensively fed beef cattle.

When expressed on a 100% dry matter basis (DMB) cattle feedlot rations usually contain by composition between 70 and 80% grain (NSA, 2003). This equates to an average daily consumption (100% DMB) of 10.8 Kg per Standard Cattle Unit (SCU) (NSA, 2003b). Expressed as a daily grain intake per SCU, this represents 7.8 to 8.1 Kg (100% DMB), or 8.8 to 9.2 Kg (as-received).

This paper explores the requirements for feed grains and possible utilization of any alternate feedstuffs in normal and several drought induced seasonal conditions. Several scenarios are presented, referenced on the basis of:

(a) Cattle feeding region, i.e., Southern (Riverina NSW, VIC/TAS, SA and WA) and Northern (NE NSW and Qld);

(b) Feedlot grain processing technology (dry roll/temper versus steam flaking/reconstitution); and,

(c) Continental environmental conditions, i.e. location and extent of droughts directly impacting cereal grain production.

## 2.1 Cattle Feeding Region and Occupancy

Australian Lot Feeding Association Survey data (ALFA, 2003) identifies the following feedlot utilization (Table 1).

**Table 1:** Australian Feedlot Utilization and SCU Equivalent by Cattle Feeding Region

| | Feedlot occupancy, 1000 head | | |
|---|---|---|---|
| **Region** | **Export** | **Domestic** | **SCU Equivalent** |
| Queensland | 319 | 103 | 406 |
| Northern NSW | 138 | 25 | 159 |
| Total North | 458 | 128 | 565 |
| | | | |
| Southern NSW | 138 | 25 | 159 |
| Victoria | 41 | 11 | 50 |
| South Australia | 10 | 11 | 20 |
| Western Australia | 30 | 16 | 43 |
| Total South/Other | 220 | 63 | 272 |
| | | | |
| TOTAL | 678 | 191 | 836 |

Source: ALFA, 2003

Overall, approximately 678,000 Export/Bullocks and 191,000 domestic cattle were reported on feed in the first quarter 2003. These feedlot occupancy numbers can further be expressed on a SCU basis for calculation of feed and feed grain requirements. On the basis of primary available feed grains these cattle can be further defined as being fed in Queensland and Northern NSW (North), and, Southern and Western regions (South/Other).

## 2.2 Feedlot grain processing technology

Processing of grains can significantly improve the digestibility of cereal grains for beef cattle. The ability of rumen microbes to digest grain is primarily dependent on particle size and the integrity of the outer protein matrix that surrounds starch granules in the endosperm. The order of response to the extent of processing is, sorghum > corn > barley > triticale > wheat. Therefore, more aggressive processing technologies (requiring greater capital and operational input associated with steam flaking or extended fermentation) are required to effectively process sorghum and corn, compared to wheat, triticale and barley, if the greatest possible metabolisable energy is to be utilised by the feedlot animal.

Feedlot grain milling systems can be broadly classified as aggressive (steam flaking/reconstitution) that can, if required use significant quantities of sorghum and or corn;

versus less intense systems (dry rolling or tempered/rolled) that are better suited to using barley, triticale and wheat.

## 2.3 Grain Purchasing Criteria

Grain purchasing habits by feedlots is determined by a reference to:

(a) Raw ingredient price per unit of nutrient density delivered to the feedlot (which includes availability); minus;

(b) Grain processing costs (greater for sorghum > corn > barley > triticale = wheat); taking into consideration;

(c) Infrastructure limitations;

(d) Carcass and market goals; and,

(e) Guarantees of feedstuff quality and safety (i.e. absence of pesticide and herbicide residues).

## 2.4 Feedlot Grain Utilisation patterns in varying Climatic Conditions

Five scenarios are developed with reference to energy dense feedstuff supplies to feedlots under varying climatic patterns affecting feedstuff supply:

(a) Normal year with dual Australian Continental Summer and Winter crops;

(b) Seasonal drought with a low Winter crop;

(c) Seasonal drought with a low Summer crop;

(d) Multiseason drought (Eastern States); and

(e) Extreme ongoing Continental drought.

### *2.4.1 Normal year with Dual Australian Continental Summer and Winter crops*

During periods of dual Australian continental summer and winter crops, a number of specific comments can be with regard to energy dense feedstuff purchases by feedlots (Table 2).

**Table 2:** Normal Year Feedlot Grain Purchasing Habits

| **Normal year** | | | | | Grain intake, SCU | | | Grain composition (as-received) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Zone | Season | Milling type | WCS | 100% DMB | ration, 100% | Kg 100% DMB | Kg as-received | Grain 1 | % of grain | Grain 2 | % of grain |
| North | Apr - Sept | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 50 | Barley | 50 |
| North | Apr - Sept | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Sorghum | 66 | Wheat/Barley/Corn | 33 |
| South | Apr - Sept | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 50 | Barley/Triticale | 50 |
| South | Apr - Sept | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat | 75 | Barley | 25 |
| | | | | | | | | | | | |
| North | Oct - Feb | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 50 | Barley | 50 |
| North | Oct - Feb | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Barley | 50 | Wheat | 50 |
| South | Oct - Feb | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 30 | Barley/Triticale | 70 |
| South | Oct - Feb | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat | 50 | Barley | 50 |

White Cotton Seed (WCS), will be used (cost permitting) by many Northern and Southern feedlots as there will normally be concurrent high acreage cotton cropping and therefore WCS availability. This product will tend to be, but not exclusively, utilised to a greater extent by feedyards without steam flaking or reconstitution milling systems.

During April through September, feedlots with less intensive feedmilling systems will utilize primarily barley, wheat and combinations in the North, with some triticale (if price competitive) included in the South. In the South, feedyards with steam flaking capacity may tend to use greater quantities of wheat (50% + of grain) than barley/triticale, than feedlots with less intensive grain milling systems. Although not presented, some Northern feedyards with intensive grain milling systems may still use some sorghum (30 – 50%) inclusion during the October – February period. This will be at lower inclusion rates than during the Winter period.

Conversely, during April through September, Northern feedyards with intensive grain processing systems will primarily feed from 50 – 100% sorghum (average 66%), as this is most abundant during following the Summer cropping period. Frequently, combinations of sorghum with wheat, barley or corn may be fed during this period. From October through November, with increased availability of winter cereal grains, greater quantities of wheat and barley is utilized by Northern feedlots, especially those with intensive grain processing capability. However, some sorghum may be used during this period, but at lower inclusion rates (0 – 33%) of grain, depending upon relative price differentials from wheat and barley. During this same period, Southern feedlots (both intensive and less intensive grain processing systems) still continue to primarily utilize wheat and barley. However, lower wheat inclusions may be utilized during the peak summer period to reduce heat loads (from rapid grain fermentation).

## 2.4.2 Seasonal drought with low winter crop

During October – February and April – September periods following a low winter crop, grain utilization by Southern feedlots will remain similar to those detailed for normal cropping years (Table 3).

**Table 3:** Grain Utilization by Feedlots Following a Low Winter Crop

| Seasonal drought - Low Winter Crop | | | | | Grain intake, SCU | | | Grain composition (as-received) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 100% | ration, | Kg 100% | Kg as- | | | | |
| Zone | Season | Milling type | WCS | DMB | 100% | DMB | received | Grain 1 | % of grain | Grain 2 | % of grain |
| North | Apr - Sept | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 50 | Barley | 50 |
| North | Apr - Sept | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Sorghum | 75 | Wheat/Barley/Corn | 25 |
| South | Apr - Sept | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 50 | Barley/Triticale | 50 |
| South | Apr - Sept | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat | 75 | Barley | 25 |
| North | Oct - Feb | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 50 | Barley | 50 |
| North | Oct - Feb | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Sorghum | 66 | Wheat | 34 |
| South | Oct - Feb | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 30 | Barley/Triticale | 70 |
| South | Oct - Feb | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat | 50 | Barley | 50 |

Grain is anticipated to be purchased at a greater price. The inability to change to alternate options reflects an inability to effectively seek other suitable grains at cost-effective prices versus the limited regional grain supplies (grown and pools), or short-interstate sources (eg. South Australian grain).

However, most notably Northern feedlots with intensive grain processing systems will utilize greater inclusions of sorghum during both October – February and April – September periods. Northern feedlots with less intensive grain processing technologies will tend to remain on cereal grains at higher prices unless the differential (relative to sorghum) becomes extremely high when reductions in performance (average daily gain and feed conversion efficiency), can be offset by reduced cost-of-liveweight gain.

White cottonseed is anticipated to remain in many feedlot rations during this period, as water supplies for irrigation are available and therefore the cotton crop is not limited. Although purchase price increases, this has historically remained within a normal price relationship relative to available grains.

### 2.4.3 Seasonal drought with low summer crop

A single summer drought with low Summer crop yields will have an effect largely limited to Northern feedlots, especially those feedlots with intensive grain processing systems (Table 4).

**Table 4:** Grain Utilization by Feedlots Following a Low Summer Crop

| **Seasonal drought - Low Summer Crop** | | | | Grain intake, SCU | | | | Grain composition (as-received) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Zone | Season | Milling type | WCS | 100% DMB | ration, 100% | Kg 100% DMB | Kg as-received | Grain 1 | % of grain | Grain 2 | % of grain |
| North | Apr - Sept | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 50 | Barley | 50 |
| North | Apr - Sept | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Sorghum | 34 | Wheat/Barley/Corn | 66 |
| South | Apr - Sept | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 50 | Barley/Triticale | 50 |
| South | Apr - Sept | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat | 75 | Barley | 25 |
| | | | | | | | | | | | |
| North | Oct - Feb | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 50 | Barley | 50 |
| North | Oct - Feb | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Barley | 50 | Wheat | 50 |
| South | Oct - Feb | Temper | Yes | 10.8 | 72 | 7.776 | 8.836 | Wheat | 30 | Barley/Triticale | 70 |
| South | Oct - Feb | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat | 50 | Barley | 50 |

During these periods, feedlots with steam flaking and reconstitution will use less sorghum grain during April – September and virtually none following the Winter crop harvest. Northern feedyards with less intensive grain processing technology will not use sorghum during the April – September period as it will be well outside opportunity cost relationships.

A low Summer crop will have no effect on the ratio of different grains used by Southern feedlots over the subsequent April – September and October – February periods.

Because of little limitation to irrigation water, reasonable cotton crops are still anticipated, and although price will be higher than normal (associated with reduced dry land yields) and increased grain prices, these should remain within opportunity price relationships for many feedlots, and therefore will remain in some rations.

### 2.4.4 Multiseason drought

The impact on Australian feedlots of a multiseason drought is more dramatic than of either single Summer or Winter drought periods.

Most notable effects are:

(a) An increase in sorghum utilization by all Northern feedyards;

(b) Increased interstate movement of cereal grains, especially in Southern feedyards; and

(c) A reduction in the inclusion or removal of WCS from feedlot rations, further increasing grain requirements (Table 5).

**Table 5:** Grain Utilization by Feedlots Following a Multiseason Drought

| **Multi-season drought** | | | | | Grain intake, SCU | | | Grain composition (as-received) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 100% | ration, | Kg 100% | Kg as- | | | | |
| Zone | Season | Milling type | WCS | DMB | 100% | DMB | received | Grain 1 | % of grain | Grain 2 | % of grain |
| North | Apr - Sept | Temper | No | 10.8 | 76 | 8.208 | 9.327 | Wheat/Barley* | 50 | Sorghum | 50 |
| North | Apr - Sept | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Sorghum | 80 | Wheat/Barley* | 20 |
| South | Apr - Sept | Temper | No | 10.8 | 76 | 8.208 | 9.327 | Wheat* | 50 | Barley/Triticale* | 50 |
| South | Apr - Sept | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat* | 75 | Barley* | 25 |
| | | | | | | | | | | | |
| North | Oct - Feb | Temper | No | 10.8 | 76 | 8.208 | 9.327 | Wheat/Barley* | 75 | Sorghum | 25 |
| North | Oct - Feb | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Sorghum | 50 | Wheat/Barley* | 50 |
| South | Oct - Feb | Temper | No | 10.8 | 76 | 8.208 | 9.327 | Wheat* | 50 | Barley/Triticale* | 50 |
| South | Oct - Feb | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat* | 50 | Barley* | 50 |

*grain supplies may be from interstate sources

Feedyards with intensive grain processing technology will increase sorghum utilization to 80-100% of feedgrains during the April – September period because of greater availability than other cereals, and, greater price differential with increased demand from pastoral drought feeders that use easier grains to manage, such as barley, oats and wheat. Similarly, during the October through February period, sorghum may be used at 50% or greater of grain in feedlot rations with intensive grain processing.

During these same periods, Northern feedyards with dry rolling and tempering grain milling systems will tend to utilize some greater quantities of sorghum (50 and 25% of grain in rations), because of significantly greater price differentials versus other cereal grains. These price differences tend to be large enough whereby cost-of-gain remains similar or lower than it would be if 100% white grains are utilized.

In contrast, Southern feedyards (with intensive and less intensive milling systems) will tend to feed similar grain ratios to previous seasonal conditions, because of the absence of suitable alternatives. Some of these grain supplies may from interstate sources, namely South Australia and Western Australia.

Under these climatic conditions, reduced water allocation to cotton growers and significantly increased pastoral sector demands on WCS increase the WCS versus grain price relationship. Therefore, this commodity frequently is removed from feedlot rations with the dual negative effects of:

(a) Increasing grain requirements; and

(b) Increasing roughage requirements (i.e., silage and hay).

### 2.4.5 Extreme ongoing continental drought

During an extreme ongoing continental drought period, the supply of feed grains and energy dense feedstuffs for feedlot rations becomes muddled and relatively directionless, primarily driven by the absence of suitable replacement feedstuffs for grain (Table 6).

**Table 6:** Grain Utilization by Feedlots During an Ongoing Continental Drought

| Extreme ongoing continental drought | | | | Grain intake, SCU | | | | Grain composition (as-received) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Zone | Season | Milling type | WCS | Intake, 100% DMB | % of ration, 100% DMB | Intake/hd/d, Kg 100% DMB | Intake/hd/d, Kg as-received | Grain 1 | % of grain | Grain 2 | % of grain |
| North | Apr - Sept | Temper | No | 10.8 | 76 | 8.208 | 9.327 | Wheat/Barley/Sorghum/Corn* | 75 | Sorghum/by products** | 25 |
| North | Apr - Sept | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat/Barley/Sorghum/Corn* | 90 | Sorghum/by products** | 10 |
| South | Apr - Sept | Temper | No | 10.8 | 76 | 8.208 | 9.327 | Wheat/Barley/Sorghum/Corn* | 75 | Grain/By products** | 25 |
| South | Apr - Sept | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat/Barley/Sorghum/Corn* | 90 | Grain/By products** | 10 |
| North | Oct - Feb | Temper | No | 10.8 | 76 | 8.208 | 9.327 | Wheat/Barley/Sorghum/Corn* | 75 | Sorghum/by products** | 25 |
| North | Oct - Feb | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat/Barley/Sorghum/Corn* | 90 | Sorghum/by products** | 10 |
| South | Oct - Feb | Temper | No | 10.8 | 76 | 8.208 | 9.327 | Wheat/Barley/Sorghum/Corn* | 75 | Grain/By products** | 25 |
| South | Oct - Feb | Steam Flake | No | 10.6 | 76 | 8.056 | 9.155 | Wheat/Barley/Sorghum/Corn* | 90 | Grain/By products** | 10 |

* Interstate supply of grains
** Interstate and/or International supply of grains

Northern feedyards (both intensive and less intensive feed milling systems) will continue to used higher quantities of Sorghum, as noted for a multi-season drought, however, final individual grain demand will driven primarily by feed grain availability, ie. What else is there to feed?

Similarly, Southern feedlots will utilize whatever feedgrains can be purchased, and may begin to consider Sorghum in North-Riverina regions.

In both Northern and Southern cattle feeding regions, grain supplies will consist of a mix from local/interstate and possibly (protocols pending) imported grains.

Increased quantities of alternate energy feedstuffs and by-products may be used during these periods, depending on availability and the functional limitations of each feedstuff on a case by case basis. However, ‘real’ supplies of these alternatives to feed grains are presently limited. Only modest volumes of alternative feedstuffs and by-products can be incorporated into feedlot rations before their inclusion causes significant declines in cattle performance.

## 2.5 Secondary Issues to Feedstuff Supply Under Multiseason and Extreme Continental Drought Conditions

During periods of multiseason and extreme continental drought conditions, other feedstuff security issues arise.

### *2.5.1 Water*

In the current 2002 – 2003 drought water quality and supply are presenting profound limitations to feedlot operations in Northern and Southern feeding regions. Water is required by feedlot cattle for regulation of body temperature, growth, digestion, metabolism, excretion, hydrolysis of proteins, fat and carbohydrates; regulation of mineral homeostasis, joint lubrication, nervous system cushioning, sound transmission and sight. Restriction of water intake immediately reduces feed intake and cattle performance (Utley et al., 1970).

Water requirements (Litres/day) can be defined (Hicks et al., 1988) as

$$= -19.76 + (0.4202 \times MT) + (0.1329 \times DMI) - (6.5966 \times PP) - (1.1739 \times DS)$$

Where: MT = maximum temperature (°F)
DMI = dry matter intake (Kg)
PP = precipitation (cm/day)
DS = % dietary salt

A feedlot cannot operate without a supply of suitable quality water that meets minimum daily animal requirements and feedlot operational needs.

### *2.5.2 Roughage*

Aside from shortages of feedgrains and suitable energy dense feedstuffs, roughage supplies become increasing limited during drought periods because of:

1. A virtual absence of rainfall for dry land silage and hay crops;

2. Reduced irrigation water supplies for silage and(or) hay crops;

3. Reduced cotton plantings and harvest, therefore reduced supplies of cottonseed by-products with energy and(or) roughage value such as WCS and cottonseed hulls;

4. Lower cereal cropping activity translates into lower cereal straw or sorghum stubble supplies; and

5. Increased roughage demand from pastoral sector.

Roughage is required in feedlot diets to initially restore rumen function following marketing and transportation stresses, and protect animal health (for stomach epithelial integrity) during the initial starting and ongoing feeding period.

## 2.6 Utilisation Potential of Alternative Feedstuffs in Australian Feedlots

A large array of alternative (and by-product) feedstuffs have been cited as suitable for utilization in the rations fed to Australian feedlot cattle (MRC, 1997; Sparke et al., 1997). Extensive subject reviews are scattered through the scientific literature.

The chemical composition of by-product and industrial feed ingredients is highly variable (Wright, 1998), depending primarily on the primary plant material and the manufacturing process involved. Much older tabulated nutritional data becomes obsolete because of modern designs and efficiencies involved with newer manufacturing techniques (Feedstuffs, 1999).

Frequently, by-products that appear and calculate as an inexpensive feedstuffs, yield inferior cattle performance and in reality impair feedlot profit potential (Peters, 2000, 2001).

A summary of alternate feedstuffs as identified by previous Australian research (MRC, 1997b) with accompanying upper ration inclusion rates with indexed energy value relative to wheat are presented in Tables 7a and 7b.

**Table 7a:** Alternate Feedstuffs, Nutrient Analyses and Utilization Limitations and Energy Index Values Relative to Wheat for Feedlot Cattle

| Product | Form | Dry matter, % | ME | CP, % | Limitation to utilisation | Max ration inclusion on Dry Matter Basis, % | Max inclusion as-fed for 75% DM ration | Energy Index value 100% Dry matter basis, relative to Wheat | Energy Index value as-received relative to Wheat |
|---|---|---|---|---|---|---|---|---|---|
| Barley | Grain | 88 | 12.7 | 13.2 | None | 85 | 72.44 | 95.49 | 95.49 |
| Barley | Grain screenings | 89 | 12.1 | 13.0 | Supply | 25 | 21.07 | 90.98 | 92.01 |
| Maize, dent yellow | Grain | 88 | 13.3 | 11.2 | Supply | 85 | 72.44 | 100.00 | 100.00 |
| Maize, dent yellow | Grain, high moisture | 77 | 14.1 | 10.6 | Supply | 85 | 82.79 | 106.02 | 92.76 |
| Maize, popcorn | Grain | 90 | 14.6 | 12.8 | Supply | 85 | 70.83 | 109.77 | 112.27 |
| Maize, sweetcorn | Grain | 91 | 14.9 | 12.4 | Supply, milling logistics | 85 | 70.05 | 112.03 | 115.85 |
| Millet, Foxtail | Grain | 89 | 12.8 | 13.1 | Supply | 85 | 71.63 | 96.24 | 97.33 |
| Millet, Pearl | Grain | 90 | 12.7 | 14.3 | Supply | 85 | 70.83 | 95.49 | 97.66 |
| Oats | Grain | 89 | 12.0 | 13.3 | Fibre content | 85 | 71.63 | 90.23 | 91.25 |
| Rice | Rough rice, paddy | 89 | 12.0 | 8.4 | Palatability, silica | 20 | 16.85 | 90.23 | 91.25 |
| Rye | Grain | 87 | 12.7 | 13.8 | Supply, ergot, tannins | 20 | 17.24 | 95.49 | 94.40 |
| Sorghum | Grain | 88 | 11.5 | 10.0 | Milling infrastructure, urinary calculi | 85 | 72.44 | 86.47 | 86.47 |
| Triticale | Grain | 89 | 13.2 | 17.3 | Palatability | 50 | 42.13 | 99.25 | 100.38 |
| Wheat | Grain | 88 | 13.3 | 14.7 | None | 85 | 72.44 | 100.00 | 100.00 |
| Wheat, durum | Grain | 88 | 14.2 | 15.7 | None | 85 | 72.44 | 106.77 | 106.77 |
| Beet, common red | Roots | 13 | 12.4 | 12.5 | Supply, moisture | 10 | 57.69 | 93.23 | 13.77 |
| Beet, sugar | Roots | 20 | 13.7 | 6.8 | Supply, moisture | 10 | 37.50 | 103.01 | 23.41 |
| Cassava | Tubers, dehydrated pellets | 88 | 14.2 | 2.6 | Supply | 50 | 42.61 | 106.77 | 106.77 |
| Cassava | Tubers, fresh | 35 | 13.4 | 3.6 | Supply, moisture | 10 | 21.43 | 100.75 | 40.07 |
| Dasheen (Taro) | Tubers, fresh | 28 | 13.6 | 5.4 | Supply, moisture | 10 | 26.79 | 102.26 | 32.54 |
| Kohlrabi | Roots | 13 | 10.8 | 15.4 | Supply, moisture | 10 | 57.69 | 81.20 | 12.00 |
| Potato | Tubers fresh | 23 | 12.3 | 9.5 | Supply, moisture | 10 | 32.61 | 92.48 | 24.17 |
| Potato | Tubers, silage | 25 | 12.4 | 7.6 | Supply, moisture | 10 | 30.00 | 93.23 | 26.49 |
| Turnip | Roots, fresh | 9 | 13.9 | 13.1 | Supply, moisture | 10 | 83.33 | 104.51 | 10.69 |
| Flax, common | Grain | 90 | 19.4 | 26.0 | Supply, crude protein, palatability | 15 | 12.50 | 145.86 | 149.18 |
| Flax, common | Grain screenings | 91 | 9.5 | 18.2 | Supply, palatability | 15 | 12.36 | 71.43 | 73.86 |
| Olive | Fruit without pips, dehydrated | 93 | 8.3 | 11.6 | Supply, energy density | 10 | 8.06 | 62.41 | 65.95 |
| Rape (Canola) | Grain | 83 | 12.0 | 16.0 | Supply, crude protein, palatability | 20 | 18.07 | 90.23 | 85.10 |
| Safflower | Grain | 93 | 11.8 | 16.0 | Supply, crude protein, palatability | 20 | 16.13 | 88.72 | 93.76 |
| Soybean | Grain | 92 | 15.2 | 41.7 | Urease concentration | 10 | 8.15 | 114.29 | 119.48 |
| Sunflower | Grain | 94 | 13.6 | 22.2 | Protein concentration, oil | 15 | 11.97 | 102.26 | 109.23 |
| Bean, Butter | Grain | 86 | 12.6 | 26.5 | Urease, protein concentration, supply | 10 | 8.72 | 94.74 | 92.58 |
| Bean, Kidney | Grain | 89 | 13.5 | 24.7 | Urease, protein concentration, supply | 10 | 8.43 | 101.50 | 102.66 |
| Bean, Lima | Grain | 90 | 14.3 | 23.1 | Urease, protein concentration, supply | 10 | 8.33 | 107.52 | 109.96 |
| Bean, Mung | Grain | 90 | 13.9 | 26.6 | Urease, protein concentration, supply | 10 | 8.33 | 104.51 | 106.89 |
| Bean, Navy | Grain | 89 | 14.1 | 25.6 | Urease, protein concentration, supply | 10 | 8.43 | 106.02 | 107.22 |
| Bean, Pinto | Grain | 90 | 13.3 | 25.1 | Urease, protein concentration, supply | 10 | 8.33 | 100.00 | 102.27 |
| Chickpea | Grain | 89 | 13.8 | 21.4 | Urease, protein concentration, supply | 10 | 8.43 | 103.76 | 104.94 |
| Cowpea | Grain | 89 | 13.6 | 26.0 | Urease, protein concentration, supply | 10 | 8.43 | 102.26 | 103.42 |
| Faba bean | Grain | 88 | 13.1 | 29.0 | Urease, protein concentration, supply | 10 | 8.52 | 98.50 | 98.50 |
| Lab Lab | Grain | 90 | 12.5 | 25.0 | Urease, protein concentration, supply | 10 | 8.33 | 93.98 | 96.12 |
| Lentil, common | Grain | 88 | 13.7 | 27.6 | Urease, protein concentration, supply | 10 | 8.52 | 103.01 | 103.01 |
| Lupins, Sweet | Grain | 85 | 13.5 | 30.0 | Urease, protein concentration, supply | 20 | 17.65 | 101.50 | 98.04 |
| Vetch | Grain | 91 | 12.1 | 32.6 | Urease, protein concentration, supply | 10 | 8.24 | 90.98 | 94.08 |

**Table 7b:** Industrial By-product Feedstuffs, Nutrient Analyses, and Utilization Limitations, and Energy Index Values Relative to Wheat for Feedlot Cattle

| Industrial by-products | Form | Dry matter, % | ME | CP, % | Limitation to utilisation | Max ration inclusion on Dry Matter Basis, % | Max inclusion as-fed for 75% DM ration | Energy index value 100% Dry matter basis, relative to Wheat | Energy index value as-received relative to Wheat |
|---|---|---|---|---|---|---|---|---|---|
| Apple | Pomace, wet | 23 | 11.7 | 5.6 | Freight, Pesticides, supply | 15 | 48.91 | 87.97 | 22.99 |
| Apple | Pomace, dehydrated | 89 | 10.7 | 5.0 | Pesticides, supply | 15 | 12.64 | 80.45 | 81.37 |
| Bakery | Waste, dehydrated | 91 | 14.5 | 11.1 | Sodium, toxins during storage, supply | 10 | 8.24 | 109.02 | 112.74 |
| Banana | Fruit, dehydrated | 86 | 12.5 | 4.1 | Pesticides, supply | 15 | 13.08 | 93.98 | 91.85 |
| Banana | Peelings, dehydrated | 91 | 10.8 | 9.4 | Pesticides, supply | 15 | 12.36 | 81.20 | 83.97 |
| Barley | Malt sprouts, dehyrated | 93 | 11.3 | 24.6 | Freight, Stability, phosphorus, sulfur | 15 | 12.10 | 84.96 | 89.79 |
| Biscuit & Cake Mix | Waste | 95 | 13.5 | 7.4 | Sodium, toxins during storage, supply | 15 | 11.84 | 101.50 | 109.58 |
| Bread, Wheat | Dehydrated | 95 | 13.0 | 13.0 | Supply | 15 | 11.84 | 97.74 | 105.52 |
| Breakfast Cereal | Waste | 92 | 13.1 | 11.6 | Supply | 15 | 12.23 | 98.50 | 102.97 |
| Brewers Grains | Grain, dehydrated | 92 | 10.0 | 29.6 | Palatability, phosphorus, sulfur | 15 | 12.23 | 75.19 | 78.61 |
| Brewers Grains | Grain, wet | 22 | 10.7 | 26.4 | Freight, Stability, phosphorus, sulfur | 25 | 85.23 | 80.45 | 20.11 |
| Cassava | Tapioca flour | 90 | 15.0 | 2.0 | None | 15 | 12.50 | 112.78 | 115.35 |
| Cassava | Tubers, fresh | 37 | 12.7 | 3.6 | Freight, storage | 30 | 60.81 | 95.49 | 40.15 |
| Citrus | Pulp, silage | 21 | 13.3 | 7.3 | Freight, storage | 5 | 17.86 | 100.00 | 23.86 |
| Citrus | Pulp, wet | 18 | 12.6 | 6.6 | Freight, storage | 5 | 20.83 | 94.74 | 19.38 |
| Citrus | Syrup (molasses) | 67 | 11.8 | 8.5 | Supply, palatability | 5 | 5.60 | 88.72 | 67.55 |
| Corn gluten feed | Pellet | 90 | 12.0 | 27.0 | Palatability, phosphorus, sulfur | 15 | 12.50 | 90.23 | 92.28 |
| Cotton Seed | Meal, solvent | 91 | 11.7 | 37.0 | Protein content | 100 | 82.42 | 87.97 | 90.97 |
| Cotton Seed | Whole white seed | 92 | 13.6 | 23.0 | Oil content | 16 | 13.04 | 102.26 | 106.90 |
| Fats & Oils | Animal | 99 | 37.0 | 0.0 | Oil content, perception? | 4 | 3.03 | 278.20 | 312.97 |
| Fats & Oils | Vegetable | 99 | 34.0 | 0.0 | Oil content | 4 | 3.03 | 255.64 | 287.59 |
| Grapes | Fruit (raisins) | 87 | 10.0 | 7.4 | Tannins | 20 | 17.24 | 75.19 | 74.33 |
| Grapes | Pomace, wet (marc) | 37 | 7.3 | 13.8 | Palatability, energy content, tannins | 6 | 12.16 | 54.89 | 23.08 |
| Hops | Leaves and vine, dried | 89 | 8.2 | 14.0 | Palatability, energy content, tannins | 15 | 12.64 | 61.65 | 62.35 |
| Linseed | Meal | 90 | 12.9 | 35.4 | Palatability | 10 | 8.33 | 96.99 | 99.20 |
| Macadamia Nut | Waste | 98 | 16.5 | 10.1 | | 15 | 11.48 | 124.06 | 138.16 |
| Maize, Dent Yellow | Gluten, meal | 91 | 13.0 | 36.7 | | 34 | 28.02 | 97.74 | 101.08 |
| Maize, Dent Yellow | Bran | 89 | 12.4 | 9.4 | | 34 | 28.65 | 93.23 | 94.29 |
| Maize, Dent Yellow | Oil | 99 | 34.0 | 0.0 | | 4 | 3.03 | 255.64 | 287.59 |
| Maize, Dent Yellow | Starch | 90 | 14.3 | 0.6 | | 15 | 12.50 | 107.52 | 109.96 |
| Maize, Sweet | Cannery residue, fresh | 77 | 10.8 | 8.8 | | 15 | 14.61 | 81.20 | 71.05 |
| Molasses, cane | Liquid | 75 | 11.3 | 5.8 | Supply, feed intake | 10 | 10.00 | 85.19 | 72.60 |
| Oats | Cereal by-product | 91 | 15.8 | 15.3 | | 20 | 16.48 | 118.80 | 122.85 |
| Oil Palm Kernel | Meal, mech extracted | 90 | 12.5 | 15.0 | | 10 | 8.33 | 93.98 | 96.12 |
| Olive | Meal | 90 | 12.7 | 7.1 | | 15 | 12.50 | 95.49 | 97.66 |
| Pea | Split grain by-product (peameal) | 90 | 12.0 | 19.7 | | 10 | 8.33 | 90.23 | 92.28 |
| Peanut | Meal, mech extracted | 93 | 12.6 | 52.0 | Supply, aflatoxins, crude protein | 10 | 8.06 | 94.74 | 100.12 |
| Pear | Pomace, dehydrated | 90 | 11.2 | 5.5 | Supply, palatability | 10 | 8.33 | 84.21 | 86.12 |
| Pear | Pomace, wet | 17 | 10.0 | 4.2 | Supply, storage, freight, palatability | 10 | 44.12 | 75.19 | 14.52 |
| Pineapple | Hay, aerial part without fruit | 89 | 9.2 | 7.8 | Supply, storage, freight | 15 | 12.64 | 69.17 | 69.96 |
| Pineapple | Cannery by-product | 13.6 | 10.8 | 5.4 | Supply, storage, freight, palatability | 10 | 55.15 | 81.20 | 12.55 |
| Poppy Seed | Meal | 90 | 11.3 | 40.8 | | 15 | 12.50 | 84.96 | 86.89 |
| Potato | Cannery residue, dehydrated | 89 | 13.5 | 8.4 | | 30 | 25.28 | 101.50 | 102.66 |
| Potato | Cannery residue, wet | 12 | 12.0 | 8.5 | | 10 | 62.50 | 90.23 | 12.30 |
| Potato | Fresh | 23 | 12.3 | 9.5 | | 20 | 65.22 | 92.48 | 24.17 |
| Potato | Tubers, dehydrated | 91 | 12.7 | 8.9 | | 20 | 16.48 | 95.49 | 98.74 |
| Potato, Sweet | Cannery residue, dehydrated | 90 | 12.1 | 2.8 | | 20 | 16.67 | 90.98 | 93.05 |
| Potato, Sweet | Tubers, dehydrated | 89 | 12.6 | 7.2 | | 20 | 16.85 | 94.74 | 95.81 |
| Rape (Canola) | Grain, meal, mech extracted | 92 | 11.5 | 38.7 | | 15 | 12.23 | 86.47 | 90.40 |
| Rice | Bran with germs | 91 | 10.0 | 14.3 | Rancidity, phosphorus | 18 | 14.84 | 75.19 | 77.75 |
| Rice | Polishings | 90 | 14.6 | 13.3 | | 18 | 15.00 | 109.77 | 112.27 |
| Rice | Rice, brown | 88 | 14.5 | 8.4 | Palatability | 30 | 25.57 | 109.02 | 109.02 |
| Rice | Rice, polished | 89 | 15.0 | 7.9 | Palatability, digestability | 30 | 25.28 | 112.78 | 114.06 |
| Rye | Bran | 91 | 10.8 | 17.5 | Rancidity, phosphorus, palatability | 15 | 12.36 | 81.20 | 83.97 |
| Rye | Flour | 89 | 13.8 | 11.7 | Supply, palatability | 10 | 8.43 | 103.76 | 104.94 |
| Safflower | Meal, mech extracted | 91 | 9.1 | 22.0 | | 10 | 8.24 | 68.42 | 70.75 |
| Safflower | Meal, solvent extracted | 92 | 9.0 | 25.0 | | 10 | 8.15 | 67.67 | 70.75 |
| Sesame | Meal, mech extracted | 93 | 11.6 | 49.0 | | 15 | 12.10 | 87.22 | 92.17 |
| Soybean | Grain, meal, mech extracted | 90 | 12.8 | 47.7 | | 15 | 12.50 | 96.24 | 98.43 |
| Soybean | Meal, solvent extracted | 90 | 13.2 | 55.1 | | 15 | 12.50 | 99.25 | 101.50 |
| Soybean | Mill feed | 90 | 10.7 | 14.1 | | 15 | 12.50 | 80.45 | 82.28 |
| Sunflower, Common | Meal, mech extracted | 93 | 11.2 | 44.6 | Supply,Palatability, crude protein | 10 | 8.06 | 84.21 | 89.00 |
| Sunflower, Common | Meal, solvent extracted | 93 | 9.9 | 49.8 | Supply,Palatability, crude protein | 10 | 8.06 | 74.44 | 78.67 |
| Wheat | Bran | 89 | 11.3 | 17.5 | Phosphorus, sulfur | 15 | 12.64 | 84.96 | 85.93 |
| Wheat | Gluten | 90 | 14.7 | 70.3 | Phosphorus, sulfur | 15 | 12.50 | 110.53 | 113.04 |
| Wheat | Pollard | 85 | 12.2 | 18.0 | Phosphorus, sulfur | 15 | 13.24 | 91.73 | 88.60 |

While many by-product feeds present as minor alternates (at low ration inclusion rates) to primary feed grains, there is insufficient production capacity to supply significant nutrient mass to the feedlot industry. Moreover, the location of these ingredients and frequent physical form (high moisture) preclude their significant utilization because of freight distances relative to other cattle industries, such as dairies, that are located more closely to manufacturing and urban areas.

Recently, the use of dried corn fermentation by-products have raised as possible alternatives to Australian feed grains.

Results of studies (Lodge et al. 1997; Ham et al., 1994) showed lower energy value for dried distillers' grains relative to wet distillers' grains. Tessner (personal communication, 2002) forwarded that dried distillers grains are less palatable than wet distillers' grains, and therefore negatively impact total energy consumption in trials where lower net energy for gain is calculated for dried distillers grains. Moreover, Tessner (2002) suggested an upper limit of dry matter dietary inclusion be between 10 and 20%, before palatability problems begin to reduce dry matter intakes.

Research recently reported from Kansas State University (Gordon et al., 2002) evaluated the finishing performance (153 days) and carcass characteristics of feedlot heifers (n = 345) fed six different concentrations of dried distillers grains with solubles (DDGS). Cattle fed 0 and 30% DDGS has similar (P >.05) average daily gain, final weight and hot carcass weight, however, heifers fed 15% had the best growth performance (P < .05). The addition of higher than 30% DDGS to the diets led to decreased performance.

Therefore, while by-products can in specific regional circumstances offer minor contributions to cattle feed energy supply, they are severely limited relative to grain in their potential to contribute to viable feedlot production.

## 2.7 Estimates of Total Grain Consumption Requirements by the Australian Feedlot Sector

Estimates of total grain consumption requirements by the Australian feedlot sector were generated (Table 8) from ALFA survey data (ALFA, 2003) and feedlot cattle calculated daily feed intakes (NSA, 2003).

**Table 8:** Grain Requirements and Maximum By-product Utilization Capability by the Australian Feedlot Sector under Different Environmental Conditions

| | Grain or by-product requirements, Tonnes | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Season | Wheat | Barley | Triticale | Corn | Sorghum | Total Grain (undefined)* | Additional Non-Sorghum grain or byproducts** | Additional Sorghum grain or byproducts*** |
| **Normal year** | | | | | | | | |
| Apr - Sept | 558454 | 454409 | 58426 | 41492 | 249202 | | | |
| Oct - Feb | 612848 | 671169 | 81797 | | | | | |
| Total | 1171301 | 1125577 | 140224 | 41492 | 249202 | 2727796 | | |
| **Seasonal drought - Low Winter Crop** | | | | | | | | |
| Season | | | | | | | | |
| Apr - Sept | 548395 | 444350 | 58426 | 31433 | 283184 | | | |
| Oct - Feb | 552435 | 482379 | 81797 | | 249202 | | | |
| Total | 1100830 | 926729 | 140224 | 31433 | 532387 | 2731602 | | |
| **Seasonal drought - Low Summer Crop** | | | | | | | | |
| Season | | | | | | | | |
| Apr - Sept | 599946 | 495901 | 58426 | 82984 | 128377 | | | |
| Oct - Feb | 612848 | 671169 | 81797 | | | | | |
| Total | 1212793 | 1167069 | 140224 | 82984 | 128377 | 2731448 | | |
| **Multi-season drought** | | | | | | | | |
| Season | | | | | | | | |
| Apr - Sept | 435389 | 328088 | 61672 | | 590591 | | | |
| Oct - Feb | 541436 | 479578 | 61672 | | 333053 | | | |
| Total | 976825 | 807666 | 123345 | | 923644 | 2831480 | | |
| **Extreme ongoing continental drought** | | | | | | | | |
| Season | | | | | | | | |
| Apr - Sept | | | | | | 1132214 | 101690 | 182022 |
| Oct - Feb | | | | | | 1132214 | 101690 | 182022 |
| Total | | | | | | 2264428 | 203380 | 364043 |

* Total of all grains required. Grain type not specified during Extreme ongoing continental drought because of unknown supply

** Potential use of suitable energy dense by-products if available. If not, wheat, barley, triticale or corn would be anticipated to be the primary grain substituted

***Potential use of suitable energy dense by-products if available. If not, sorghum would be anticipated to be the primary grain substituted

Review of these data note:

1. Total annual feedlot grain requirements are approximately 2.73 Million Tonnes;
2. In normal years, order of grain utilization is wheat, barley, sorghum, triticale and corn;
3. During Low Winter crop periods, greater volumes of sorghum are used, with less wheat, barley and corn;
4. Following a Low Summer crop, greater volumes of wheat, barley and corn are used (as alternatives) versus sorghum;
5. During a multi-season drought, total grain requirements by the feedlot sector increases because of reduced white cotton seed availability and (or) utilization;
6. Under extreme ongoing continental drought conditions, grain requirements (unspecified type) for the feedlot industry remains at minimum 2.26 Million Tonnes, however, may include another 0.57 Million Tonnes if suitable by-products are not available, or unavailable as a cost effective feedstuff relative to grain supplies; and
7. The maximum volume of alternative energy dense feedstuffs that could be used by the feedlot industry prior to significant reductions in feedlot cattle performance would be approximately 0.57 Million Tonnes.

# 3. CONCLUSION

Australian feedlot production is dependent on feed grains as the primary energy source for cattle growth. There is limited capability to change primary grain usage rates for feedlot cattle under increasingly severe drought conditions. There is an absence of suitable alternative energy dense feedstuffs in Australia. If available, maximum alternate feedstuff volumes would be 0.57 Million Tonnes, and would reduce grain minimum annual requirement of 2.26 Million Tonnes. Clearly a solution to provide economically viable energy dense feedstuffs is required. The minimum volume of grain in this 'energy composite' is 84% of 2.73 Million Tonnes annual usage.

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# GRAIN DEMAND AND ECONOMIC COST OF DROUGHT TO THE GRASS FED RUMINANT SECTOR MULTIVARIABLE MODEL FROM A NATIONAL PERSPECTIVE

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## ABSTRACT

A multivariable model was built to quantify the nature of grass fed ruminant feed demand during drought and is overlain with a weather probability curve to describe some of the logistical and economic impacts.

As drought theory has no knowable endpoint the total and monthly demand is analysed from a perspective of a normal weather probability curve. The model is discussed in broad terms to find any economic and logistical issues that may impact on the ruminant industries in a weather event that is beyond most planning horizons.

The existing intense drought has stretched the ruminant sector economy into a stress zone. There is a low probability of a continuation of the drought event, even so, if this future unfolds market failure will evolve where significant long term damage is experienced by the grass fed ruminant sector and reliant industries.

# EXECUTIVE SUMMARY

The current weather event has impacted heavily on the grass fed ruminant sector (ruminant sector). This is defined as all Sheep and Cattle that would normally gather their energy requirements from pastures. Due to widespread moisture deficits, pasture growth is less than ruminant demand and standing grass pasture is insufficient to maintain the energy requirements of the “flocks and herds”.

At this point the ruminant sector begins to move to existing pasture stocks, begins to consume fodder stocks (both grain and roughage), and/or loses body fat to maintain energy requirements. This process is well understood and functions continuously through existing markets in all seasons as pasture supply is geographically variable and the herd is transportable.

The current drought situation is extreme in terms of the widespread nature and the magnitude of the pasture deficit, this necessitates a “significant and growing” reliance on fodder stocks as the drought lengthens and intensifies. This fodder demand spills out from the ruminant sector to the grains sector at and only when the grains supply is at a low level. The worse the weather the less grain and the higher the ruminant grain demand. The ruminant sector is dependent on the grains sector at these times to avoid long term economic damage.

Information regarding the scale and distribution of this fodder demand is scarce and unreliable. It may be linked to the intermittent nature of this fodder demand that only arises in full force during major and widespread drought events. There is no reliable statistics that describe either the magnitude or the logistics of this demand.

A multivariable model was constructed to quantify this demand and to consider the magnitude of the economic effects. This approach tries to model a complex and interrelated system that is currently experiencing a 1:100 climactic event. As with all complex systems that are pushed out of normal operating parameters there runs a risk of system failure. The model allows one to change the assumptions about what is thought to be happening in the Ruminant sector and to test what the probabilities of significant long term damage to each part of the system is. When areas of strategic weakness are identified the question still remains, what, if anything, can be done to mitigate these impacts.

The author has chosen a set of assumptions that reflect his own subjective judgment on the matter and apologizes for all the inherent biases. What is assumed in this matter is, that as the drought continues in length and intensity the energy deficit grows, the fodder demand increases. That is, the end point of the drought is “unknowable”. Therefore, a standard weather probability curve is used to estimate the probability of the “Break” occurring. (Which for this discussion, is where the pasture growth can again supply the energy requirements of the Ruminant sector and the fodder demand is at normal levels).

As there is an infinitely variable set of futures the worst 10% scenario was modelled to see where deficiencies in the system may lie. That is, if the current 2003 calendar season unfolds as a 1:10 dry year nationally. This scenario has in my view a 10% chance of eventuating. If so the ruminant sector will face another difficult year compounded by depleted resources on all fronts from the previous 1:100 dry year.

Although not wishing this nightmare on man nor beast the point of good strategy is to be aware of possible difficult events arising. Even if this season is in the dry 30% of years the compounding effect of the previous dry years will amplify the negative impacts relative to a similar dry year.

What is clear from the exercise is that if the intensity of this drought continues into the future the fodder demand of the ruminant sector on the East Coast will be of sufficient magnitude to:

(a) Strain the supply chains logistical capacity to deliver grain and roughage from stocks held in South Australia and Western Australia.

(b) It will also test the ruminant sectors financial capacity to source capital to maintain production capacity.

(c) Will in the worst 10% of future seasons cause significant long term damage to the ruminant sector in terms of residual debt and reduced production capacity from stock losses.

## PASTORAL RUMINANT INDUSTRY DISTRIBUTION AND RESPONSE TO DROUGHT

The pastoral ruminant industry in Australia is those cattle and sheep that rely on pasture and rangelands for their nutritional requirements. These are significant industries with large numbers of animals (Figures 1 and 2). Their distribution is across the pastoral and wheat / sheep zones in Australia (Figures 3 and 4). The three eastern states hold 80% of the cattle and 64% of sheep population. Of the eastern states cattle population Queensland holds 50% of the population, of the eastern states sheep population NSW holds 58%.

The current weather event has impacted heavily on the grass fed ruminant sector that is defined as the extensive pastoral sheep and cattle industries. These are sheep and cattle that would normally gather their energy requirements from pastures. In normal seasons the majority of feed requirements are derived from native or improved pasture with some low levels of supplementary feeding. In drought conditions due to widespread moisture deficits, pasture growth is less than ruminant demand and standing grass pasture is insufficient to maintain the energy requirements of the “flocks and herds”.

At this point the pastoral ruminant sector begins to move to remaining existing pasture stocks, starts to consume fodder stocks (both grain and roughage), and/or looses body fat to maintain energy requirements. This process is well understood and functions continuously through existing markets in all seasons as pasture supply is geographically variable and the herd is transportable. That is producers start to sell down flocks and herds when there is insufficient pasture stocks and where cost of supplementary feeding exceed perceived benefits. Depending on the livestock condition these animals are bought by other producers with adequate feed stocks or the animals are sent to slaughter.

In the current drought situation feed deficit is extreme in terms of the widespread nature and the magnitude of the pasture deficit, this situation necessitates a “significant and growing” reliance on fodder stocks as the drought lengthens and intensifies. Fodder demand spills out from the ruminant sector to the grains sector at and only when, the grains supply is at a low level. The drier the weather the less grain is produced and the higher the ruminant grain demand. The ruminant sector is dependent on the grains sector at these times to avoid long term economic damage.

Figure 1 Cattle Population [(a)], by State and Territory

| | NSW | Vic. | Qld | SA | WA | Tas. | NT | Aust.[(b)] |
|---|---|---|---|---|---|---|---|---|
| | '000 | '000 | '000 | '000 | '000 | '000 | '000 | '000 |
| 1995 | 6,236 | 4,280 | 9,947 | 1,216 | 1,899 | 793 | 1,421 | **25,731** |
| 1996 | 6,390 | 4,396 | 10,214 | 1,219 | 1,924 | 718 | 1,503 | **26,377** |
| 1997 | 6,511 | 4,411 | 10,415 | 1,181 | 1,909 | 725 | 1,530 | **26,695** |
| 1998 | 6,351 | 4,142 | 10,867 | 1,214 | 1,973 | 728 | 1,567 | **26,851** |
| 1999 | 6,291 | 4,125 | 10,748 | 1,183 | 1,931 | 724 | 1,567 | **26,578** |
| 2000 | 5,970 | 4,264 | 11,808 | 1,184 | 2,165 | 617 | 1,571 | **27,588** |
| 2001 | 6,470 | 4,739 | 11,586 | 1,343 | 2,210 | 683 | 1,722 | **27,736** |
| 2002 | na | na | na | na | na | na | na | **28,500** |

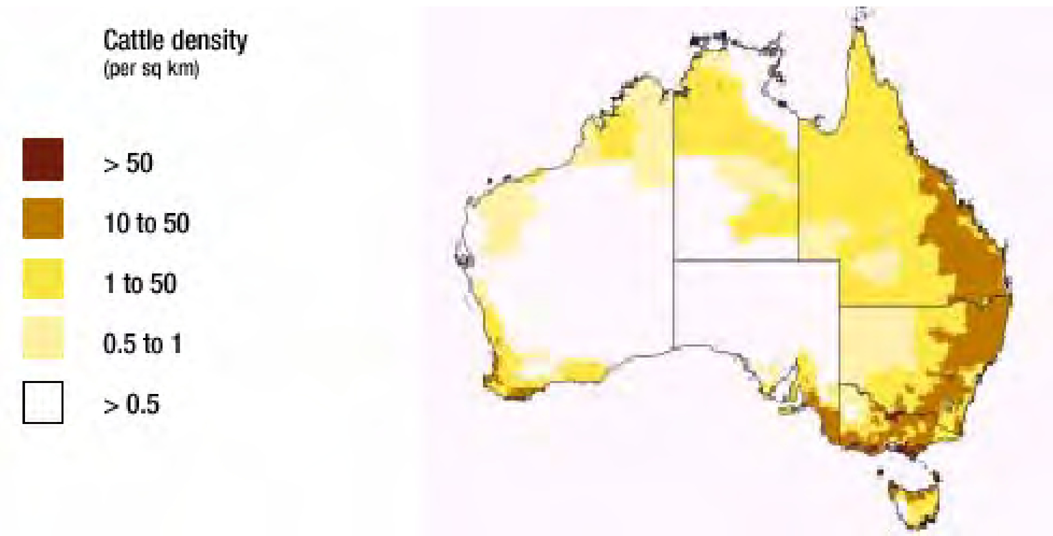
(a) Excludes house cows; (b) Includes ACT
Source: Agricultural Commodities, Australia (7121.0).

Figure 2 Sheep and Lambs Populations , by State

| | NSW | Vic. | Qld | SA | WA | Tas. | Aust.[(a)] |
|---|---|---|---|---|---|---|---|
| | mill. | mill. | mill. | mill. | mill. | mill. | mill. |
| 1995 | 40.5 | 21.4 | 11.6 | 13.2 | 30.2 | 3.9 | **120.9** |
| 1996 | 41.1 | 22.0 | 10.7 | 13.6 | 29.8 | 3.9 | **121.1** |
| 1997 | 42.4 | 22.3 | 10.5 | 13.1 | 27.8 | 4.0 | **120.2** |
| 1998 | 40.8 | 21.1 | 11.0 | 13.1 | 27.5 | 3.9 | **117.5** |
| 1999 | 40.6 | 21.0 | 10.6 | 13.1 | 28.4 | 3.8 | **115.5** |
| 2000 | 42.4 | 22.1 | 9.0 | 13.4 | 25.5 | 3.3 | **118.6** |
| 2001 | 41.0 | 23.0 | 9.1 | 13.1 | 23.9 | 3.3 | **110.9** |
| 2002 | na | na | na | Na | na | na | **103.0** |

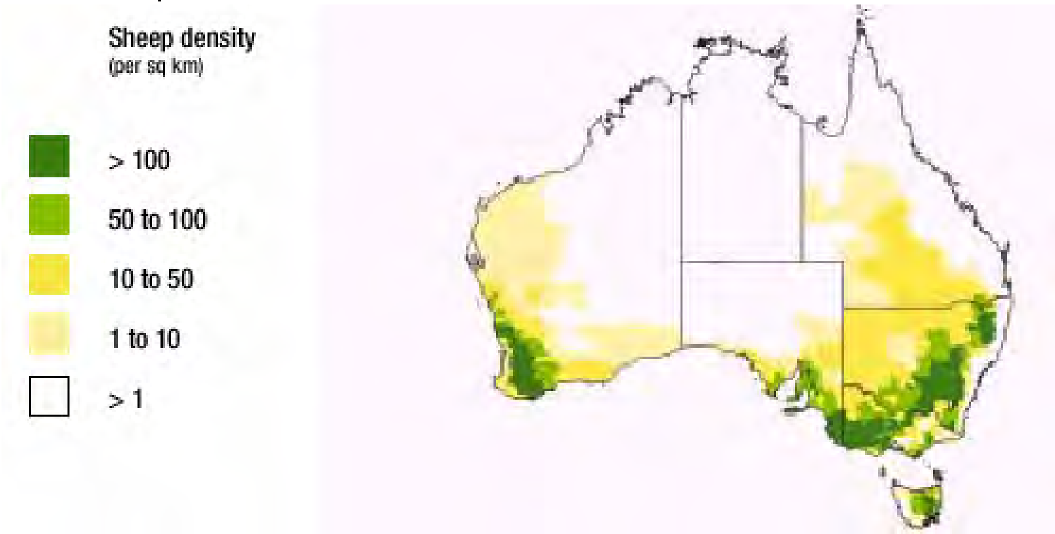
(a) Includes ACT.
Source: Agricultural Commodities, Australia (7121.0).

**Figure 3:** Cattle Distribution in Australia




Source: Animal Health Australia, 2001

**Figure 4:** Sheep Distribution in Australia

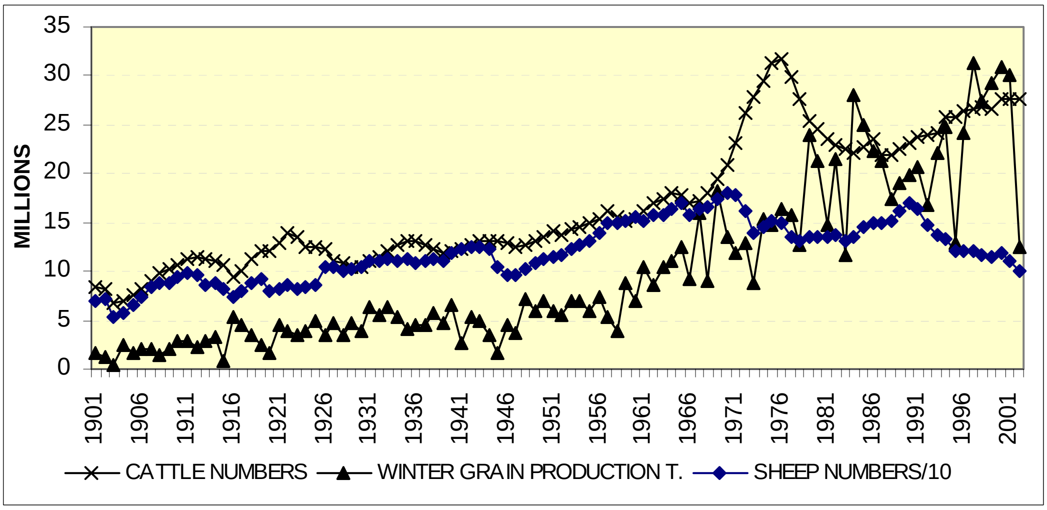



Source: Animal Health Australia, 2001

## HISTORICAL PERSPECTIVE ON GRAIN AND RUMINANTS

The relationship between the weather, production of winter grains and the number of each livestock class is represented in the ABS data series graphed below. Livestock population defines the core production capacity of these sectors. The loss of population during dry times has a long-term impact on the sector. The historical responses to large-scale weather events determines assumptions in the model.

**Figure 5:** Sheep and Cattle Populations Relative to Winter Grain Production




Winter grain production varies greatly with growing season rainfall. This is analogous for pasture production in the wheat sheep zone and a broad indicator of general good and bad rainfall seasons.

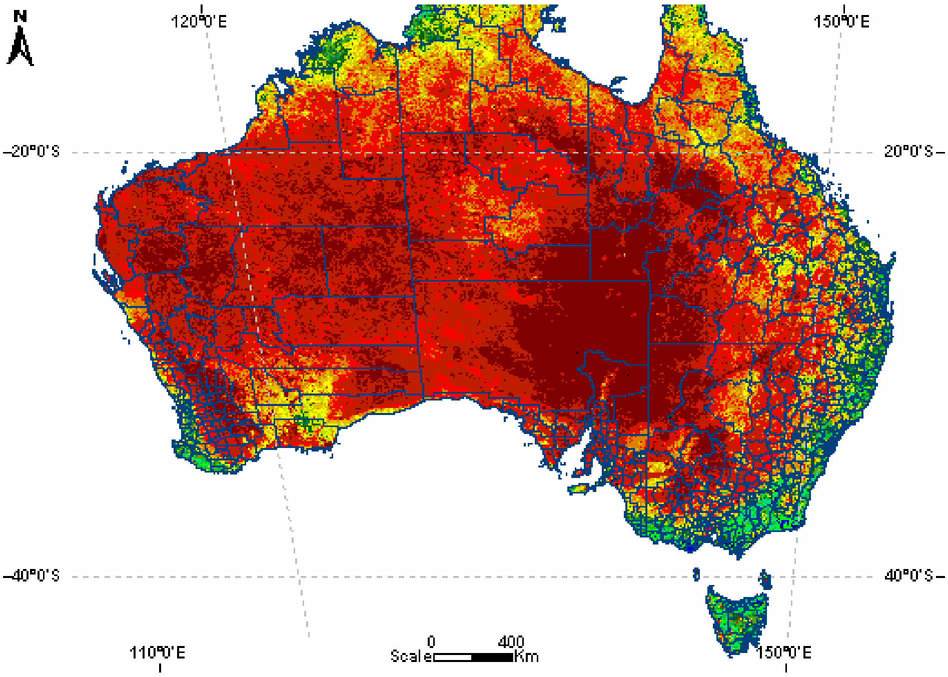
The core production capacity of both sheep and cattle industries is determined by their population, and their growth in productivity. Relative profitability and technological change drive populations over time. Significant dry events such as the 1940's impact within an economic cycle, when both the economics is bad and the weather is bad population decline is significant, note the 1940's and 1994 in the sheep populations.

The 1940's is significant as it was a series of dry years which impacted on both sheep and cattle numbers. These back to back dry series of years have the biggest impact.

The population decline is dependant on the intensity and length of the event and what part of the economic cycle the sector is in, loss rate and availability of feedstuffs either on farm or from imported sources.

## Pastoral Industry Responses to 2002-2003 Drought

The following is a map of Australia showing the vegetative index of pasture and rangelands in Spring 2002, red indicates no moisture no pasture growth, green denotes moisture and pasture growth. This technology has the capacity to measure both growth and standing biomass and stock density by local government area.




The ruminant sector is well used to the variable nature of Australian weather and has sophisticated strategies in place to manage the pasture / fodder, demand / supply equation. Pasture supply is a cheap form of energy and a core input into the production system. Due to the variable nature of regional weather, pasture supply is geographically variable. Fodder and cash reserves are kept livestock inventory is adjusted and livestock is transportable over long distances.

All livestock owners take risks against the weather all their lives. Most existing risk management strategies of individual firms have within them, resources, inter generational knowledge and contingencies to handle out to a 1:20 drought event for their particular region.

Only vague notions of what to do exist beyond these planning horizons. The existing drought event is somewhere in the magnitude of 1:100 on a moisture basis Australia wide and characterised by the higher than normal temperatures, high evaporation rates and low levels of surface water availability. The point has been reached where collective strategic failure in the pastoral livestock industries may occur. As all players share the same basic assumptions, that, there will be someone with cash, pasture or fodder to take surplus stock, and that it could not possibly be another dry year.

However as with all natural and complex systems, if the moisture deficit is protracted enough a perish results; both the federation drought at the turn of the century and the nineteen forties are recorded as historical event's that have had significant long-term impacts on the pastoral ruminant sector.

## Assessment of the Drought induced needs of the Pastoral ruminant industries

### *Model Assumptions*

There is very little information in the public domain that clearly estimates the drought induced needs of the pastoral ruminant industry. The following analysis attempts to do this by estimating livestock needs on a comparative dry sheep equivalent basis through a prolonged drought event such as is being experienced currently.

The basic building block of the model is a Dry Sheep Equivalent (DSE) unit, which represents the maintenance energy requirement for a dry 45-kg merino sheep. It is assumed that the daily energy requirement of this unit can be satisfied by feeding 0.5kg of wheat, or the equivalent energy in other fodder forms, this equates to approximately 6 Megajoules of metabolisable energy per day. The average "beast" in the cattle herd is assumed to be 8 DSE.

To put the magnitude of this demand in perspective the ruminant sector eats approximately 320,000 tonnes of dry grass (at 6 Mj/Kg dry matter) per day, 75% of this demand occurs in the Eastern states. Moisture deficits reduce pasture supply, demand stays constant, standing pasture stocks are eaten and then fodder stocks and/or body fat is used to supplement energy requirements. Ruminants are exceptionally hardy in their ability to utilize body fat as they are adapted to fluctuating food supply. Eventually, if energy deficits exist for too long the reproduction cycle is disrupted and death rates increase.

The distribution of this fodder demand is dependent on the pasture deficit of each region. The regions used in this analysis are the Rural Land Protection Boards (RLPB) as there is data of stock numbers at this level. As a pasture deficit evolves in a region stock are shipped out of the region. For example, the sheep population of the western divisions of NSW is estimated to decrease by 70% on pre drought levels.

In a regional drought this is a legitimate strategy, however it is still a "nil sum game" from a national perspective where one region's loss is another regions gain. The total energy requirement remains stable except for reductions due to stock losses, in normal droughts of a 1:10-1:20 magnitude there are regions to take drought affected stock, markets function normally and fodder is fed.

### *Drought Fodder Logistics*

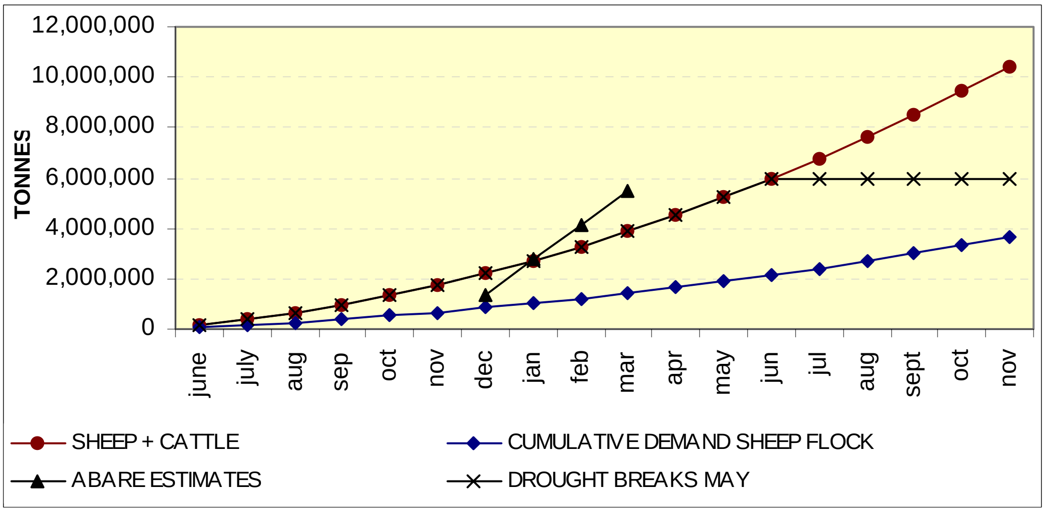
The logistics of fodder supply varies, as the drought demand is not where the population distribution was at the beginning of the drought but where the residual population now resides. In the current drought a general trend is that the livestock population has drifted from the pastoral zones toward the coast. The residual grain stocks are in South Australia and Western Australia. Who owns these stocks and how large they are is regarded as commercially sensitive information by grain traders. Anecdotal evidence suggests it may not be possible to import from offshore much more than 100,000 tonnes per month into the Eastern Seaboard as the capacity is limited by a lack of machinery to process the imported grain to the standards required by the AQIS import protocols.

If the modelled grain demand eventuates (June 740,000/Month) the transhipment of grain from Western Australia and South Australia by boat, train and road at the rate the modelled will strain logistical capacity but is not seen as a limiting factor. The capital required to purchase and ship these volumes is discussed later in the report.

## DISCUSSION OF MODEL, THE ASSUMPTIONS AND LOGIC

The following chart shows the cumulative grain demand of both sheep and cattle under the following assumptions.

**Figure 6:** Cumulative Grain Demand, Sheep and Cattle




### Sheep Flock, Drought Fodder Demand

ABARE data suggests a normal seasonal grain demand of 41,600 tonnes of grain per month for the pastoral ruminant sector, "grass fed" sheep and cattle, as even in an average season there are large parts of the continent with below average pasture stocks and areas of significant local drought. As the existing drought was already quite extensive by June 2002 the figure of 75,000 tonnes per month for sheep only was an estimate of current demand. This equates to 5% of the energy requirement of the Australian sheep flock being fed from existing fodder stocks.

There is significant debate on total sheep numbers and in this analysis a figure of 100 million head of sheep and lambs is used. Assuming lambs need less energy and higher protein than a DSE and pregnant ewes need higher energy and protein than a DSE dependant on stage of pregnancy and lactation a figure of 100 Million DSE was used to approximate the energy requirement of the Australian sheep flock.

The start point for sheep is that in June 2002, 5% of the national flocks maintenance energy requirement comes from fodder stocks, represented in tonnes of wheat equivalent. (Fodder is all types of hay and grains, from on farm stocks and commercial holdings). As the drought lengthens and maintains its intensity the energy deficit deepens and the demand for fodder increases by 1% per month. The wheat equivalent demand curve represents a continuation of the existing drought in length and intensity, approximating to a 1:10 percentile dry year. This is one of the core assumptions within the model that has a large impact in the longer term. As a drought of the current drought intensity continues the pasture deficit grows and the demand for fodder supplies grows. A demand growth figure of 1% per month is assumed. Therefore June 2002 fed 5% equating to 75,000 tonnes wheat equivalent. July 2002 fed 6% equating to 90,000 tonnes wheat equivalent fed to the flock for that month and a cumulative total of 165,000 tonnes fed by the end of July. This demand curve can be seen on the above graph. By May 2003 16% of the total flock's energy requirement are being fed from fodder stocks. This equates to a feeding rate of 240,000 tonnes/month and calculates to a total volume of 1.89 Mt equivalent being consumed by the sheep flock from June 2002.

Under normal climate circumstances there is a 50% chance that the drought has broken by the end of May and a 50% chance that it continues.

As the drought begins to break, regions with moisture and suitable temperature will produce pasture thus reducing fodder demand growth, and as is most likely, eliminating fodder demand in the near future provided the autumn break occurs. In the drought breaking scenario fodder demand stagnates and then reverts to average usage levels of normal seasons.

## Cattle Herd, Drought Fodder Demand

The national cattle herd population is assumed to be 27.2 million head down 1.3 million head from last year (source: ABARE Outlook). The logic of the model is the same for the cattle herd as for the sheep flock, however the percentage assumptions are different due to differences in geographic distribution and drought feeding behaviour. The common unit of the model is once again a DSE, which requires 0.5kg/day of wheat equivalent energy to maintain bodyweight. The model assumes that the average "Beast" in the herd has an energy requirement of 8 DSE. This assumption enables the relative magnitude of the energy requirement of the sheep and cattle "herds" and the magnitude of the energy consumption underpinning both sectors.

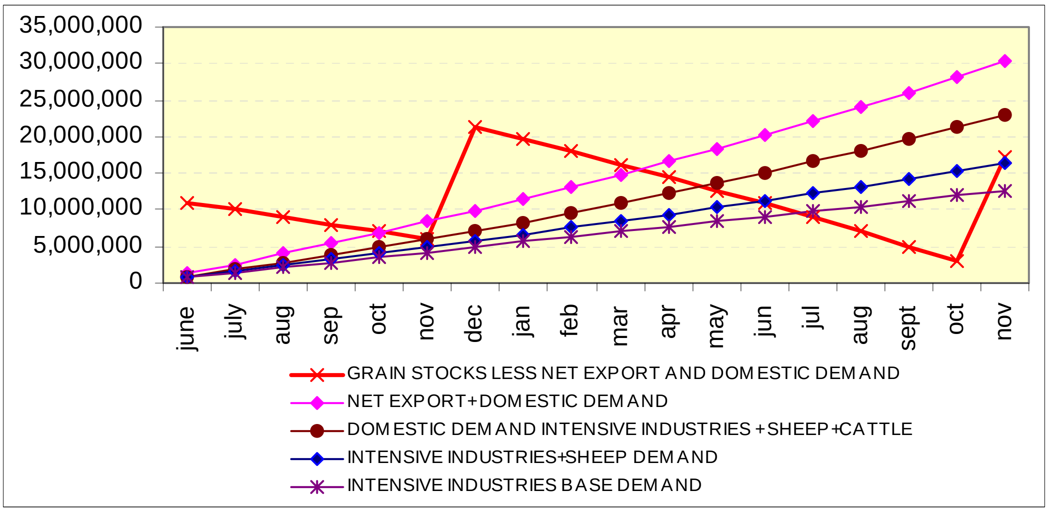
At 8 DSE per Head the National cattle herd equates to 217.6 Million DSE compared to 100 Million DSE for the national sheep flock. The start point for cattle demand at June 2002 is a difficult assumption and is set for this model run to be 3% of national herd energy requirement i.e. it is estimated that 3% of the pastoral cattle populations' energy requirement is coming from some sort of supplementary feeding during June. It is further assumed that the demand growth factor is 1%, the same as the sheep flock.

This current drought has impacted most severely where the vast majority of the pastoral ruminant sector exists, both sheep and cattle share a similar zone, they both are transportable over long distances and compete for both standing pasture and existing fodder stocks. The starting demand is less for cattle due to the distribution of the herd in the tropical north, the growth in demand is similar as both ruminants compete for the same resources. The collective demand curve in Figure 4 is labelled sheep + cattle. Under these assumptions the cattle demand is significantly larger than sheep demand and the cumulative demand is graphed against ABARE early estimates December 2002 to validate the model against other estimates.

The final blue line in Figure 10 (Drought breaks in May), indicates the nature of cumulative demand when the drought breaks, the model allows for one months fodder demand in July at 740,000 tonnes, allowing one month following drought breaking rains to grow enough pasture to eradicate grain demand. At this point the monthly fodder demand will fall to average the cumulative fodder, cost stops accruing and stock losses revert to normal.

## The Issue of Domestic Demand in Drought, Exports and Strategic Stocks

**Figure 7:** Grain Stocks Assuming Continuing Drought




In Figure 7 above the magnitude of the potential grain demand of the pastoral ruminant sector is put into context by graphing the cumulative demand of the sector in addition to normal intensive industry cumulative demand. After including net grain exports, drought domestic demand is determined, this enables the issue of stocks to be addressed.

Intensive industry base demand is the current normal seasonal grain demand for all domestic market grain user industries of 8.42 Mt per year giving a monthly demand volume of 701,000 tonnes. This estimate includes baking processing, chicken, pork, feedlot beef and normal dairy grain demand.

Intensive industries + sheep demand is the cumulative total of both sectors. The total of domestic demand is labelled domestic demand intensive industries+sheep+cattle. This reflects the total onshore drought induced grain demand. There is a double counting in that a small percentage of the pastoral ruminant demand is roughage and this is reflected here as grain demand.

The domestic grain demand is then coupled with net export, this is the amount of grain exported less the amount of grain imported. This total figure indicates the amount of draw down of existing stocks present at the end of the 2002 winter crop harvest.

Once this point is reached the question of grain stocks and the net export volume comes into focus. The National grain stocks at the beginning of the 2002 winter harvest is estimated from various sources to be 5 MT, the winter crop yield was in the vicinity of 16.2 MT indicating a post harvest stock level of 21.2 MT.

High net export volumes and increased domestic demand have lead to "critically low" domestic grain stock levels. The current model run assumes that the net exports equate to 400,000 tonnes/month. That is, exports of 500,000 tonnes/month i.e. a 6 Mt/year rate and feed grain imports limited to 100,000 tonnes/month. Feed grain imports are limited to this quantum based on anecdotal evidence that there are processing capacity constraints at import ports. The lack of machinery and infrastructure to process imported grain to the standard required by the AQIS quarantine protocols.

Trade information indicates that the net export volume is in the vicinity of 1 Mt/month and has been at this level for the first six months of the export season. The actual export figures are unknown, as it is AWB commercially sensitive information. Statistics on the true stock position are not freely available in the public domain.

There are two major impediments to a free grain trading market in Australia. Firstly the export monopoly rights issued by the state to AWB gives AWB similar monopolistic rights in the domestic market, secondly the quarantine protocols issued by the state restrict the free import of grains and fodder. The grain sellers sit in a powerful negotiating position with grain buyers from the pastoral ruminant sector many of whom will only enter the grain market at these extreme drought purchase levels once in a lifetime.

The grains industry has a legitimate right to protect its sector from disease and to market their product in any way they seem fit. However, if the model assumptions are even remotely correct the issue of sufficient grain stocks to satisfy pastoral ruminant drought demand in an event over a 1:100 magnitude needs addressing. Organisations such as the AWB and ABB will act in the best interest of their shareholders/stakeholders, but it has no duty of care to the pastoral ruminant sector other than to maintain a domestic client base in the long term. The legislated market power issued by the state presents an opportunity for grain sellers to harvest monopoly rents on the domestic market. The issue of who is to be supplied with grain stocks is relevant here, does AWB supply long term valuable export clients or hold stocks domestically for the possible benefit of the domestic users in a dry year.

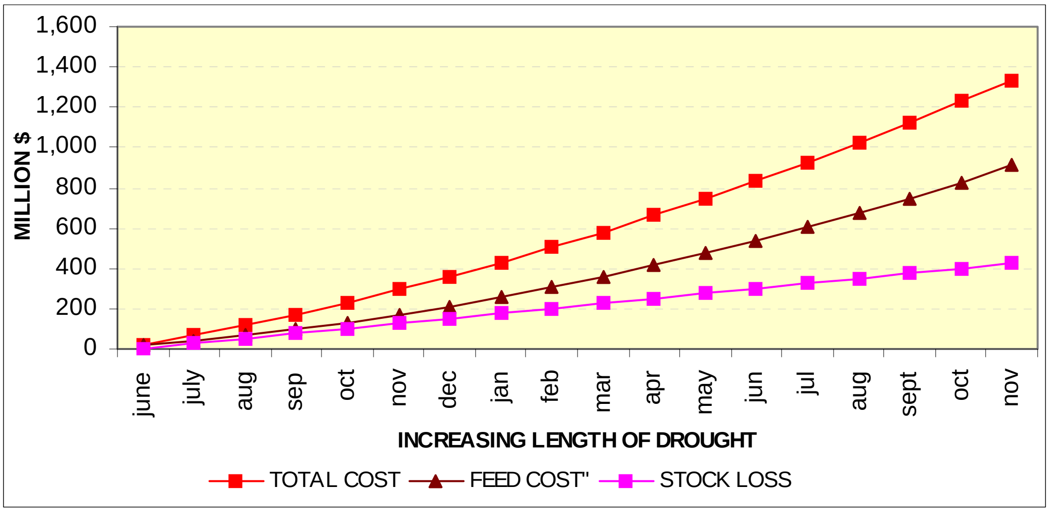
The success of the new season winter crop is critical in a severe drought event. Each day that passes after the optimum sowing date reduces the probability of yield. The optimum sowing period is approximately the end of May. As time passes the yield expectation declines at a faster daily rate. Those who are managing Australia's grain stock levels may not be aware or interested in the pastoral ruminant sectors need for grain in a continuing drought. The continuation of a significant export program by AWB in a dry season creates a large and growing risk for the pastoral ruminant sector if the domestic market is ignored in favour of those demands from export client markets for grains.

Net Grain exports in the model are estimated at 400,000 tonnes per month. Net export per month at a rate more than this could push stocks in a continuing drought scenario to a point where a price squeeze could occur. This price squeeze is where the value of a core input is in such short supply that the market begins to trade chaotically. Excessive grain prices without the pressure valve relief of grain imports would push domestic grain prices to uneconomic levels for pastoral ruminant feeders. The major impact would be in the form of increased debt levels post drought. Inability to feed herds and flocks would inevitably lead to higher stock loss rates which has a long term impact on total herd and flock productive capacity as previously happened in severe drought events last century.

One could argue that this is the reaction of the free market, it is however not free. Government has imposed restrictions to protect and enhance the grains industry without due consideration of the impacts on the domestic grain users in drought years. The State therefore, has a role in balancing the impacts. If stocks are low and the season remains poor the issue of strategic grain reserves and the reduction of export volumes until seasonal conditions guarantee sufficient reserves should be considered and discussed to arrive at arrangements that satisfy the needs of both the grain production and livestock demand industries.

## Economic Cost of Drought to Cattle and Sheep and Grass Feed Ruminant Sector

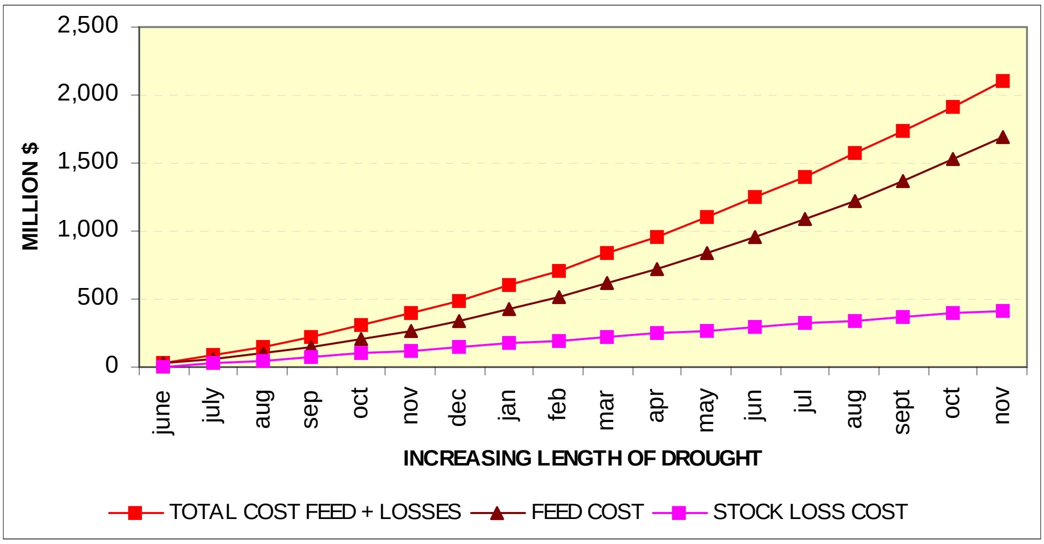
**Figure 8:** Drought Cost to Sheep Flock




The economic impact of the existing drought and the continuation scenario on the pastoral ruminant sector has been undertaken to estimate the quantum of the economic impacts. The economic cost is a simple addition of the cost of fodder at a grain equivalent at $250/tonne fed on farm and a stock loss percentage that is multiplied by an average value for stock lost.

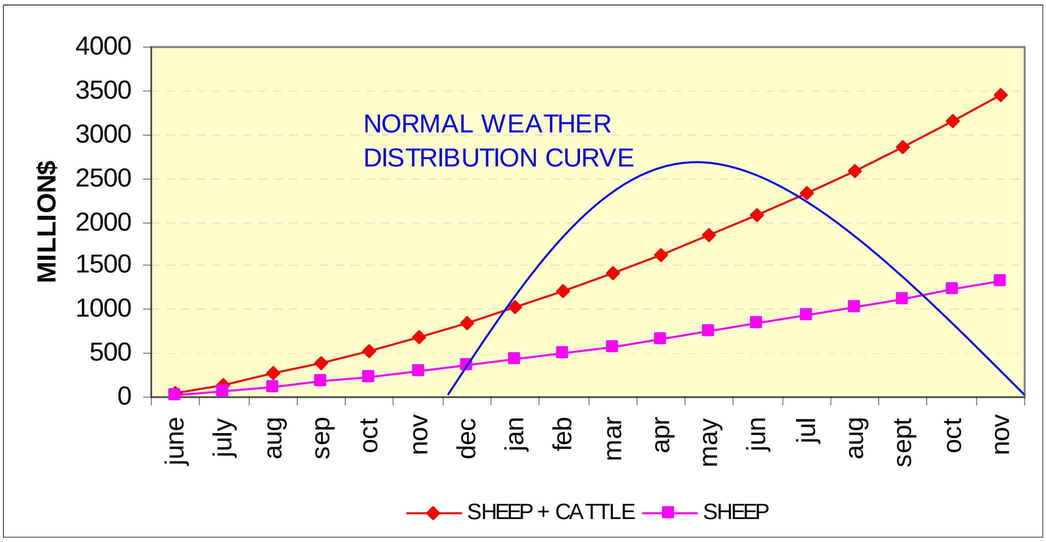
**For sheep** a stock loss estimate that begins at zero in June 2002 growing by 0.5% per month which equates to a 6% loss over the 12 month period from June 2002 to June 2003. These are paddock losses where stock that is sold into the meat processing chain are not counted. Stock lost to production capacity are valued at $50/ Head. The valuation is low as lost production capacity compounds the issue of excess processing capacity in this industry.

**Figure 9:** Drought Cost to Cattle Herd




**For cattle** the same logic is followed with grain equivalent valued a $250/tonne and a stock loss percentage starting at zero and growing by 0.3% per month equating to a 3.6% stock loss factor over the 12 month period to June 2003. The average value of stock lost is assumed to be $300.

**Figure 10:** Drought Cost to Grassfed Ruminant Sector




The addition of both sheep and cattle economic costs equate to a total cost of drought to the pastoral ruminant sector. This is by no means a comprehensive economic analysis, it measures two parameters that at industry level are major impacts during drought. The grain cost is expressed as either reduced capital in the form of on-farm stocks of fodder or increased debt as capital flowed to the owners of grain.

The normal weather distribution curve represents the probability of a "break" in the drought. The break is defined as the point in time that the pasture growth is sufficient to satisfy the energy demand of the ruminant sector and the fodder demand from the sector returns to a normal level. Capital stops flowing out of the sector and the stock loss rate returns to normal levels.

As of May 2003, there is probably a 50% chance that the drought would have broken and a 50% chance it will break in the future, the process has began but is not complete. By August 2003 there is a 75% chance the drought event will be over, however there is still 25% chance that drought is yet to break.

As the break is delayed the costs to the ruminant sector mount. A probability can be attached to this cost being accrued. The model suggests that at May 2003, the sector is at the 50-percentile point and has accrued a cost to the sheep flock of $747 Million, and to the cattle herd of $1,101 million totalling $1,848 million. The 75 percentile is approximately August where there was a 75% chance of the drought having broken and a 25% chance that it has not, if not then the cost to this point is $2.5 billion.

In the real world the break is not a single point. Regional rainfall will stimulate pasture growth in different regions, stock will flow to these regions and fodder demand will taper off and begin to fall. The red sheep + cattle total cost line is probably in the lowest 10% of dry years. This worst case scenario assumes a constant price of grain a $250/tonne and a constant loss rate in both sectors. If grain stocks are low and the season remains dry grain costs will escalate (without import grain price relief) and loss rates will increase (without increased slaughter rates of drought affected stock).

The extent and intensity of the current drought has strained the fabric of the ruminant sector economy and will have some long-term impacts, however, all markets are functioning within reasonable parameters. The biggest strategic issue facing the sector is, in the unlikely event of a continuation of the current weather that there is a price squeeze on residual grain stocks. This eventuality would have significant long-term costs to the sector. To avoid this scenario the ruminant sector should do further work to understand the magnitude and probability of this risk. If proven to be significant then the sector has to find ways to mitigate and manage this risk.

# FEED GRAINS AND THE AUSTRALIAN DAIRY INDUSTRY

## EXECUTIVE SUMMARY

Purchased feed grain and fodder are critical components in the feed base on most Australian dairy farms. An adequate supply of feed grains, both cereals and proteins, is vital to milk production and the economics of the downstream milk processing sector, as the current drought has shown unequivocally. Despite the importance of the pasture base on which the dairy industry depends and the increasing use of co-products, any shortfall in feed grains supply over the next decade will constrain milk production and limit both domestic milk product supply and the industry's export activities. Any such constraints will negatively impact on the financial performance of stakeholders within the dairy supply chain.

It is estimated (Figure 1) that the Australian dairy industry's requirement for feed grains will grow by 24%, from 2,134 kt in 2000/01 to 2,648 kt in 2006/07. The cereal grain component is estimated to grow by 21% over this period, to 2,233 kt. The protein component, particularly lupins and canola meal, is estimated to grow by 47% over this period, to 415 kt.

Underpinning these grain supply numbers are a 21% increase in per cow feed grain requirement from the current 0.94 t/cow to a projected 1.13 t/cow and a 2% increase in the national dairy herd. This takes account of the culling of herds in response to the drought. Assuming the availability of the required feed grains and no further severe drought events, national milk production will rise 15% to 12.1 million litres and average per cow yield will rise 13% to 5,203 litres by 2006/07.

**Figure 1:** Projected Production and Feed Grains Requirements – Australian Dairy Industry

| | **Base 2000/01** | **Projected 2006/07** | **Change (%)** |
|---|---|---|---|
| Total Farms | 11,837 | 8,976 | -24.2% |
| Total Cows ('000) | 2,281 | 2,334 | 2.3% |
| Total Milk (ML) | 10,546 | 12,144 | 15.2% |
| Milk/Cow (L) | 4,624 | 5,203 | 12.6% |
| | | | |
| Total Cereals (kt) | 1,852 | 2,233 | 20.5% |
| Total Protein (kt) | 282 | 415 | 47.4% |
| Total Feed Grain (kt) | 2,134 | 2,648 | 24.1% |
| Feed Grain per Cow | 0.94 | 1.13 | 21.3% |

The projected feed grain supply and demand "push / pull" situation requires change by both grains industry and dairy industry stakeholders. Grain producers need the importance of high quality feed grains to Australia's animal industries affirmed to them through both farmer education and commercial marketing initiatives. Likewise, dairy farmers (and many of their farm advisors) need better information on the merit of feed grains in enhancing dairy profit, not just through filling short-term feed gaps but as a permanent daily ration component.

The generic phrase "grain" needs to be stricken from the dairy industry's vocabulary and replaced with a grain's actual name, so that dairy farmers can associate merit or demerit more readily. For instance, dairy nutritionists know that oats does not provide the same level of nutrients as wheat and that white wheats tend to produce more milk than red wheats. Being descriptively specific is more informative to all. This labelling "sin" is a much under-rated barrier to rational use of the "right" feed grains by dairy farmers.

The milk processing sector needs to be pro-active in investigating and initiating robust bulk-buy and forward-commitment commercial arrangements for feed grain supply to their milk supplier base. Since such moves will change the face of the feed grains industry, not only dairy co-operatives, grain handlers and traders, and industry organisations but also the government and the finance sectors will have a key enabling role. By these means, the grain sector's ability to profitably grow enough of particular crops, within agronomic limits, to meet the dairy industry's requirements will be enhanced. Nonetheless, matching supply with demand for particular crops will continue to be an acute challenge to both industries.

# INTRODUCTION

The Australian dairy industry is a major user of feed grains. On most dairy farms, specialist grain or fodder producers now supply a significant part of the farm's total feed requirements. The current drought has highlighted the strategic value of feed grains and purchased fodder to the dairy farm and the dairy sector at large, including the downstream milk processing sector. Importantly, when drought conditions recede, it is likely that feed grain demand in the Australian dairy industry will not fall back to its pre-drought level but will increase steadily over the next decade.

The aim of this supplementary report is to describe the quantity of grain and fodder used by the Australian dairy industry and to describe some of the key economic and biological factors driving grain use. While accurate grain usage data at industry level is scarce, particularly for individual grains, a picture has been built from available sources. Several contentious issues relating to supply and demand for feed grains by the dairy industry are also discussed.

# DATA SOURCES AND TOOLS

There is no definitive database that provides an accurate measure of the current consumption of feed grains by the Australian dairy industry. Likewise, neither is definitive trend data on feed grain use within the industry readily available.

Kellaway and Porta (1993) report the results of a Dairy Research & Development Corporation (DRDC) survey of "concentrate" usage on Australian dairy farms in 1991. Responses were obtained on behalf of 82% of dairy farmers, Australia-wide. These data contribute to the baseline for feed grain consumption in this report.

Victoria, being the largest dairy producer, is also the largest consumer of grain on dairy farms. Therefore, changes in Victorian feed grain consumption are of particular interest. The annual Victorian Dairy Farm Survey conducted historically by the now defunct Victorian Dairy Industry Authority enjoyed a relatively high farmer response rate and is used to highlight changes in feed grain usage practices over time.

The Meyers Strategy Group report to DRDC on Australia-wide feed grain usage within the 1993/94 and 1994/95 years and the 1993 and 1994 VDIA reports contain summary data for those years. The 1999 VDIA report contains summary data on "grain" (grain + concentrates) use on Victorian dairy farms from 1996 – 1999. These data combined are used to develop trend information on changes in feed grain usage within the dairy industry over the 1990's.

The most recent attempt by the industry to identify the practices involved in management of dairy farms including the demographics of purchased feed usage at an industry level was through a major environmental audit project (Dairying for Tomorrow - DFT) that was undertaken in 2000 through funding provided by the DRDC. The DFT project surveyed 1,826 dairy farms in the industry across all regions. As part of the audit, usage of feed grains was canvassed in the context of current feeding practices and their impact on the utilisation of pastures. These data are used in an extrapolation exercise to forward project industry use of bought-in feeds, including feed grains.

A Grain Estimation Model (GEM), developed by Dairy Business Centre, has been used to forward project industry use of feed grains, for comparison with the DFT extrapolation numbers. GEM combines a ration balancing approach with quartile estimates of milk yield and herd size. Checking how well the DFT and GEM numbers align is an important sanity-check on the estimates.

ABARE studies relating to dairy industry productivity, financial performance and structural change over time plus those conducted specifically to monitor feed grain stocks and usage by dairy farmers have been used to provide context to the GEM outcomes reported in this appendix. The regular ABARE dairy farm sample size is approximately 300 farms.

The other source of information used in this report is private data compiled by the Dairy Business Centre (DBC-CowData) from 125 client farms in 2000/2001. While this data comes from a relatively small sample and is not representative of the industry at large, it provides a more detailed insight into grain and fodder use and grain feeding economics on specialist dairy farms.

Dairy industry demand for feed grains is strongly influenced by current market conditions for milk and feed grain – but not always in isolation. Dairy farm businesses which can survive negative movements in milk and grain price due to off-farm wage contributions (possibly around one third of Australia's current dairy farms) do not approach the feed grain question in the same way as specialist farms which have invested in new infrastructure or new technology and are entirely reliant on milk profitability.

This difference in approach is often buried in national averages of and trends in feed grain usage, which may mask both the imperatives and requirements of the serious commercial feed grain user. The data presented in this appendix needs to be viewed with this in mind.

## GRAIN AND FODDER IN AUSTRALIAN DAIRY SYSTEMS

Australian dairy farms have traditionally been and, for the most part, continue to be grazed pasture-based enterprises. A diverse range of production systems are employed in the Australian industry, but most systems have grazed pasture as the base feed source. This fact is reflected in the location of the dairying regions in Australia (Figure 2), all of which can claim substantial pasture resources.

The type of milk production system employed on farm plays a significant part in the use of different feedstuffs. There are four main types of dairy production system:

Open Grazing systems (the majority in Australia);

- Open Grazing with Feed pad;
- Cut & Carry systems, often with free-stall housing; and
- Integrated Feedlot systems.

Open grazing systems rely on traditional pasture grazing, where the land provides both the feed base and the flooring platform. Feed pads provide a much greater control over supplement feeding with substantial reduction in feed losses through trampling, wind and faecal contamination. Cut & carry systems involve pasture or crop being harvested and brought to the cows, which may be held in paddocks or in intensive housing.

A small portion of the Australia's milk production is based on an integrated feedlot model which relies on a mix of home-grown commodities and bought-in feed. The feedlot model lends itself more to locations and/or supply contracts where market access assures a higher year-round milk price.

Base pasture feed also varies between dryland (seasonal rains) and irrigated areas – a more intensive grazing operation will attempt to increase the availability of pasture supplies in periods of normal pasture growth through irrigation and fertiliser applications.

**Figure 2:** Australian Dairy Regions


The respective proportions of each category of feed varies greatly from farm to farm based on a host of factors including land and water availability, soil quality, milk production targets and management and husbandry practices. However, grain use in dairying is now the norm for most producers, particularly those who take a longer-term strategic view of their feeding strategy.

| | |
|---|---|
| **Strategic supplement** | Bought-in grains and fodder |
| **Risk management** | Home grown fodder & cereal (fed fresh or after storage) |
| **Base feed** | Dairy Pastures |

Home grown and purchased supplements (including grains, hay and silage) have several purposes in a dairy production system. They can:

- Reduce the impact of short-term and unforeseen shortages in pasture feed;
- Reduce the impact of normal seasonal shortages in pasture feed with the aim of better meeting "customer" needs for a constant milk supply;
- Allow an increase in enterprise scale through increased stocking rate with the aim of capturing scale efficiencies; and
- Overcome pasture-based limits to individual cow feed intake and hence increase per cow yields to capture both biological and economic efficiencies.

In relation to conserved fodder usage:

- More intensive pasture management practices (new varieties, fertilisers, irrigation, etc) tend to produce bigger peaks in pasture growth, which then need to be conserved for later use;
- Quality of fodder is important for achieving high intakes and good milk yields, so early conservation of fodder as silage has become more common;
- Hay and especially silage production is often used as a means of maintaining high quality pastures;
- There has been increased acceptance of contract fodder production to avoid the capital cost of additional land and feed production infrastructure and equipment.

All of these factors have led to an increase in investment in handling equipment and storage facilities for grains, meals, hay and silage.

Therefore, grain use in the Australian dairy industry cannot be viewed in isolation – it must be correlated to and contrasted with alternative sources of essential cow nutrients, both from within Australia's own feed resources and from imported feedstuffs.

# GRAIN USE TRENDS

Data from the early 90's provide a useful starting position in assessing the growth in demand and usage of feed grains in dairy rations in Australia. These data are summarised in Figure 3.

**Figure 3:** Concentrate Usage on Australian Dairy Farms 1991

| | Parameter | TOTAL | WA | NSW | QLD | SA | VIC | TAS |
|---|---|---|---|---|---|---|---|---|
| 1 | **Farms Responding** | **12198** | **196** | **1709** | **1828** | **970** | **6650** | **845** |
| | % Total Responding | 82% | 39% | 83% | 93% | 100% | 77% | 98% |
| 2 | **Av. Herd Size (cows)** | **113** | **112** | **98** | **84** | **90** | **127** | **122** |
| 3 | **% Feeding Concentrates to:** | | | | | | | |
| | Milkers | **77%** | **99%** | **95%** | **95%** | **87%** | **69%** | **48%** |
| | Dry Cows | 7% | 4% | 15% | 13% | 6% | 5% | 1% |
| | Heifers | 19% | 7% | 19% | 36% | 19% | 17% | 3% |
| 4 | **% farmers feeding mainly [a]:** | | | | | | | |
| | commercial pellets & meals | 32% | 22% | 25% | 46% | 28% | 27% | 76% |
| | cereal grains | 53% | 25% | 56% | 47% | 62% | 58% | 16% |
| | molasses | 8% | 0% | 5% | 37% | 2% | 1% | 0% |
| | custom mixed concentrates | 6% | 1% | 10% | 4% | 9% | 5% | 0.5% |
| | protein meals | 7% | 46% | 11% | 17% | 3% | 1% | 0.5% |
| | brewer's grains (wet) | 6% | 8% | 7% | 2% | 6% | 6% | 9% |
| | other | 2% | 0% | 1% | 5% | 0.6% | 2% | 3% |
| 5 | **Weighted Average Amount Fed (kg/yr)[b]** | | | | | | | |
| | **Milkers:** | | | | | | | |
| | commercial pellets & meals | 710 | 1070 | 994 | 1152 | 1083 | 476 | 348 |
| | cereal grains | 705 | 1029 | 1048 | 928 | 1176 | 507 | 349 |
| | molasses | 744 | 0 | 848 | 817 | 100 | 100 | 0 |
| | custom mixed concentrates | 966 | 0 | 1118 | 973 | 1087 | 859 | 200 |
| | protein meals | 307 | 1100 | 153 | 122 | 254 | 221 | 200 |
| | brewer's grains (wet) | 2034 | 0 | 4288 | 2389 | 2037 | 1342 | 1577 |
| | other | 796 | 0 | 0 | 534 | 0 | 820 | 1919 |
| | **Dry Cows:** | | | | | | | |
| | commercial pellets & meals | 128 | 30 | 112 | 176 | 0 | 100 | 130 |
| | cereal grains | 99 | 30 | 88 | 115 | 89 | 100 | 180 |
| | molasses | 148 | 0 | 0 | 148 | 0 | 0 | 0 |
| | custom mixed concentrates | 104 | 0 | 113 | 75 | 0 | 0 | 0 |
| | protein meals | 22 | 0 | 0 | 21 | 50 | 0 | 0 |
| | brewer's grains (wet) | 376 | 0 | 0 | 400 | 300 | 374 | 500 |
| | other | 25 | 0 | 0 | 25 | 0 | 0 | 0 |
| | **Growing Heifers:** | | | | | | | |
| | commercial pellets & meals | 116 | 150 | 169 | 195 | 126 | 52 | 101 |
| | cereal grains | 86 | 150 | 159 | 131 | 195 | 42 | 0 |
| | molasses | 232 | 0 | 0 | 232 | 0 | 0 | 0 |
| | custom mixed concentrates | 63 | 0 | 0 | 75 | 104 | 50 | 0 |
| | protein meals | 51 | 0 | 0 | 48 | 100 | 50 | 0 |
| | brewer's grains (wet) | 403 | 0 | 0 | 0 | 0 | 400 | 500 |
| | other | 50 | 0 | 0 | 50 | 0 | 0 | 0 |
| 6 | **% self-processing grains** | 63% | 96% | 75% | 57% | 63% | 61% | 14% |
| 7 | **% feeding minerals** | 26% | 31% | 30% | 58% | 61% | 13% | 14% |

[a] Percentages do not total to 100 because many farmers use more than one category of feed.

[b] average amounts apply only to farms where fed.

Source: DRDC Survey results. In Kellaway & Porta (1993).

These usage numbers reflect the then differences between the "perceived affordability" of feed grains in the market milk states (higher average milk price) compared to manufacturing milk states (lower milk price based on world market returns). That this "affordability" characteristic had undergone serious review and revision by the Victorian industry by the closing years of that decade is shown in Figure 4.

**Figure 4:** Supplement Use in the Victorian Dairy Industry 1996-1999

| | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|
| % Farms using Bought-In Feed | 83% | 88% | 87% | 87% |
| Total tonnes of Bought-In Feed | 740,793 | 903,546 | 844,645 | 925,442 |
| Average tonnes of B/I Feed per farm | 167 | 216 | 226 | 256 |
| **Average tonnes of Grain** | **118** | **142** | **155** | **181** |
| **Increase in Grain Use from 1996** | **0** | **21%** | **32%** | **54%** |
| Average tonnes of Hay | 86 | 101 | 97 | 108 |
| Average tonnes of Silage | 171 | 152 | 163 | 200 |
| Average tonnes of Other Feeds | 139 | 127 | 137 | 173 |

| **1999 Detail** | **Grain** | **Hay** | **Silage** | **Other** |
|---|---|---|---|---|
| No of Farms feeding | **3366** | 2086 | 349 | 128 |
| % of all responses | **81.1%** | 50.3% | 8.4% | 3.1% |
| Total Tonnes | **608,249** | 224,976 | 70,092 | 22,125 |
| % of Total Tonnage | **65.7%** | 24.3% | 7.6% | 2.4% |
| Average tonnes per farm | **181** | 108 | 200 | 173 |
| Average tonnes per cow | **0.990** | 0.591 | 1.096 | 0.947 |

Source: Victorian Dairy Farm Survey 1999, VDIA

From a base of around 0.5 tonnes/cow of grain/concentrate in 1991, grain and concentrate usage grew 54% over the 1996-1999 period to approach 1 tonne/cow/year, bringing Victorian grain/concentrate levels in line with that of the market milk states of a decade before.

However, there is good evidence that a significant proportion of dairy farmers, both in Victoria and other states, have now lifted usage rates even higher than these survey data show. Farms in the DBC-CowData sample from 2000/01 show an average grain usage of 1.88 tonnes per cow. With an average herd size of 295 cows, average farm usage was 572 tonnes (dry matter basis). Grain usage rates were higher on larger farms so that when weighted on the basis of herd size, weighted average usage was 1.93 tonnes per cow, which is slightly higher than the simple mean.

Figure 5 below provides further details of the distribution of grain usage rates within the DBC-CowData sample. The 25% of farms using the least grain (1st quartile) used between 0 and 1.50 tonnes per cow. Half the farms used less than 1.86 tonnes per cow (the median usage). The 25% of farms using the most grain used greater than 2.27 tonnes per cow. The highest rate of grain usage for an individual farm in the sample was 3.35 tonnes per cow.

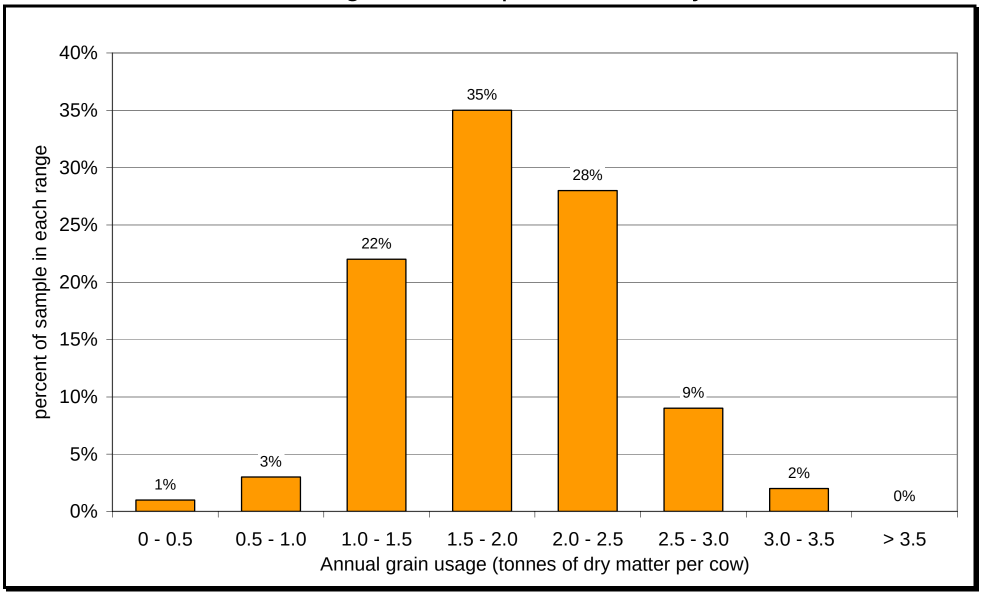
**Figure 5:** Distribution of Grain Usage on a Sample of 125 Dairy Farms in 2000/2001

| **Quartile** | **Grain usage (tonnes/cow)** | | | **Herd size (cows)** | **Farm Usage (tonnes)** |
|---|---|---|---|---|---|
| **Based on grain usage** | **Minimum** | **Maximum** | **Mean of Quartile** | **Mean of Quartile** | **Mean of Quartile** |
| 1st | 0.0 | 1.50 | 1.24 | 263 | 326 |
| 2nd | 1.51 | 1.86 | 1.69 | 285 | 481 |
| 3rd | 1.87 | 2.24 | 2.05 | 306 | 628 |
| 4th | 2.27 | 3.35 | 2.55 | 339 | 864 |

Source: DBC-CowData

The distribution of usage rates is shown in Figure 6 in an alternative way. This highlights that 85% of dairy farms in the DBC-CowData sample used between 1.0 and 2.5 tonnes per cow.

**Figure 6:** Distribution of Grain Usage in a Sample of 125 Dairy Farms in 2000/2001

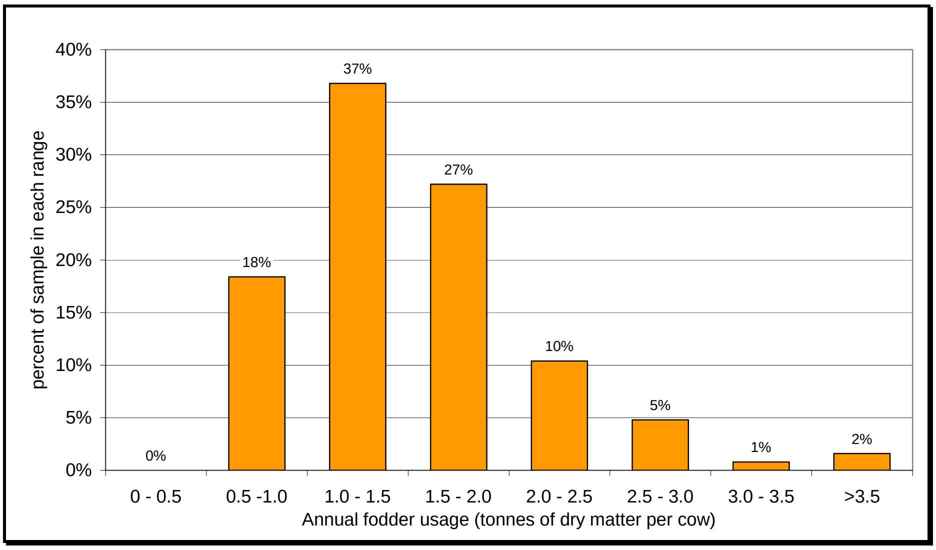



Source: DBC-CowData

## Fodder (hay & silage)

From the DBC-CowData sample, use of hay and silage supplements was lower than grain usage. Total fodder use per cow (consisting of hay and silage grown on the farm and purchased from suppliers) averaged 1.04 tonnes per cow in 2000/2001. As was the case for grain supplements, the higher forage users tended to have larger herds. One quarter of DBC farms used less than 0.6 tonnes DM of hay and silage. The median usage was 0.94 tonnes per cow. A quarter of the sample farms used more than 1.37 tonnes of fodder dry matter per cow.

**Figure 7:** The Distribution of Fodder Usage Rates in a Sample of 125 Dairy Farms in 2000/2001




Source: DBC-CowData

The proportion of fodder purchased rather than grown on the farm varied significantly on the farms sampled. Just over a third of farms purchased all their fodder, while 20% grew all or nearly all their fodder requirements on the home dairy farm.

The lower fodder-using farms tended to purchase more of their fodder (1st quartile averaged 70%) than did the higher fodder users (4th quartile averaged 50% purchased).

## Energy contribution of Grain

From the milk production and other farm data available through DBC-CowData, it is possible to estimate the total Metabolisable energy consumption by cows on each farm. From this, it is possible to define the proportion of total metabolisable energy which is sourced from feed grain.

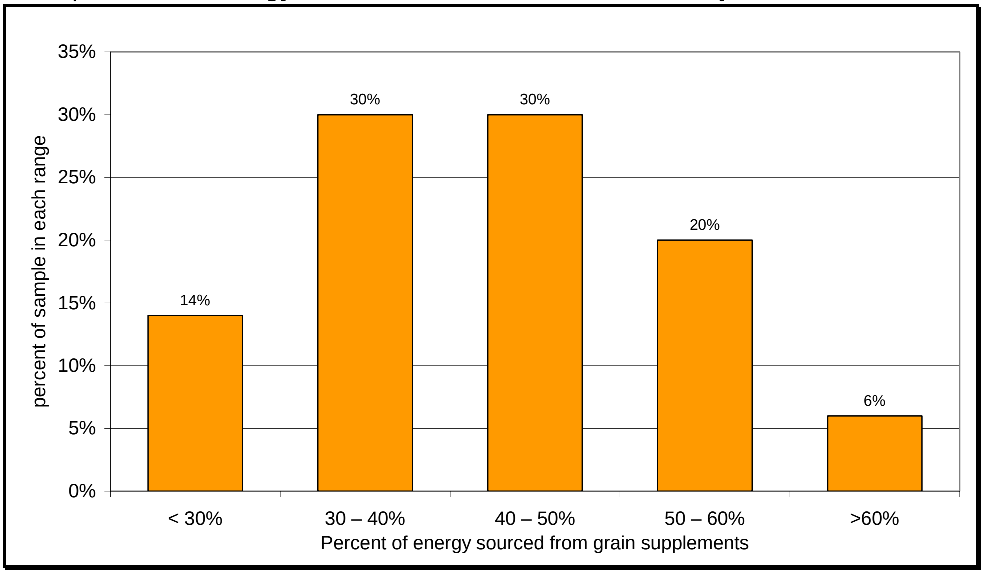
The median value for the sample was *47% of energy from grain*. *It is this value that above all others reflects the vital importance of feed grains to the dairy industry.*

Most dairy cows consume between 5.0 to 7.0 tonnes of dry matter over a year. From the data presented earlier, feed grains or grain-based concentrates at 1.0 - 1.5 tonnes DM pa only account for between 20 – 30% of a cow's dry matter intake.

*However, it is the metabolisable energy contribution which drives milk production, once the animal's energy requirements for maintenance, pregnancy, weather, walking and body condition are met.*

The range of grain energy proportions from the DBC-Cowdata group is shown in Figure 8 below.

**Figure 8:** Proportion of Energy Sourced from Grain on 125 Dairy Farms in 2000/2001




Source: DBC-CowData

As would be expected given the fodder usage data described earlier, fodder was a far less significant source of energy than grain on most farms. Almost 80% of farms sourced less than 20% of their cow's energy from hay and silage. Only 6% of farms sourced more than 30% of their energy from fodder.

The feeding data from the DBC-CowData sample shed light on the direction in which the rest of the industry will be heading over the next decade and confirms the importance of metabolisable energy contributions from feed grains on higher milk yields.

## Current Grain Use

On the DBC-CowData farms (Figure 9), average grain use per cow was lowest on NSW farms (which were mostly from the Hunter and Bega Valleys). Victorian and South Australian farms had higher average grain use at 2 tonnes per cow.

Average fodder use was substantially higher on the Victorian farms than those from the other states. Combined average fodder use (purchased plus home-grown) was just over 0.8 tonnes per cow in NSW, SA and Tasmania, compared to 1.5 tonnes per cow on the Victorian farms.

**Figure 9:** Supplement Usage on a Sample of 125 Dairy Farms across 4 States in 2000/2001

| State | Number of farms | Grain | Purchased Fodder | HG Fodder | Herd Size | Yield (l) |
|---|---|---|---|---|---|---|
| NSW | 68 | 1.77 | 0.42 | 0.40 | 238 | 6,029 |
| SA | 13 | 2.01 | 0.56 | 0.37 | 382 | 7,174 |
| TAS | 8 | 1.92 | 0.67 | 0.13 | 397 | 6,722 |
| VIC | 36 | 2.01 | 0.84 | 0.69 | 348 | 6,878 |

Source: DBC-CowData

Comparing milk yields per cow from farms in the DBC-CowData study with those in available national statistics confirms that the DBC-CowData sample is not representative of the general dairy farm population. Figure 10 below contains the average herd size and milk yield for farms in each state from ADC.

**Figure 10:** Dairy Farm Characteristics in Australia for 2000/2001

| State | Number of farms | Herd Size | Milk Yield |
|---|---|---|---|
| NSW | 1,391 | 204 | 4,682 |
| SA | 587 | 225 | 5,293 |
| TAS | 638 | 251 | 3,685 |
| VIC | 7,559 | 191 | 4,696 |
| QLD | 1,305 | 143 | 4,065 |
| WA | 357 | 202 | 5,467 |
| Australia | 11,837 | 193 | 4,624 |

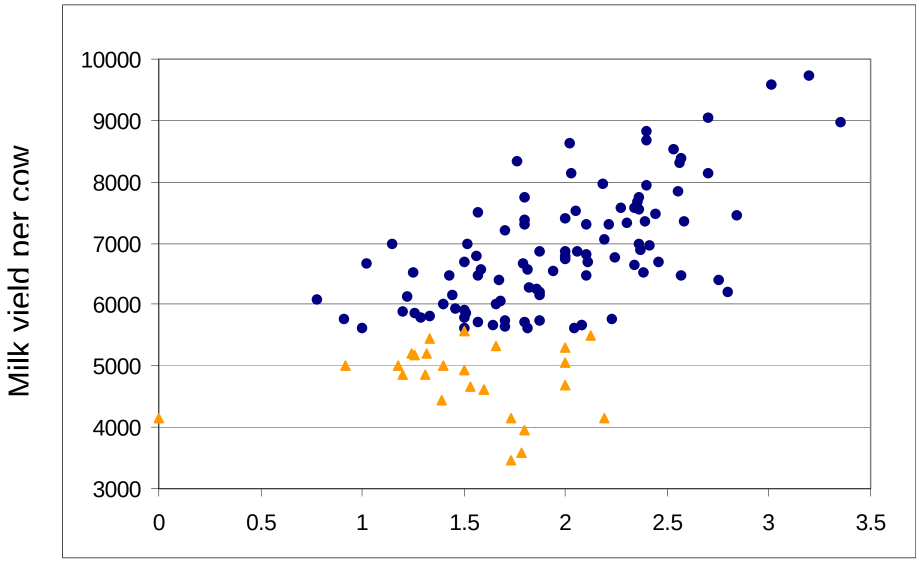
Source: Adapted from Australian Dairy Industry In Focus 2002, ADC 2002

These differences in herd size and milk yield mean that there are differences in the underlying feeding practices between the two populations which invalidate the use of DBC-CowData whole group averages in estimating *industry-wide* feed grain use.

However, one of the major determinants of milk yield is grain usage. By isolating that subset of farms within the DBC-CowData group with an average milk yield similar to the national average, an indication of grain use can be identified.

Figure 11 below shows the yield and grain use for each of the farms in the DBC-CowData sample. The lowest yielding 26 farms are shown with the orange triangles, with all other farms represented by the blue dots. The 26 farms highlighted have an average yield of 4,765 litres per cow, which is similar to the national average yield shown in Figure 10 above.

**Figure 11:** Yield and Grain use of the Lowest Yielding Farms in the DBC Sample




Grain usage per cow

Source: DBC-CowData

Assuming that this group of lower yielding farms is more representative of the national population than the study sample as a whole, then their grain usage could be used to estimate state and national consumption. The average grain use of this group was 1.51 tonnes per cow.

Using this average grain use per cow, statewide grain consumption for the 2000/01 year can be estimated and is shown in Figure 12 below.

**Figure 12:** Estimated 2000/2001 National Grain use Based on the DBC-CowData Low Yielding Subset

| State | Number of farms | Herd Size | Grain use (kt) |
|---|---|---|---|
| NSW | 1,391 | 204 | 428 |
| SA | 587 | 225 | 199 |
| TAS | 638 | 251 | 241 |
| VIC | 7,559 | 191 | 2,178 |
| QLD | 1,305 | 143 | 282 |
| WA | 357 | 202 | 108 |
| Australia | 11,837 | 193 | 3,436 |

The DBC-CowData analysis relies on a small sample and the method of calculation makes several important assumptions:

- There is no difference between the states in relative use of grain, fodder and pasture (milk yield differences indicate this assumption is incorrect);

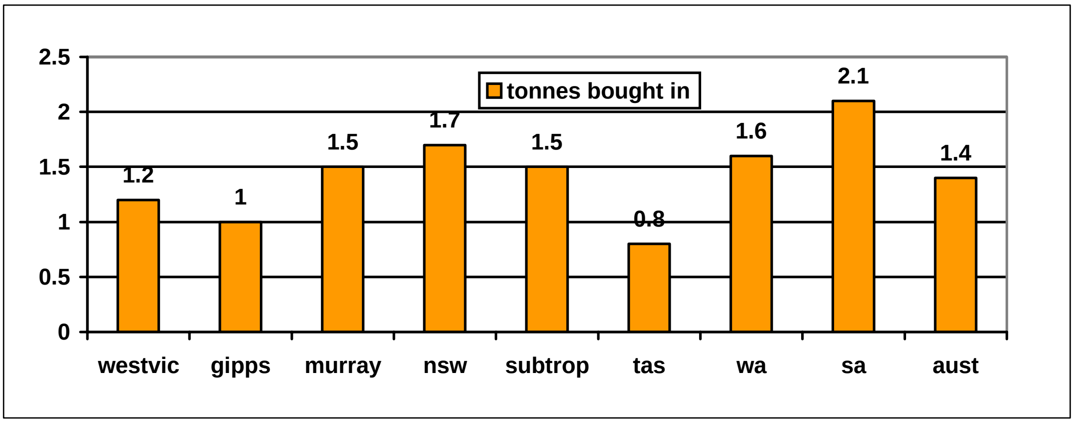
- There is no difference between states in the efficiency of grain use relative to milk yield; and

- The efficiency of grain use relative to milk yield is consistent between the study sample and the population.

However, since the DBC sample has a low representation of *nil-grain users*, there seems little doubt that the feed grain numbers in Figure 14 over-estimate feed grain usage across the industry for 2000/01. An alternative approach is needed.

The broad-ranging DFT study (IRIS Research 2000) provides a reasonably current estimate of total bought-in feed (grain + fodder) for each of the dairy regions in Australia (Figure 13).

**Figure 13:** Tonnes of Feed Bought-in per Cow per Annum




Source: Iris Research 2000

As would be expected from the broader sample, these averages are significantly lower than those of the DBC-CowData sample. The DFT estimate of total feedstuffs bought-in to dairy farms in 2001-2 is shown in Figure 14, which aligns the DFT estimates with ADC state milk production numbers and herd sizes.

**Figure 14:** Derived Estimate of Total Purchased Feedstuffs used in 2001-2

| Regions | | Production (mill litres) | Average Yield (L) | Feed (t per cow) | Cows (000) | Tonnes (000) |
|---|---|---|---|---|---|---|
| VIC | | | | | | |
| | Eastern | 2,191 | 4,690 | 1.0 | 467 | 467 |
| | Northern | 3,006 | 4,962 | 1.5 | 606 | 909 |
| | Western | 2,208 | 4,969 | 1.2 | 444 | 533 |
| | Total VIC | 7,405 | | | 1520 | 1,909 |
| NSW | | 1,343 | 4,712 | 1.7 | 285 | 485 |
| QLD | | 744 | 4,022 | 1.5 | 185 | 277 |
| SA | | 715 | 5,376 | 2.1 | 133 | 279 |
| WA | | 393 | 5,458 | 1.6 | 72 | 115 |
| TAS | | 671 | 3,947 | 0.4 | 170 | 68 |
| | Total Industry | 11,271 | 4,758 | 1.4 | 2,369 | 3,134 |

Source: ADC 2002 and Iris Research 2000

The ADC-DFT extrapolation shows national consumption of "*bought-in feed*" to be around 3.1 million tonnes, with average per cow consumption at 1.4 tonnes. The DBC-CowData study found that bought-in fodder (hay and silage) was around 0.5 tonnes per cow.

This suggests that the underlying feed grain figures from ADC-DFT were 0.9 tonnes per cow and 2.1 million tonnes nationally for the 2001/02 year.

## Specific Feedstuffs used

A wide range of feedstuffs are used by the dairy industry. Anecdotal evidence suggests that the major feedstuffs are:

- Cereal grains: wheat, triticale, barley, sorghum
- Legume grains: lupins, peas
- Other grain based products: canola meal, cottonseed meal, whole cottonseed,
- Hay: lucerne, clover, ryegrass/clover pasture, cereal
- Silage: maize, ryegrass/clover pasture
- Commercial pellets: consisting largely of cereal grains & milling by-products

Reliable industry-wide data is not available for individual feed stuffs. The DFT study provides some data (Figure 15) but it suffers from category participation problems. It reports the mean ingredient usages per cow per annum only for those farms using that particular ingredient, rather than the average ingredient usage across all farms, whether or not that farm used that ingredient.

This creates difficulty in extrapolating to industry-wide usage figures for individual feedstuffs. The column on the right in Figure 15 shows the proportion of farms claiming to use each type of feed. Obviously, many are using several types in combination.

**Figure 15:** Proportion of Farms using, and Average Consumption of, Various Feedstuffs

| | **Mean Consumption** | **% of farms using** |
|---|---|---|
| Grain | 1.0 | 56 |
| Pellets | 0.7 | 40 |
| Silage | 0.9 | 7 |
| Hay | 0.6 | 40 |
| Protein meals | 0.3 | 12 |
| Dry by-products | 2.1 | 5 |
| Wet by-products | 1.7 | 5 |
| Average | 1.4 | |

Source: Iris Research 2000

An alternate way to illustrate the relative usage of different classes of feed within the industry is to build typical feed budgets for "model" farms. Using the CUD® Decision Support System, a 250 cow spring-calving dairy farm in Western Victoria was modelled.

This will NOT reflect the same farming operation based on the Atherton Tableland, QLD or Bunbury, WA but the Victorian dairy industry is a more significant consumer of feed grains. From Figure 13 above, the WestVic region use of bought-in feed falls between that of the Murray and Gippsland region.

Case Study 1 involves a feed budget based around a milk yield of 4,758 litres per cow per year, the national average yield reported in Figure 10 above. Case Study 2 involves a feed budget based around a milk yield of 6,475 litres per cow per year, the median yield of the 125 farms in the DBC-Cowdata sample.

Case Study 3 involves a feed budget based around a milk yield of 8,475 litres per cow per year, representing a high yielding herd.

Figures 16 – 11 contain the feed budget projections derived.

Figures 16 – 18 Feed Budget Projections

**Figure 16: Tonnage requirements (tDM) for Case Study 1**

| Ingredient | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | TOTAL | tDM /cow |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Barley - P | 16.5 | 20.7 | 17.8 | 15.5 | 19.4 | 21.7 | 21.9 | 22.4 | 22.1 | 13.2 | 7.7 | 11.9 | 211 | **0.84** |
| Pasture Silage - H | 11.7 | 15.5 | 7.0 | 0.0 | 0.0 | 13.5 | 26.8 | 28.0 | 35.9 | 24.0 | 7.3 | 11.0 | 181 | **0.72** |
| Pasture Hay - H | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.4 | 9.1 | 6.4 | 9.7 | 38 | **0.15** |
| Turnips - H | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 | 19.6 | 16.7 | 9.4 | 0.0 | 0.0 | 47 | **0.19** |
| Pasture - H | 59.8 | 74.2 | 89.4 | 105.4 | 94.7 | 81.1 | 63.3 | 33.6 | 19.7 | 9.4 | 11.9 | 18.3 | 661 | **2.64** |
| TOTAL | 88.0 | 110.4 | 114.2 | 120.9 | 114.1 | 116.3 | 113.4 | 103.6 | 106.8 | 65.1 | 33.3 | 50.9 | 1137 | **4.55** |

**Figure 17: Tonnage requirements (tDM) for Case Study 2**

| Ingredient | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | TOTAL | tDM /cow |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wheat - P | 27.5 | 34.0 | 34.9 | 34.2 | 38.7 | 32.4 | 32.3 | 30.8 | 33.0 | 17.5 | 9.2 | 16.8 | 341 | **1.37** |
| Lupins - P | 3.1 | 3.1 | 3.0 | 3.1 | 6.0 | 6.2 | 6.2 | 5.8 | 6.2 | 4.2 | 2.1 | 1.9 | 51 | **0.20** |
| Canola Meal - P | 3.1 | 2.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 | 8 | **0.03** |
| Lucerne Hay - P | 10.7 | 10.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 6.5 | 29 | **0.11** |
| Pasture Silage - H | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | 30.3 | 30.8 | 33.4 | 19.3 | 7.2 | 0.0 | 143 | **0.57** |
| Turnips - H | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.0 | 31.0 | 28.0 | 26.0 | 0.0 | 0.0 | 0.0 | 109 | **0.44** |
| Pasture - H | 59.8 | 77.2 | 93.0 | 95.1 | 88.7 | 47.7 | 30.2 | 22.4 | 30.2 | 38.3 | 20.1 | 36.6 | 639 | **2.56** |
| TOTAL | 104.2 | 127.3 | 130.9 | 132.4 | 133.4 | 131.9 | 130.0 | 117.8 | 128.8 | 79.3 | 39.6 | 63.7 | 1319 | **5.28** |

**Figure 18: Tonnage requirements (tDM) for Case Study 3**

| Ingredient | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | TOTAL | tDM /cow |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wheat - P | 32.9 | 40.6 | 39.0 | 40.3 | 45.0 | 44.1 | 42.1 | 36.4 | 40.3 | 26.3 | 13.1 | 20.4 | 421 | **1.68** |
| Lupins - P | 5.6 | 6.2 | 6.0 | 6.2 | 6.0 | 6.2 | 6.2 | 5.6 | 6.2 | 4.2 | 2.6 | 3.0 | 64 | **0.26** |
| Canola Meal - P | 5.6 | 6.2 | 6.0 | 6.2 | 6.0 | 6.2 | 6.2 | 5.6 | 6.2 | 4.2 | 2.6 | 3.0 | 64 | **0.26** |
| Lucerne Hay - P | 18.5 | 13.0 | 0.0 | 0.0 | 9.0 | 21.3 | 25.1 | 23.7 | 26.1 | 21.2 | 9.0 | 7.6 | 175 | **0.70** |
| Pasture Silage - H | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.4 | 19.9 | 19.6 | 19.2 | 4.6 | 2.1 | 0.0 | 80 | **0.32** |
| Turnips - H | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.0 | 31.0 | 28.0 | 26.0 | 0.0 | 0.0 | 0.0 | 109 | **0.44** |
| Pasture - H | 59.8 | 84.5 | 99.0 | 102.3 | 86.7 | 43.5 | 29.7 | 22.6 | 30.2 | 38.3 | 20.7 | 40.3 | 658 | **2.63** |
| TOTAL | 122.4 | 150.5 | 150.0 | 155.0 | 152.7 | 159.7 | 160.2 | 141.5 | 154.2 | 98.8 | 50.1 | 74.3 | 1569 | **6.28** |

In Case Study 1, the rate of grain usage is 0.84 t/cow and that of hay / silage 0.87 t/cow, making total supplement usage equal to 1.7 t/cow.

In Case Study 2, the rate of grain usage is 1.6 t/cow and that of hay / silage 0.68 t/cow, making total supplement usage equal to 2.3 t/cow.

In Case Study 3, the rate of grain usage is 2.2 t/cow and that of hay / silage 1.02 t/cow, making total supplement usage equal to 3.2 t/cow.

The IRIS study (Figure 15) showed that grain usage averaged 1.0 t/cow and pellet usage averaged 0.7 t/cow. Dairy farmers who are geared up for pellets usually do not have the milling facilities to switch to straight grain mid-season. Therefore, if grain and pellet usage can be considered mutually exclusive, it is reasonable to view the average "grain & concentrate" usage represented in Table 8 as lying between 0.7 – 1.0 t/cow.

Since only Case Study 1 is consistent with this usage level, the implication is that many dairy farmers are foregoing the opportunity of higher milk yields through more aggressive concentrate or grain-feeding. In our view, this implies that the standard of nutritional education and knowledge within the dairy industry still has a considerable way to go. This is discussed later in this report..

In Case Studies 2 and 3, the higher milk yield target requires an increment in the protein content of the ration – hence the inclusion of lupins and canola meal.

A cow producing 10 litres per day requires around 120 MJ of metabolisable Energy and about 1.5 kg of protein per day. If that cow's milk production is lifted to 40 litres per day, the energy requirement roughly doubles (260 MJ ME) but the protein requirement triples (4.5kg).

Feeding high levels (2 tonnes + /cow) of cereal grain alone without accounting for the animal's higher protein requirement will not give the desired yields. This constraint is central to the increased use of cereal grains within the dairy industry – unless there is a matching increment in protein availability, through domestic or export sources, milk productivity gains will be constrained.

Pasture provides a key source of protein to the cow. However, as Figures 16 – 18 show, the ratio of cereal grains to protein sources changes dramatically as desired milk yields increase.

In Figure 16 (4,758 litres), no feed grain protein is required. In Figure 17 (6,475 litres), the ratio is 5.96 (1.37 / 0.23) and in Figure 18 (8,475 litres), the ratio is down to 3.23 (1.68 / 0.52).

Therefore, in forward projecting the dairy industry's requirements for cereal grains and protein meals, it is expected that there will a *higher rate of change in requirement* for protein sources compared to cereal grains over the longer term, unless productivity gains in milk yield are not required by the industry.

# MEDIUM TERM GRAIN USE FORECASTS

We have undertaken an estimate of the total purchased feedstuffs usage across the industry in 2006/07 (Figure 19), based on an extrapolation of the current situation as defined by the combined ADC-DFT data presented in Figure 14.

The scenarios for drought recovery is heavily influenced by the market conditions for dairy products in domestic and international markets, which impact on milk prices at the farm gate.

The "recovery scenario" is based on the following assumptions:

- Northern Victoria will see a further 25% reduction in herd in 2003/04 and a 20% decline in per-cow feeding;
- A 10% per annum recovery in herd in the Northern Victoria region over each of the following two years;
- Changes in per cow usage rates in 2003/04 to reflect local conditions and a 20% increase in usage over the 3 years to 2006/07;
- 10% decline in the Qld herd in 2003/04;
- 5% growth in herds in other regions per annum from 2004/05 to 2006/07, with the exception of Qld (where a 5% decline in 2004/05).

This scenario assumes a return to normal grain availability in the 2003/04 year. If the drought conditions extend beyond the 2003 harvest and grain prices remain high, the reduction in the northern Victoria region would be extended and grain usage will be further cut in areas where "shoulder" milk production is important. The "extended scenario" identifies the usage in 2006/07 if normal conditions ensue.

**Figure 19:** Medium Term Projections of Bought-in Feed Use

| Regions | 2001-2 | | 2006-7 | |
|---|---|---|---|---|
| | | | Recovery | Extended |
| | cows (000) | tonnes (000) | tonnes (000) | tonnes (000) |
| VIC | | | | |
| Eastern | 467 | 467 | 591 | 591 |
| Northern | 606 | 909 | 1,202 | 874 |
| Western | 444 | 533 | 674 | 674 |
| Total VIC | 1,520 | 1,909 | 2,466 | 2,139 |
| NSW | 285 | 485 | 613 | 554 |
| QLD | 185 | 277 | 318 | 318 |
| SA | 133 | 279 | 354 | 354 |
| WA | 72 | 115 | 147 | 147 |
| TAS | 170 | 68 | 88 | 88 |
| Total Industry | 2,369 | 3,134 | 3,986 | 3,601 |

Assuming that purchased hay and silage usage continues to account for around 0.5 tonnes per cow, hay and silage use will remain at around 1.2 million tonnes (DM) nationally, meaning that the underlying feed grain requirement in Table 12 is around 2.8 million tonnes for the "Recovery" scenario and 2.4 million tonnes for the "Extended" scenario.

To test these projections, alternative estimates were developed using the Dairy Business Centre's GEM tool. This relies on quartile estimates of herd size, milk yield and ration balance within the Australian industry. Baseline numbers were established for the 2000/01 year. As for the ADC-DFT projection, forecasts to 2006/07 were run.

Baseline assumptions are show in Figure 20.

**Figure 20:** 2000/2001 Base Year

| Farms | Farms | Av Herd | Cows | Milk | Av. Litres /cow | Cereals t/cow | Protein t/cow |
|---|---|---|---|---|---|---|---|
| 25% | 2959 | 120 | 355,110 | 798,997,500 | **2,250** | 0.00 | 0.00 |
| 25% | 2959 | 150 | 443,888 | 1,420,440,000 | **3,200** | 0.40 | 0.00 |
| 25% | 2959 | 200 | 593,327 | 2,637,337,029 | **4,445** | 0.80 | 0.10 |
| 25% | 2959 | 300 | 888,959 | 5,689,335,680 | **6,400** | 1.35 | 0.25 |
| 100% | **11837** | 193 | 2,281,283 | 10,546,110,209 | **4,623** | | |

Source: DBC GEM 2003

The substantial impact of the drought on the national herd has been factored in using recent (February 2003) ABARE survey data (Figure 21).

**Figure 21:** Estimated Drought Impact on 2002/2003 National Dairy Herd

| | 2001/02 ('000 cows) | 2002/03 ('000 cows) | Change |
|---|---|---|---|
| NSW | 285 | 259 | -9% |
| VIC | 1520 | 1368 | -10% |
| QLD | 185 | 155 | -16% |
| SA | 133 | 106 | -20% |
| WA | 72 | 66 | -9% |
| TAS | 170 | 160 | -6% |
| AUST | 2369 | 2114 | -11% |

Source: ABARE Grain & Fodder Stocks Survey 2003

Figure 22 shows the assumed structural and input changes in the dairy industry by 2006/07.

**Figure 22:** 2006/2007 Projection

| Farms | Farms | Av Herd | Cows | Milk | Av. Litres /cow | Cereals t/cow | Protein t/cow |
|---|---|---|---|---|---|---|---|
| 25% | 2244 | 150 | 336,613 | 875,194,340 | **2,600** | 0.00 | 0.00 |
| 25% | 2244 | 190 | 426,377 | 1,641,550,410 | **3,850** | 0.50 | 0.00 |
| 25% | 2244 | 300 | 673,226 | 3,433,454,720 | **5,100** | 1.00 | 0.15 |
| 25% | 2244 | 400 | 897,635 | 6,193,683,025 | **6,900** | 1.50 | 0.35 |
| 100% | **8976** | 260 | 2,333,852 | 12,143,882,496 | **5,203** | | |

Source: DBC GEM 2003

These imply a 2% increase in national herd size over the period to 2.3 million cows, after recovery from the drought, a lift in average herd size from 193 to 260 cows and a 15% increase in national milk production to 12.1 billion litres. Average annual milk yield is projected to rise to 5.203 litres per cow.

Based on these structural and input changes, the projected requirement for feed grains is shown in Figure 23. DBC GEM projects a 24% increase in feed grain requirement by 2006/07, within which protein grain requirements will rise by 47%. The projected 2.6 million tonnes lies within the 2.4 to 2.8 million tonne range reported by the ADC-DFT extrapolation.

**Figure 23:** Projected Change in Dairy Industry Feed Grain Requirements

| 2000/01 | Cereals (t) | Protein (t) | All Grains (t) | Cereals (% Grains) | Protein (% Grains) | C:P |
|---|---|---|---|---|---|---|
| Quartile 1 | - | - | - | - | - | - |
| Quartile 2 | 177,555 | - | 177,555 | 100% | 0% | |
| Quartile 3 | 474,661 | 59,333 | 533,994 | 89% | 11% | 8.00 |

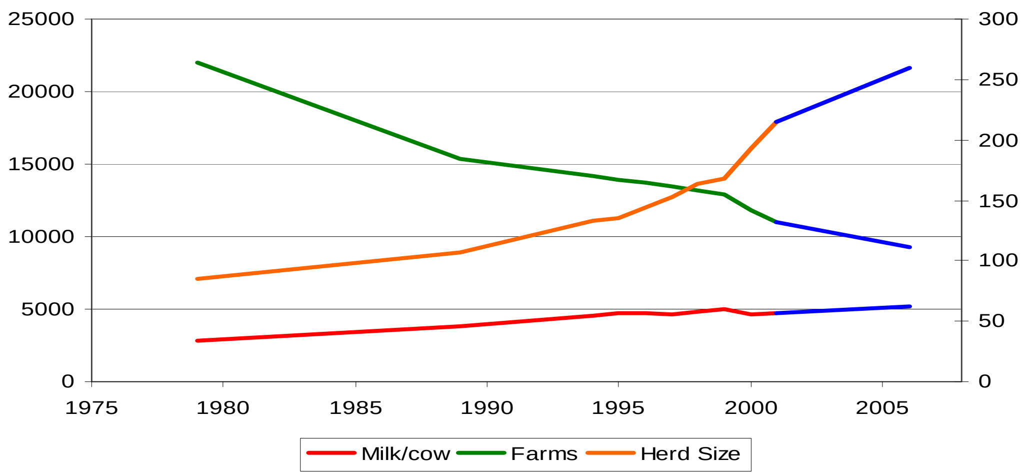
| 2000/01 | Cereals (t) | Protein (t) | All Grains (t) | Cereals (% Grains) | Protein (% Grains) | C:P |
|---|---|---|---|---|---|---|
| Quartile 4 | 1,200,094 | 222,240 | 1,422,334 | 84% | 16% | 5.40 |
| ALL | 1,852,311 | 281,572 | 2,133,883 | 87% | 13% | 6.58 |
| **2006/07** | | | | | | |
| Quartile 1 | - | - | - | - | - | - |
| Quartile 2 | 213,188 | - | 213,188 | 100% | 0% | |
| Quartile 3 | 673,226 | 100,984 | 774,210 | 87% | 13% | 6.67 |
| Quartile 4 | 1,346,453 | 314,172 | 1,660,625 | 81% | 19% | 4.29 |
| ALL | 2,232,868 | 415,156 | 2,648,024 | 84% | 16% | 5.38 |
| Change | 21% | 47% | 24% | | | |

These estimates are more bullish about the rate of change in feeding practices, herd replenishment post-drought and milk production than recent ABARE projections (Figure 24). Figure 25 ties the DBC GEM projections into past movements in farm numbers, cow numbers and milk yield – the blue extensions show the projections.

**Figure 24:** Comparison of Projected Dairy Industry Indicators for 2006/07

| | ABARE 2002 | ABARE 2003 | DBC GEM |
|---|---|---|---|
| Milk (ML) | 11,531 | 11,436 | 12,144 |
| Cows | 2,251 | 2,220 | 2,334 |
| Yield / Cow (L) | 5,123 | 5,151 | 5,203 |

**Figure 25:** DBC GEM Projections of Key Dairy Indicators

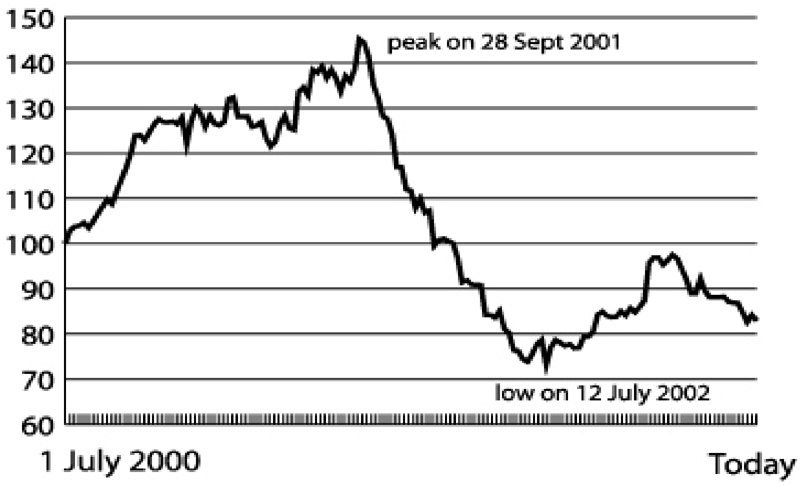



## Market & Drought Impacts

The drought has had a significant impact on the total production and profitability of the industry, particularly the unit cost of milk production. This has corresponded with a decline in the export returns to the Australian industry.

This can be illustrated by Whitehall's export index which plots the indicative average returns to the Australian industry over recent years, based on the apparent net export prices that are achieved by EU exports – who typically set "world prices". This index has been impacted by a slowing of the world economy and build-up of dairy commodity stocks in the EU and US, coupled with a slow-down in demand from the trade into certain market segments, including food service.

**Figure 26:** Index of Net EU Spot Prices




Source: Whitehall Associates 2003

The effect of lower export returns has resulted in lower farm gate prices for the majority of Victorian producers where dairy manufacturers are highly exposed to the world market for manufactured commodities. A small proportion of Victorian farmers and the majority of farmers in other states, have been protected from the full extent of this downturn due to a largely domestic exposure of their business.

The world market downturn has exacerbated the negative response to the drought. The effect of the drought conditions has seen a combination of:

- Reducing available pastures – through drastically reduced rainfall and stored water availability for pasture irrigation;

- Reducing the supplies of home-grown fodder and crops – as above; and

- Reducing the availability and significantly increasing cost of bought-in grains and fodder.

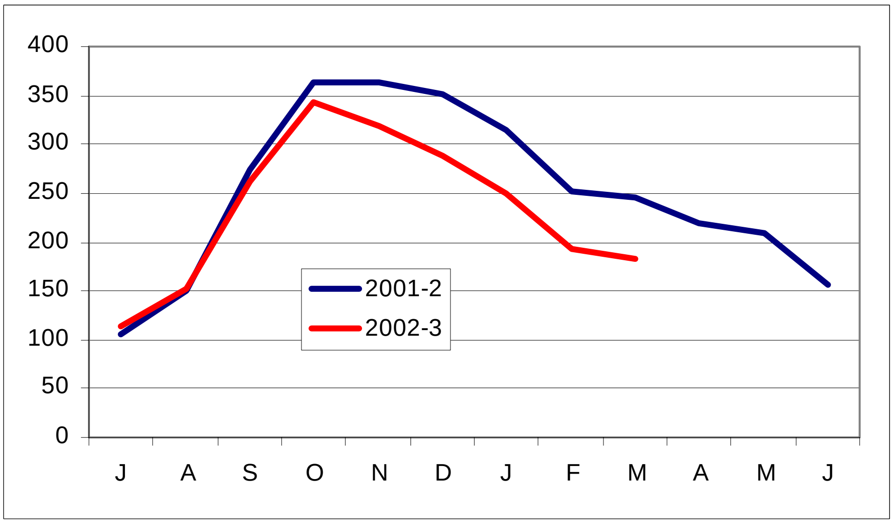
(These comments need to be linked to the earlier discussion of the drought response modelling where the recovery scenario was based on a number of assumptions – the market conditions have a major bearing on the pace and extent of recovery, as the economics of milking additional cows v sale for slaughter and v sale of heifers outside of the industry is adversely affected.)

The impacts on milk output in key production areas has been significant in the 2002-3 season and is expected to continue into 2003-4.

Production in Northern Victoria was down 13% by the end of March 2003 (Figure 27) compared to that of the prior year, with the combined effects of higher feed costs adversely affecting:

- Pre-season investment in cow-conditioning – resulting in a much lower peak production
- Lower supplementary feeding which has seen a limited "shoulder" milk production period after the peak.

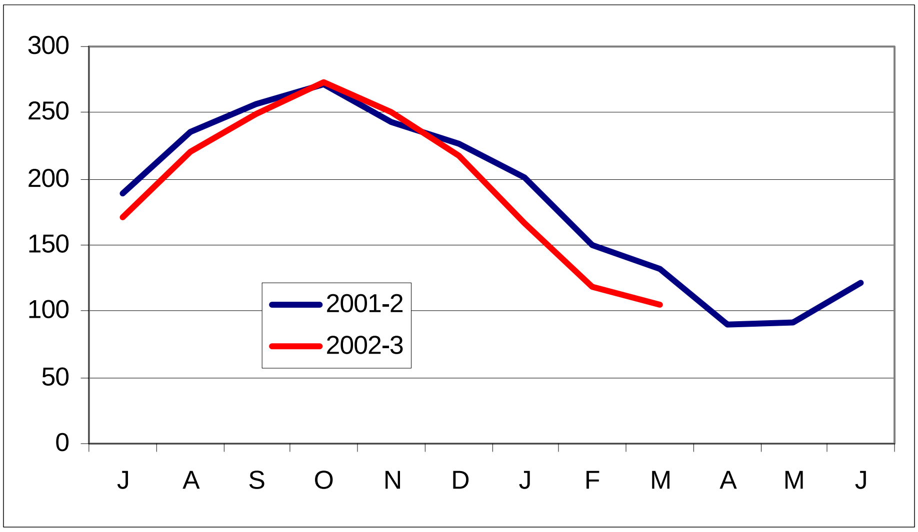
**Figure 27:** Northern Victorian Milk Production 2001-2 and 2002-3




Source: ADC 2003

A 7% fall has been experienced in the Western District of Victoria (Figure 28).

**Figure 28:** Western Victorian Milk Production 2001-2 and 2002-3




Source: ADC 2003

The Western Victoria region had a "normal" spring season (one of the few regions to have experienced rainfall) which allowed normal pasture production, yet the high cost of purchased supplement feeds has curtailed production in the late season months, as the milk return in these times is perceived as inadequate to cover the cost of purchased feeds.

The response of the individual enterprise to drought conditions has varied greatly. The strategies of producers in the Northern Victoria region – in the face of a consistently negative marginal milk price over the 2002-3 season - has included the following:

- Drying off cows and feeding at maintenance levels.
- Herd reduction – to cull herds of (historically) less-productive or poorly-conditioned cows thereby improving overall herd profitability.
- Herd relocation – a major initiative was undertaken in Victoria to "park" herds on farms in the Gippsland and Tasmania (where seasonal conditions were more favourable).
- Culling entire herds for sale to abattoirs.
- Closing down and selling the enterprise altogether

Estimates vary as to the response from the Northern Victoria region (especially in the Goulburn system) where the conditions have been at their harshest. It is expected that the region will see a 15-20% fall in annual production by the end of the season and that a fall of similar magnitude will be experienced in 2003-4. The flow-on into the next season is due to the fact that a significant number of herds have been retired and that as much as 35-50% of the regional dairy herd is not "in calf" for the coming season.

The point at which the enterprise owner makes a decision as to which of the above strategies is followed will vary across the affected region, affected by:

- The extent of cash reserves or debt in the enterprise.
- The size and condition of the herd.
- The nature of the milk supply contract that they have signed onto – and the extent to which prices benefit from domestic market conditions.
- The family business structure and propensity to pursue alternative incomes from farming and non-farming activities.

# ECONOMICS OF GRAIN USE IN THE DAIRY INDUSTRY

The economics of grain use in the dairy industry must be examined in the context of trends in herd size, seasonality of milk production, biological efficiencies and non-feed costs of milk production.

## Herd Size

Herd size on a given farm can affect whether grain use is profitable or not.

Average herd size has increased continuously for many years, resulting in a national average of 191 cows at the start of the new century (Figure 29). However, nearly 30% of national herds have herd sizes <u>above</u> this average.

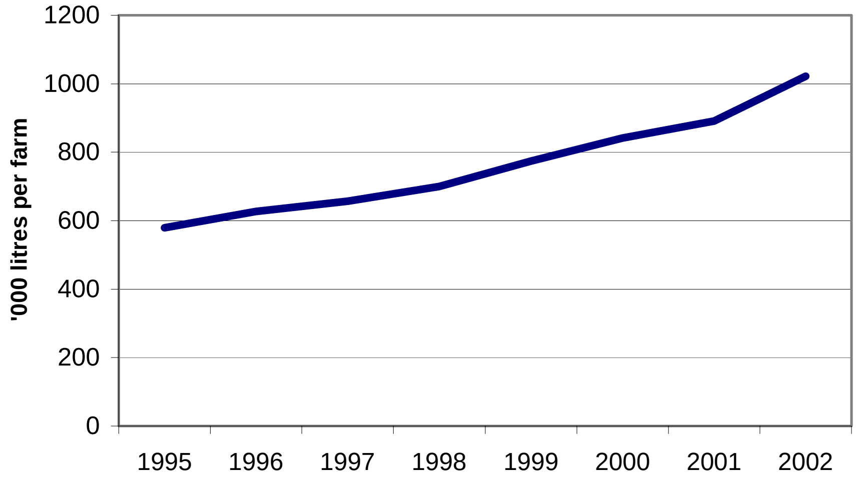
**Figure 29:** Proportion (%) of Herds in Herd Size Categories in Australian Dairy Regions.

| Herd Size | West VIC | Gipps. | Murray | DIDCO | Sub Trop | Tas | West Aust | Sth Aust | Aust |
|---|---|---|---|---|---|---|---|---|---|
| 1 to 100 | 16 | 17 | 13 | 32 | 37 | 19 | 17 | 29 | 21 |
| 101 to 150 | 22 | 30 | 30 | 28 | 34 | 21 | 26 | 22 | 28 |
| 151-200 | 22 | 23 | 24 | 18 | 19 | 23 | 21 | 20 | 22 |
| 201 to 300 | 22 | 19 | 21 | 15 | 8 | 20 | 23 | 17 | 18 |
| 301 or more | 18 | 11 | 12 | 8 | 3 | 17 | 13 | 12 | 11 |
| Median (no.) | 180 | 160 | 170 | 130 | 125 | 180 | 176 | 150 | 156 |
| Average (no.) | 226 | 192 | 206 | 159 | 137 | 219 | 200 | 188 | 191 |

Source: Iris Research 2000

A useful measure of size is total farm milk output per farm. The increase in average milk output per farm over the last eight years is shown in Figure 30 below. The rate of increase has escalated in recent years with increasing commercialisation of the industry and the buoyant market conditions in the two years 2000 - 2002.

**Figure 30:** Growth in Milk Output per Farm Since 1995




Source: ADC

Increasing farm size and/or scale is a traditional response to the declining terms of trade seen on dairy farms over the last several decades. It can be achieved by various means including:

- purchase of additional farm land.
- development of existing land through increased fertiliser, irrigation, pasture development, etc.
- increasing production per cow.
- increased stocking rate aimed at better use of existing resources

Kellaway and Porta (1993), in the standard DRDC industry text, specifically recommend higher concentrate feeding in conjunction with higher stocking rates.

However, in a great many cases, scale has been sought through higher stocking rates *without first increasing the farm's pasture production base*. For many dairy farmers, this has proved a flawed strategy since it has lead to various combinations of:

- increased reliance on bought-in grains and/or fodder and
- reduced milk yields per cow.

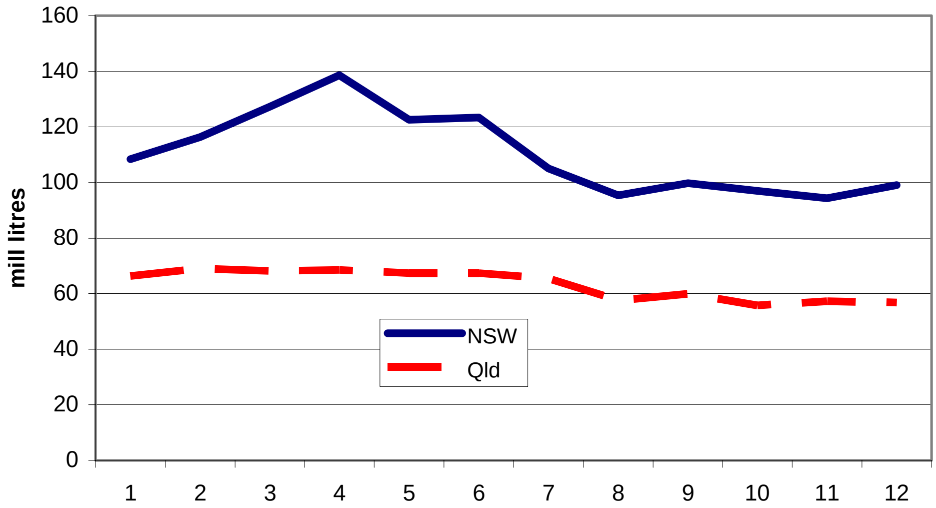
Increasing herd size per se has often proved unprofitable since the financial gains from scale efficiencies have often been smaller and the reduced yield and increased grain feeding have been more costly than expected.

A consequence of this flawed strategy is that "grain-feeding" has been blamed for the poor financial result obtained, meaning that a significant proportion of dairy farmers do not believe that, or have serious doubts about whether, "grain-feeding" pays. This misinformation has severely affected the financial situations of a great many dairy farmers during the recent drought.

## Seasonality

Seasonality affects milk price which, in turn, influences the grain-feeding practices of dairy farmers. Queensland, NSW and West Australian milk production is relatively constant throughout the year (Fig 31). These are states have geared milk production to focus on the demands of the fresh dairy products industry (packaged milk, short-shelf life chilled dairy desserts, etc) which requires a supply of milk all year round.

**Figure 31:** NSW and Qld Milk Production in 2000-2001 (million litres per month)

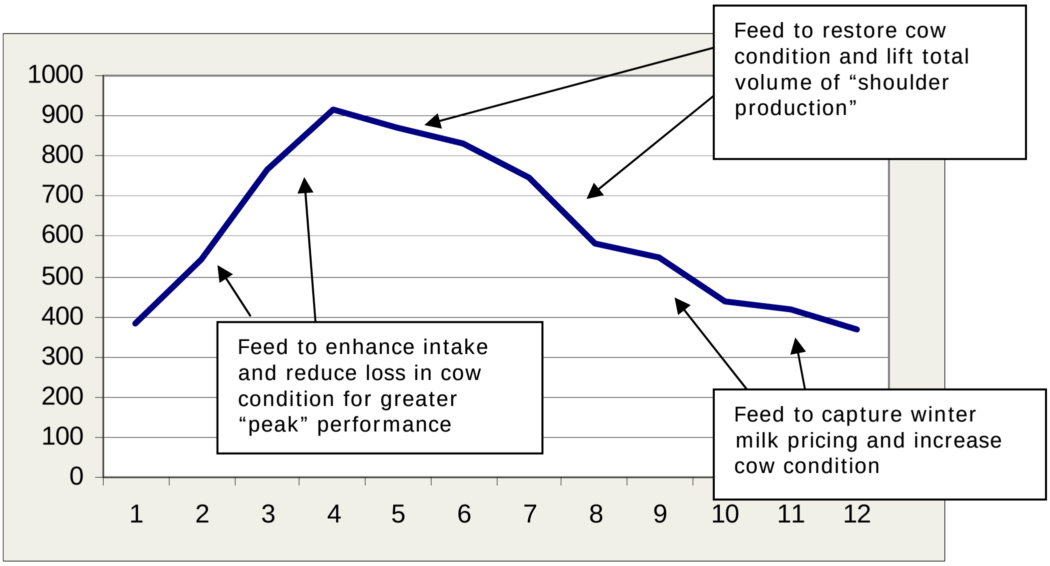



Source: ADC monthly production statistics 2003

In contrast, Victorian, Tasmanian and, to a lesser extent, South Australian milk production has traditionally been highly seasonal. The typical Victoria seasonal production season has flattened in recent years through deliberate changes in calving patterns (more split calving and autumn calving) and the lifting of feeding rates due to changes in the overall milk yield targets that are sought by farmers.

Figure 32 depicts the general approach to grain feeding in seasonal herds such as in Victoria.

**Figure 32**: Total Victorian Monthly Milk Production in 2001-2002 (July = month 1)




Source: ADC monthly production statistics 2003

The flattening of the production curve has been encouraged by dairy product manufacturing companies (mainly focused on export markets) through seasonal price incentives, so as to produce a better utilisation of manufacturing facilities throughout the year. The relative price of milk and grain at any time during the year has an impact on whether grain is fed. This aspect is discussed later in this report.

## Farm Performance - Biological Efficiency

Regression analysis of the grain feeding and milk production of 125 DBC client farms suggests the following relationship:

Milk yield (litres) = 3600 + 1500 x grain use (tonnes DM)

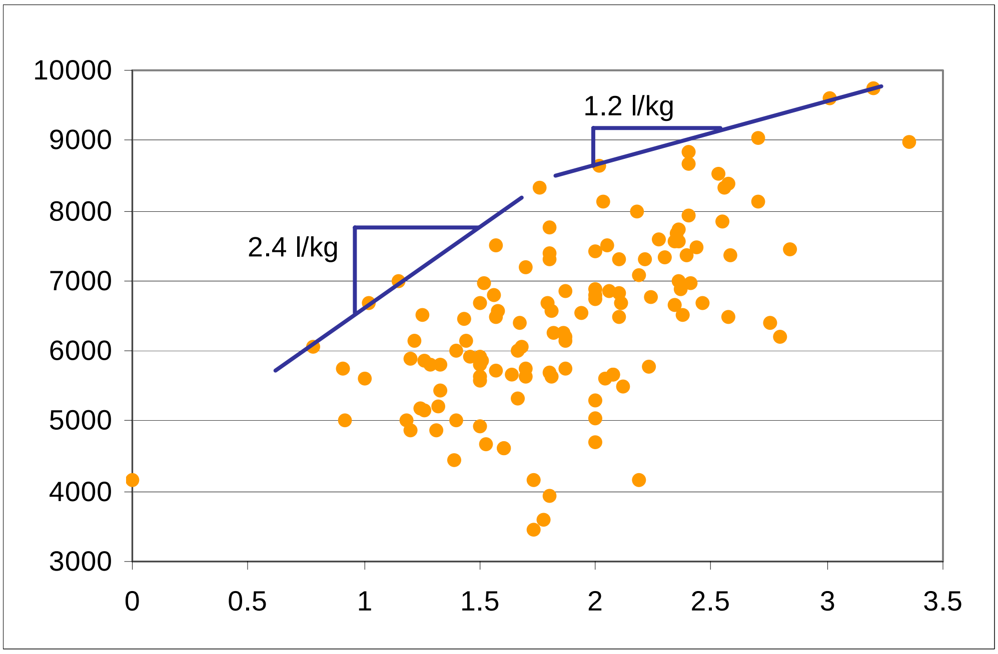
This equation implies a response to grain of 1.5 litres per kilogram of grain dry matter fed. This equation has an $R^2$ value of 0.38. This means that the variation in grain feeding level can explain 38% of the variation in milk yield.

Another approach is to consider the best performing farms, that is, those that are producing the most milk for a given level of grain feeding. It would be reasonable to assume these farms are producing close to the limits of biological efficiency. The line connecting the best performing farms forms a boundary of grain feeding efficiency for the sample in this study.

These farms are highlighted in Figure 33 overleaf.

At the lower levels of grain feeding (1 – 1.5 t/cow), the slope of this boundary is around 2.4 litres per kilogram. This means that if a farm remained near to the boundary, it could improve yields by 2.4 litres for every extra kilogram of grain dry matter. At higher levels of feeding (2 – 2.5 t/cow), the yield response at the boundary is less, at around 1.2 litres per kilogram.

**Figure 33:** The Limits of Grain Use Efficiencies in a Sample of 125 Farms in 2000/2001




Source: DBC-CowData

This is typical of biological and other systems that display diminishing marginal returns. The key limiting factors include cow intake limits and nutritional problems associated with imbalanced rations. The latter can be due to protein or specific amino acid deficiencies and fibre deficiencies that contribute to rumen acidosis. Also, the digestion and the metabolism of nutrients become less efficient as intakes increase.

Dairy nutritionists suggest that there is enough energy in a kilogram of cereal grain (12.5 megajoules of metabolisable energy per kilogram of dry matter) to produce around 2.4 litres of milk at normal fat and protein contents. This matches the boundary of responses at the lower levels of grain feeding in Figure 33.

However, most experimental results suggest that marginal responses closer to 1 litre per kilogram of grain are the norm (Stockdale et al, 1997).

It is interesting to note that within the group of lowest yielding farms highlighted above, there is no relationship between grain use and milk yield. This contrasts with the data from the higher yield farms which suggest that the level of grain feeding is responsible for much of the variation in milk yield.

Across the whole sample, there is a large range of milk yields for any given level of grain feeding. Part of this variation can be explained by differences in the level of use of other feeds - hay, silage and grazed pasture. Another source of variation is the differences in the biological efficiency of conversion of grain to milk. This varies with nutrient balances (protein, amino acids, energy, fibre, minerals, etc.), genetics, cow body reserves, energy use for walking and grazing and energy use in adverse climates.

These observations on efficiency of grain use suggest that very large opportunities to improve grain feeding strategies exist.

For example, within the DBC sample, farms using around 2 tonne of grain per cow produced from 4500 to 8,500 litres. At 25 cents per litre, this range represents a revenue difference of $1,000 per cow.

Similarly, a large milk yield range exists for the group of farms producing around 6,500 litres per cow. Within this group of farms, grain usage varied from 1.1 to 2.8 tonnes per cow. At $300 per tonne, this range represents a revenue difference of $510 per cow.

The DFT study also shows a large range in grain feeding levels for a given level of milk yield (Figure 34).

**Figure 34:** Total Bought-in Feedstuffs Relative to Cow Productivity

| **Litres per cow per annum** | **Percent of farms within feeding range** | | | | |
|---|---|---|---|---|---|
| | **Feeding level range (t/cow)** | | | | |
| | **0<0.49** | **0.5 - 0.74** | **0.75 - 1.0** | **1.0 - 1.99** | **2.0 -** |
| Less than 2999 | 26 | 19 | 14 | 32 | 9 |
| 3000 to 4000 | 23 | 19 | 18 | 31 | 9 |
| 4000 to 5000 | 12 | 17 | 16 | 39 | 16 |
| 5000 to 6000 | 8 | 6 | 15 | 50 | 20 |
| 6000 plus | 2 | 6 | 7 | 41 | 45 |

Source: Iris Research 2000

Clearly, substantial possibilities exist to improve the yield achieved through appropriate grain feeding levels and practices.

## Tactical and Strategic Grain Feeding

Our perspective of grain use in the dairy industry provides some insight into the discrepancy between normal and achievable grain responses. Many dairy farmers and other industry workers take a “tactical” approach to grain feeding. This means that grain is seen as a means of filling short term feed gaps. An alternative is to take a longer term, more holistic or strategic view.

With this perspective, grain is seen as an essential strategy for improving the biological and economic efficiency of the farm by lifting milk yield per cow.

Such a strategy improves biological efficiency by diluting the “energy overheads” of each cow (including daily maintenance energy needs, energy associated with pregnancy, early heifer growth and the dry period). It improves the economic efficiency by diluting the sunk costs associated with each cow (including breeding, health, milk harvesting, labour & infrastructure maintenance).

One of the benefits of the strategic view of grain feeding is that it makes it possible for the farm to perform closer to the boundary of achievable grain responses described earlier. A long term view will encourage the investment in well-grown heifers and optimum body reserves.

It will also encourage adoption of a stocking rate and grazing management that allows high intake of high quality pasture. A strategic view also recognises the long term benefits of improved reproductive performance that can be achieved through optimum nutritional management.

## Core Cost per Cow

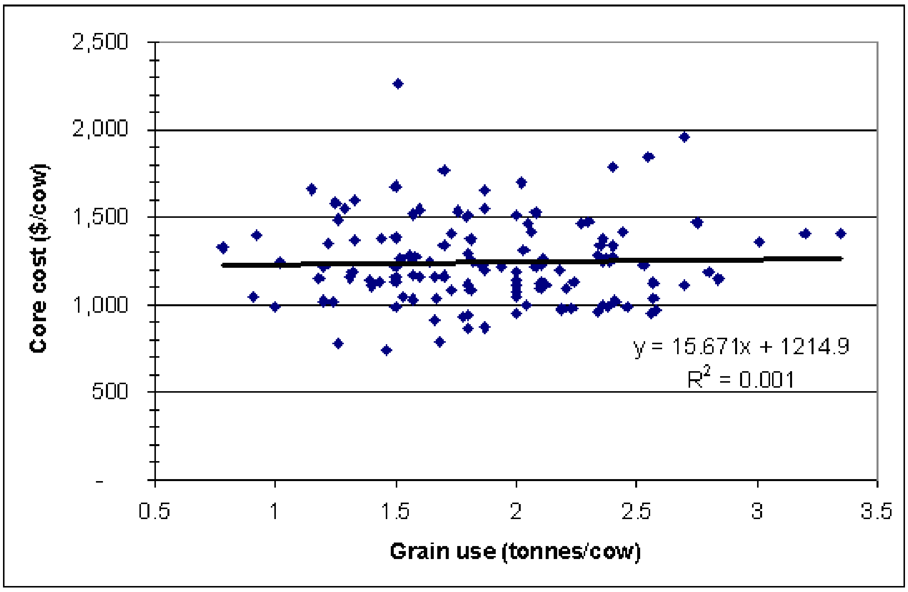
Associated with a strategic view of grain feeding is the concept of “core cost per cow” and its dilution through higher milk yields per cow.

Core cost per cow consists of all herd, shed, labour and overhead costs plus non-supplement feed costs. Our survey work suggests that Core cost per cow varies considerably between farms but is relatively constant on any farm from one year to the next.

The implication of this is that scale efficiencies are difficult to achieve simply by adding more cows. Further, we have found that greater scale efficiencies can be more easily achieved by diluting the “core cost per cow” with increased milk yields. The two main strategic variables which determine milk yield are stocking rate (which impacts on pasture intake per cow) and the level of grain feeding.

Figure 35 shows that Core cost per cow is not related to the level of grain feeding – ie. Core cost per cow does not necessarily increase when grain feeding increases.

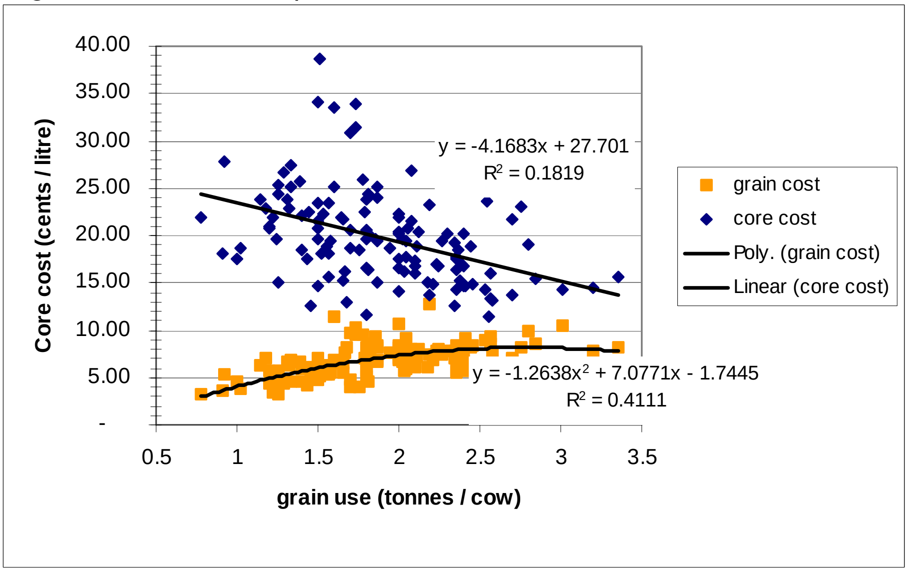
**Figure 35:** Relationship between Core Cost and Level of Grain Feeding




Source: DBC-CowData

Since milk yield increases with grain use, the core cost tends to be diluted as more grain is fed per cow. That is, core cost per litre of milk decreases as grain use increases. This is shown in Figure 36 below which also shows the grain cost expressed as a cost per litre of milk.

**Figure 36:** Regression Relationship between Costs and Grain Use

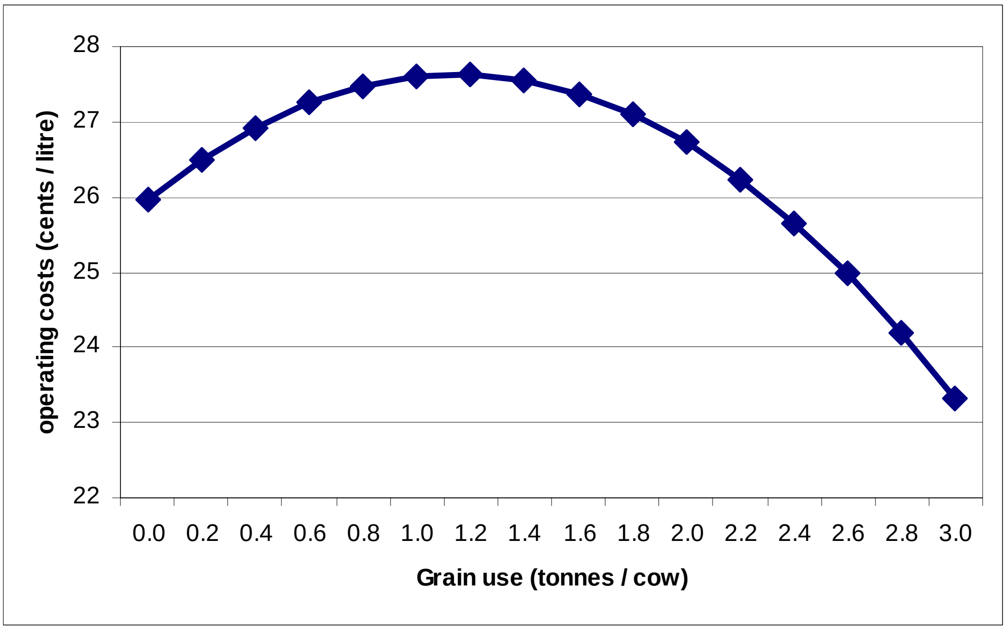



Source: DBC-CowData

Note that the cost of grain does not increase much when feeding reaches about 2 tonnes per cow. This means that beyond around 2 tonnes per cow, the benefits of core cost dilution can be achieved while maintaining the cost of grain at around 8 cents per litre.

Combining the two regression equations and plotting the resulting theoretical cost function highlights the potential benefits of a strategic approach to grain feeding (Figure 37).

**Figure 37:** Empirical Total Operating Cost Function Related to Grain Use in Australian Dairying




Source: CowData Pty Ltd. Based on 2000/2001 farm data.

Care needs to be taken in relying on absolute values contained in this graph. It is based on a relatively small sample of farms operating across many economic and climatic environments. It does however highlight the concepts and the potential benefits of taking a strategic view of grain feeding rather than a tactical approach which relies on short term marginal responses as the basis for decision making.

It is significant that many dairy farmers who do use feed grains offer around 4-5 kg/day to the milking herd. Over a 305 day lactation, this amounts to between 1.2 – 1.5 tonnes per cow per year – the highest operating cost levels in Figure 37 above.

In summary, there are many ways to lose money feeding grain in the short term but there are opportunities to benefit from biological and economic efficiencies by taking a strategic perspective of grain feeding.

In the longer term it is possible, and the economics suggest likely, that the level of grain use will increase. If average farm grain use were to increase to the median of the DBC study sample (1.86 tonnes/cow) then grain use of the industry would increase to 4.4 million tonnes per annum, even assuming constant cow numbers.

# RELEVANT INDUSTRY ISSUES

## Developing knowledge for strategic grain feeding

A strategic approach to grain feeding requires a broader understanding of the dairy farm business when making decisions about feeding grain. Farmers generally are very good at thinking holistically about their business. This is often not the case though for those advising farmers.

### *Farmers*

In addition to a holistic view of the dairy business, successful implementation of higher level grain feeding strategies require some specific practices and knowledge at the farm operations level. It is beyond the scope of this study to examine these issues in detail. It would, however, be in the interests of both the grains and dairy industries to achieve a greater understanding amongst dairy farmers of the critical success factors in strategic grain feeding. These include:

- Ration balancing
- Rumen degradable protein
- Rumen un-degradable protein
- Pasture as a nutrient source
- Feedstuff nutrient contents
- “Back of the envelope” ration balancing techniques
- Role of minerals and additives
- Preventing rumen acidosis
- Fibre requirements
- Acid buffers
- Maximising pasture intake
- Agronomic and grazing practices for high quality and high intake per cow
- Using substitution to protect post-grazing residuals and subsequent pasture growth rates
- Nutrient requirements of the cow
- Limits to intake
- Energy requirements for reproduction and body condition

It has been unfortunate in the extreme that so many dairy farmers have had to face the current drought with so much ignorance about cow nutritional matters.

## *Advisory Service Providers*

In many instances, advice to farmers from professional advisors has taken a tactical rather than strategic approach to grain feeding. Reasons for this may include:

- To take a strategic view, the advisor must be familiar with the whole business. For this reason, specialist nutrition advisors and government technical advisors are often limited to providing advice based on short term marginal response analyses and cash flow.

- Similarly, specialist financial advisors often struggle to account for the complex interactions that occur and the longer timeframes associated with strategic grain feeding.

- The “loudest”, best marketed industry research into the merits and role of grain feeding takes a short term and uni-factor approach. Much effort is made to remove all but one or two variables from an experimental design. While this is necessary to achieve statistically valid results and reduce costs, it generally ignores the broad and complex array of interactions in a typical grazing dairy system. It also distorts the truth about grain feeding economics.

## *Banking sector*

In the current drought, there has been anecdotal evidence of some banking sector personnel imposing restrictions on grain spending, as the quickest way to “fix” a cash flow crisis. This practice has in some instances severely impacted on the long term profitability of the dairy farm business. Given the bank’s focus, this is understandable:

- “Cash flow is king” - this reinforces the power of tactical thinking and the need for immediate responses from grain;

- When cash flow is tight, grain is seen as the largest single expenditure item and an easy one to reduce so often it is the first to be targeted by a zealous but ignorant bank manager;

- It is akin to a bank manager telling a grain farmer that he can improve short term cash flow by reducing spending on fertiliser at sowing time.

It is beyond the scope of this study to examine the detail these issues. Nonetheless, until a more balanced story about grain feeding is promulgated, a great many resource allocation decisions in the dairy industry will continue to be flawed.

## Grain supply

The current drought has highlighted a number of key infra-structural and policy issues related to grain feeding.

## *Short term supply*

- The potential range of short term strategies to solve the immediate feed grains shortages are considered to be limited in number. Any effective work in this area has to address the impediment to the movement of grains upcountry, overcoming the AQIS zero-risk assessment and urgently developing protocols for achieving such a low-risk status.
- At present, the industry has adopted a cautious approach to the use of GMO's in dairy products. The official stance by dairy companies is to offer and promote GM-free dairy products and accordingly to adopt a no-GMO feed policy in milk supply contracts.

## *Contracts*

Use of grain supply contracts in the dairy industry is limited. Those that exist have proven to be little more than forward supply intentions. There is little hard evidence on farmer's reluctance to adopt such contracts. However, anecdotal evidence suggests:

- Many farmers, both grain suppliers and dairy farmers, are averse to locking in prices for more than 1 season. Rather, both parties will often prefer to retain exposure to the possible benefits of favourable price changes from one year to the next.

- Payment terms and credit risk are important issues that must be considered by the respective parties.

- Simple forward selling contracts limit the flexibility of both parties when circumstances change.

- More sophisticated types of contracts that are more liquid and offer more flexible settlement possibilities may be attractive.

- Dairy farmers typically will only want to contract several hundred tonne at a time so the size of contracts available can sometimes limit their attractiveness to farmers.

## *Supply Chain*

There is potential for a direct role by dairy co-operatives – in conjunction with feed grains traders and handlers – in the development of a feed grains supply chain that is integrated with the activities of the co-operative.

| Role of the grains company | Role of the dairy co-operative |
|---|---|
| • Accumulation<br>• Bulk storage and transhipment to regional (dairy) facilities<br>• Provision of a range of forward purchase contracts | • Use of supplier pay system for cost deduction<br>• Education and communications<br>• Price/volume incentives to encourage commitment to grains usages |

The critical element in the success of such a measure will be the education of producers to the gains of using forward purchase as a risk management tool that allows them to lock in costs and supply certainty. There are two aspects of such education in the dairy industry – the role of a strategic approach to grain feeding and the use of risk management (forward contracts and other instruments) products in the business.

To be effective, the dairy farm user of forward purchase commitments has to be provided with the confidence that delivery under such forward arrangements will be secure. The involvement of major grains accumulators is accordingly seen as an effective way of providing such assurance, given the volumes that could be committed to the domestic feed grains sector.

**Figure 38:** Potential Grain Supply Chain in the Dairy Industry

If this supply chain is built into the dairy industry in parallel to other consumption industries, there would be significant commercial incentive for the accumulator to invest in downstream logistics to underpin the livestock consumption market.

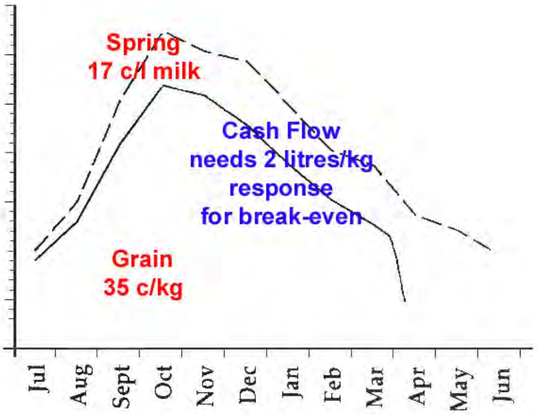
There is no significant knowledge base within the grains supply industry as to the usage of grains and feedstuffs by the industry. Major suppliers to the industry (including AWB and Cargill) have said that their knowledge base extends only to regional demand levels at each of the terminals that service the industry in key consumption areas.

## Milk Pricing by Processors

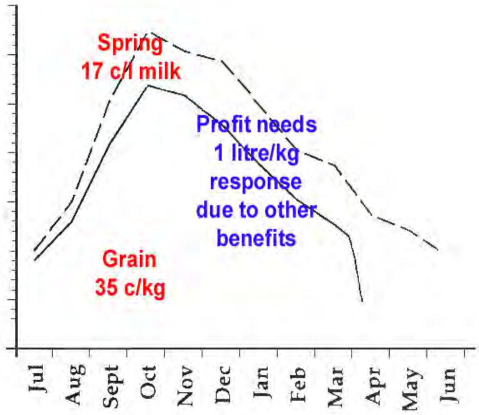
Seasonal milk pricing is a powerful factor in manipulating seasonal milk supply patterns. There is some argument for enhanced use of meaningful price incentives across the year to encourage flatter milk production in line with the economics of supplementary feeding. There has been recent criticism by farmers of some major manufacturers who have failed to provide any actual incentive in seasonal milk prices when attempting to encourage a flatter production profile. This initiative may be aided by greater awareness by both suppliers and manufacturers of the issues associated with flattening production curves and the role that milk price plays in that equation.

It is not only the price of milk which impacts on decision making but the timing of milk payments over the year. As stated earlier, cash flow imperatives play a large part in spending on grain. Again, there would be an overall benefit from greater understanding of the complexities of seasonal milk production and processing by processors and producers respectively.

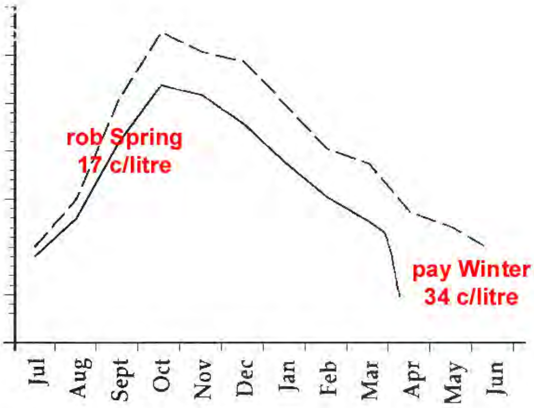
**Figure 39:** Milk Price Shifts and Grain Feeding Decisions



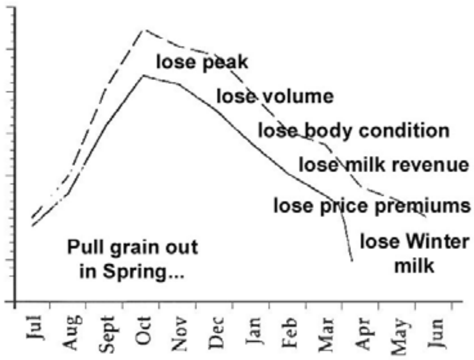
(a).



(b).



(c).



(d).

The above charts depict the production output from an individual milking cow – the dotted line reflecting a higher level of grain feeding than the solid line. Graphs (a) and (b) depict the perspective of a producer facing a situation at September in any year when milk is paying 17c a litre and grain costing the equivalent of 35 cents a kg. In cash flow terms a 2litres/kg production response is required to break even at those price-cost parameters. Due to the other benefits derived from continued feeding, b depicts the fact that "profit" only requires a 1litre/kg response in production. Such other benefits have been shown by Kellaway and Porta to include:

- Extra body condition;
- Improved reproductive efficiency;
- Extra pasture;
- Improved pasture quality;
- Increased numbers of culled cows and calves; and
- Greater cost dilution per litre of milk.

The typical response has shown to be that most producers sacrifice profit to protect cash flow, and move to the solid line. In (c) the chart shows the effect of a pricing approach where a spring price rate has been "robbed" to fund the increase in winter price – where a dairy company may attempt to shift milk revenue to the winter months to encourage a flatter production curve. This lower spring pricing signal has been shown to have the effect of removing the incentive to feed grain in the early part of the season – thereby producing the effect in (d) – which has seen a lower production peak, followed by a series of sub-optimal results through herd condition, income effects for the producer, and production outcomes for the milk company.

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# PORK INDUSTRY FEEDSTUFF SECURITY MANAGEMENT STRATEGIES

The Australian pork industry has long recognised the need to effectively manage feedstuff usage and the need secure feed grains and/or pulses and protein meals at competitive prices to enable effective competition in domestic and export markets. One key driver of this need is the fact that the Australian pork industry is one of the few livestock industries that has to compete with imported meat products particularly those from Europe and North America. Unlike the extensive livestock industries the intensive livestock industries are not eligible for state government assistance in most States except Victoria and Western Australia where the state government have given the pork producers equal recognition.

# INDUSTRY LEVEL STRATEGIES

At an industry level APL wants the following matters to be resolved with respect to feedstuff security especially in protracted drought scenarios:

- Access to grain at no more than word parity price;
- Meeting with State and Federal government representatives explaining the impact of drought on pig producers and identifying specific needs for producers;
- Eligibility for drought assistance for intensive and extensive livestock industries;
- A tailored intensive livestock industry drought assistance package at the State level;
- Revision of Exceptional Circumstance provisions by government;
- Developing marketing initiatives to secure and grow both the domestic and export markets including import reduction strategies;
- Working closely with the other intensive livestock feeding industries to ensure a unified voice;

- Enquiry by an independent body into grain supply and pricing by the AWB;

- Discussions on labelling issues, identification of Australian pork at the point of sale;

- Access to low interest loans to purchase grains;

- Accelerated depreciation on silos and other feed and water storage facilities as a medium and long term recovery measure;

- Undertaking a study on options available to reduce recurrent feedstuff supply shortages;

- Managing production risk through identified R&I projects and management of grain risk;

- Meeting with AWB to address grain prices, grain supply and the impact on pork production - one outcome was that AWB was keen to develop a partnership approach for future risk management;

- Media support in both Singapore and Japan outlining how the drought is affecting cost of production and how this will impact on prices for Australia generally;

- In Queensland at a state level the following strategies regrading feed grain availability have been previously outlined in a report examining the requirements for an expansion of the Pork industry in that State; and

- Domestic consumption accounts for about 60% of Queensland's total production of wheat, sorghum and barley. Based on production of dedicated feed grains (eg, sorghum, barely, lupins etc), Queensland is already dependent on transfers from grain producing regions in other states. In recognition of the competitive advantage held by Queensland in intensive animal feeding, strategies that will assist expansion of the pig industry from the perspective of feed security include:

    - Encourage investigation of the National Trunk Railway25 and/or use of foreign registered vessels for grain shipments between Australian ports (especially from WA (Pitts 2001)) as a more efficient means of transferring grain between regions;

    - Encourage pig producers to proactively manage the demand and price risk surrounding feed. The central issues with feed grain security is coping with the supply variability between years as most grain is grown under dryland conditions and increasingly in marginal rainfall areas. Substitution between the three grain markets open to buyers/sellers (local food, local feed and export) already occurs according to quality, price and delivery considerations. When local feed grain prices exceed import parity, the intensive animal industries will want to have the option to import grain from overseas. In terms of protection against price risk, neither grain sellers nor buyers are generally willing to enter longer-term contracts. However some 'through chain alliances' have developed between growers and end-users;

- Marketing arrangements should be developed to better reconcile the interests of feed grain producers and the feed grain users within Queensland, so that access for local users is improved. Presently, it seems, an advantage is given to export markets for Australian feed grains without due consideration to the opportunity costs to domestic users; and

- Investigate the establishment of a feed grain import and treatment facility at Gladstone. At present, untreated whole grain can only be imported for usage in metropolitan areas where the risk of incursion is low26. Biosecurity Australia has established protocols for heat treatment of whole grains destined for transport inland. But as the need to import grain has so far been infrequent, there are no facilities to manage the processing standards required by Biosecurity Australia.

## Farm Level Strategies

The Australian pork industry has a number of farm level strategies that complement the industry level strategies especially with respect to drought induced feedstuff supply shortfalls.

The pork industry has been encouraged not to utilise low cost waste products from the food industries despite the obvious attraction in drought induced tight grain supply situations.

Irrespective of the seasonal condition or competition for feed grain supply the key measures that pork producers use to make production and grain procurement decisions are whole herd feed efficiency (kg feed used /kg carcase sold) and feed / pig meat price ratio. As one APL technical note *("Management and Nutritional Strategies to Address The Challenges of Low Profitability"*) says a critical aspect of surviving tough times will be maintaining productivity and efficiency rather than relying solely on attempts to reduce the cost of feed. Increasing sow productivity improves herd feed conversion ratio (HFCR) by creating more kilograms of production over which to spread the fixed breeder feed tonnage. For example sows normally consume about 1,200 kg/year so when 16 pigs are produced this equate to 75 kg breeder feed per baconer but if 20 pigs are produced this reduces to 60kg/baconer and a reduction in HFCR from say 4.0 initially to 3.8; all other things being equal. However the sow herd only consumes about 20 peer cent of total feed so it's the progeny and in particular the finishers that mainly influence HFCR. Pigs have a feed conversion ratio close to 1.0 at weaning and this rises as the pig ages due to increasing maintenance energy requirements and changing body composition. Maintenance costs are a dead loss but must be met before any growth can take place. Hence efficiency will be maximised when feed is mainly directed towards growth and the proportion going to maintenance is minimised. Also impacting on the efficiency of feed conversion is the differential energy cost of fat versus lean deposition. Since fat requires over five times the energy per kilogram deposited as fat compared to lean energetic efficiency is maximised when fat deposition is minimal of lean deposition.

There are some constraints to use as illustrated by the following from a 2002 QDPI pig note P0019 on feed grain constraints:-

## Ingredient Constraints

The extent to which an ingredient may be used in a particular diet is an area of largely subjective judgement. Constraints in ingredient use may be associated with their specific influence on palatability, digestibility, toxicology, palatability, availability, compatibility with other ingredients, variability in quality or simply disappointment with previous involvements.

Blood meal for example, is often constrained to levels of less than 4 percent in diets for pigs because of its unpalatability. A guide to the maximum levels of certain feed ingredients is given in Table 1.

**Figure 1:** A guide to maximum levels of some feed ingredients

| Feed Ingredient | Maximum limits |
|---|---|
| Wheat | No limit. |
| Barley | No limit. |
| Triticale | No limit. Modern triticale varieties represent excellent value as a cereal base in pig diets. |
| Sorghum | No specified limit although mixture with other grains is often preferred. Some mills report difficulty pelleting when sorghum exceeds 30%. |
| Maize | Limit to 30% of grain component. Th unsaturated fat and pigments affect fat quality. |
| Soybean meal | No limit. |
| Sunflower meal | No limit although high fibre/low lysine content tends to be self restricting to less than 10%. |
| Canola meal | Limit to 15% in diets for growing and finishing pigs. |
| Cottonseed meal | Limit to 10% maximum for good quality material. Contains gossypol. |
| Meat and Bone Meal | Limit to 10% depending on calcium content and protein quality. |
| Blood meal | Limit to 4% due to palatability and isoleucine imbalance. |
| Fish meal | Limit to 5% for growing and finishing pigs if a withholding period of 5 to 7 weeks is observed before slaughter. High levels of fishmeal affects the quality of stored pork or processed pork. |
| Lupins | L angustifolius (known as the sweet lupin) is preferred for pig diets. L albus is not recommended. Limit L angustifolius to 20% for growing pigs and sows and 30% for finishing pigs. |
| Lysine HCI | No limit except awareness that high levels of synthetic lysine may not be used efficiently when pigs are fed restrictively. |
| DL Methionine | No limit, however, if used at high levels, most likely only serves as a filler. |
| Limestone | Limit to 2%. If more, it is most likely only serving as an energy diluent. |
| Dicalphos | No limit other than Ca and P limits in diet. |
| Salt | Limit to 0.3%. If used beyond this limit, it is most likely serving only as energy diluent. |
| Vit-Min Premix | Set level recommended by supplier. |

## Nutrient constraints

Nutrient levels may be expressed either in terms of a daily requirement, a proportion of the diet or as a proportion of other nutrient levels in the diet.

The requirement for some nutrients is dependent on the supply of others. This is particularly the case with amino acids and energy supply. For example, lysine needs are best expressed relative to the DE content. Similarly, the levels of other essential amino acids are considered in relation to lysine and to one another so that an optimum balance of the essential amino acids can be maintained.

Clearly the starting point in feed grain security in the pork industry is efficient use of available feed grain supplies irrespective of the supply/demand situation. Consequently the industry has been developing a number of tools that producers can use to manage feedstuff input costs in normal and regional drought situations. Some of those tools and decision support systems are:

## *PigStats*

One useful tool the industry has generated is PigStats which enables pork producers to benchmark their costs including feedstuff procurement and feeding efficiency to optimise available feedstuff supplies in normal or drought seasonal conditions.

## *Auspig*

AUSPIG is a computer decision support system that models a herd's unique performance a characteristics enabling more profitable management strategies to be implemented. Some of those management issues are reduction in the over supply of amino acids of respective diets; reduction in the amount of feed wastage; reduction in the level of overstocking and implementation of appropriate marketing strategies. One AUSPIG study undertaken in Queensland found that feed wastage ranged from 5-27% with 70% of herds wasting more than 10% of feed. In this study reducing feed wastage from 15to10% improved profitability by $65 per sow.

## *FeedCheque*

FEEDCHEQUE is a group training package that is applicable to home mixers of feed. This enables pig producers to improve on farm diet mixing practices as well as maintaining the quality of mixed feed prepared on farm in the long term. Feed Cheque use to date has identified performance improvements by achieving desired particle size and uniformity of feed ingredients in the milling process; inadequate mixing times; overfilling mixers; segmentation of feed ingredients in the mix and cross contamination of ingredients between feed batches. Improving feed conversion efficiency by 0.1% in a 200 sow unit has been shown to improve profitability by approximately $6,000 per annum.

The next tranche of activities that Australian pig producers are using involves small pig producers working collectively to achieve some of the economies of scale available to larger players. These activities encouraged by the Australian pork industry include:

- Forming vertical or horizontal alliances such as Pipestone models where there is a high degree of specialisation; and

- Formation of buying groups enabling producers to obtain consistent high quality feed at competitive prices.

The above activities are must haves for cost effective and competitive pork production under most seasonal conditions and low intensity drought situations. As the demand for feed grain increases from other livestock industries the relevance of the above decision making tools becomes self evident. The reality is that the long term trend towards a smaller number of larger pork producers is unlikely to change resulting in amore professional and sophisticated industry.

Feedstuff security will most likely be achieved with regional or state based supply contracts with either larger grain producers or grain accumulators for annual supplies. This trend recognises that even in the worst droughts there is feed grain at some price somewhere in Australia. The first step is to identify those sources of grain and using price basis above export parity attract that gain out of the export pipeline. This practice is already being done by the larger operators, who jealously guard their supply relationships. Some are using price management instruments such a grain futures. However the depth of trades in the ASX grain futures is thin. Smaller operators who have traditionally only bought on the spot market and hoped the next season crop would eventuate are the ones who suffer when there is a significant winter and summer season or continental drought.

In the course of this study or discussions with pork producers identified that their preference is to have short supply chains for supply of feedstuffs and that the preference was for feedstuffs sourced in Australia. Only when that option was totally exhausted would they consider imported grain as a feed stuff source.

## Feed Grains and the Single Desk: A Fair Return – APL's Feedgrain Policy Position

**The Australian pork industry's policy position is that it requires access to feed grain at no more than world parity price at all times.**

The Australian Government grants a monopoly licence on wheat exports to a private company, Australian Wheat Board International (AWBI), and this monopoly effectively stifles price competition on the domestic market. This is government intervention in the market place which discriminates between businesses competing for a common input - grain.

The Australian pork industry is forced to bear the cost of the government's wheat marketing arrangements without any provision for the impact on its own competitiveness in domestic and international markets. It is critical that the government address this major public policy failing so as to secure the prosperity and jobs of people in rural and regional Australia.

The issue for the pork industry is not that the single desk is retained or abandoned but that the Australian Government address the impact on domestic grain users of any price premium through regulations that they have sanctioned.

We need systems of supply in place that will deliver to our farmers the inputs they need at competitive world prices and give a fair return to grain farmers.

**ACTION REQUIRED**

1. A guarantee from the Australian Government that the grain sold to Australian pig farmers is no more than the price it leaves the port to be exported.

2. A wide ranging review of the Wheat Export Authority which examines and recommends measures to address the effects on domestic users of regulations restricting grain imports of wheat and other feed grains.

3. An early review of the single desk regulation no later than June 2005.

**BACKGROUND**

With over 80 per cent of wheat produced destined for export, the AWB has the ability to dominate all aspects of grain traded in domestic and export markets. AWB International (AWBI) is a separate wholly owned subsidiary of AWB and is responsible for the operation of the National Pool on behalf of growers who deliver to it through the Single Desk. The Single Desk was established under the Australian Government's Wheat Marketing Act 1999 in which AWBI is appointed as the sole marketer of Australian export bulk wheat. As the only exporter, AWB can acquire most of the grain available. When one company holds most of the grain, they are in a monopoly position to charge what they like – particularly when supply is short and quarantine restrictions make grain imports costly. There may be many domestic buyers but they are all effectively forced to trade at the price set by the AWB. The export monopoly kills price competition on the domestic market and the effect is most pronounced in times of shortage.

During the recent drought, pig farmers feed costs increased by 50-70 per cent pushing a number of them out of business. Market analysts ProFarmer (10/41) reported that domestic prices for wheat in October 2002 exceeded export parities by up to $40 tonne.

Grain represents more than 60% of the cost of pork production. Any premium due to the single desk, no matter how slight, reduces the competitiveness of the Australian pork industry. Following government decisions to change quarantine rules to allow pork imports, Australian pig farmers are forced to compete in a global market. The Australian pork industry must compete inequitably against overseas pork suppliers, both on export and domestic markets, which have year-round access to international feed grain prices and subsidies.

Further distortions to the domestic feed grain market will result from the government's recent subsidy package for wheat-based ethanol production and will come at the expense of existing livestock feeding industries. This package provides ethanol producers with an indirect subsidy on grain of approximately $152 per tonne (Macarthur Agribusiness 2003). This will artificially drive up the price of grain, placing increasing pressure on the feed grain market.

As a major customer of the grains industry the livelihood and survival of the pig industry plays an important role in the future of the grain farmers. Total feed grain usage by the intensive industries has grown by almost 100 per cent since 1992/93 to 10.92million tonnes in 2001/02. The pig industry's usage of grain has increased by 35 per cent from 1.57 million tonnes to 2.13 million tonnes over the same period. ABARE's Feed Grains Projections (July 2003) reports that demand for feed grains is expected to rise significantly over the next five years. With the total feed grain supply set to increase only slightly, this strengthening of demand could well result in regional shortages forcing extra costs on producers. Further, there are strong prospects for pork industry growth to supply domestic and export markets.

The pork industry, with a farm gate value of more than $1billion, generates substantial income and employment in rural and regional Australia. The Australian pork supply chain is valued at $2.6 billion and employs more than 33000 people, while pork exports are currently valued at $270million. The distortions in the feed grain market will reduce the industry's capacity to expand exports and its ability to attract investment to build the critical mass.

The issue of competitive access to domestic feed grains will be crucially important in influencing the growth prospects of the industry over the next decade. The wheat export monopoly is a major public policy failing which is costing the future growth of grain value adding industries and the prosperity of the rural communities that depend on them to generate jobs and income.

# FODDER SUPPLY AND DEMAND SCENARIOS AND RISK MANAGEMENT OPTIONS FOR THE LIVESTOCK INDUSTRIES

# EXECUTIVE SUMMARY

## FODDER SUPPLY AND DEMAND MODELLING

Using ABS hay and livestock statistics and Bureau of Meteorology rainfall data, four supply and demand scenarios for fodder were modelled. During a normal year of average rainfall, Australian annual fodder (hay and silage) supply and demand runs at a surplus (estimated to be 590,000 mt). In these years fodder producers are able to store hay and silage and carry stocks over to the next year.

When rainfall is limited in the growing season, the reduced fodder production leads to higher hay prices a reduced demand and a rationing of supply. The model takes into account the various responses to these market changes to fodder.

The dairy industry, particularly in Victoria shows up as a dominant consumer of fodder with relatively inelastic demand for lactating cows.

In the most extreme drought scenario, the model used the ABARE survey figures of the anticipated changes in livestock numbers from June 30 2002 to June 30 2003. Despite the aggressive culling of stock, the fodder deficit for this model was 1.2 mmt.

In this instance, this is not a realistic outcome in the current farming practises, as supply and demand would not meet. As seen in recent ABS surveys, carryover stocks are insufficient to satisfy such a large nearby deficit. It does show however that if the livestock industry was to experience such a drought, the livestock numbers would need to fall below the levels indicated in the ABARE surveys of February 2003.

## FODDER IMPORTS

One response to such domestic shortfalls of feeds has been to import stocks of feedgrains from international sources. This has occurred to a limited extent with fodder supplies. Alfalfa cubs and wheat bran pellets have been imported into Australia during recent droughts. They appear to have a good nutritional balance and despite some minor physical problems, they have been fed successfully to sheep and cattle.

In the case of future droughts, reliance on these fodder substitutes appears a high-risk strategy. The production capacity of overseas mills is limited and the fibre-starved markets of north Asia also seek these feed supplements. While there may be some on-going potential for some livestock feeders to purchase these feeds, they will remain a risky and opportunistic option for the majority of livestock enterprises.

## PRICE RISK MANAGEMENT STRATEGIES

There are many price risk management tools available now or able to be created should the need justify it. Spot purchases and forward contracting of the physical grain remain the key tools for all livestock feeds wishing to avoid grain price exposure.

Often this is not possible to gain coverage of the physical grain and grain futures need to be considered. With the advent of the ASX grain futures contracts there will be more acceptable tools at the disposal of managers.

Not all the strategies outlined were considered appropriate for all livestock producers. Time and training budgets are limiting in all agricultural businesses and the scale of the operations need to be taken into account when selecting management strategies for price risk. Large consumers have greater access and resources to invest in learning and managing the upper end risk management tools.

# FODDER SUPPLY AND DEMAND

## Introduction

Previous studies of the supply and demand of hay and silage have not considered the dynamics of the fodder industry. During droughts livestock producers and fodder producers learn the function of the market and respond by reducing demand and increasing production. The innovations these farmers are able to implement during droughts is impressive. Production of fodder in these circumstances can be underestimated.

Previous modelling of fodder demand have also underestimated the demand of roughages by the ruminant industries.

## Methods

Unlike the grains industry, the availability of production data for fodder is limited. As fodder is not received in a central system and only a small portion of production is traded, there are few collection points for data.

Data sources used in this study are primarily ABS statistics. ABARE surveys conducted in 2003 have provided some valuable information on demand trends in the livestock sector. Conclusions drawn in the supply and demand study are heavily clouded by the substitution of grain and fodder by livestock feeders during drought periods. All assumptions are listed.

The supply and demand of fodder are analysed under four rainfall scenarios:

- Normal: Taken as 100% of average rainfall
- Meteorological Drought: A short term regional drought
- Agricultural Drought: A long term regional drought the includes intermittent chances of continental drought
- Hydrological Drought: A long term continental drought with no surface water

## Production

To ensure the supply and demand model for hay and silage production is well founded, production scenarios are devised by matching the rainfall records with the corresponding fodder production of that season.

All data has been analysed to state level and five different sources of fodder have been studied:

- Lucerne
- Pastures
- Cereal hay crops
- Non-cereal crops
- Silage

These distinctions are made as the production of each crop type varies in dry times and each has varying dependence on irrigation.

For each state rainfall patterns were studied and a growing season rainfall (six months from April to September) closest to 100% of the average was considered a “normal” season (see appendix 1). Fodder yield figures for these years were then used.

Rainfall records showing the lowest percentage of average for the growing season since 1993 were also correlated to the appropriate yield data for the season. These were considered the drought yield figures (see table 1).

**Table 1:** Production Years Used as Examples of Normal and Drought Seasons

| | NSW | Vic | Qld | SA | WA | Tas | NT | ACT |
|---|---|---|---|---|---|---|---|---|
| Normal growing season | 1995 | 1993 | 1996 | 1995 | 1995 | 1993 | 1997 | 1996 |
| Drought growing season | 1994 | 1994 | 1994 | 1994 | 2000 | 1994 | 1993 | 1994 |

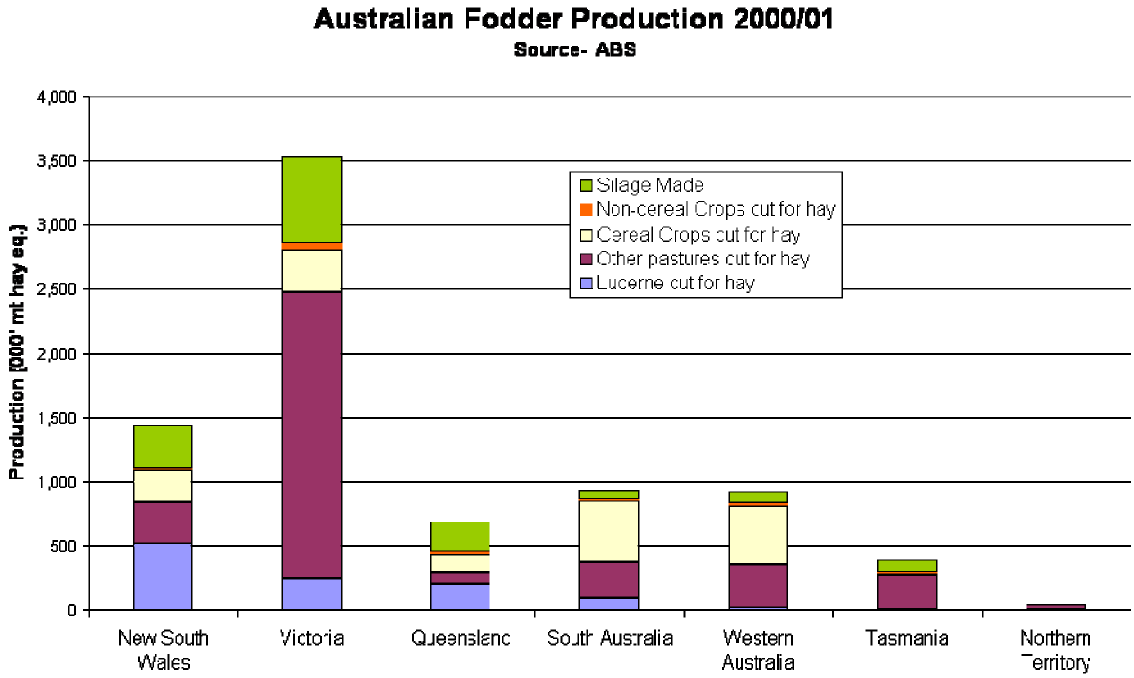
## Demand

Demand has been calculated for five categories:

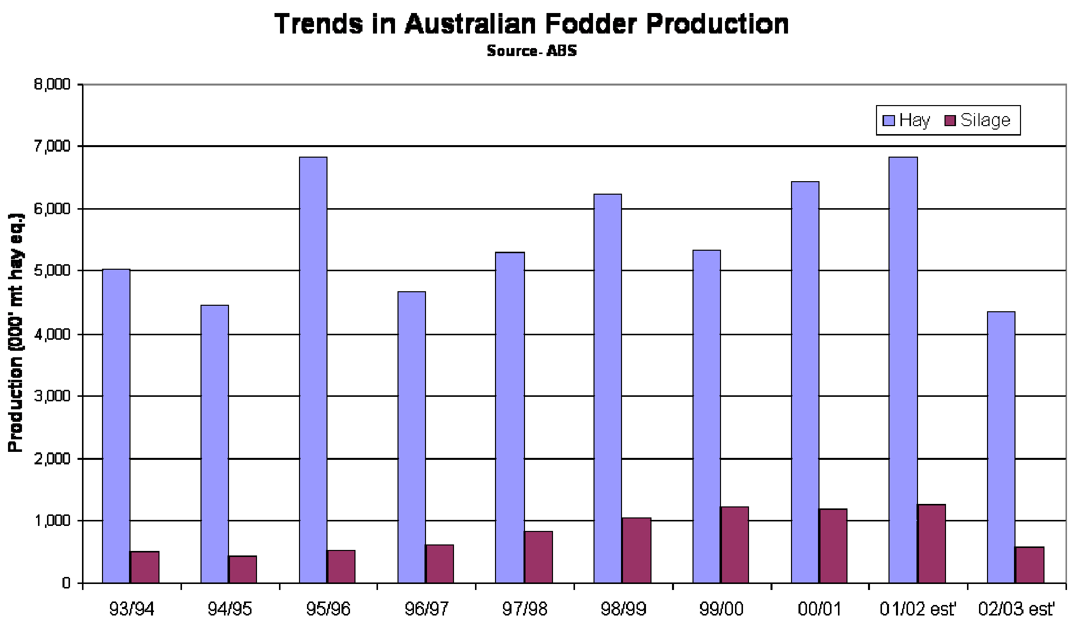
- Beef
- Dairy
- Beef Feedlot
- Sheep
- Horses
- Export

## Production Data

Appendix 2 provides all ABS production data since 1993/94. The last full agricultural census was done on June 30 2001. A summary of this data is seen below.




In all calculations, silage tonnage has been converted from a wet tonnage to a moisture equivalent to that of hay. As silage contains approximately 55% moisture, overestimated occur when silage production is added to other fodder crops.




There has been an increasing trend in fodder production, particularly with silage production.

**Table 2:** Estimated Fodder Production in a Normal Year (mt)

| | | **Lucerne cut for hay** | | | **Other pastures cut for hay** | | | **Cereal Crops cut for hay** | | | **Non-cereal Cropsy** | | | **Silage** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Area ha** | **Yield t/ha** | **Production t** | **Area ha** | **Yield t/ha** | **Production t** | **Area ha** | **Yield t/ha** | **Production t** | **Area ha** | **Yield t/ha** | **Production t** | **Production t wet** |
| **Normal** | | 2 | 1 | | | | | | | | | | | 3 |
| New South Wales | | 90,407 | 4.20 | 379,711 | 90,561 | 3.30 | 298,851 | 48,578 | 3.50 | 170,022 | 4,323 | 3.20 | 13,835 | 799,334 |
| Victoria | | 44,750 | 5.40 | 241,652 | 501,453 | 3.90 | 1,955,668 | 66,036 | 4.00 | 264,143 | 13,175 | 3.50 | 46,111 | 1,579,051 |
| Queensland | | 29,017 | 8.20 | 237,937 | 26,758 | 3.70 | 99,005 | 57,617 | 3.30 | 190,136 | 11,371 | 3.10 | 35,251 | 531,593 |
| South Australia | | 31,945 | 3.80 | 121,392 | 80,451 | 3.00 | 241,352 | 103,856 | 3.60 | 373,882 | 4,268 | 3.10 | 13,229 | 161,510 |
| Western Australia | 5 | 3,094 | **5.70** | 17,635 | 91,867 | **3.80** | 349,093 | 141,047 | 4.00 | 564,188 | 7,034 | 3.20 | 22,510 | 226,949 |
| Tasmania | | 3,196 | 4.60 | 14,702 | 53,641 | 4.50 | 241,386 | 1,591 | 5.00 | 7,954 | 996 | 4.60 | 4,579 | 251,649 |
| Northern Territory | 5 | 282 | **4.70** | 1,325 | 12,325 | **3.00** | 36,975 | 98 | 6.50 | 637 | 406 | 3.20 | 1,299 | 180 |
| ACT | 5 | 249 | **4.20** | 1,048 | 126 | 3.50 | 441 | 70 | 3.50 | 245 | | | 0 | 2,280 |
| Australia | | 202,941 | 5.00 | 1,015,402 | 857,182 | 3.76 | 3,222,772 | 418,892 | 3.75 | 1,571,207 | 41,573 | 3.29 | 136,815 | 3,552,545 |

Notes:

1. Normal year yield was taken as the year where the actual rainfall during the six month growing season April to September was closest to 100% of the average. Normal yields for hay production were taken from 1995 for NSW, SA and WA, 1993 for Vic and Tas, 1996 for Qld and ACT and 1997 for NT (see colour maps).
2. The normal area for hay was taken as that for the 2001 census.
3. Silage production was taken as that during the 2001 census plus 20% accounting for the progressive increase since 1993 of 13% pa.
4. As ABS express silage on an as is moisture basis, total fodder production is expressed as tonnes hay equivalent.
5. Bold figures are estimates as there were no recorded yield figures in defined "normal" year's data.

**Table 3:** Estimated Fodder Production in a Meteorological Drought Year (mt)

| | Lucerne cut for hay | | | Other pastures cut for hay | | | Cereal Crops cut for hay | | | Non-cereal Crops cut for hay | | | Silage Made |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Area** | **Yield** | **Production** | **Area** | **Yield** | **Production** | **Area** | **Yield** | **Production** | **Area** | **Yield** | **Production** | |
| | **ha** | **t/ha** | **t** | **ha** | **t/ha** | **t** | **ha** | **t/ha** | **t** | **ha** | **t/ha** | **t** | **t wet** |
| **Meteorological** | 2 | 1 | | | | | | | | | | | 4 ,3 |
| New South Wales | 90,407 | 4 | 325,467 | 90,561 | 3 | 235,458 | 48,578 | 2 | 92,298 | 4,323 | 3 | 10,808 | 663,447 |
| Victoria | 44,750 | 5 | 228,227 | 501,453 | 4 | 1,905,523 | 66,036 | 3 | 217,918 | 13,175 | 3 | 38,206 | 1,310,612 |
| Queensland | 29,017 | 8 | 220,527 | 26,758 | 3 | 85,626 | 57,617 | 2 | 132,519 | 11,371 | 4 | 39,800 | 441,222 |
| South Australia | 31,945 | 4 | 111,808 | 80,451 | 3 | 233,307 | 103,856 | 2 | 249,255 | 4,268 | 2 | 8,535 | 134,053 |
| Western Australia | 3,094 | 5 | 16,398 | 91,867 | 4 | 344,500 | 141,047 | 3 | 448,529 | 7,034 | 2 | 16,320 | 188,368 |
| Tasmania | 3,196 | 4 | 12,465 | 53,641 | 4 | 198,473 | 1,591 | 4 | 5,886 | 996 | 4 | 4,281 | 208,868 |
| Northern Territory | 282 | 5 | 1,325 | 12,325 | 2 | 27,115 | 98 | 4 | 421 | 406 | 6 | 2,233 | 149 |
| ACT | 249 | 3 | 848 | 126 | 2 | 227 | 70 | 2 | 119 | 10 | 3 | 25 | 1,892 |
| Australia | 202,941 | 5 | 917,065 | 857,182 | 4 | 3,030,229 | 418,892 | 3 | 1,146,945 | 41,583 | 3 | 120,208 | 2,948,613 |

Notes

1. Met drought yield was taken as the year where the actual rainfall during the six month growing season April to September was lowest of the period from 1993 to 2000.
2. Met drought yields for hay production were taken from 1994 for NSW, Vic, Qld, SA, Tas and ACT and from 2000 for WA (see colour maps).
3. The Met drought area for hay was taken as that for the 2001 census.
4. Silage production was taken as 83% of the 2001 census ie equivalent to the fall in pasture production from the 1993/94 to the 1994/95.
5. As ABS express silage on an as is moisture basis, total fodder production is expressed as tonnes hay equivalent.
6. Bold figures are estimates as there were no recorded yield figures in defined "Met drought" year's data.

**Table 4:** Estimated Fodder Production in an Agricultural Drought Year (mt)

| | Lucerne cut for hay | | | Other pastures cut for hay | | | Cereal Crops cut for hay | | | Non-cereal Crops cut for hay | | Silage Made |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Area | Yield | Production | Area | Yield | Production | Area | Yield | Production | Area | Production | |
| | ha | t/ha | t | ha | t/ha | t | ha | t/ha | t | ha | t | t wet |
| Agricultural | 2 | 1 | | | | | | | | | 5 | 3 |
| New South Wales | 63,285 | 3.15 | 199,348 | 63,393 | 2.60 | 164,821 | 38,862 | 1.90 | 73,838 | 3,459 | 5,511 | 479,600 |
| Victoria | 31,325 | 4.05 | 126,867 | 351,017 | 3.80 | 1,333,866 | 52,829 | 3.30 | 174,334 | 10,540 | 19,334 | 947,431 |
| Queensland | 20,312 | 6.15 | 124,917 | 18,731 | 3.20 | 59,938 | 46,094 | 2.30 | 106,015 | 9,097 | 220,028 | 318,956 |
| South Australia | 22,362 | 2.85 | 63,731 | 56,315 | 2.90 | 163,315 | 83,085 | 2.40 | 199,404 | 3,414 | 4,329 | 96,906 |
| Western Australia | 2,166 | 4.28 | 9,259 | 64,307 | 3.75 | 241,150 | 112,838 | 3.18 | 358,824 | 5,627 | 8,204 | 136,170 |
| Tasmania | 2,237 | 3.45 | 7,719 | 37,549 | 3.70 | 138,931 | 1,273 | 3.70 | 4,709 | 796 | 2,150 | 150,989 |
| Northern Territory | 197 | 3.53 | 696 | 8,627 | 2.20 | 18,980 | 78 | 4.30 | 337 | 325 | 1,117 | 108 |
| ACT | 175 | 3.15 | 550 | 88 | 1.80 | 159 | 56 | 1.70 | 95 | 8 | 13 | 1,368 |
| Australia | 142,059 | 3.75 | 533,086 | 600,027 | 3.54 | 2,121,160 | 335,114 | 2.74 | 917,556 | 33,266 | 260,685 | 2,131,527 |

Notes

1. Ag. drought yield is taken as same as Meteorological years for all crops.
2. Irrigated lucerne yields reduced to 75% of Normal values.
3. Areas were taken as 80% of the 2001 census with the exception of lucerne and pastures which were reduced to 70% due lack of irrigation water.
4. Silage production was taken as 60% of the 2001 census ie equivalent to the fall in pasture production from 1993/94 to 1994/95.
5. As ABS express silage on an as is moisture basis, total fodder production is expressed as tonnes hay equivalent.
6. Non-cereal production includes that 50% of the straw production capacity is employed.
7. Non-cereal production also includes that 50% of the assumed cane tops production capacity is employed in Qld (100,000 mt added)

**Table 5:** Estimated Fodder Production in a Hydrological Drought Year (mt)

| | **Lucerne cut for hay** | | | **Other pastures cut for hay** | | | **Cereal Crops cut for hay** | | | **Non-cereal Crops** | | **Silage** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Area** | **Yield** | **Production** | **Area** | **Yield** | **Production** | **Area** | **Yield** | **Production** | **Area** | **Production** | |
| | **ha** | **t/ha** | **t** | **ha** | **t/ha** | **t** | **ha** | **t/ha** | **t** | **ha** | **t** | **t wet** |
| Hydrological - | 2 | 1 | | | | | | | | | 5 | 3 |
| New South Wales | 31,643 | 3.15 | 99,674 | 63,393 | 2.31 | 146,437 | 43,720 | 1.90 | 83,068 | 3,085 | 11,021 | 147,800 |
| Victoria | 11,188 | 2.70 | 30,206 | 250,727 | 2.73 | 684,484 | 46,225 | 2.70 | 124,807 | 21,596 | 38,669 | 515,467 |
| Queensland | 10,156 | 6.15 | 62,458 | 18,731 | 2.59 | 48,513 | 57,617 | 2.30 | 132,519 | 12,862 | 240,056 | 305,735 |
| South Australia | 7,986 | 1.90 | 15,174 | 56,315 | 2.10 | 118,262 | 72,699 | 2.40 | 174,478 | 6,217 | 8,658 | 66,513 |
| Western Australia | 773 | 2.85 | 2,204 | 64,307 | 2.66 | 171,056 | 98,733 | 3.18 | 313,971 | 1,070 | 16,407 | 121,393 |
| Tasmania | 799 | 2.30 | 1,838 | 37,549 | 3.15 | 118,279 | 1,114 | 3.70 | 4,120 | 1,301 | 4,299 | 99,771 |
| Northern Territory | 71 | 2.35 | 166 | 8,627 | 2.10 | 18,118 | 69 | 4.30 | 295 | 1,095 | 2,234 | 71 |
| ACT | 62 | 2.10 | 131 | 88 | 2.45 | 216 | 49 | 1.70 | 83 | 10 | 26 | 926 |
| Australia | 62,678 | 3.38 | 211,852 | 499,737 | 2.61 | 1,305,365 | 320,225 | 2.60 | 833,342 | 47,235 | 321,370 | 1,257,675 |

Notes:

1. Hydrological drought yield is taken as 70% of the Normal values.
2. Lucerne areas are 25 to 35% of Normal consistent with Northern Vic experiences during 2002/03. Pastures are 70 % of Normal with Vic reduced to 50% with lack of irrigation. NSW and Qld lucerne areas are an exception as lucerne can get 7 cuts/season on some river flats without irrigation. Hydrological yields taken as 75% of Normal values for irrigated crops.
3. The Hydrological drought areas for cereals and other crops were taken as 70% of the 2001 census. This modest fall is due to the increase of failed grain crops that are made into hay.
4. NSW and Qld areas are 90 and 100% respectively of normal due to the greater sorghum that would be made for hay.
5. Silage production was taken as 83% of the 2001 census.
6. Non-cereal crops numbers include 100% of the straw production capacity which only occurs when prices for hay in summer are high. They also include 100% of the cane tops production capacity (200,000 mt)which only occurs when prices for hay in summer are high.

**Table 6:** Estimated Fodder Demand in a Normal Year (mt)

| | Export | Horses | Beef | Dairy | Feedlot | Sheep | Total Demand | Total Fodder | Surplus/Deficit |
|---|---|---|---|---|---|---|---|---|---|
| Normal | 6 | 8 | 10 | | 9 | | | 4 | 7 |
| New South Wales | 28,758 | 81,866 | 414,540 | 412,500 | 178,317 | 297,600 | 1,413,581 | 1,276,074 | -137,506 |
| Victoria | 92,810 | 102,332 | 193,704 | 2,105,681 | 28,112 | 186,240 | 2,708,879 | 3,324,732 | 615,854 |
| Queensland | 16,000 | 102,332 | 368,795 | 307,500 | 224,631 | 48,000 | 1,067,258 | 837,429 | -229,829 |
| South Australia | 211,000 | 12,280 | 80,927 | 159,000 | 20,357 | 165,600 | 649,164 | 833,436 | 184,273 |
| Western Australia | 259,000 | 61,399 | 142,296 | 105,000 | 23,391 | 320,400 | 911,486 | 1,070,872 | 159,386 |
| Tasmania | 0 | 18,665 | 35,700 | 238,500 | 7,317 | 28,400 | 328,583 | 398,851 | 70,268 |
| Northern Territory | 588 | 2,865 | 109,620 | 0 | 0 | 0 | 113,074 | 40,330 | -72,744 |
| ACT | | 409 | 0 | 0 | 0 | 1 | 410 | 2,914 | 2,504 |
| Australia | 608,157 | 382,149 | 1,345,582 | 3,328,181 | 482,125 | 1,046,241 | 7,192,433 | 7,784,638 | 592,205 |

Notes

1. Demand for Normal year taken from season 2001/02 using recent animal populations with 50,000 mt extra exports due to processors under construction.
2. A small surplus is carried over at the end of the year as silage or hay
3. Horse populations are drawn from a 1997 RIRDC study titled "The contribution of horses to Australia"
4. Feedlot numbers are an annual average of ALFA quarterly reports.
5. Dairy, beef and sheep numbers are sourced from ABS statistics.

**Table 7:** Estimated Fodder Demand in a Meteorological Drought Year

| | Export | Horses | Beef | Dairy | Feedlot | Sheep | Total Demand | Total Fodder | Surplus/Deficit |
|---|---|---|---|---|---|---|---|---|---|
| Meteorological Drought | 7 | | | | 8 | | 6, 9 | 4 | |
| New South Wales | 25,882 | 90,052 | 455,994 | 453,750 | 178,317 | 327,360 | 1,531,356 | 1,007,365 | -523,990 |
| Victoria | 83,529 | 112,565 | 213,074 | 2,316,249 | 28,112 | 204,864 | 2,958,393 | 3,068,115 | 109,722 |
| Queensland | 14,400 | 112,565 | 405,675 | 338,250 | 224,631 | 52,800 | 1,148,320 | 706,804 | -441,516 |
| South Australia | 189,900 | 13,508 | 89,020 | 174,900 | 20,357 | 182,160 | 669,844 | 672,277 | 2,433 |
| Western Australia | 233,100 | 67,539 | 156,526 | 115,500 | 23,391 | 352,440 | 948,496 | 923,227 | -25,269 |
| Tasmania | 0 | 20,532 | 39,270 | 262,350 | 7,317 | 31,240 | 360,709 | 329,195 | -31,514 |
| Northern Territory | 529 | 3,152 | 120,582 | 0 | 0 | 0 | 124,263 | 31,172 | -93,091 |
| ACT | 0 | 450 | 0 | 0 | 0 | 1 | 451 | 2,198 | 1,747 |
| | | | | | | | | | |
| Australia | 547,341 | 420,364 | 1,480,140 | 3,660,999 | 482,125 | 1,150,865 | 7,741,833 | 6,740,354 | -1,001,479 |

Notes

1. Demand is taken from season 2001/02 plus 10% ie a late break in most states with depleted pastures
2. Exports are reduced slightly by 10% due to increased domestic competition
3. Feedlot demand is unchanged as fodder prices will rise in line with grain prices and maintain similar inclusion rates in the ration.
4. Total demand increased to account for the increased feeding and availability of carryover stocks of hay and silage.

**Table 8:** Estimated Fodder Demand in an Agricultural Drought Year (mt)

| | Export | Horses | Beef | Dairy | Feedlot | Sheep | Total Demand | Total Fodder | Surplus/Deficit |
|---|---|---|---|---|---|---|---|---|---|
| Agricultural Drought | 5 | 6 | 7 | | | | 8 | 4 | |
| New South Wales | 20,131 | 98,239 | 290,178 | 453,750 | 178,317 | 208,320 | 1,248,934 | 691,711 | -557,223 |
| Victoria | 55,686 | 122,798 | 135,593 | 2,316,249 | 28,112 | 130,368 | 2,788,806 | 2,144,697 | -644,109 |
| Queensland | 9,600 | 122,798 | 258,157 | 338,250 | 224,631 | 33,600 | 987,036 | 675,958 | -311,078 |
| South Australia | 191,879 | 14,736 | 56,649 | 174,900 | 20,357 | 115,920 | 574,441 | 480,927 | -93,514 |
| Western Australia | 259,000 | 73,679 | 99,607 | 115,500 | 23,391 | 224,280 | 795,457 | 687,903 | -107,554 |
| Tasmania | 0 | 22,398 | 24,990 | 262,350 | 7,317 | 19,880 | 336,936 | 231,646 | -105,290 |
| Northern Territory | 579 | 3,438 | 76,734 | 0 | 0 | 0 | 80,751 | 21,186 | -59,565 |
| ACT | 0 | 491 | 0 | 0 | 0 | 0 | 492 | 1,525 | 1,033 |
| | | | | | | | | | |
| Australia | 536,875 | 458,579 | 941,907 | 3,660,999 | 482,125 | 732,368 | 6,812,853 | 4,935,553 | -1,877,300 |

Notes

1. Exports will be reduced by more in states of high domestic demand
2. Export processors with plants in Vic, SA and WA will export more from WA to maintain markets.
3. Demand from horses will be aggressive as recreational animals will be fed and maintained
4. Beef and sheep demand will shrink by 30% as hay becomes unavailable and more grain is preferred.
5. Total feeding of hay and silage constricts due to lack of supply, culling and preference feeding of grain

**Table 9:** Estimated Fodder Demand in a Hydrological Drought Year (mt)

| ABS Census & Surveys | Export | Horses | Beef | Dairy | Feedlot | Sheep | Total | Total | Surplus/Deficit |
|---|---|---|---|---|---|---|---|---|---|
| Hydrological Drought - | 8 | | 5, 6 | 6 | 7 | 6 | | 4 | |
| New South Wales | 4,026 | 79,205 | 126,139 | 318,000 | 177,266 | 91,512 | 796,148 | 416,687 | -379,461 |
| Victoria | 16,706 | 99,006 | 70,564 | 1,768,772 | 33,322 | 50,634 | 2,039,004 | 1,144,921 | -894,083 |
| Queensland | 9,600 | 99,006 | 139,088 | 234,000 | 234,947 | 26,280 | 742,922 | 641,764 | -101,158 |
| South Australia | 57,564 | 11,881 | 26,012 | 124,800 | 11,312 | 38,916 | 270,484 | 350,993 | 80,508 |
| Western Australia | 129,500 | 59,404 | 51,836 | 81,600 | 20,285 | 56,070 | 398,695 | 566,459 | 167,764 |
| Tasmania | 0 | 18,059 | 15,147 | 198,000 | 7,321 | 9,905 | 248,432 | 180,168 | -68,263 |
| Northern Territory | 579 | 2,772 | 44,631 | 0 | 0 | 0 | 47,982 | 20,849 | -27,133 |
| ACT | 0 | 396 | 0 | 0 | 0 | 192 | 588 | 935 | 347 |
| Australia | 217,975 | 369,729 | 473,417 | 2,725,172 | 484,453 | 273,508 | 4,544,254 | 3,322,776 | -1,221,479 |

Notes

1. Hay demand from the pastoral sector is dramatically reduced.
2. Grain takes up much of this demand as it's the only readily available source of energy.
3. Producers can save on re-stocking costs following the drought if they continue feeding rather than culling.
4. Demand is based on stock culling anticipated by June 2003 according to the ABARE survey of February 14 2003
5. Despite the dairy industry having a relatively inelastic demand, the scarcity of fodder reduces hay demand and accelerates levels of grain feeding.
6. Feedlot numbers are expected to rise during the Hydrological drought
7. Although exports reduced only by 4% during the drought of 1994/95, export tonnage will contract greatly.

## Discussion

The four scenarios are summarised below.

From the analysis it can be seen that fodder supply and demand has the capacity to provide a surplus for storage of hay and silage as a carry over to the new season. In normal years this can act as a buffer for regional droughts that can occur from time to time.

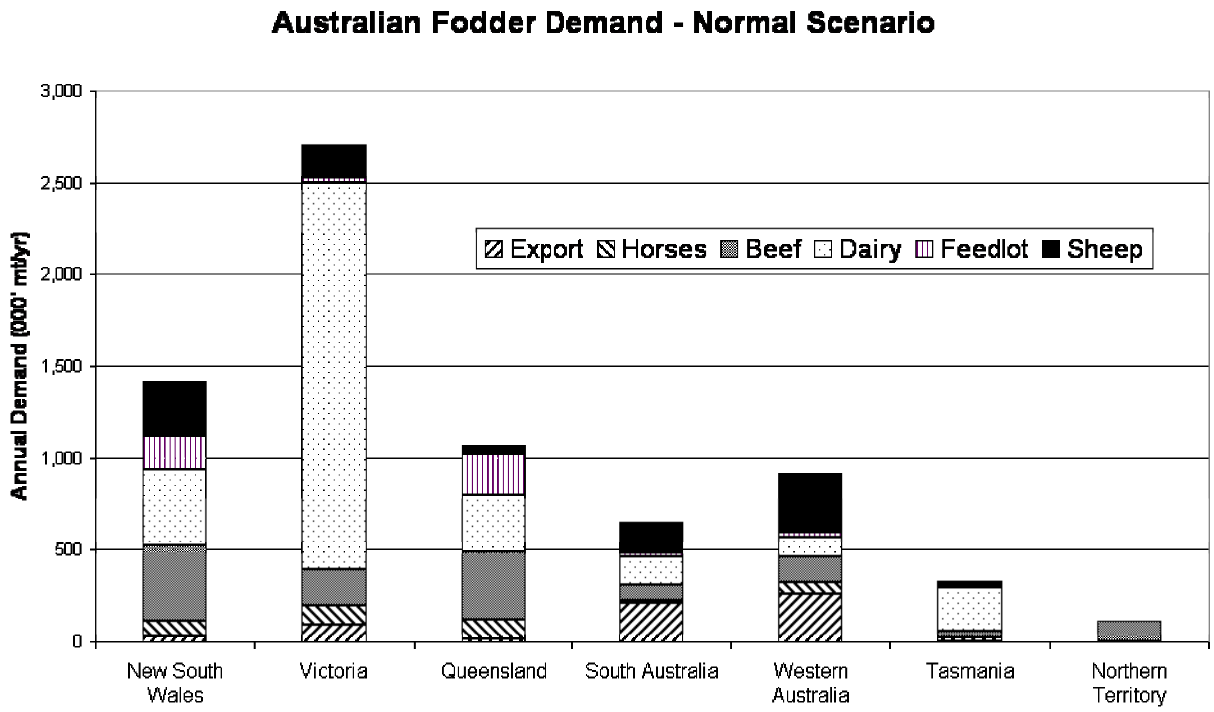
The large deficits of 1.8 mmt and 1.2 mmt can never occur. Supply and demand must meet during the season as both the production is increased with new fodder substitutes imported or produced and the demand is restricted through culling of livestock.

The marked fall in animal numbers that ABARE reported in their February 14, 2003 survey of livestock feeders was used for the demand portion of the Hydrological Drought scenario. This was later considered a much greater fall in animal numbers than actually eventuated. Despite this great reduction of livestock in this scenario, the production fodder was well short of the fodder demand.

Table 10 Summary of Estimated Fodder Demand in all Scenarios Years (000' mt/yr)

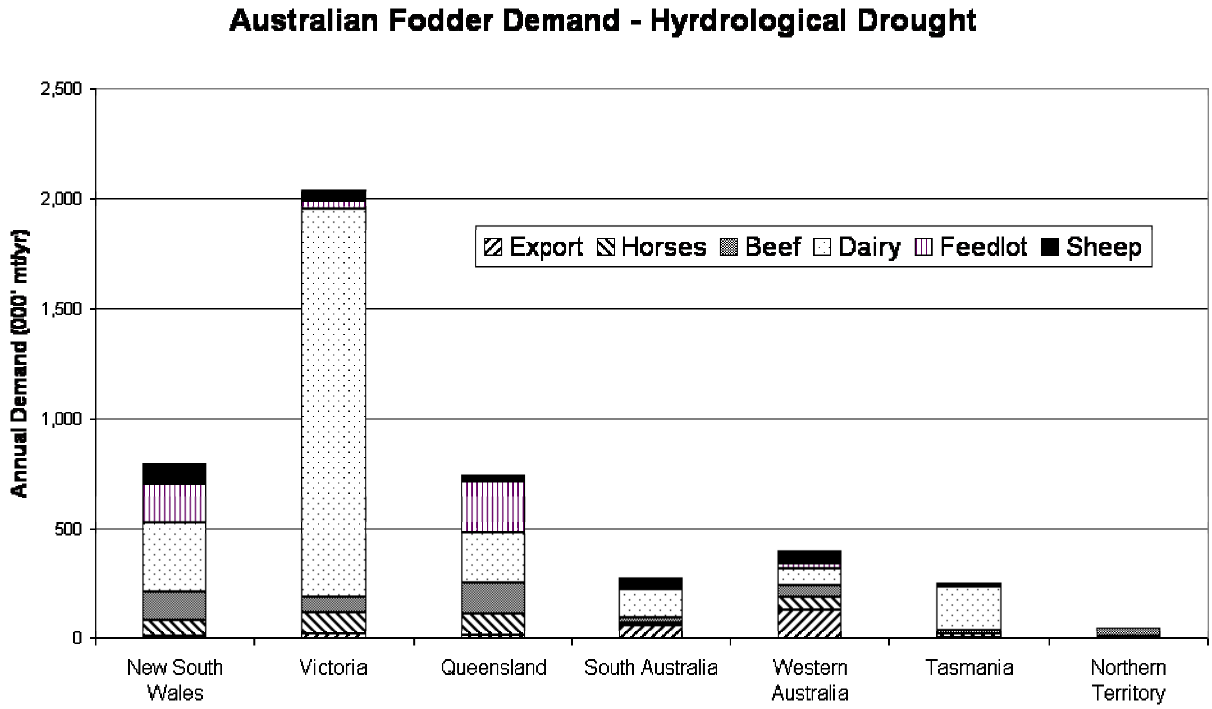
| | **Normal** | | | **Meteorological** | | | **Agricultural** | | | **Hydrological** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Demand** | **Supply** | **Surplus /Deficit** | **Demand** | **Supply** | **Surplus /Deficit** | **Demand** | **Supply** | **Surplus /Deficit** | **Demand** | **Supply** | **Surplus /Deficit** |
| New South Wales | 1,414 | 1,276 | -138 | 1,531 | 1,007 | -524 | 1,249 | 692 | -557 | 796 | 417 | -379 |
| Victoria | 2,709 | 3,325 | 616 | 2,958 | 3,068 | 110 | 2,789 | 2,145 | -644 | 2,039 | 1,145 | -894 |
| Queensland | 1,067 | 837 | -230 | 1,148 | 707 | -442 | 987 | 676 | -311 | 742 | 642 | -101 |
| South Australia | 649 | 833 | 184 | 670 | 672 | 2 | 574 | 481 | -94 | 270 | 351 | 80 |
| Western Australia | 911 | 1,071 | 159 | 948 | 923 | -25 | 795 | 688 | -108 | 398 | 566 | 167 |
| Tasmania | 329 | 399 | 70 | 361 | 329 | -32 | 337 | 232 | -105 | 248 | 180 | -68 |
| Northern Territory | 113 | 40 | -73 | 124 | 31 | -93 | 81 | 21 | -60 | 47 | 21 | -27 |
| ACT | 0 | 3 | 3 | 0 | 2 | 2 | 0 | 2 | 1 | .6 | 1 | .3 |
| Australia | 7,192 | 7,785 | 592 | 7,742 | 6,740 | -1,001 | 6,813 | 4,936 | -1,877 | 4,544 | 3,323 | -1,221 |

Representing the national fodder demand in the figure below, gives an appreciation as to the scale of demand from the Victorian dairy industry. Unlike the pastoral sheep and cattle, lactating dairy cows require a source of fibre for proper rumen function and high milk fat production.




The significance of the exports can be seen in the case of the key exporting states of SA and WA. In normal years, seasonal feed gaps are filled with hay and silage for address shortfalls for sheep and cattle graziers.

With droughts and despite the reduced demand, the deficit grows rapidly. This is despite the model accounting for a dramatic lift in straw production and a contribution from a new sugar cane top production method.




Under these extreme drought conditions, the lack of surface water occurs after prolonged dry seasons. As preceding seasons would have been drought of varying degrees in many agricultural areas of Australia, carry over stocks of fodder reserves into such a Hydrological Drought would be negligible. Market signals would be suggesting livestock producers that there is a strong need to seek alternative feeds for the season. The normal requirement for hay and silage would be pressured.

Imported grains either from interstate or overseas would be primarily destined to the metropolitan stockfeed compounders. This trade would however displace upcountry grains stocks and release them to the regional demand points.

As grain is typically a more cost effective way of buying metabolisable energy for ruminants (see Table 11), it represents good value in a drought. Lactating dairy cows have less flexibility in using grain only during droughts. The need for long straw fibre is necessary for rumen function and the efficient production of milk fat.

**Table 11:** Relative cost of Energy for Ruminant Rations Under a Hydrological Drought Scenario.

| Commodity | Price ($/mt del farm) | Energy density (MJ/kgDM) | Cost of energy ($/MJ) | Cost relative to hay (%) |
|---|---|---|---|---|
| Cereal Hay | $ 300 | 8.5 | $ 35.29 | 100% |
| Wheat | $ 280 | 10.0 | $ 28.00 | 79% |

Source: Prices paid during Autumn 2003 in Goulburn Valley Victoria.

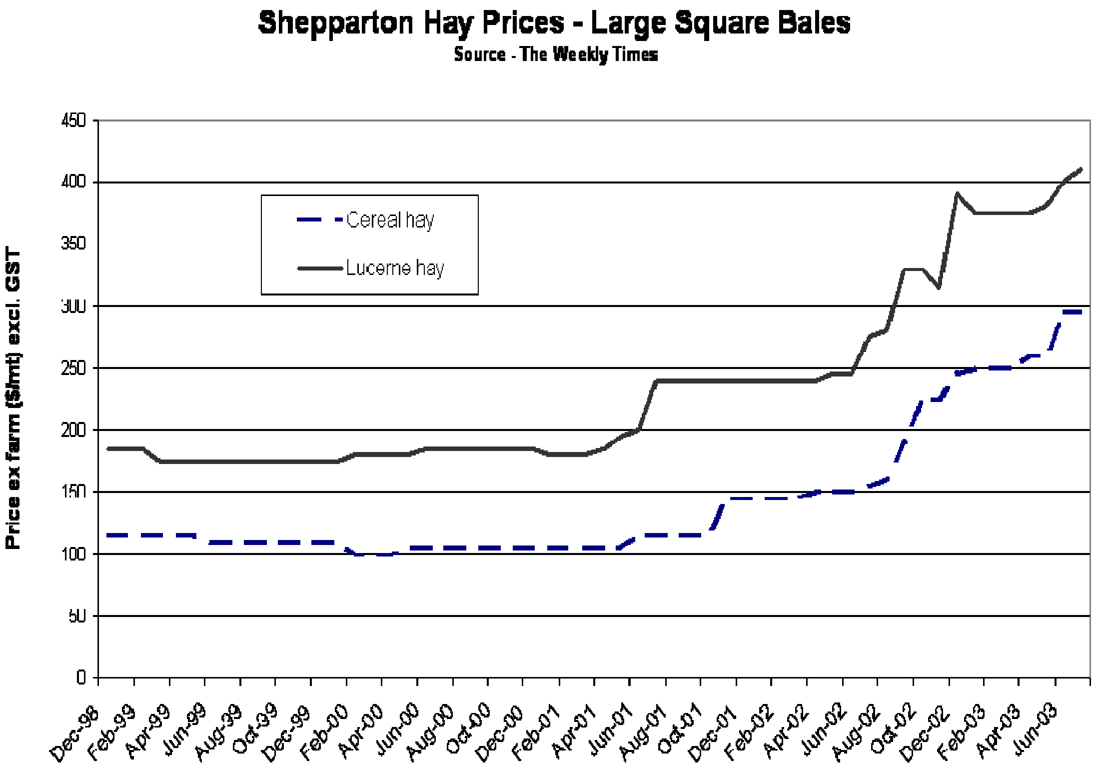
## Straw

Cereal straw became a much more important source of fodder during 2003 than at any time previously. Certain conditions are required before significant tonnages of straw are produced. These include:

- The fodder prices reaching a level that can sustain a price of between $40 and $50/mt to the grain grower for a contractor to bale cereal straw;
- The price of fodder achieving this high level before the grain grower has decided to incorporate stubble into the soil;
- The grain grower willing to defer the advantages of grazing for their own livestock; and
- Sufficient contractor capacity to do the work.

There is some reluctance of grain growers to have contractors bale stubble as many grain growers use the stubble as a form of fodder. As many grain growers in Western Victoria in 2003 were lightly stocked, the percentage of grain growers baling stubble was estimated at around 60%.

As can be seen in the figure below, hay prices began moving up in mid 2001 but more significantly in late 2002, in each case responding to a less than expected hay season. This accumulated impact of poor seasons has severely reduced the ability of the livestock industry to cope with the 2002/03 drought.




Straw can supply a necessary roughage component in all ruminant rations and should not be underestimated in its value in times of drought. Rice straw has been used more in the 2003/03 drought than ever before. Some advisors are not in favour of recommending feeding of rice straw due to issues with ulcerated mouths of sheep and cattle.

Sources of straw can be cereal crops such as wheat and barley and sorghum. Significantly in the 2003/03 drought, many stubbles from summer crops were baled as well. These included rice straw (not popular with many livestock feeders), maize straw, soybean straw and peanut straw. Some issues occurred early in 2003 with sorghum hay baled from drought stressed grain crops. These were found to contain toxic amounts of prussic acid

## Cane Tops

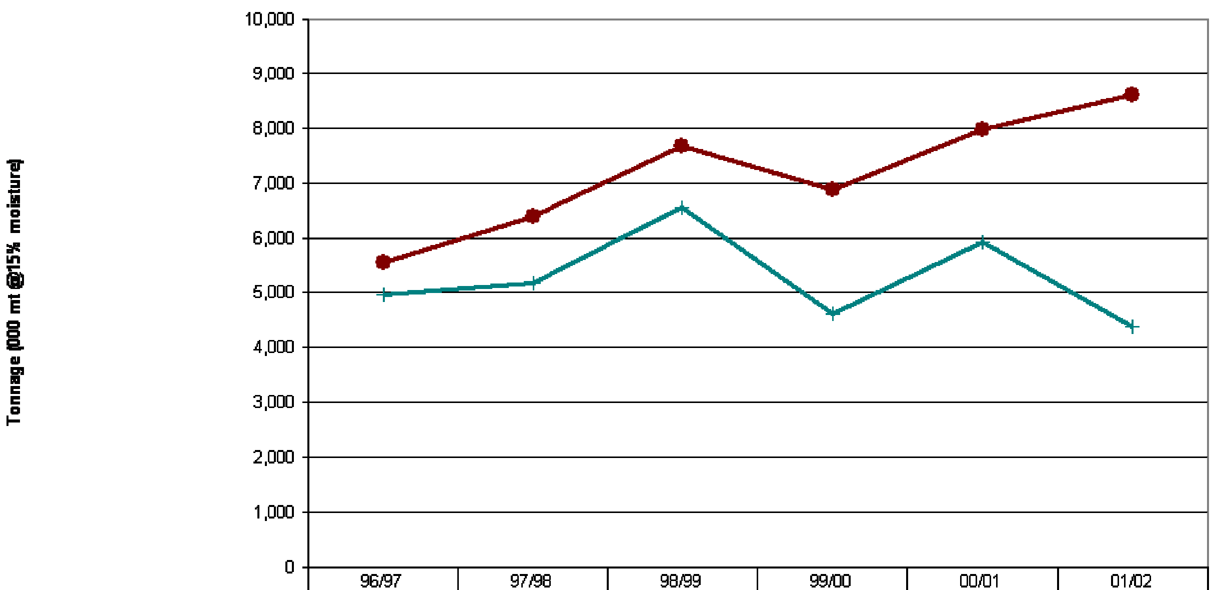
The models in this project have incorporated some supply contribution from cane tops. This is a novel product that some Queensland cane producers are about to commercialise. The concept relies on a machine to cut the tops of the standing cane five to six weeks before cutting. Unlike the more conventional cane tops, the fodder material never reaches the ground and is packed and ensiled.

With some cane mills such as the Morton mill in southern Queensland closing down, this and other fodder crops may be an opportunity for the struggling cane industry. With the modelled Queensland fodder supply in deficit in all the scenarios, this could prove a valuable fodder source.

## Stocks

With the stocks data available from the ABS, an alarming trend appears.

**Total Fodder Production and Stocks**




| | 96/97 | 97/98 | 98/99 | 99/00 | 00/01 | 01/02 |
|---|---|---|---|---|---|---|
| Fodder Production | 5,558 | 6,39E | 7,675 | 6,873 | 7,962 | 8,600 |
| Fodder Stocks as at March 31 | 4,976 | 5,17E | 6,547 | 4,625 | 5,914 | 4,390 |

Despite the increasing trend of production, fodder stocks are trending down in the period of data available. To better prepare for future droughts and the ‘just-in-time’ style of buying feeds, this trend needs to be reversed.

## Fodder Imports

Hay is typically a low value, high volume commodity making it expensive to import from overseas suppliers. However, during the droughts of 1994/95 and 2002/03 there have been a number of commodities that have been successfully imported to meet the fibre/energy demands of Australia's farmed ruminants. These commodities were, to some extent, a replacement for Australian silage and hay.

The likelihood of these commodities being imported into Australia is unpredictable. These imports are highly opportunistic depending on Australian feed markets, exchange rates, international markets for the feed sources and regional surpluses in producing countries.

All imports need to be compliant with AQIS import protocols with respect to heat treatment and freedom of pests and diseases. In a fodder context this excludes all feed supplements except those that have been through a heat treatment process. For countries that are infected with Foot and Mouth Disease the treatment required is 80 degrees C for 10 minutes.

This requirement for an expensive heat treatment effectively excludes most of the world's traded fodder. Japan is the largest market for hay in the world and imports between 3.0 and 3.5 million tonnes per year. Most hay shipped to north Asia from the US and Canada is fumigated for insects. The additional costs of heat treatment on a low value commodity such as hay, means that it could only be justified for high valued fodder or those feeds that under go the heat process as part of their production chain.

### *Alfalfa Cubes*

In the 1994/95 drought, North American alfalfa pellets were imported into northern NSW and Qld. These pellets or cubes are compacted during processing and can overcome some of the disadvantages of less dense hay products. A typical analysis of these cubes is found in Table 13.

The cubes proved to be expensive for many livestock feeders and the importer was not able to sell the product in a quick period of time.

### *Wheat Bran Pellets*

In the most recent drought of 2002/03, wheat bran pellets have been imported into Eastern Australian ports. In the six month period to July 2003, there was a total of 80,000 tonnes of the pellets imported with another 25,000 tonnes ordered for delivery through to May 2004.

The pellets have been popular with compound stockfeeders who are blending the pellets into their least cost rations. The pellets have also found favour with farmers who have been feeding them directly to their sheep and cattle.

Comments from those involved suggest that there are some problems in feeding the pellets. Cattle and sheep producers have experienced problems with adjusting animals to the feed, maintaining a low moisture level and minimising dust.

Some farmers have seen stock experience acidosis from feeding high rates of pellets without a gradual introduction of the new feed. Moisture has been an issue with the farmers who are storing and feeding the pellets directly to sheep and cattle. At levels of 12.4% moisture, the pellets have been known to develop a non-toxic mould, which alters the palatability and handling characteristics of the material. Dust has also been a consideration.

Conversely, comments from the compound stockfeeders have been favourable. These millers say that the pellets blend very well with other ingredients and handle well within the mills.

The imports have been shared between Grain Exporters Pty Ltd and the ABB Limited. These companies are receiving enquiries from consumers considering long term supply arrangements. The future of the pellets will rest on the price scenarios of 2004 as the pellets are also a popular feed in Japan. Malaysia and Taiwan.

**Table 12:** Typical Nutritional Analysis of Imported Feeds – Tested on an as is basis

| Parameter | Unit | Wheat Bran Pellets | Alfalfa cubes |
|---|---|---|---|
| Protein (Nx6.25) | % | 15.5 | 19 |
| Oil/fat by ether extract | % | 4.4 | |
| Fibre | % | 7.5 | |
| Ash | % | 4.41 | |
| Moisture | % | 11.6 | 10 |
| Energy Ruminant | MJ/kg | 12.2 | 9.3 |
| ADF | % | 9.6 | |
| NDF | % | 36.8 | 44.7 |
| Digestible Dry Matter | % | 75.4 | 64.6 |
| *Source: Agrifood Technology, Vic. Feedtest, Vic* | | | |

## Grain Price Risk Management Alternatives

In a drought scenario, price risk management of feeds is an important factor. Once livestock businesses have considered the price risk management of the animal output (e.g. milk, meat or wool), consideration can be given to the management of the input costs such as grain. As the grain market is more liquid and sophisticated, there are more price risk management alternatives for feed grains than hay.

Assuming that livestock feeders are not able to grow some or all of their grain requirements, there are a number of tools that are available to manage the price risk of grain. Many analysts say that some price management tools are more applicable to others and not all buyer's requirements are best locked into one particular strategy.

Factors influencing price risk management for each of the major livestock sectors can be considered.

### *Dairy*

The acceptance and proven benefits of grain feeding in the dairy industry are wide spread. This enables dairy farmers to predict their grain demand forward and use relevant price risk management tools. Grain demand will increase during periods of reduced pasture production. As droughts become progressively worse, grain demand will continue to increase until the price of grain becomes prohibitive and culling of stock numbers commences.

During Hydrological droughts the production of irrigated pasture will fall. In this case, hay and silage price risk management will be an important factor. Lactating dairy cows require long straw fibre for milk production and unlike the sheep and cattle in the pastoral industry, must maintain a higher level of fibre in the ration. The most appropriate strategy in this case is the long-term storage of hay or silage.

## Pastoral - Beef / Sheep

This sector of the livestock industry does not intend to routinely feed grain. This changes the price risk management needs of the sector considerably. In times of drought, this sector often purchases grain in preference to hay and silage. This happens for three reasons:

- In drought times, hay is very difficult to source in the local area
- During drought the price of hay and silage is often prohibitively expensive particularly when road freight is taken into account.
- Unlike grain, hay is not a dense source of metabolisable energy. Previous droughts have proven that sheep and cattle can be maintained on grain diets alone

## Beef Feedlot and Pork Operations

These sectors have one of the more predictable requirements for grain demand. Managers of beef feedlots and pork operations who have a regular and predictable numbers of animals on feed are able to employ more price risk management tools than the other sectors.

Depending on the individual businesses size and appetite for risk, the following strategies may be used in varying combinations. These factors are taken into account in the adjoining Table 14.

**Prompt purchases**

Prompt pricing of grain can involve high levels of price risk but also provide some good opportunistic buying as well.

***Flat price physical delivered farm***

The most common form of grain purchasing is the contract that buys grain to the consumption point when it’s needed and payment occurs as the grain is being processed.

***Grain Tenders***

Some farmer co-operatives and traders offer grain for sale in a tender. These tenders can be for a forward or nearby delivery. Nearby delivery tenders are offered to larger tonne buyers (2,000 tonnes plus) through the AWB Weekly Tenders. Few trades have been conducted through the system.

**Forward contracting**

If a livestock producer has a predictable demand pattern for feedgrain in a liquid market, forward contracting is an ideal way to meet future requirements. By purchasing grain deliveries well before delivery, a grain buyer has the opportunity to make an informed marketing decision. Many questions arise when buying grain forward such as who to buy from, what portion of total demand, what quality, when and what price. The variety of risk management profiles that exist under this buying strategy will cover all consumers in all cases.

In comparison to nearby purchases, forward contracting can lead to higher counterparty risk. Care needs to be taken in selecting a reliable supplier who will deliver despite changes to the price and quality of grain available in the market place.

Increasingly the dairy farmers are buying a portion of their demand for two and three years forward.

***Flat price physical grain contracts delivered farm***

This is the most common and straightforward way to forward purchase grain. The drought markets will provide grain traders with opportunities to tranship grain from interstate and offer to livestock feeders.

***Flat price physical delivered to a related market in Australia***

Often grain markets may be inactive in the drawing arc of supply to a demand point. Markets in other more distant areas may be trading when the market in the source area is not.

In this case a less common price risk management strategy is to buy physical grain in another area. This will cover the majority of the price risks yet leave a small basis risk between the two markets. This works well for companies who are buying grain for multiple consumption points across Australia. If good buying opportunities present themselves in some areas and equitable arrangements can be put into place, stock swaps can be conducted with national grain marketers so grain can be exchanged for stocks close to the preferred delivery point. Dairy farmers who lease grain-growing properties have used this strategy. In some seasons it has been a cheaper option to sell grain that is contract grown for them and purchase cheaper grain delivered to their farms.

***Multi delivery point sales at buyer’s option***

In a similar vein, large grain users with many delivery points across the country can buy grain delivered to many points at buyer’s option. This can then be used to advantage through arbitrage by opting to take delivery in the highest priced market and separately buying in other grain in the less expensive markets.

***Contracting grain for several years forward***

Depending on their confidence in the livestock, milk or wool markets, farmers may be able to take advantage of long term contracts. By taking a fixed price for a fixed tonnage over two or three years, there can be an overall improvement in a good average price over that period. Dairy farmers are considering these more often according to grain brokers in Victoria. Dairy farmers are increasingly considering a strategy involving:

- Forward contracting a third of grain requirements at least 12 months in advance
- Covering a third of grain requirements at harvest and
- Buying the remaining third of requirements on the prompt market through the year

**Feed Bank**

As proposed by Xavier Martin and the NSW Farmers Federation, there are concerns that despite managing grain price risks, there is also an issue of access to physical grain during severe droughts.

Under a scheme proposed in early 2003, a primary producer would deliver or buy feed grain in store, managed by a professional bulk storage operator. The storage operator would issue a feed-grain warrant to the primary producer, stating the type of grain and tonnage. The producer would declare a value for the warrant at the date of warrant issue for tax purposes.

This value would be fully tax deductible for the producer in the year of issue and taxable in the year of withdrawal. The storage operator would manage the turnover of stocks by type from season to season within the region. Storage fees would be payable by the producer on invoice and be 150% tax deductible. The feed-grain would be eligible for withdrawal once appropriate drought severity criteria are met. If the grain were withdrawn outside this period, accumulated tax concessions would be repayable.

It would need to be determined if producers are prepared to pay for stocks of grain that they may not have access to until a third party says they do. Also, in the instance of an extended drought-free period, the issue of grain stock disposal would need to be resolved. With accumulated tax deductions payable, any withdrawal of grain from the Feed Bank in a good season would prove to be very costly. It is yet to be seen if these complexities of the scheme can be overcome.

**Futures Contracts**

Futures contracts enable grain buyers to flat price purchase their grain needs in a market that is parallel to their own. The objective is to cover the price exposure at a time when it is not possible to purchase the physical grain.

***CBOT corn and wheat***

The largest agricultural futures markets of the US can provide a hedging mechanism for some grain buyers. It is usual for Australian sorghum prices to follow the US corn prices and likewise Australian wheat to follow US wheat. The difference between the two markets can be large particularly when Australia is suffering a drought. This difference is the basis, which has its own set of associated risks.

***ASX futures***

Despite the Sydney Stock Exchange delisting their grain futures contracts in June 2001, the Australian Stock Exchange has recently established futures contracts for feed wheat, feed barley, sorghum and canola. An Australian exchange with the three feed grains will bring reduced basis and exchange rate risk for livestock feeders. The liquidity or volume of trading in the contracts is still small although trades are expected to increase with the new season’s grain harvest in November 2003.

***Basis contracts***

These contracts are offered to grain buyers as a contract price with a premium or discount to a nominated futures market. The contracts involve a settlement where the grain buyer exchanges futures and usually a small premium for the physical grain from the seller.

Basis contracts are currently written using US futures on the Chicago Board of Trade. With the advent of the ASX feed grain futures contracts, basis contracts may be written as a premium or discount to an Australian market. The reduction of risk with ASX basis contracts will be significant as exchange rate risk is eliminated and basis risk (between the local market and ASX futures) will be much less that the CBOT basis contracts.

**Options contracts**

These are commonly done in all high volume international agricultural commodity exchanges. From an Australian grain buyer's perspective the barriers to these types of contracts are:

- Exchange rate risk
- Basis risk
- Inability to freely trade in and out of the contracts during Australian business hours
- Margin calls

For grain buyers, options offer a chance to cap the maximum level grain prices may reach while maintaining the advantage on the downside if prices were to become cheaper with time. With the payment of a premium buyers can ensure that the futures grain price will not exceed a certain level during a specified period and advantage can be taken if markets move lower.

These contracts are available on the US exchanges. The ASX may offer these corresponding option markets on the Exchange for the three feed grains if the liquidity is deemed sufficient.

**Tailored products**

Some special over the counter contracts have been devised so that a financial instrument is able to deliver a price risk management role without the involvement of the physical commodity.

Major grain traders or banks will arrange some product for a client if the tonnage can justify the trouble for designing the risk management tool. Generally these companies would require a client to be using in excess of 15,000 mt/yr to warrant a specific tool for a client.

The National Australia Bank offers several strategies that are currently used by grain producers and wheat millers. Some of these strategies may also be useful for feed grain buyers.

***Swaps***

Swaps are an instrument that locks in a price for grain for future delivery. Swaps have been packaged so that the grain futures contract relies on a cash settlement on expiry. They are based on either Chicago or Kansas City Boards of Trade futures contracts in US cents/bushel. These contract prices are converted to AUD/tonne. Swaps are able to account for the exchange rate fluctuations; brokerage and margin calls associated with foreign futures contracts. Swaps do however leave participants fully exposed to the domestic basis.

In most cases, grain growers use Swaps to manage the price risk of selling grain. In some circumstances, Swaps could be a useful tool for grain buyers. In a case where US futures prices are low and the AUD/USD exchange rate is high, a low price could be achieved for the purchase of grain extending out for up to three years. Cash earned on settlement of the contract can then offset the costs of buying grain on the domestic market.

### *Caps*

Grain buyers can use a Cap strategy to limit the upside of their price exposure. These contracts do not lock in the price but give the grain buyer a right but not an obligation to buy grain at a certain price.

By using US call options and exchange rates, the NAB charges payment of a premium for the grain buyer to ensure that the grain price will not exceed a particular level.

### *Collar*

This financial instrument enables a grain buyer to cap the maximum price of the futures contract while giving up some of the advantage on the downside. The premiums for these contracts are cheaper and they set a range for the pricing of a futures contract.

**Table 13:** Risk Management Tools and Recommended Adoption by Livestock Industries

| Risk Management tool | Dairy | | | Beef / Sheep Pastoral | | | Beef Feedlot & Pork Operations | | |
|---|---|---|---|---|---|---|---|---|---|
| | Small | Medium | Large | Small | Medium | Large | Small | Medium | Large |
| **1 Prompt Purchases** | | | | | | | | | |
| 1.1 Flat Price physical | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 1.2 Grain Tenders | | | ✓ | | | | | ✓ | ✓ |
| **2 Forward Contracting** | | | | | | ✓ | | | |
| 2.1 Flat Price Delivered Farm | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| 2.2 Flat price Delivered elsewhere | | | ✓ | | | ✓ | | | ✓ |
| 2.3 Multi-delivery Point | | | | | | ✓ | | | ✓ |
| 2.4 Contracting years forward | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ |
| **3. Feed Bank** | ✓ | ✓ | ✓ | | | | ✓ | ✓ | ✓ |
| **4. Futures Contracts** | | | | | | | | | |
| 4.1 CBOT corn and wheat | | | ✓ | | | | | ✓ | ✓ |
| 4.2 ASX futures | | ✓ | ✓ | | | | | ✓ | ✓ |
| 4.3 Basis Contracts | | | ✓ | | | | | | ✓ |

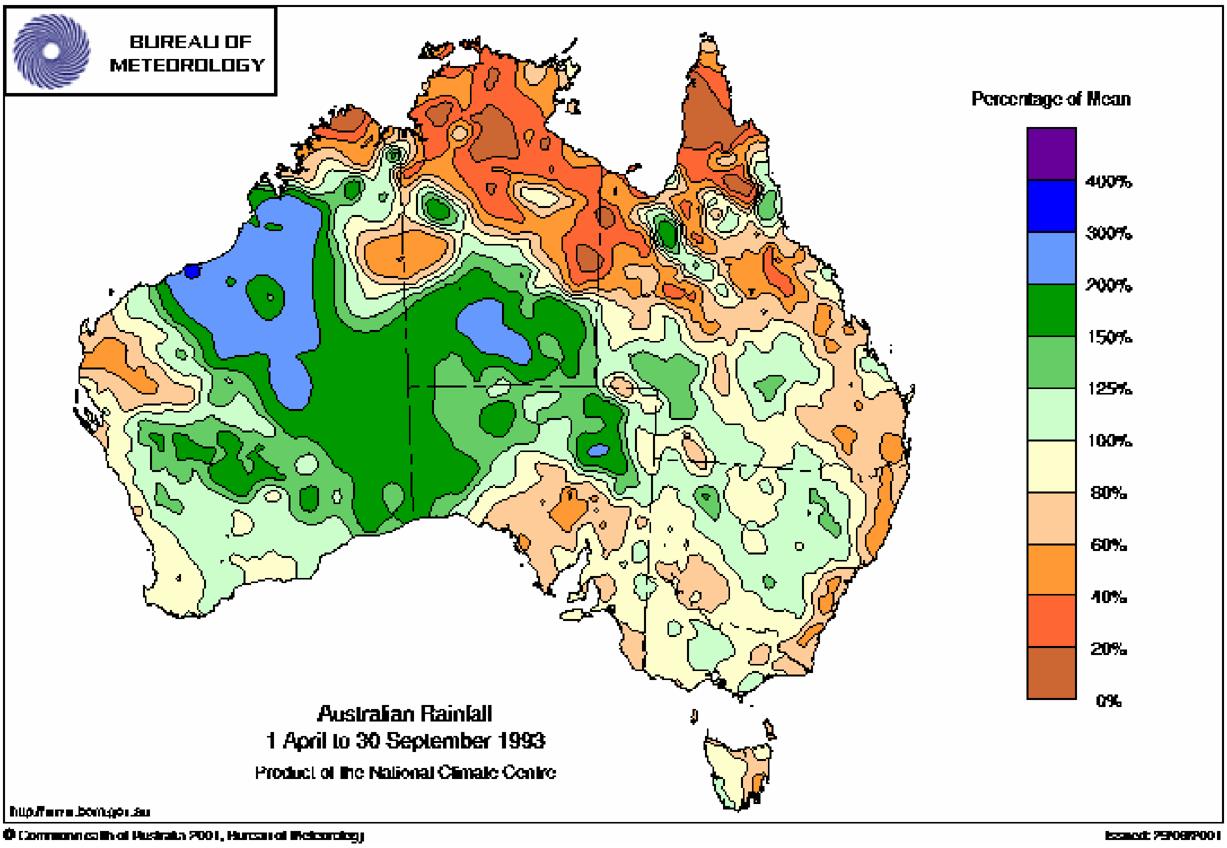
| | Dairy | | | Pastoral Beef / Sheep | | | Beef Feedlot & Pork Operations | | |
|---|---|---|---|---|---|---|---|---|---|
| | Small | Medium | Large | Small | Medium | Large | Small | Medium | Large |
| **5 Options Contracts** | | | ✓ | | | | | ✓ | ✓ |
| **6. Tailored Products** | | | | | | | | | |
| 6.1 Swaps | | ✓ | ✓ | | | | | ✓ | ✓ |
| 6.2 Caps | | ✓ | ✓ | | | | | ✓ | ✓ |
| 6.3 Collars | | | ✓ | | | | | | ✓ |

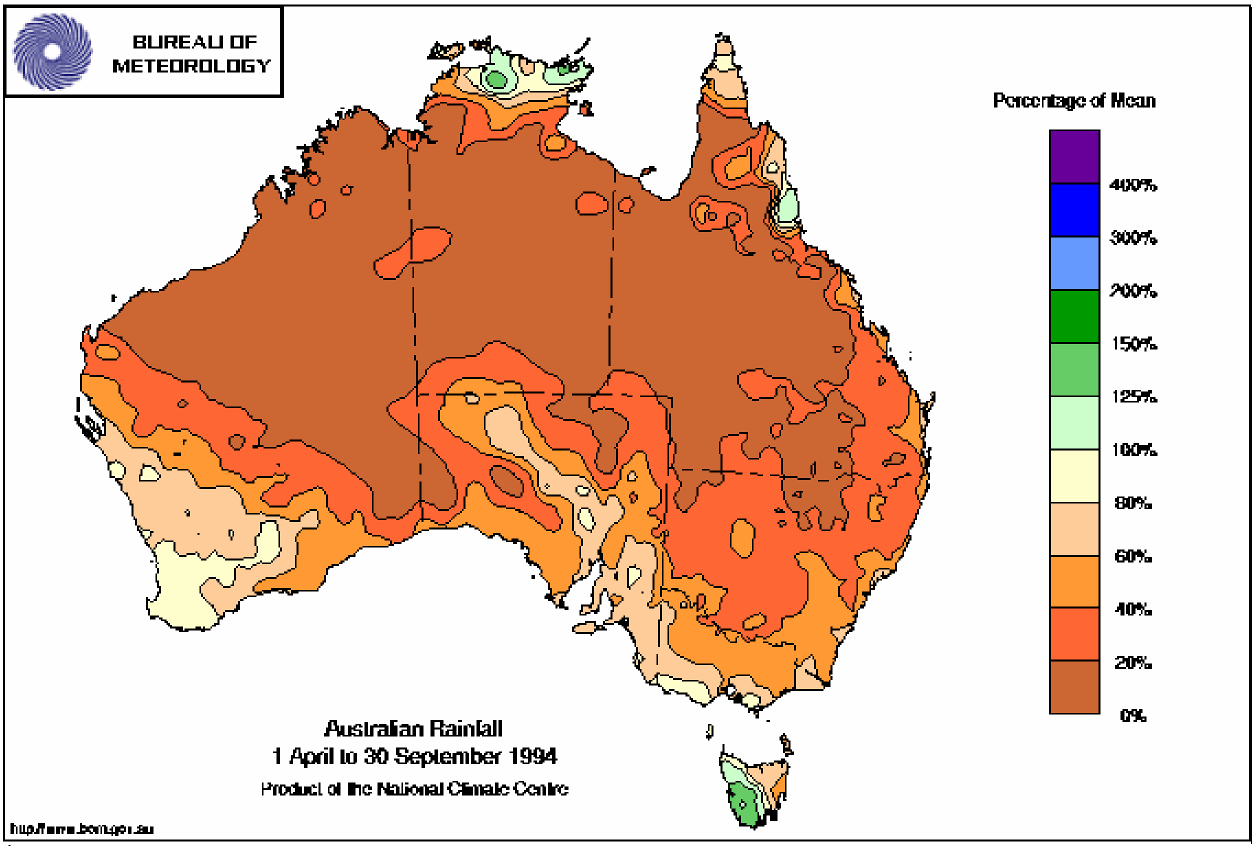
Not all of these options suit all livestock feeders of all sizes. The predicability of grain demand has a big impact on the price risk exposure of each operator and correspondingly the strategies that would relate to that exposure. In this instance, livestock producers normally dependant on grazing will be less suited to any on-going price risk management programs.

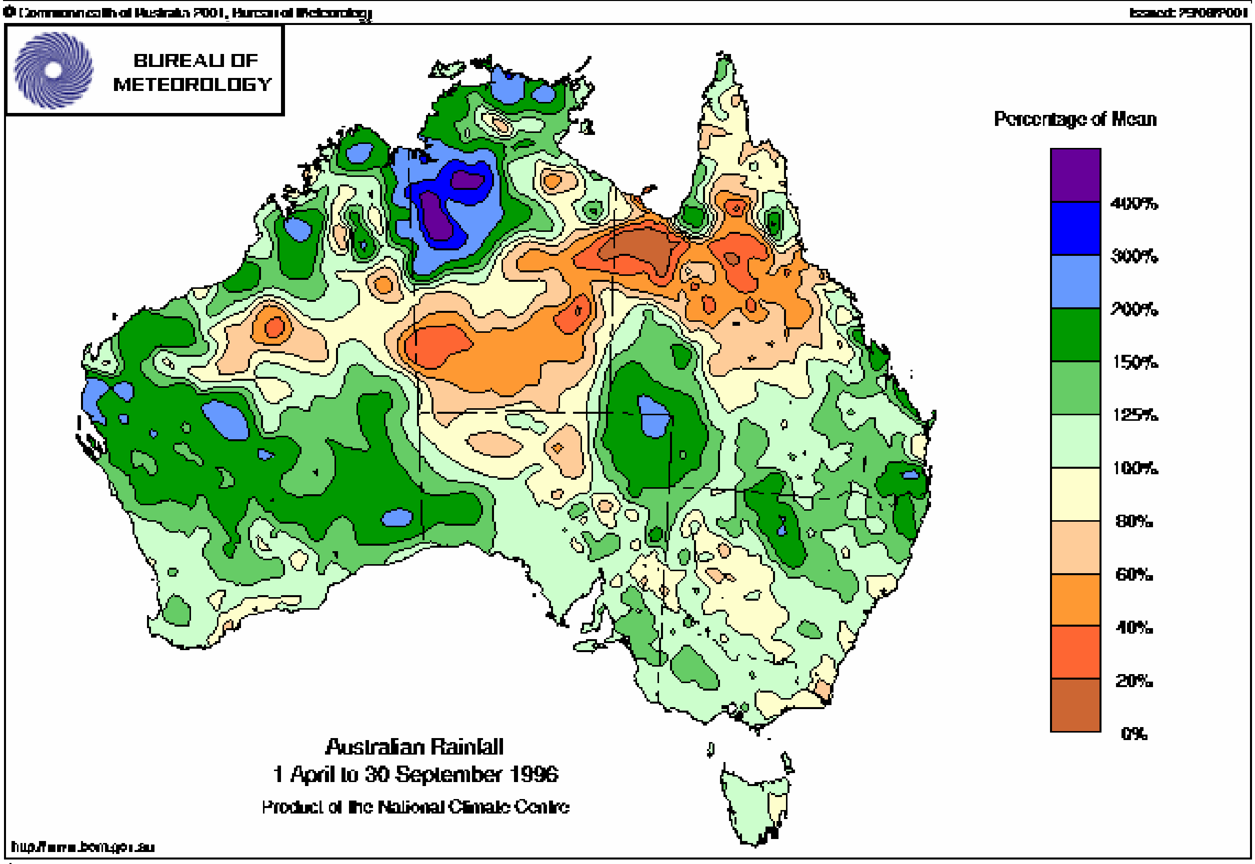
There is always some downtime from farming activities to undertake the training to learn some specific price risk management tools. The time and expense of this training is best spread over a larger income base that exists within the larger operators of each livestock sector.

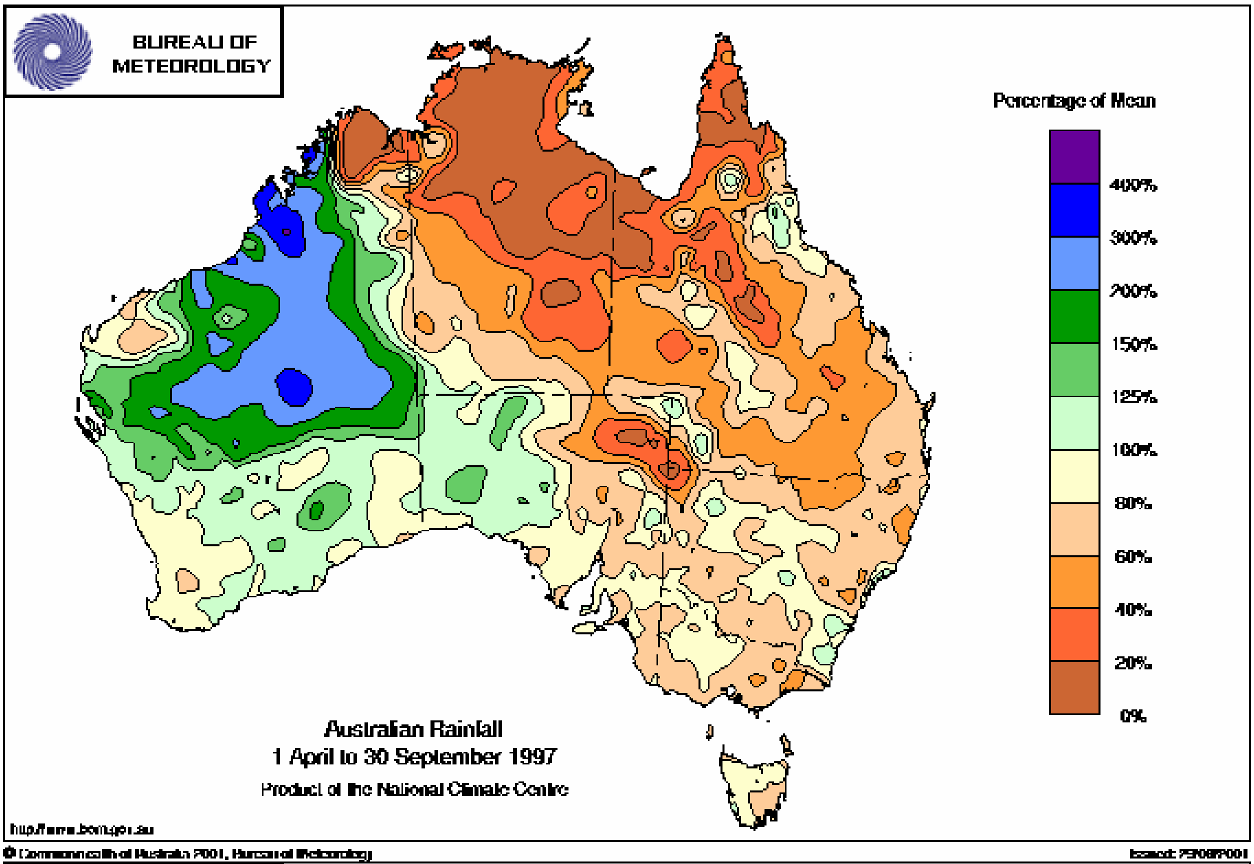
The varying predictability of demand between livestock producers will alter the adoption of these price risk management tools. Graziers for instance, who would only buy grain in during drought periods, are not exposed to the grain price risk on a regular or predictable basis.

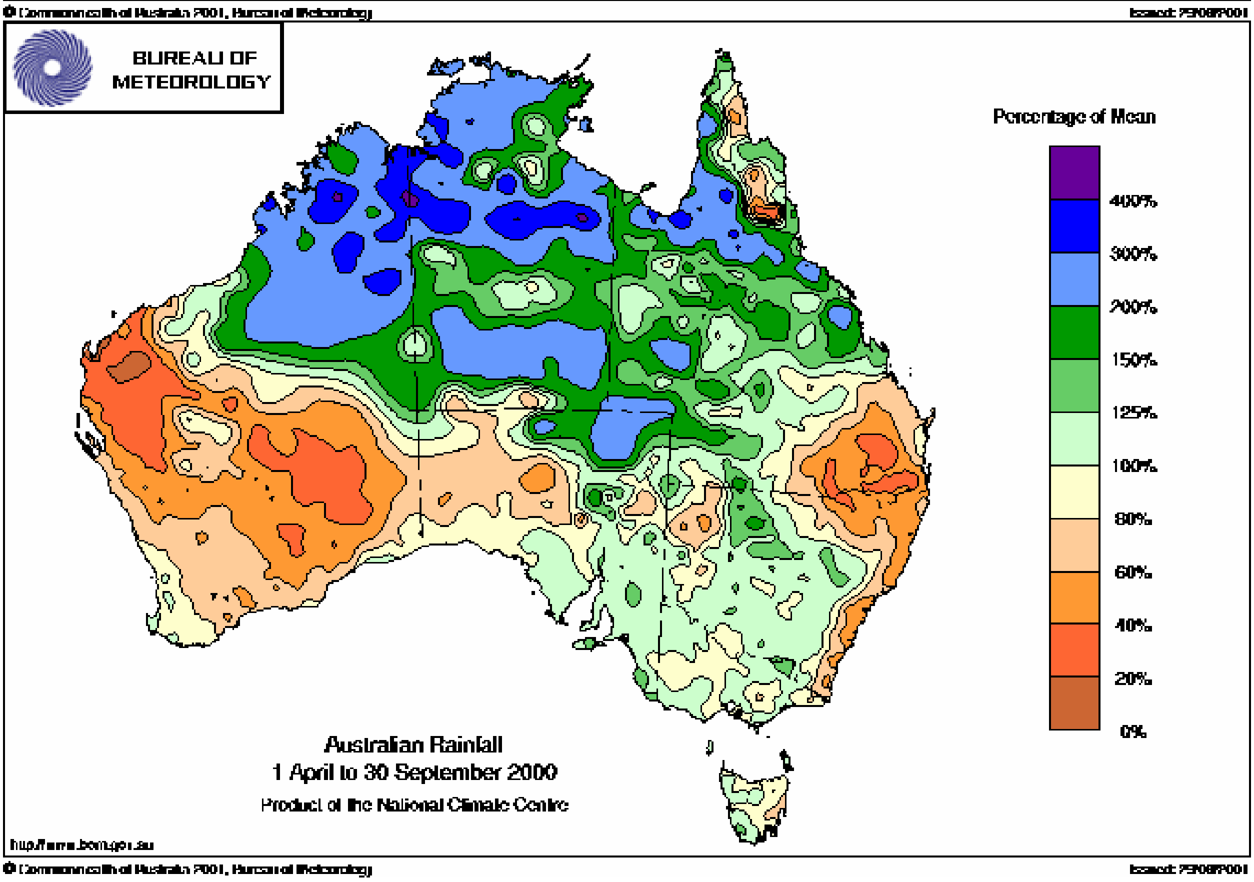
# Appendix 1: Rainfall Charts used to analyse normal and drought rainfall seasons




BUREAU OF
METEOROLOGY
Percentage of Mean
400%
300%
200%
150%
125%
100%
80%
60%
40%
20%
0%
Australian Rainfall
1 April to 30 September 1994
Product of the National Climate Centre


BUREAU OF
METEOROLOGY
Percentage of Mean
400%
300%
200%
150%
125%
100%
80%
60%
40%
20%
0%
Australian Rainfall
1 April to 30 September 1996
Product of the National Climate Centre


BUREAU OF
METEOROLOGY
Percentage of Mean
400%
300%
200%
150%
125%
100%
80%
60%
40%
20%
0%
Australian Rainfall
1 April to 30 September 1997
Product of the National Climate Centre
http://www.bom.gov.au
© Commonwealth of Australia 2001, Bureau of Meteorology
Issued: 25/06/2001


BUREAU OF
METEOROLOGY
Percentage of Mean
400%
300%
200%
150%
125%
100%
80%
60%
40%
20%
0%
Australian Rainfall
1 April to 30 September 2000
Product of the National Climate Centre
http://www.bom.gov.au
© Commonwealth of Australia 2001, Bureau of Meteorology
Issued: 25/06/2001

# Appendix 2 Summary of Australian Hay Production (kmt as is)

| | | NSW | Vic | Qld | SA | WA | Tas | NT | ACT | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lucerne | 93/94 | 488 | 191 | 181 | 72 | 0 | 8 | 0 | | | 940 |
| | 94/95 | 356 | 188 | 188 | 78 | 0 | 11 | 0 | | | 822 |
| | 95/96 | 468 | 238 | 183 | 81 | 0 | 19 | 0 | | | 989 |
| | 96/97 | 412 | 187 | 179 | 84 | 21 | 12 | 1 | 0 | | 896 |
| | 97/98 | 370 | 182 | 184 | 103 | 11 | 9 | 2 | 1 | | 862 |
| | 98/99 | 406 | 199 | 196 | 86 | 16 | 11 | 19 | 1 | | 933 |
| | 99/00 | 381 | 177 | 192 | 77 | 34 | 13 | 19 | 1 | | 894 |
| | 00/01 | 513 | 247 | 207 | 98 | 16 | 12 | 1 | 1 | | 1,096 |
| | 01/02 | 380 | 242 | 238 | 121 | 18 | 15 | 1 | 1 | | 1,015 |
| | 02/03 | 152 | 48 | 143 | 24 | 11 | 6 | 1 | 0 | 1 | 385 |
| | | | | | | | | | | | 0 |
| Pastures | 93/94 | 450 | 1,561 | 78 | 284 | 427 | 221 | 0 | | | 3,022 |
| | 94/95 | 252 | 1,246 | 161 | 285 | 404 | 172 | 0 | | | 2,519 |
| | 95/96 | 472 | 1,971 | 125 | 249 | 413 | 249 | 0 | | | 3,479 |
| | 96/97 | 355 | 1,255 | 66 | 249 | 325 | 204 | 7 | 1 | | 2,461 |
| | 97/98 | 273 | 1,573 | 62 | 269 | 310 | 199 | 10 | 0 | | 2,696 |
| | 98/99 | 527 | 1,925 | 47 | 242 | 365 | 239 | 11 | 1 | | 3,358 |
| | 99/00 | 390 | 1,547 | 78 | 243 | 373 | 209 | 10 | 1 | | 2,851 |
| | 00/01 | 322 | 2,231 | 82 | 278 | 345 | 264 | 42 | 1 | | 3,565 |
| | 01/02 | 238 | 2,185 | 94 | 344 | 369 | 314 | 50 | 1 | 1 | 3,595 |
| | 02/03 | 71 | 874 | 56 | 138 | 221 | 126 | 20 | 0 | 1 | 1,507 |
| | | | | | | | | | | | 0 |
| Other crops | 93/94 | 0 | 16 | 0 | 14 | 0 | 2 | 2 | | | 34 |
| | 94/95 | 17 | 27 | 0 | 4 | 1 | 0 | 2 | | | 52 |
| | 95/96 | 36 | 53 | 0 | 78 | 5 | 4 | 1 | | | 176 |
| | 96/97 | 15 | 26 | 21 | 23 | 19 | 4 | 2 | 0 | | 109 |
| | 97/98 | 17 | 50 | 48 | 33 | 15 | 5 | 1 | 0 | | 170 |
| | 98/99 | 29 | 31 | 21 | 18 | 17 | 4 | 5 | 0 | | 126 |
| | 99/00 | 10 | 78 | 38 | 18 | 3 | 5 | 7 | 0 | | 159 |
| | 00/01 | 12 | 45 | 21 | 15 | 16 | 3 | 2 | 0 | | 115 |
| | 01/02 | 10 | 28 | 17 | 17 | 27 | 2 | 0 | 0 | 1 | 100 |
| | 02/03 | 213 | 463 | 256 | 123 | 88 | 19 | 1 | 1 | 1 | 1,162 |

# Appendix 2. Summary of Australian Hay Production (kmt as is) – cont'

| | | NSW | Vic | Qld | SA | WA | Tas | NT | ACT | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cereals | 93/94 | 314 | 291 | 0 | 190 | 226 | 10 | 1 | | | 1,031 |
| | 94/95 | 327 | 144 | 0 | 211 | 383 | 6 | 1 | | | 1,072 |
| | 95/96 | 571 | 574 | 59 | 444 | 536 | 10 | 1 | | | 2,196 |
| | 96/97 | 229 | 189 | 52 | 330 | 413 | 6 | 1 | 0 | | 1,220 |
| | 97/98 | 286 | 305 | 74 | 412 | 478 | 9 | 3 | 0 | | 1,567 |
| | 98/99 | 410 | 362 | 86 | 418 | 539 | 10 | 1 | 0 | | 1,827 |
| | 99/00 | 183 | 364 | 60 | 284 | 525 | 12 | 1 | 0 | | 1,429 |
| | 00/01 | 252 | 329 | 145 | 472 | 449 | 8 | 1 | 0 | | 1,657 |
| | 01/02 | 195 | 208 | 115 | 539 | 730 | 5 | 0 | | 1 | 1,792 |
| | 02/03 | 98 | 104 | 127 | 377 | 584 | 4 | 0 | 0 | 1 | 1,293 |
| | | | | | | | | | | | 0 |
| Total Hay | 93/94 | 1,252 | 2,059 | 259 | 560 | 653 | 241 | 3 | 0 | | 5,027 |
| | 94/95 | 952 | 1,605 | 349 | 578 | 789 | 190 | 3 | 0 | | 4,465 |
| | 95/96 | 1,547 | 2,836 | 367 | 851 | 954 | 282 | 3 | 0 | | 6,840 |
| | 96/97 | 1,011 | 1,657 | 318 | 686 | 778 | 226 | 10 | 1 | | 4,686 |
| | 97/98 | 947 | 2,110 | 368 | 817 | 814 | 222 | 16 | 1 | | 5,295 |
| | 98/99 | 1,372 | 2,517 | 350 | 764 | 937 | 264 | 37 | 2 | | 6,245 |
| | 99/00 | 964 | 2,166 | 368 | 622 | 935 | 239 | 37 | 1 | | 5,332 |
| | 00/01 | 1,100 | 2,852 | 455 | 864 | 827 | 288 | 46 | 2 | | 6,433 |
| | 01/02 | 879 | 2,683 | 494 | 1,117 | 1,282 | 335 | 51 | 2 | | 6,843 |
| | 02/03 | 534 | 1,489 | 582 | 662 | 904 | 154 | 21 | 1 | | 4,346 |
| | | | | | | | | | | | |
| Silage 2 | 93/94 | 392 | 372 | 250 | 62 | 139 | 171 | 2 | | | 1,388 |
| | 94/95 | **326** | **309** | **208** | **51** | **116** | **142** | **1** | | | 1,152 |
| | 95/96 | **611** | **489** | **162** | **45** | **118** | **205** | 6 | | | 1,635 |
| | 96/97 | 482 | 492 | 264 | 85 | 195 | 168 | 0 | 0 | | 1,686 |
| | 97/98 | 567 | 744 | 299 | 109 | 210 | 200 | 0 | 0 | | 2,129 |
| | 98/99 | 764 | 1,051 | 365 | 114 | 235 | 234 | 5 | 0 | | 2,770 |
| | 99/00 | 632 | 1,268 | 585 | 106 | 184 | 205 | 0 | 1 | | 2,981 |
| | 00/01 | 666 | 1,316 | 443 | 135 | 189 | 210 | 0 | 2 | | 2,960 |
| | 01/02 | 493 | 1,289 | 510 | 166 | 202 | 249 | 0 | 2 | 1 | 2,911 |
| | 02/03 | 148 | 515 | 306 | 67 | 121 | 100 | 0 | 1 | 1 | 1,258 |
| | | | | | | | | | | | |
| Total Fodder | 93/94 | 1,455 | 2,252 | 389 | 591 | 726 | 329 | 4 | 0 | | 5,745 |
| | 94/95 | 1,120 | 1,765 | 456 | 605 | 848 | 263 | 3 | 0 | | 5,061 |
| | 95/96 | 1,863 | 3,089 | 451 | 874 | 1,015 | 388 | 6 | 0 | | 7,686 |
| | 96/97 | 1,260 | 1,912 | 454 | 729 | 879 | 313 | 10 | 1 | | 5,559 |
| | 97/98 | 1,240 | 2,495 | 522 | 874 | 923 | 326 | 16 | 1 | | 6,397 |
| | 98/99 | 1,768 | 3,061 | 539 | 823 | 1,059 | 385 | 39 | 3 | | 7,678 |
| | 99/00 | 1,291 | 2,822 | 671 | 677 | 1,030 | 345 | 37 | 2 | | 6,875 |
| | 00/01 | 1,444 | 3,533 | 684 | 933 | 925 | 397 | 46 | 3 | | 7,965 |
| | 01/02 | 1,134 | 3,350 | 757 | 1,203 | 1,387 | 464 | 51 | 3 | | 8,350 |
| | 02/03 | 610 | 1,756 | 740 | 696 | 966 | 205 | 21 | 2 | | 4,997 |

Notes:
1. Estimate extrapolated from other data
2. Silage is assumed to be 55% moisture and totals are converted to hay moisture equivalent

# VARIABILITY IN SUPPLY OF FEED GRAINS ASSOCIATED WITH CLIMATIC VARIABILITY IN AUSTRALIA

## EXECUTIVE SUMMARY

During June 2003, Macarthur Agribusiness (MA) commissioned APSRU to undertake an analysis of impact of climatic variability on feed grain supply in Australia. MA sought an analysis of regional yield indices as an aid to a study on feed grain security for intensive livestock industries. In particular, MA was interested in knowing the crop yield likelihood (as a fraction of the long-term median) for protracted periods when main summer and winter feed grains experienced below average yield. A comprehensive simulation analysis was conducted using APSRU's operational shire scale wheat and sorghum models. Crop yield indices were derived for each year in specific protracted periods, i.e. 1911-1915, 1940-1945, 1981-1985 and 1991-1995, chosen for their significant impact on crops in either or both growing seasons. The yield indices were aggregated to reflect the zones used in the ABARE economic model of the feed grains industry. It was shown that continuous dry periods had the worst impact on the wheat crop in southern Australia during years like those in the early 1940s while the impact on the sorghum crop was worst in southern Queensland for years like those in the 1910's.

## INTRODUCTION

In June 2003, Macarthur Agribusiness (MA) commissioned APSRU to undertake an analysis of impact of climatic variability on feed grain supply in Australia. MA sought an analysis of regional yield indices as an aid to a study on feed grain security for intensive livestock industries. MA sought quantitative information on effects of climatic episodes on yield of the main winter (wheat) and summer (sorghum) crops in a manner that could be readily integrated into ABARE's economic modelling framework for feed grain in Australia. In particular, MA was interested in knowing the crop yield likelihood (as a fraction of the long-term median) for protracted periods when main summer and winter feed grains experienced below average yield.

APSRU has implemented a modelling system for crop yield at shire level for wheat and sorghum. This system underpins crop forecasts for these crops throughout the Australian grain belt (see http:/www.dpi.qld.gov.au/climate/). The modelling system incorporates an agro-climatic stress index model that has been calibrated to predict yield per unit area at shire scale (Stephens, 1995; Hammer et al., 1996). It was agreed that a study focussed on crop yield indices for wheat and sorghum for specific known drought periods during the 20th century would be sufficient for MA needs. This could be done by adapting the existing modelling system, conducting long-term simulations and aggregating resultant indices at shire scale to suit the larger supply zones used in the ABARE model.

Hence, the objective of this study was to develop wheat and sorghum crop yield indices, which were expressed as a fraction of the long-term median yield likelihood, for each supply zone used in the ABARE economic model for the sets of years specified.

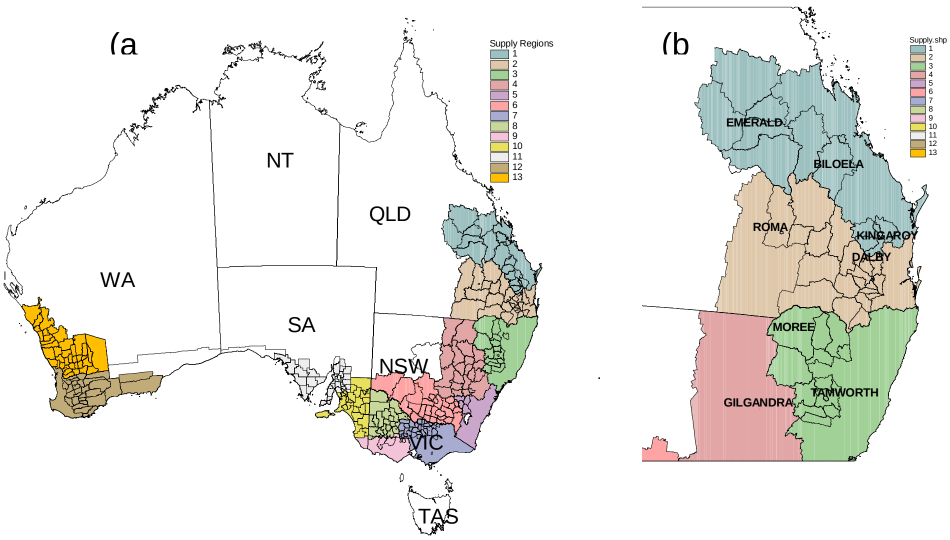
# METHODS

## Yield Modelling

The shire yield model estimates yield per unit area via a regression on degree of water limitation and year. The year term accounts for any technology trend in the data. The degree of water limitation is derived by running a simple water balance through the season, which is driven by the daily rainfall received at recording stations throughout the shire. It thus accounts for the major soil and rainfall effects. At shire scale, correlations with yield per unit area exceeded 0.8 in most instances for the 19-year wheat data set (1975-1993) (Hammer et al., 1996) and the 15-year sorghum data set (1983-1997) used in developing the model (Potgieter et al., in preparation).

A 102-year simulation of shire yield was conducted using the shire yield model with relevant long-term daily historical rainfall data for the period 1901-2002. The year term in the model was set to 2002, so that current technology levels were applied to all years. The procedure was similar to that reported by Potgieter et al. (2002). The resultant simulations of yield per unit area for wheat and sorghum for each shire were converted to supply zone yield per unit area by weighted aggregation according to the proportional shire area in each supply zone (Figs. 1a and 1b).

**Figure 1:** Supply Regions Used by ABARE for (a) Wheat and (b) Sorghum and the Associated Shire Boundaries



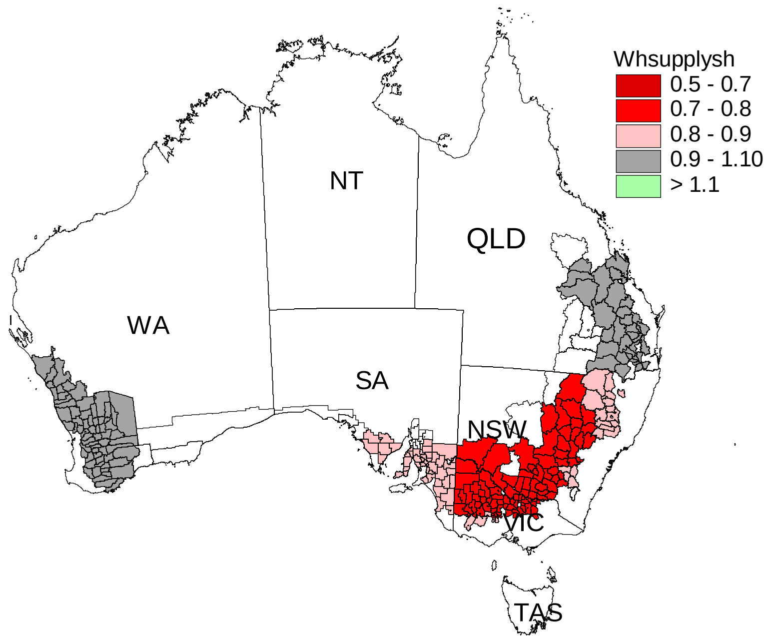

## Yield Indices

A yield ratio for each year was derived by contrasting crop yield per unit area relative to the long-term median yield value for each zone. This constituted the crop yield indices for each year within each ABARE supply zone. Crop yield indices were derived for each year in the specific requested, i.e. 1911-1915, 1940-1945, 1981-1985 and 1991-1995. These periods were chosen for their significant impact on crops in either or both growing seasons. The crop yield indices indicated the shift in yield above (>1.0) or below (<1.0) normal expectation for each zone in each year. They could be applied to ABARE production estimates for each zone as a means to take account of year-to-year climate variability. However, it should be noted that the index is based only on yield per unit area, so that this approach will not take account of any differences in area planted among years.

# RESULTS AND DISCUSSION

There were 4 prolonged periods likely to contain below average wheat and sorghum yields. They were 1911-15, 1940-45, 1981-85 and 1991-95. All are 5-year periods except 1940-45 (encompassing 6-years) as there were poor years in both 1940 and 1945. The yield indices for these periods are included as appendix I. For wheat most of these protracted periods had an average yield index below 1. The worst protracted period for wheat was for years like the 1940-45 period when the 6-year fraction average for most parts of southern Australia were as low as 0.7 (Figure 2). During this period northeast and Western Australia experienced near normal crop yields. However, the effect of protracted drier periods on sorghum yield over all selected periods was not in the same magnitude as for wheat and the worst protracted period for sorghum was for years like 1911-1915 when southern Queensland (zone 2) experienced protracted below average sorghum yields of as low as 0.87 (Appendix I).

**Figure 2:** Average Regional Yield Index for Wheat for the 1940 – 1945 period




It should be noted that the analysis presented depends on use of historical climate data to quantify indices. No account of possible effects of climate change on climate variability has been included.

# CONCLUSION

Robust crop yield indices for the national wheat and sorghum crops during the past 102 years were developed using a modelling and simulation approach based on prediction of shire yield. A 102-year simulation using long-term historical rainfall data for 1901-2002 was used to generate national wheat and sorghum yield indices. Likely protracted periods of below average crop yield were selected and indices aggregated to ABARE crop regions. It was shown that prolonged dry spells had the worst impact on wheat yield in southern Australia during the early 1940s while the southern Queensland experienced below average sorghum yields during the early 1910s. The analysis depended on use of historical climate data to quantify indices. No account of possible effects of climate change on climate variability has been included. Year-to-year variability in indices was based solely on relative yield per unit area and did not take into account any differences in planted area.

**REFERENCES**

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Potgieter, A.B., Hammer, G.L. and Butler, D. (2002). Spatial and temporal patterns in Australian wheat yield and their relationship with ENSO. Australian Journal of Agricultural Research 53:77-89.

Potgieter, A.B., Hammer, G.L. and DeVoil, P. A simple shire-scale model for determining sorghum yield across North-Eastern Australia. In preparation.

Stephens DJ (1995) Crop yield forecasting over large areas in Australia. Unpublished PhD Thesis. (Murdoch University: Perth, Western Australia)

# APPENDIX I

Yield index (Frac) by ABARE region (as numbered in figure 1), crop and year. Yield is the simulated yield for the particular year (t/ha) and Med is the long term median simulated yield (t/ha) for that zone.

## A. Data for sorghum

| Region | Year | Yield | Med | Frac |
|---|---|---|---|---|
| 1.00 | 1911.00 | 2.25 | 1.99 | 1.13 |
| 2.00 | 1911.00 | 2.12 | 1.66 | 1.28 |
| 3.00 | 1911.00 | 2.89 | 2.39 | 1.21 |
| 4.00 | 1911.00 | 3.54 | 2.58 | 1.37 |
| 1.00 | 1912.00 | 1.57 | 1.99 | 0.79 |
| 2.00 | 1912.00 | 1.18 | 1.66 | 0.71 |
| 3.00 | 1912.00 | 2.11 | 2.39 | 0.88 |
| 4.00 | 1912.00 | 2.03 | 2.58 | 0.79 |
| 1.00 | 1913.00 | 2.22 | 1.99 | 1.12 |
| 2.00 | 1913.00 | 1.46 | 1.66 | 0.88 |
| 3.00 | 1913.00 | 2.20 | 2.39 | 0.92 |
| 4.00 | 1913.00 | 2.07 | 2.58 | 0.80 |
| 1.00 | 1914.00 | 2.09 | 1.99 | 1.05 |
| 2.00 | 1914.00 | 1.28 | 1.66 | 0.77 |
| 3.00 | 1914.00 | 2.48 | 2.39 | 1.04 |
| 4.00 | 1914.00 | 2.07 | 2.58 | 0.80 |
| 1.00 | 1915.00 | 1.53 | 1.99 | 0.77 |
| 2.00 | 1915.00 | 1.17 | 1.66 | 0.71 |
| 3.00 | 1915.00 | 2.23 | 2.39 | 0.93 |
| 4.00 | 1915.00 | 2.54 | 2.58 | 0.98 |
| 1.00 | 1940.00 | 2.30 | 1.99 | 1.16 |
| 2.00 | 1940.00 | 2.23 | 1.66 | 1.34 |
| 3.00 | 1940.00 | 2.06 | 2.39 | 0.86 |
| 4.00 | 1940.00 | 1.79 | 2.58 | 0.69 |
| 1.00 | 1941.00 | 2.10 | 1.99 | 1.05 |
| 2.00 | 1941.00 | 2.28 | 1.66 | 1.37 |
| 3.00 | 1941.00 | 2.97 | 2.39 | 1.24 |
| 4.00 | 1941.00 | 3.37 | 2.58 | 1.31 |
| 1.00 | 1942.00 | 2.04 | 1.99 | 1.02 |
| 2.00 | 1942.00 | 1.51 | 1.66 | 0.91 |
| 3.00 | 1942.00 | 1.89 | 2.39 | 0.79 |
| 4.00 | 1942.00 | 2.46 | 2.58 | 0.95 |
| 1.00 | 1943.00 | 2.10 | 1.99 | 1.05 |
| 2.00 | 1943.00 | 2.05 | 1.66 | 1.24 |
| 3.00 | 1943.00 | 2.77 | 2.39 | 1.16 |
| 4.00 | 1943.00 | 2.74 | 2.58 | 1.06 |
| 1.00 | 1944.00 | 2.12 | 1.99 | 1.06 |
| 2.00 | 1944.00 | 2.23 | 1.66 | 1.35 |

| Region | Year | Yield | Med | Frac |
|---|---|---|---|---|
| 3.00 | 1944.00 | 2.59 | 2.39 | 1.08 |
| 4.00 | 1944.00 | 2.33 | 2.58 | 0.90 |
| 1.00 | 1945.00 | 1.75 | 1.99 | 0.88 |
| 2.00 | 1945.00 | 1.62 | 1.66 | 0.98 |
| 3.00 | 1945.00 | 2.35 | 2.39 | 0.98 |
| 4.00 | 1945.00 | 2.12 | 2.58 | 0.82 |
| 1.00 | 1981.00 | 2.26 | 1.99 | 1.14 |
| 2.00 | 1981.00 | 1.95 | 1.66 | 1.18 |
| 3.00 | 1981.00 | 2.32 | 2.39 | 0.97 |
| 4.00 | 1981.00 | 2.06 | 2.58 | 0.80 |
| 1.00 | 1982.00 | 1.99 | 1.99 | 1.00 |
| 2.00 | 1982.00 | 2.21 | 1.66 | 1.33 |
| 3.00 | 1982.00 | 2.52 | 2.39 | 1.06 |
| 4.00 | 1982.00 | 2.53 | 2.58 | 0.98 |
| 1.00 | 1983.00 | 1.36 | 1.99 | 0.68 |
| 2.00 | 1983.00 | 1.28 | 1.66 | 0.77 |
| 3.00 | 1983.00 | 2.12 | 2.39 | 0.89 |
| 4.00 | 1983.00 | 2.32 | 2.58 | 0.90 |
| 1.00 | 1984.00 | 2.08 | 1.99 | 1.04 |
| 2.00 | 1984.00 | 2.38 | 1.66 | 1.44 |
| 3.00 | 1984.00 | 3.16 | 2.39 | 1.33 |
| 4.00 | 1984.00 | 3.85 | 2.58 | 1.49 |
| 1.00 | 1985.00 | 1.92 | 1.99 | 0.96 |
| 2.00 | 1985.00 | 1.70 | 1.66 | 1.02 |
| 3.00 | 1985.00 | 2.07 | 2.39 | 0.87 |
| 4.00 | 1985.00 | 1.93 | 2.58 | 0.75 |
| 1.00 | 1991.00 | 2.06 | 1.99 | 1.04 |
| 2.00 | 1991.00 | 1.32 | 1.66 | 0.80 |
| 3.00 | 1991.00 | 2.61 | 2.39 | 1.09 |
| 4.00 | 1991.00 | 3.47 | 2.58 | 1.34 |
| 1.00 | 1992.00 | 1.88 | 1.99 | 0.94 |
| 2.00 | 1992.00 | 1.97 | 1.66 | 1.19 |
| 3.00 | 1992.00 | 2.90 | 2.39 | 1.22 |
| 4.00 | 1992.00 | 3.72 | 2.58 | 1.44 |
| 1.00 | 1993.00 | 1.30 | 1.99 | 0.65 |
| 2.00 | 1993.00 | 0.84 | 1.66 | 0.51 |
| 3.00 | 1993.00 | 2.32 | 2.39 | 0.97 |
| 4.00 | 1993.00 | 3.11 | 2.58 | 1.21 |
| 1.00 | 1994.00 | 1.93 | 1.99 | 0.97 |
| 2.00 | 1994.00 | 1.68 | 1.66 | 1.01 |
| 3.00 | 1994.00 | 2.34 | 2.39 | 0.98 |
| 4.00 | 1994.00 | 2.63 | 2.58 | 1.02 |
| 1.00 | 1995.00 | 1.46 | 1.99 | 0.73 |
| 2.00 | 1995.00 | 1.73 | 1.66 | 1.04 |
| 3.00 | 1995.00 | 2.52 | 2.39 | 1.06 |

| Region | Year | Yield | Med | Frac |
|---|---|---|---|---|
| 4.00 | 1995.00 | 3.23 | 2.58 | 1.25 |

## Data for wheat

| Region | Year | Yield | Med | Frac |
|---|---|---|---|---|
| 1.00 | 1911.00 | 1.29 | 1.64 | 0.79 |
| 2.00 | 1911.00 | 1.15 | 1.42 | 0.81 |
| 3.00 | 1911.00 | 1.82 | 1.81 | 1.01 |
| 4.00 | 1911.00 | 1.68 | 1.68 | 1.00 |
| 5.00 | 1911.00 | 2.63 | 3.04 | 0.86 |
| 6.00 | 1911.00 | 1.96 | 2.04 | 0.96 |
| 7.00 | 1911.00 | 1.82 | 2.03 | 0.89 |
| 8.00 | 1911.00 | 2.20 | 2.16 | 1.02 |
| 9.00 | 1911.00 | 2.12 | 2.23 | 0.95 |
| 10.00 | 1911.00 | 1.42 | 1.56 | 0.91 |
| 11.00 | 1911.00 | 1.73 | 1.80 | 0.96 |
| 12.00 | 1911.00 | 1.88 | 1.88 | 1.00 |
| 13.00 | 1911.00 | 1.35 | 1.71 | 0.78 |
| 1.00 | 1912.00 | 1.81 | 1.64 | 1.10 |
| 2.00 | 1912.00 | 1.40 | 1.42 | 0.98 |
| 3.00 | 1912.00 | 1.64 | 1.81 | 0.90 |
| 4.00 | 1912.00 | 1.62 | 1.68 | 0.96 |
| 5.00 | 1912.00 | 3.09 | 3.04 | 1.02 |
| 6.00 | 1912.00 | 1.91 | 2.04 | 0.93 |
| 7.00 | 1912.00 | 1.86 | 2.03 | 0.92 |
| 8.00 | 1912.00 | 2.13 | 2.16 | 0.99 |
| 9.00 | 1912.00 | 2.18 | 2.23 | 0.98 |
| 10.00 | 1912.00 | 1.62 | 1.56 | 1.04 |
| 11.00 | 1912.00 | 1.71 | 1.80 | 0.95 |
| 12.00 | 1912.00 | 1.93 | 1.88 | 1.02 |
| 13.00 | 1912.00 | 1.60 | 1.71 | 0.94 |
| 1.00 | 1913.00 | 1.83 | 1.64 | 1.12 |
| 2.00 | 1913.00 | 1.43 | 1.42 | 1.00 |
| 3.00 | 1913.00 | 1.59 | 1.81 | 0.88 |
| 4.00 | 1913.00 | 1.41 | 1.68 | 0.84 |
| 5.00 | 1913.00 | 2.45 | 3.04 | 0.80 |
| 6.00 | 1913.00 | 1.77 | 2.04 | 0.87 |
| 7.00 | 1913.00 | 2.02 | 2.03 | 0.99 |
| 8.00 | 1913.00 | 2.02 | 2.16 | 0.94 |
| 9.00 | 1913.00 | 2.17 | 2.23 | 0.97 |
| 10.00 | 1913.00 | 1.49 | 1.56 | 0.95 |
| 11.00 | 1913.00 | 1.44 | 1.80 | 0.80 |
| 12.00 | 1913.00 | 1.85 | 1.88 | 0.98 |
| 13.00 | 1913.00 | 1.69 | 1.71 | 0.99 |
| 1.00 | 1914.00 | 1.63 | 1.64 | 1.00 |
| 2.00 | 1914.00 | 1.34 | 1.42 | 0.94 |

| Region | Year | Yield | Med | Frac |
|---|---|---|---|---|
| 3.00 | 1914.00 | 1.32 | 1.81 | 0.73 |
| 4.00 | 1914.00 | 0.78 | 1.68 | 0.46 |
| 5.00 | 1914.00 | 2.08 | 3.04 | 0.68 |
| 6.00 | 1914.00 | 1.00 | 2.04 | 0.49 |
| 7.00 | 1914.00 | 0.77 | 2.03 | 0.38 |
| 8.00 | 1914.00 | 0.72 | 2.16 | 0.33 |
| 9.00 | 1914.00 | 1.06 | 2.23 | 0.48 |
| 10.00 | 1914.00 | 0.60 | 1.56 | 0.39 |
| 11.00 | 1914.00 | 0.81 | 1.80 | 0.45 |
| 12.00 | 1914.00 | 1.46 | 1.88 | 0.78 |
| 13.00 | 1914.00 | 1.18 | 1.71 | 0.69 |
| 1.00 | 1915.00 | 1.24 | 1.64 | 0.76 |
| 2.00 | 1915.00 | 0.84 | 1.42 | 0.59 |
| 3.00 | 1915.00 | 1.70 | 1.81 | 0.94 |
| 4.00 | 1915.00 | 1.39 | 1.68 | 0.83 |
| 5.00 | 1915.00 | 3.11 | 3.04 | 1.02 |
| 6.00 | 1915.00 | 2.14 | 2.04 | 1.05 |
| 7.00 | 1915.00 | 2.19 | 2.03 | 1.08 |
| 8.00 | 1915.00 | 2.36 | 2.16 | 1.09 |
| 9.00 | 1915.00 | 2.30 | 2.23 | 1.03 |
| 10.00 | 1915.00 | 1.72 | 1.56 | 1.10 |
| 11.00 | 1915.00 | 2.10 | 1.80 | 1.17 |
| 12.00 | 1915.00 | 2.03 | 1.88 | 1.08 |
| 13.00 | 1915.00 | 1.97 | 1.71 | 1.15 |
| 1.00 | 1940.00 | 1.49 | 1.64 | 0.91 |
| 2.00 | 1940.00 | 0.83 | 1.42 | 0.59 |
| 3.00 | 1940.00 | 0.77 | 1.81 | 0.42 |
| 4.00 | 1940.00 | 0.75 | 1.68 | 0.44 |
| 5.00 | 1940.00 | 2.30 | 3.04 | 0.76 |
| 6.00 | 1940.00 | 1.28 | 2.04 | 0.63 |
| 7.00 | 1940.00 | 1.38 | 2.03 | 0.68 |
| 8.00 | 1940.00 | 1.24 | 2.16 | 0.57 |
| 9.00 | 1940.00 | 1.28 | 2.23 | 0.57 |
| 10.00 | 1940.00 | 1.15 | 1.56 | 0.74 |
| 11.00 | 1940.00 | 1.20 | 1.80 | 0.67 |
| 12.00 | 1940.00 | 1.50 | 1.88 | 0.80 |
| 13.00 | 1940.00 | 1.39 | 1.71 | 0.81 |
| 1.00 | 1941.00 | 1.36 | 1.64 | 0.83 |
| 2.00 | 1941.00 | 0.73 | 1.42 | 0.51 |
| 3.00 | 1941.00 | 1.21 | 1.81 | 0.67 |
| 4.00 | 1941.00 | 1.14 | 1.68 | 0.68 |
| 5.00 | 1941.00 | 2.65 | 3.04 | 0.87 |
| 6.00 | 1941.00 | 1.69 | 2.04 | 0.83 |
| 7.00 | 1941.00 | 1.83 | 2.03 | 0.90 |
| 8.00 | 1941.00 | 2.10 | 2.16 | 0.98 |

| Region | Year | Yield | Med | Frac |
|---|---|---|---|---|
| 9.00 | 1941.00 | 2.32 | 2.23 | 1.04 |
| 10.00 | 1941.00 | 1.69 | 1.56 | 1.08 |
| 11.00 | 1941.00 | 1.77 | 1.80 | 0.98 |
| 12.00 | 1941.00 | 1.93 | 1.88 | 1.02 |
| 13.00 | 1941.00 | 1.80 | 1.71 | 1.05 |
| 1.00 | 1942.00 | 1.77 | 1.64 | 1.08 |
| 2.00 | 1942.00 | 1.34 | 1.42 | 0.94 |
| 3.00 | 1942.00 | 1.54 | 1.81 | 0.85 |
| 4.00 | 1942.00 | 1.58 | 1.68 | 0.94 |
| 5.00 | 1942.00 | 3.10 | 3.04 | 1.02 |
| 6.00 | 1942.00 | 2.04 | 2.04 | 1.00 |
| 7.00 | 1942.00 | 2.11 | 2.03 | 1.04 |
| 8.00 | 1942.00 | 2.29 | 2.16 | 1.06 |
| 9.00 | 1942.00 | 2.27 | 2.23 | 1.02 |
| 10.00 | 1942.00 | 1.75 | 1.56 | 1.12 |
| 11.00 | 1942.00 | 2.08 | 1.80 | 1.16 |
| 12.00 | 1942.00 | 1.97 | 1.88 | 1.04 |
| 13.00 | 1942.00 | 1.70 | 1.71 | 0.99 |
| 1.00 | 1943.00 | 1.72 | 1.64 | 1.05 |
| 2.00 | 1943.00 | 1.61 | 1.42 | 1.13 |
| 3.00 | 1943.00 | 1.82 | 1.81 | 1.01 |
| 4.00 | 1943.00 | 1.44 | 1.68 | 0.86 |
| 5.00 | 1943.00 | 3.15 | 3.04 | 1.04 |
| 6.00 | 1943.00 | 1.72 | 2.04 | 0.84 |
| 7.00 | 1943.00 | 1.70 | 2.03 | 0.84 |
| 8.00 | 1943.00 | 1.77 | 2.16 | 0.82 |
| 9.00 | 1943.00 | 1.95 | 2.23 | 0.87 |
| 10.00 | 1943.00 | 1.35 | 1.56 | 0.87 |
| 11.00 | 1943.00 | 1.56 | 1.80 | 0.87 |
| 12.00 | 1943.00 | 1.89 | 1.88 | 1.00 |
| 13.00 | 1943.00 | 1.82 | 1.71 | 1.06 |
| 1.00 | 1944.00 | 1.79 | 1.64 | 1.09 |
| 2.00 | 1944.00 | 1.80 | 1.42 | 1.26 |
| 3.00 | 1944.00 | 1.77 | 1.81 | 0.98 |
| 4.00 | 1944.00 | 1.11 | 1.68 | 0.66 |
| 5.00 | 1944.00 | 1.65 | 3.04 | 0.54 |
| 6.00 | 1944.00 | 1.10 | 2.04 | 0.54 |
| 7.00 | 1944.00 | 0.96 | 2.03 | 0.47 |
| 8.00 | 1944.00 | 0.96 | 2.16 | 0.45 |
| 9.00 | 1944.00 | 1.31 | 2.23 | 0.59 |
| 10.00 | 1944.00 | 0.93 | 1.56 | 0.60 |
| 11.00 | 1944.00 | 1.14 | 1.80 | 0.63 |
| 12.00 | 1944.00 | 1.73 | 1.88 | 0.92 |
| 13.00 | 1944.00 | 1.64 | 1.71 | 0.96 |
| 1.00 | 1945.00 | 1.95 | 1.64 | 1.19 |

| Region | Year | Yield | Med | Frac |
|---|---|---|---|---|
| 2.00 | 1945.00 | 1.73 | 1.42 | 1.22 |
| 3.00 | 1945.00 | 1.97 | 1.81 | 1.09 |
| 4.00 | 1945.00 | 1.76 | 1.68 | 1.05 |
| 5.00 | 1945.00 | 2.59 | 3.04 | 0.85 |
| 6.00 | 1945.00 | 1.62 | 2.04 | 0.79 |
| 7.00 | 1945.00 | 1.75 | 2.03 | 0.86 |
| 8.00 | 1945.00 | 1.81 | 2.16 | 0.84 |
| 9.00 | 1945.00 | 2.11 | 2.23 | 0.95 |
| 10.00 | 1945.00 | 1.26 | 1.56 | 0.81 |
| 11.00 | 1945.00 | 1.39 | 1.80 | 0.77 |
| 12.00 | 1945.00 | 1.53 | 1.88 | 0.81 |
| 13.00 | 1945.00 | 1.87 | 1.71 | 1.09 |
| 1.00 | 1981.00 | 1.63 | 1.64 | 1.00 |
| 2.00 | 1981.00 | 1.56 | 1.42 | 1.10 |
| 3.00 | 1981.00 | 1.77 | 1.81 | 0.98 |
| 4.00 | 1981.00 | 1.69 | 1.68 | 1.01 |
| 5.00 | 1981.00 | 3.04 | 3.04 | 1.00 |
| 6.00 | 1981.00 | 2.30 | 2.04 | 1.13 |
| 7.00 | 1981.00 | 1.89 | 2.03 | 0.93 |
| 8.00 | 1981.00 | 2.34 | 2.16 | 1.09 |
| 9.00 | 1981.00 | 2.22 | 2.23 | 1.00 |
| 10.00 | 1981.00 | 1.49 | 1.56 | 0.95 |
| 11.00 | 1981.00 | 1.77 | 1.80 | 0.98 |
| 12.00 | 1981.00 | 1.75 | 1.88 | 0.93 |
| 13.00 | 1981.00 | 1.78 | 1.71 | 1.04 |
| 1.00 | 1982.00 | 1.29 | 1.64 | 0.79 |
| 2.00 | 1982.00 | 1.09 | 1.42 | 0.77 |
| 3.00 | 1982.00 | 1.09 | 1.81 | 0.60 |
| 4.00 | 1982.00 | 0.64 | 1.68 | 0.38 |
| 5.00 | 1982.00 | 1.61 | 3.04 | 0.53 |
| 6.00 | 1982.00 | 1.03 | 2.04 | 0.51 |
| 7.00 | 1982.00 | 0.85 | 2.03 | 0.42 |
| 8.00 | 1982.00 | 0.73 | 2.16 | 0.34 |
| 9.00 | 1982.00 | 1.17 | 2.23 | 0.53 |
| 10.00 | 1982.00 | 0.81 | 1.56 | 0.52 |
| 11.00 | 1982.00 | 1.02 | 1.80 | 0.57 |
| 12.00 | 1982.00 | 1.89 | 1.88 | 1.00 |
| 13.00 | 1982.00 | 1.68 | 1.71 | 0.98 |
| 1.00 | 1983.00 | 1.84 | 1.64 | 1.12 |
| 2.00 | 1983.00 | 1.98 | 1.42 | 1.39 |
| 3.00 | 1983.00 | 2.26 | 1.81 | 1.25 |
| 4.00 | 1983.00 | 2.14 | 1.68 | 1.27 |
| 5.00 | 1983.00 | 3.18 | 3.04 | 1.05 |
| 6.00 | 1983.00 | 2.32 | 2.04 | 1.14 |
| 7.00 | 1983.00 | 2.21 | 2.03 | 1.09 |

| Region | Year | Yield | Med | Frac |
|---|---|---|---|---|
| 8.00 | 1983.00 | 2.47 | 2.16 | 1.15 |
| 9.00 | 1983.00 | 2.27 | 2.23 | 1.02 |
| 10.00 | 1983.00 | 1.68 | 1.56 | 1.08 |
| 11.00 | 1983.00 | 1.89 | 1.80 | 1.05 |
| 12.00 | 1983.00 | 1.78 | 1.88 | 0.95 |
| 13.00 | 1983.00 | 1.70 | 1.71 | 0.99 |
| 1.00 | 1984.00 | 2.22 | 1.64 | 1.36 |
| 2.00 | 1984.00 | 2.23 | 1.42 | 1.57 |
| 3.00 | 1984.00 | 2.03 | 1.81 | 1.12 |
| 4.00 | 1984.00 | 2.03 | 1.68 | 1.21 |
| 5.00 | 1984.00 | 3.18 | 3.04 | 1.05 |
| 6.00 | 1984.00 | 2.29 | 2.04 | 1.12 |
| 7.00 | 1984.00 | 2.17 | 2.03 | 1.07 |
| 8.00 | 1984.00 | 2.13 | 2.16 | 0.99 |
| 9.00 | 1984.00 | 2.23 | 2.23 | 1.00 |
| 10.00 | 1984.00 | 1.60 | 1.56 | 1.03 |
| 11.00 | 1984.00 | 1.86 | 1.80 | 1.03 |
| 12.00 | 1984.00 | 2.01 | 1.88 | 1.07 |
| 13.00 | 1984.00 | 1.83 | 1.71 | 1.07 |
| 1.00 | 1985.00 | 1.87 | 1.64 | 1.14 |
| 2.00 | 1985.00 | 1.74 | 1.42 | 1.22 |
| 3.00 | 1985.00 | 1.86 | 1.81 | 1.03 |
| 4.00 | 1985.00 | 1.55 | 1.68 | 0.92 |
| 5.00 | 1985.00 | 3.02 | 3.04 | 0.99 |
| 6.00 | 1985.00 | 1.88 | 2.04 | 0.92 |
| 7.00 | 1985.00 | 1.96 | 2.03 | 0.97 |
| 8.00 | 1985.00 | 1.81 | 2.16 | 0.84 |
| 9.00 | 1985.00 | 1.92 | 2.23 | 0.86 |
| 10.00 | 1985.00 | 1.53 | 1.56 | 0.98 |
| 11.00 | 1985.00 | 1.66 | 1.80 | 0.92 |
| 12.00 | 1985.00 | 1.82 | 1.88 | 0.96 |
| 13.00 | 1985.00 | 1.59 | 1.71 | 0.93 |
| 1.00 | 1991.00 | 1.31 | 1.64 | 0.80 |
| 2.00 | 1991.00 | 0.71 | 1.42 | 0.50 |
| 3.00 | 1991.00 | 1.44 | 1.81 | 0.80 |
| 4.00 | 1991.00 | 1.34 | 1.68 | 0.80 |
| 5.00 | 1991.00 | 3.03 | 3.04 | 1.00 |
| 6.00 | 1991.00 | 1.90 | 2.04 | 0.93 |
| 7.00 | 1991.00 | 2.05 | 2.03 | 1.01 |
| 8.00 | 1991.00 | 2.11 | 2.16 | 0.98 |
| 9.00 | 1991.00 | 2.26 | 2.23 | 1.01 |
| 10.00 | 1991.00 | 1.45 | 1.56 | 0.93 |
| 11.00 | 1991.00 | 1.97 | 1.80 | 1.10 |
| 12.00 | 1991.00 | 1.91 | 1.88 | 1.01 |
| 13.00 | 1991.00 | 1.65 | 1.71 | 0.96 |

| Region | Year | Yield | Med | Frac |
|---|---|---|---|---|
| 1.00 | 1992.00 | 1.64 | 1.64 | 1.00 |
| 2.00 | 1992.00 | 1.41 | 1.42 | 0.99 |
| 3.00 | 1992.00 | 1.86 | 1.81 | 1.03 |
| 4.00 | 1992.00 | 1.81 | 1.68 | 1.08 |
| 5.00 | 1992.00 | 3.19 | 3.04 | 1.05 |
| 6.00 | 1992.00 | 2.22 | 2.04 | 1.09 |
| 7.00 | 1992.00 | 2.15 | 2.03 | 1.06 |
| 8.00 | 1992.00 | 2.59 | 2.16 | 1.20 |
| 9.00 | 1992.00 | 2.41 | 2.23 | 1.08 |
| 10.00 | 1992.00 | 1.93 | 1.56 | 1.24 |
| 11.00 | 1992.00 | 2.17 | 1.80 | 1.20 |
| 12.00 | 1992.00 | 2.06 | 1.88 | 1.09 |
| 13.00 | 1992.00 | 1.95 | 1.71 | 1.14 |
| 1.00 | 1993.00 | 1.52 | 1.64 | 0.93 |
| 2.00 | 1993.00 | 1.07 | 1.42 | 0.75 |
| 3.00 | 1993.00 | 2.23 | 1.81 | 1.23 |
| 4.00 | 1993.00 | 2.21 | 1.68 | 1.32 |
| 5.00 | 1993.00 | 3.19 | 3.04 | 1.05 |
| 6.00 | 1993.00 | 2.42 | 2.04 | 1.18 |
| 7.00 | 1993.00 | 2.22 | 2.03 | 1.09 |
| 8.00 | 1993.00 | 2.58 | 2.16 | 1.20 |
| 9.00 | 1993.00 | 2.32 | 2.23 | 1.04 |
| 10.00 | 1993.00 | 1.92 | 1.56 | 1.23 |
| 11.00 | 1993.00 | 2.07 | 1.80 | 1.15 |
| 12.00 | 1993.00 | 1.96 | 1.88 | 1.04 |
| 13.00 | 1993.00 | 1.83 | 1.71 | 1.07 |
| 1.00 | 1994.00 | 1.20 | 1.64 | 0.74 |
| 2.00 | 1994.00 | 0.78 | 1.42 | 0.55 |
| 3.00 | 1994.00 | 0.88 | 1.81 | 0.49 |
| 4.00 | 1994.00 | 0.82 | 1.68 | 0.49 |
| 5.00 | 1994.00 | 2.33 | 3.04 | 0.77 |
| 6.00 | 1994.00 | 1.53 | 2.04 | 0.75 |
| 7.00 | 1994.00 | 1.41 | 2.03 | 0.70 |
| 8.00 | 1994.00 | 1.55 | 2.16 | 0.72 |
| 9.00 | 1994.00 | 1.66 | 2.23 | 0.74 |
| 10.00 | 1994.00 | 1.20 | 1.56 | 0.77 |
| 11.00 | 1994.00 | 1.23 | 1.80 | 0.68 |
| 12.00 | 1994.00 | 1.79 | 1.88 | 0.95 |
| 13.00 | 1994.00 | 1.54 | 1.71 | 0.90 |
| 1.00 | 1995.00 | 1.30 | 1.64 | 0.80 |
| 2.00 | 1995.00 | 1.33 | 1.42 | 0.94 |
| 3.00 | 1995.00 | 1.79 | 1.81 | 0.99 |
| 4.00 | 1995.00 | 1.61 | 1.68 | 0.96 |
| 5.00 | 1995.00 | 3.14 | 3.04 | 1.03 |
| 6.00 | 1995.00 | 2.07 | 2.04 | 1.01 |

| Region | Year | Yield | Med | Frac |
|---|---|---|---|---|
| 7.00 | 1995.00 | 1.98 | 2.03 | 0.98 |
| 8.00 | 1995.00 | 2.20 | 2.16 | 1.02 |
| 9.00 | 1995.00 | 2.09 | 2.23 | 0.93 |
| 10.00 | 1995.00 | 1.42 | 1.56 | 0.91 |
| 11.00 | 1995.00 | 1.77 | 1.80 | 0.99 |
| 12.00 | 1995.00 | 1.91 | 1.88 | 1.01 |
| 13.00 | 1995.00 | 1.76 | 1.71 | 1.03 |

# AQIS CONDITIONS FOR THE IMPORT OF VARIOUS GRAINS

# CONDITIONS FOR THE IMPORT OF BULK WHEAT (TRITICUM AESTIVUM) FROM THE UNITED KINGDOM FOR MILLING

This permit approval is for ***«quantity»*** of bulk wheat in one shipment on the vessel ***«name of vessel»*** for discharge in ***«name of port(s)»*** for milling at the AQIS-approved mill located in the metropolitan area of the port of entry.

## PRIOR TO IMPORTING ANY GRAIN

1. The importer must:

   (a) Contact the AQIS Office in the port of entry to confirm:

      (i) The vessel's name and submit a copy of the vessel cleanliness certificate;

      (ii) The vessel's prior six cargoes, including load port, date and cargo; and

      (iii) Ports of discharge in Australia, and ETA at each port.

   (b) Confirm all arrangements for inspections and treatments with the AQIS Senior Import Inspector;

   (c) Ensure that the method of post arrival discharge, the precautions to minimise spillage, and the procedures for storage and processing are discussed with and approved by the AQIS Senior Import Inspector;

   (d) Prepare and submit to AQIS a contingency plan for the clean up of any spillage in the event of an accident between the wharf, approved storage facilities and the approved processing premises.

2. The importer is to ensure that the consignment is as free as possible of contamination such as crop seeds prohibited by quarantine legislation, weed seeds and soil.

3. The importer is to ensure that all transportation units (eg railcars, trucks, barges) and the vessel have been thoroughly cleaned of insect pests, infestable residues and contaminating whole grain prior to loading any grain.

## On Arrival Entry Conditions and Procedures

1. The issuance of this permit does not imply compliance with the requirements of any other government organisation.

2. The goods being on board an overseas vessel that has arrived in Australia from a place outside Australia, or an Australian vessel are subject to quarantine and remain subject to quarantine until released from quarantine.

3. The grain must be imported for milling only. The grain must not to be used directly for stock feed, sown or used for agricultural purposes.

4. A Quarantine Entry must be lodged.

5. The grain must have been grown and sourced from the United Kingdom.

6. The consignment must be accompanied by certification from an approved third party certifier certifying that; all transportation units (railcars, trucks, barges) and the vessel prior to loading had been thoroughly cleaned of contamination with imported and/ or local whole grain, stock feed or stock feed ingredients, insect pests, and other infestable residues, soil, animal or avian remains, faeces or any other extraneous contamination and that there was no evidence of Trogoderma spp. infestation in any of the transportation units or the vessel.

7. The consignment must be accompanied by an International Phytosanitary Certificate bearing the following additional declarations:

   (a) "Grain in this consignment was grown in the United Kingdom."

   (b) "Representative samples drawn from this consignment have been subjected to a seed test by (insert name of laboratory performing the seed analysis test) and found to be free of Cephalosporium stripe fungus (Hymenula cerealis Ell. & Ev.). "

   (c) "Alternaria leaf blight (Alternaria triticina Prasada & Prabhu), dwarf bunt (Tilletia contraversa Kuhn) and Karnal bunt (Neovossia indica (Mitra) Mundk, synonym Tilletia indica Mitra) are not known to occur in the United Kingdom."

   (d) Grain in this consignment has been inspected and found apparently free from all species of the genus Trogoderma."

8. The consignment must also be accompanied by certification from an approved third party certifier certifying that:

- the consignment contains a maximum of 1% foreign material and that no admixture or blending has been added at load.

**NOTE: AQIS will not accept blended grain and the maximum tolerance for foreign material is 1%.**

9. The importer must provide AQIS with a gas free certificate from a licensed fumigator or industrial chemist, prior to AQIS inspection of the consignment.

10. On arrival, and prior to any discharge, the consignment must be thoroughly examined by an AQIS officer for the presence of arthropod pests, contamination with prohibited seeds and weed seeds, contamination with ruminant derived material and other material of quarantine concern, including soil and plant debris, etc. The AQIS officer may direct treatment as necessary following inspection prior to permitting any discharge of grain from the vessel.

    If insects are detected or suspected, the discharge must be stopped and the AQIS Entomologist contacted for advice on the treatment to be applied.

11. The AQIS inspecting officer must draw bulk samples of the grain for on forwarding to:

    AQIS-approved ISTA seed laboratory for a bulk seed analysis; and the AQIS Plant Pathologist for analysis for pathogens.

12. The AQIS officer may direct treatment as necessary following inspection prior to permitting any discharge of grain from the vessel.

13. If the above conditions are met the consignment may be discharged from the ship and transferred to AQIS-approved storage premises or direct to the AQIS-approved processing premises.

14. The vessel must discharge at berths in ***«Place and Company»*** under AQIS supervision. Any dust extracted at any stage of the import process must be disposed of by:

    (a) deep burial under AQIS supervision; or
    (b) incineration under AQIS supervision; or
    (c) any other AQIS approved method under quarantine supervision.

For all of the above options, movement of dust prior to destruction must be in transport approved by an AQIS officer.

## Discharge from Ship and Transfer to AQIS-Approved Storage Premises

1. For the purpose of storage of the grain upon discharge from the vessel, the following premises must be approved by AQIS prior to import:

    «Name of Premises must be supplied prior to importing»

2. All consignments are subject to full AQIS supervision during discharge from the vessel and during receival at an AQIS-approved storage premises and or the AQIS-approved processing premises.

3. The importer must ensure that all precautions are taken to minimise spillage during discharge at the wharf and at the AQIS-approved storage premises. Spillage at any point must be recovered by the importer and destroyed under AQIS supervision unless taken directly into approved storage at the AQIS-approved premises. In the event of a road or rail accident, the importer must have a contingency plan in place to deal with the collection of any spillage. Details of this contingency plan must be discussed and finalised with the AQIS Senior Import Inspector.

4. Only bulk grain type and tanker-type trucks or rail wagons that have been approved by AQIS may be used for the transport of grain from wharf discharge area to the AQIS-approved storage premises. Before moving from the wharf area each truck/wagon must be cleaned to remove grain from ledges. The trucks/wagons must then proceed directly to the AQIS-approved storage premises. Details of the routes to be taken must be discussed and finalised with the AQIS Senior Import Inspector.

5. The importer must maintain records of all transfers and receivals of the grain from the wharf area to the approved storage premises.

6. Discharge from wharf, transportation (including checking trucks for spillage), cleaning and movement into AQIS-approved storage must be carried out to the satisfaction of an AQIS officer.

7. Upon discharge at the AQIS-approved storage premises, all trucks/wagons must be inspected to ensure freedom from any grain or grain residues prior to leaving the premises. Any contamination must be removed. All trucks/wagons must be cleaned upon completion of last load and presented for inspection by AQIS.

8. Wharf equipment and wharf is to be cleaned at the cessation of each day's discharge to the satisfaction of an AQIS officer. The residues must be disposed of by an AQIS approved method at completion of discharge, or as, and when directed by AQIS staff.

9. The bulk grain is to be stored under the control and to the satisfaction of an AQIS officer at the AQIS-approved storage premises prior to the movement to the AQIS-approved milling premises.

## Movement to Approved Milling Premises

1. For the purposes of milling the grain into flour the following premises must be approved by AQIS prior to import:

   «Name of Premises must be supplied prior to importing»

2. All consignments are subject to full AQIS supervision during discharge from the AQIS-approved storage premises and during receival at the AQIS-approved milling premises.

3. The importer must ensure that all precautions are taken to minimise spillage during discharge at the approved storage premises and at the AQIS-approved milling premises. Spillage at any point must be recovered by the importer and destroyed under AQIS supervision unless taken directly into approved storage at the AQIS-approved milling premises. In the event of a road or rail accident, the importer must have a contingency plan in place to deal with the collection of any spillage. Details of this contingency plan must be discussed and finalised with the AQIS Senior Import Inspector.

4. Only bulk grain type and tanker-type trucks or rail wagons that have been approved by AQIS may be used for the transport of the grain from the AQIS-approved storage premises, to the approved storage area at the AQIS-approved milling premises. Discharge of grain into trucks/wagons for movement must be done under AQIS supervision. Before moving from the AQIS-approved storage premises, each truck/wagon must be cleaned to remove grain from ledges. The trucks/wagons must then proceed directly to the AQIS-approved milling premises. Details of the routes to be taken must be discussed and finalised with the Senior Import Inspector.

5. The importer must maintain records of all transfers and receivals of the grain from the AQIS-approved storage premises to the AQIS-approved milling premises.

6. Upon discharge at the approved milling premises, all trucks/wagons must be inspected to ensure freedom from any grain and grain residues prior to leaving the premises. Any contamination must be removed. All trucks/wagons must be cleaned upon completion of last load and presented for inspection by AQIS.

7. The grain must be held and milled under AQIS supervision at the AQIS-approved premises and shall not be removed from these premises without prior approval from AQIS. **The grain must be milled to the extent that no whole grain or other seeds are present in the milled product**. At the completion of milling, and/or as directed by quarantine officers the associated equipment is to be cleaned to the satisfaction of an AQIS officer of all residues. Residues must be disposed of by an AQIS-approved method.

8. All screenings, contaminant seeds and other contaminating material removed from the bulk grain must be incinerated, deep buried, or heat treated in a manner approved by an AQIS officer.

9. All processing by-products (ie pollard, bran, offal etc) must be used and/or treated in a manner approved, in writing, by AQIS. Written applications for the intended use/treatment of any milling by-products must be forwarded to AQIS Canberra for approval.

10. Detailed records of all grain held and processed in the AQIS-approved premises must be maintained. Records must be maintained for:

    (a) all transfers and receival of the grain from the AQIS-approved storage area to the processing/milling plant.

    (b) records of processing at approved premises.

(c) records of waste disposal.

Records must be maintained to such an extent that AQIS is able to accurately trace the fate of all the imported material and it's derivatives. These records may be subject to audit by AQIS:

1. Supervision by an AQIS officer is to be carried out as necessary in accordance with directions made by an AQIS officer who may release the goods from quarantine at the conclusion of processing.

## By-Product Intended for Animal Food

1. For the purposes of processing by-product, the following premises must be approved by AQIS prior to import:

   «Name of Premises must be supplied prior to importing»

2. All consignments are subject to full AQIS supervision during discharge from the approved storage area at the AQIS-approved milling premises and during receival at the AQIS-approved processing premises.

3. The importer must ensure that all precautions are taken to minimise spillage during discharge at the approved milling premises and at the AQIS-approved processing premises. Spillage at any point must be recovered by the importer and destroyed under AQIS supervision unless taken directly into approved storage at the AQIS-approved processing premises. In the event of a road or rail accident, the importer must have a contingency plan in place to deal with the collection of any spillage. Details of this contingency plan must be discussed and finalised with the AQIS Senior Import Inspector.

4. Only bulk grain type and tanker-type trucks or rail wagons that have been approved by AQIS may be used for the transport of the by-product from the approved storage area at the AQIS-approved milling premises, to the approved storage area at the AQIS-approved processing premises. Discharge of by-product into trucks/wagons for movement must be done under AQIS supervision. Before moving from the approved storage area at the AQIS-approved milling premises, each truck/wagon must be cleaned to remove by-product and/or residues from ledges. The trucks/wagons must then proceed directly to the AQIS-approved processing premises. Details of the routes to be taken must be discussed and finalised with the Senior Import Inspector.

5. The importer must maintain records of all transfers and receivals of the by-product from the approved storage area at the AQIS-approved milling premises to the AQIS-approved processing premises.

6. Upon discharge at the approved storage area at the AQIS-approved processing premises, all trucks/wagons must be inspected to ensure freedom from any by-product and/or residues prior to leaving the premises. Any contamination must be removed. All trucks/wagons must be cleaned upon completion of last load and presented for inspection by AQIS.

7. The by-product must be held and hammer milled under AQIS supervision at the AQIS-approved premises and shall not be removed from these premises without prior approval from AQIS. The by-product must be hammer milled to the extent that no whole grain or other seeds are present in the hammer-milled product. Following hammer milling, the milled product is to be steam pelletised at 100KPA – 200 KPA steam pressure at 88oC – 100oC for 10-20 seconds. The mill and associated equipment are to be cleaned to the satisfaction of an AQIS officer at the completion of processing.

   Residues must be disposed of by an AQIS-approved method by:

   (a) deep burial under AQIS supervision; or
   (b) incineration under AQIS supervision; or
   (c) any other AQIS approved method under quarantine supervision.

8. Detailed records of all by-product held and processed in the AQIS-approved premises must be maintained. Records must be maintained for:

   (a) all transfers and receival of the by-product from the AQIS-approved milling premises to the AQIS-approved processing premises.

   (b) records of processing at approved processing premises.

   (c) records of waste disposal.

   Records must be maintained to such an extent that AQIS is able to accurately trace the fate of all the imported material and it's derivatives. These records may be subject to audit by AQIS.

9. Supervision by an AQIS officer is to be carried out as necessary in accordance with directions made by an AQIS officer who may release the goods from quarantine at the conclusion of processing.

10. AQIS reserves the right, at any time, to (a) apply further controls on the use of prohibited seeds; and (b) rescind the right of individuals to process prohibited seeds.

# CONDITIONS FOR THE IMPORT OF BULK WHEAT (TRITICUM AESTIVUM) FROM THE UNITED KINGDOM FOR PROCESSING

## Prior to Importing Any Grain

1. The importer must:

   (a) contact the AQIS Office in the port of entry to confirm:

      (i) the vessel’s name and submit a copy of the vessel cleanliness certificate;

(ii) the vessel's prior six cargoes, including load port, date and cargo; and

(iii) ports of discharge in Australia, and ETA at each port.

(b) confirm all arrangements for inspections and treatments with the AQIS Senior Import Inspector;

(c) ensure that the method of post arrival discharge, the precautions to minimise spillage, and the procedures for storage and processing are discussed with and approved by the AQIS Senior Import Inspector;

(d) prepare and submit to AQIS a contingency plan for the clean up of any spillage in the event of an accident between the wharf, approved storage facilities and the approved processing premises.

1. The importer is to ensure that the consignment is as free as possible of contamination such as crop seeds prohibited by quarantine legislation, weed seeds and soil.

2. The importer is to ensure that all transportation units (eg railcars, trucks, barges) and the vessel have been thoroughly cleaned of insect pests, infestable residues and contaminating whole grain prior to loading any grain.

## On Arrival Entry Conditions and Procedures

1. The issuance of this permit does not imply compliance with the requirements of any other government organisation.

2. The goods being on board an overseas vessel that has arrived in Australia from a place outside Australia, or an Australian vessel are subject to quarantine and remain subject to quarantine until released from quarantine.

3. The grain must be imported for processing only. The grain must not to be used directly for stock feed, sown or used for agricultural purposes.

4. A Quarantine Entry must be lodged.

5. The grain must have been grown and sourced from the United Kingdom.

6. The consignment must be accompanied by certification from an approved third party certifier certifying that; all transportation units (railcars, trucks, barges) and the vessel prior to loading had been thoroughly cleaned of contamination with imported and/ or local whole grain, stock feed or stock feed ingredients, insect pests, and other infestable residues, soil, animal or avian remains, faeces or any other extraneous contamination and that there was no evidence of *Trogoderma* spp. infestation in any of the transportation units or the vessel.

7. The consignment must be accompanied by an International Phytosanitary Certificate bearing the following additional declarations:

(a) "Grain in this consignment was grown in the United Kingdom."

(b) "Representative samples drawn from this consignment have been subjected to a seed test by (*insert name of laboratory performing the seed analysis test*) and found to be free of Cephalosporium stripe fungus (*Hymenula cerealis* Ell. & Ev.). "

(c) "Alternaria leaf blight (*Alternaria triticina* Prasada & Prabhu), dwarf bunt (*Tilletia contraversa* Kuhn) and Karnal bunt (*Neovossia indica* (Mitra) Mundk, synonym *Tilletia indica* Mitra) are not known to occur in the United Kingdom."

(d) "Grain in this consignment has been inspected and found apparently free from all species of the genus *Trogoderma*."

8. The consignment must also be accompanied by certification from an approved third party certifier certifying that:

   - the consignment contains a maximum of 1% foreign material and that no admixture or blending has been added at load.

   NOTE: AQIS will not accept blended grain and the maximum tolerance for foreign material is 1%.

9. The importer must provide AQIS with a gas free certificate from a licenced fumigator or industrial chemist, prior to AQIS inspection of the consignment.

10. On arrival, and prior to any discharge, the consignment must be thoroughly examined by an AQIS officer for the presence of arthropod pests, contamination with prohibited seeds and weed seeds, contamination with ruminant derived material and other material of quarantine concern, including soil and plant debris, etc. The AQIS officer may direct treatment as necessary following inspection prior to permitting any discharge of grain from the vessel.

    If insects are detected or suspected, the discharge must be stopped and the AQIS Entomologist contacted for advice on the treatment to be applied.

11. The AQIS inspecting officer must draw bulk samples of the grain for on forwarding to:

AQIS-approved ISTA seed laboratory for a bulk seed analysis; and the AQIS Plant Pathologist for analysis for pathogens.

1. The AQIS officer may direct treatment as necessary following inspection prior to permitting any discharge of grain from the vessel.

2. If the above conditions are met the consignment may be discharged from the ship and transferred to AQIS-approved storage premises or direct to the AQIS-approved processing premises.

3. The vessel must discharge at berths in ***«Place and Company»*** under AQIS supervision. Any dust extracted at any stage of the import process must be disposed of by:

   (a) deep burial under AQIS supervision; or,
   (b) incineration under AQIS supervision; or,
   (c) any other AQIS approved method under quarantine supervision

For all of the above options, movement of dust prior to destruction must be in transport approved by an AQIS officer.

## Discharge from Ship and Transfer to AQIS-Approved Storage Premises

1. For the purpose of storage of the grain upon discharge from the vessel, the following premises must be approved by AQIS prior to import:

   «Name of Premises must be supplied prior to importing»

2. All consignments are subject to full AQIS supervision during discharge from the vessel and during receival at an AQIS-approved storage premises and or the AQIS-approved processing premises.

3. The importer must ensure that all precautions are taken to minimise spillage during discharge at the wharf and at the AQIS-approved storage premises. Spillage at any point must be recovered by the importer and destroyed under AQIS supervision unless taken directly into approved storage at the AQIS-approved premises. In the event of a road or rail accident, the importer must have a contingency plan in place to deal with the collection of any spillage. Details of this contingency plan must be discussed and finalised with the AQIS Senior Import Inspector.

4. Only bulk grain type and tanker-type trucks or rail wagons that have been approved by AQIS may be used for the transport of grain from wharf discharge area to the AQIS-approved storage area. Before moving from the wharf area each truck/wagon must be cleaned to remove grain from ledges. The trucks/wagons must then proceed directly to the AQIS-approved storage premises. Details of the routes to be taken must be discussed and finalised with the AQIS Senior Import Inspector.

5. The importer must maintain records of all transfers and receivals of the grain from the wharf area to the approved storage area.

6. Discharge from wharf, transportation (including checking trucks for spillage), cleaning and movement into AQIS-approved storage must be carried out to the satisfaction of an AQIS officer.

7. Upon discharge at the AQIS-approved storage area, all trucks/wagons must be inspected to ensure freedom from any grain or grain residues prior to leaving the AQIS-approved storage area. Any contamination must be removed. All

trucks/wagons must be cleaned upon completion of last load and presented for inspection by AQIS.

8. Wharf equipment and wharf is to be cleaned at the cessation of each day's discharge to the satisfaction of an AQIS officer. The residues must be disposed of by an AQIS approved method at completion of discharge, or as, and when directed by AQIS staff.

9. The bulk grain is to be stored under the control and to the satisfaction of an AQIS officer at the AQIS-approved storage area prior to the movement to the AQIS-approved processing premises.

## Movement to Approved Processing Premises

1. For the purposes of processing the grain by means of hammer milling followed by steam pelleting, the following premises must be approved by AQIS prior to import:

   «Name of Premises must be supplied prior to importing»

2. All consignments are subject to full AQIS supervision during discharge from the AQIS-approved storage area and during receival at the AQIS-approved processing premises.

3. The importer must ensure that all precautions are taken to minimise spillage during discharge at the approved storage area and at the AQIS-approved processing premises. Spillage at any point must be recovered by the importer and destroyed under AQIS supervision unless taken directly into approved storage at the AQIS-approved processing premises. In the event of a road or rail accident, the importer must have a contingency plan in place to deal with the collection of any spillage. Details of this contingency plan must be discussed and finalised with the AQIS Senior Import Inspector.

4. Only bulk grain type and tanker-type trucks or rail wagons that have been approved by AQIS may be used for the transport of the grain from the AQIS-approved storage area, to the AQIS-approved storage area at the AQIS-approved processing premises. Discharge of grain into trucks/wagons for movement must be done under AQIS supervision. Before moving from the AQIS-approved storage premises, each truck/wagon must be cleaned to remove grain from ledges. The trucks/wagons must then proceed directly to the AQIS-approved processing premises. Details of the routes to be taken must be discussed and finalised with the Senior Import Inspector.

5. The importer must maintain records of all transfers and receivals of the grain from the AQIS-approved storage area to the AQIS-approved processing premises.

6. Upon discharge at the approved processing premises, all trucks/wagons must be inspected to ensure freedom from any grain and grain residues prior to leaving the approved premises. Any contamination must be removed. All trucks/wagons must be cleaned upon completion of last load and presented for inspection by AQIS.

7. The grain must be held and hammer milled under AQIS supervision at the AQIS-approved premises and shall not be removed from these premises without prior

approval from AQIS. The grain must be hammer milled to the extent that no whole grain or other seeds are present in the hammer-milled product. Following hammer milling, the milled product is to be steam pelletised at 100KPA – 200 KPA steam pressure at 88oC – 100oC for 10-20 seconds. The mill and associated equipment are to be cleaned to the satisfaction of an AQIS officer at the completion of processing.

8. All screenings, contaminant seeds and other contaminating material removed from the bulk grain must be incinerated, deep buried, or heat treated in a manner approved by an AQIS officer.

9. All processing by-products (ie pollard, bran, offal etc) must be used and/or treated in a manner approved, in writing, by AQIS. Written applications for the intended use/treatment of any milling by-products must be forwarded to AQIS Canberra for approval.

10. Detailed records of all grain held and processed in the AQIS-approved premises must be maintained. Records must be maintained for:

    (a) all transfers and receival of the grain from the AQIS-approved storage area to the processing plant.

    (b) records of processing at approved processing premises.

    (c) records of waste disposal.

    (d) Records must be maintained to such an extent that AQIS is able to accurately trace the fate of all the imported material and it's derivatives. These records may be subject to audit by AQIS.

11. Supervision by an AQIS officer is to be carried out as necessary in accordance with directions made by an AQIS officer who may release the goods from quarantine at the conclusion of processing.

12. AQIS reserves the right, at any time, to (a) apply further controls on the use of prohibited seeds; and (b) rescind the right of individuals to process prohibited seeds.

# CONDITIONS FOR THE IMPORT OF BULK MAIZE (ZEA MAYS) FROM THE USA FOR PROCESSING

This permit approval is for **«quantity»** of bulk maize in one shipment on the vessel **«name of vessel»** for discharge in **«name of port(s) »**.

## Prior to Importing any Grain

1. The importer must:

    (a) Contact the AQIS Office in the port of entry to confirm:

(i) the vessel's name and submit a copy of the vessel cleanliness certificate;

(ii) the vessel's prior six cargoes, including load port, date and cargo; and

(iii) ports of discharge in Australia, and ETA at each port.

(b) confirm all arrangements for inspections and treatments with the AQIS Senior Import Inspector;

(c) ensure that the method of post arrival discharge, the precautions to minimise spillage, and the procedures for storage and processing are discussed with and approved by the AQIS Senior Import Inspector;

(d) prepare and submit to AQIS a contingency plan for the clean up of any spillage in the event of an accident between the wharf, approved storage facilities and the approved processing premises.

2. The importer is to ensure that the consignment is as free as possible of contamination such as crop seeds prohibited by quarantine legislation, weed seeds and soil.

3. The importer is to ensure that all transportation units (eg railcars, trucks, barges) and the vessel have been thoroughly cleaned of insect pests, infestable residues and contaminating whole grain prior to loading any grain.

## On Arrival Entry Conditions and Procedures

1. The issuance of this permit does not imply compliance with the requirements of any other government organisation.

2. The goods being on board an overseas vessel that has arrived in Australia from a place outside Australia, or an Australian vessel are subject to quarantine and remain subject to quarantine until released from quarantine.

3. The grain must be imported for processing only. The grain must not to be used directly for stock feed, sown or used for agricultural purposes.

4. A Quarantine Entry must be lodged.

5. The grain must have been grown and sourced from one of the following States of the USA:

   - Iowa;
   - Minnesota;
   - South Dakota;
   - North Dakota; and
   - Wisconsin.

6. The grain must be transported directly to Pacific North West load ports or to gulf ports (excluding Texas) via the river system.

7. The consignment must be accompanied by certification from the USA Grain Inspection and Stockyard Packers Association (GIPSA) certifying that, all transportation units (railcars, trucks, barges) and the vessel prior to loading had been thoroughly cleaned of insect pests, infestable residues and contaminating whole grain and that there was no evidence of Trogoderma spp. infestation in any of the transportation units or the vessel.

8. The consignment must be accompanied by an International Phytosanitary Certificate bearing the following additional declaration:

   "Seed in the consignment has been inspected and found apparently free from all species of the genus *Trogoderma*."

9. The consignment must also be accompanied by certification from GIPSA (or approved equivalent) certifying that:

   - the maize is US Grade 1 or US Grade 2 except No. 1 Grade for foreign material and that no admixture or blending has been added at load; and

   - the grain loaded on the MV……(*vessel name*)…… was received from railcars/trucks/barges loaded at ………(*elevator/city/state/date*)……… under the supervision of GIPSA authorised/licensed personnel.

   NOTE: AQIS will not accept blended grain and grain must be Grade 1. for foreign matter.

10. The importer must provide AQIS with a gas free certificate from a licenced fumigator or industrial chemist, prior to AQIS inspection of the consignment.

11. On arrival, and prior to any discharge, the consignment must be thoroughly examined by an AQIS officer for the presence of arthropod pests, contamination with prohibited seeds and weed seeds, contamination with ruminant derived material and other material of quarantine concern, including soil and plant debris, etc. The AQIS officer may direct treatment as necessary following inspection prior to permitting any discharge of grain from the vessel.

    If *Trogoderma* spp. is detected or suspected, the discharge must be stopped and the AQIS Entomologist contacted for advice on the action to be taken.

    If insects other than *Trogoderma* spp. are found, the discharge is to be stopped and the AQIS Entomologist contacted for advice on the treatment to be applied.

12. The AQIS inspecting officer must draw bulk samples of the grain for on forwarding to: AQIS-approved ISTA seed laboratory for a bulk seed analysis; and the AQIS Plant Pathologist for analysis for pathogens.

13. The AQIS officer may direct treatment as necessary following inspection prior to permitting any discharge of grain from the vessel.

14. If the above conditions are met the consignment may be discharged from the ship and transferred to AQIS-approved storage premises or direct to the AQIS-approved processing premises.

15. The vessel must discharge at berths in ***«Place and Company»*** under AQIS supervision. Any dust extracted at any stage of the import process must be disposed of by:

    (a) deep burial under AQIS supervision; or
    (b) incineration under AQIS supervision; or
    (c) any other AQIS approved method under quarantine supervision.

For all of the above options, movement of dust prior to destruction must be in transport approved by an AQIS officer.

## Discharge from Ship and Transfer to AQIS-Approved Storage Premises

1. For the purpose of storage of grain upon discharge from the vessel, the following premises must be approved by AQIS prior to import:

   «Name of Premises must be supplied prior to importing»

2. All consignments are subject to full AQIS supervision during discharge from the vessel and during receival at an AQIS-approved storage premises and or the AQIS-approved processing premises.

3. The importer must ensure that all precautions are taken to minimise spillage during discharge at the wharf and at the AQIS-approved storage premises. Spillage at any point must be recovered by the importer and destroyed under AQIS supervision unless taken directly into approved storage at the AQIS-approved premises. In the event of a road or rail accident, the importer must have a contingency plan in place to deal with the collection of any spillage. Details of this contingency plan must be discussed and finalised with the AQIS Senior Import Inspector.

4. Only bulk grain type and tanker-type trucks or rail wagons that have been approved by AQIS may be used for the transport of grain from wharf discharge area to the AQIS-approved storage area. Before moving from the wharf area each truck/wagon must be cleaned to remove grain from ledges. The trucks/wagons must then proceed directly to the AQIS-approved storage premises. Details of the routes to be taken must be discussed and finalised with the AQIS Senior Import Inspector.

5. The importer must maintain records of all transfers and receivals of grain from the wharf area to the approved storage area.

6. Discharge from wharf, transportation (including checking trucks for spillage), cleaning and movement into AQIS-approved storage must be carried out to the satisfaction of an AQIS officer.

7. Upon discharge at the AQIS-approved storage area, all trucks/wagons must be inspected to ensure freedom from any grain or grain residues prior to leaving the AQIS-approved storage area. Any contamination must be removed. All trucks/wagons must be cleaned upon completion of last load and presented for inspection by AQIS.

8. Wharf equipment and wharf is to be cleaned at the cessation of each day's discharge to the satisfaction of an AQIS officer. The residues must be disposed of by an AQIS approved method at completion of discharge, or as, and when directed by AQIS staff.

9. The bulk grain is to be stored under the control and to the satisfaction of an AQIS officer at the AQIS-approved storage area prior to the movement to the AQIS-approved processing premises.

## Movement to Approved Processing Premises

1. For the purposes of processing the grain by means of hammer milling followed by steam pelleting, the following premises must be approved by AQIS prior to import:

   «Name of Premises must be supplied prior to importing»

2. All consignments are subject to full AQIS supervision during discharge from the AQIS-approved storage area and during receival at the AQIS-approved processing premises.

3. The importer must ensure that all precautions are taken to minimise spillage during discharge at the approved storage area and at the AQIS-approved processing premises. Spillage at any point must be recovered by the importer and destroyed under AQIS supervision unless taken directly into approved storage at the AQIS-approved processing premises. In the event of a road or rail accident, the importer must have a contingency plan in place to deal with the collection of any spillage. Details of this contingency plan must be discussed and finalised with the AQIS Senior Import Inspector.

4. Only bulk grain type and tanker-type trucks or rail wagons that have been approved by AQIS may be used for the transport of grain from the AQIS-approved storage area, to the AQIS-approved storage area at the AQIS-approved processing premises. Discharge of grain into trucks/wagons for movement must be done under AQIS supervision. Before moving from the AQIS-approved storage premises, each truck/wagon must be cleaned to remove grain from ledges. The trucks/wagons must then proceed directly to the AQIS-approved processing premises. Details of the routes to be taken must be discussed and finalised with the Senior Import Inspector.

5. The importer must maintain records of all transfers and receivals of grain from the AQIS-approved storage area to the AQIS-approved processing premises.

6. Upon discharge at the approved processing premises, all trucks/wagons must be inspected to ensure freedom from any grain and grain residues prior to leaving the approved premises. Any contamination must be removed. All trucks/wagons must be cleaned upon completion of last load and presented for inspection by AQIS.

7. The grain must be held and hammer milled under AQIS supervision at the AQIS-approved premises and shall not be removed from these premises without prior approval from AQIS. The grain must be hammer milled to the extent that no whole seed or other seeds are present in the hammer-milled product. Following hammer milling, the milled product is to be steam pelletised at 100KPA – 200 KPA steam pressure at 88oC – 100oC for 10-20 seconds. The mill and associated equipment are to be cleaned to the satisfaction of an AQIS officer at the completion of processing.

8. All screenings, contaminant seeds and other contaminating material removed from the bulk grain must be incinerated, deep buried, or heat treated in a manner approved by an AQIS officer.

9. All processing by-products (ie pollard, bran, offal etc) must be used and/or treated in a manner approved, in writing, by AQIS. Written applications for the intended use/treatment of any milling by-products must be forwarded to AQIS Canberra for approval.

10. Detailed records of all grain held and processed in the AQIS-approved premises must be maintained. Records must be maintained for:

    (a) all transfers and receival of grain from the AQIS-approved storage area to the processing plant.

    (b) records of processing at approved processing premises.

    (c) records of waste disposal.

    Records must be maintained to such an extent that AQIS is able to accurately trace the fate of all the imported material and it's derivatives. These records may be subject to audit by AQIS.

11. Supervision by an AQIS officer is to be carried out as necessary in accordance with directions made by an AQIS officer who may release the goods from quarantine at the conclusion of processing.

12. AQIS reserves the right, at any time, to (a) apply further controls on the use of prohibited seeds; and (b) rescind the right of individuals to process prohibited seeds.

# CONDITIONS FOR THE IMPORT OF BULK SORGHUM (SORGHUM BICOLOR) FROM THE USA FOR PROCESSING

This permit approval is for **«quantity»** of bulk sorghum in one shipment on the vessel **«name of vessel»** for discharge in **«name of port(s)».**

## Prior to Importing any Grain

1. The importer must:

(a) contact the AQIS Office in the port of entry to confirm:

   (i) the vessel's name and submit a copy of the vessel cleanliness certificate;

   (ii) the vessel's prior six cargoes, including load port, date and cargo; and

   (iii) ports of discharge in Australia, and ETA at each port.

(b) confirm all arrangements for inspections and treatments with the AQIS Senior Import Inspector;

(c) ensure that the method of post arrival discharge, the precautions to minimise spillage, and the procedures for storage and processing are discussed with and approved by the AQIS Senior Import Inspector;

(d) prepare and submit to AQIS a contingency plan for the clean up of any spillage in the event of an accident between the wharf, approved storage facilities and the approved processing premises.

2. The importer is to ensure that the consignment is as free as possible of contamination such as crop seeds prohibited by quarantine legislation, weed seeds and soil.

3. The importer is to ensure that all transportation units (eg railcars, trucks, barges) and the vessel have been thoroughly cleaned of insect pests, infestable residues and contaminating whole grain prior to loading any grain.

## On Arrival Entry Conditions and Procedures

1. The issuance of this permit does not imply compliance with the requirements of any other government organisation.

2. The goods being on board an overseas vessel that has arrived in Australia from a place outside Australia, or an Australian vessel are subject to quarantine and remain subject to quarantine until released from quarantine.

3. The grain must be imported for processing only. The grain must not to be used directly for stock feed, sown or used for agricultural purposes.

4. A Quarantine Entry must be lodged.

5. The grain must have been grown and sourced from one of the following States of the USA:

   - Kansas;
   - Nebraska;
   - Missouri;
   - Illinois; and
   - South Dakota.

6. The grain must be transported directly to Pacific North West load ports or to gulf ports (excluding Texas) via the river system.

7. The consignment must be accompanied by certification from the USA Grain Inspection and Stockyard Packers Association (GIPSA) certifying that, all transportation units (railcars, trucks, barges) and the vessel prior to loading had been thoroughly cleaned of insect pests, infestable residues and contaminating whole grain and that there was no evidence of *Trogoderma* spp. infestation in any of the transportation units or the vessel.

8. The consignment must be accompanied by an International Phytosanitary Certificate bearing the following additional declaration:

   "Seed in the consignment has been inspected and found apparently free from all species of the genus *Trogoderma*."

9. The consignment must also be accompanied by certification from GIPSA (or approved equivalent) certifying that:

   - the sorghum is US Grade 1 or US Grade 2 except No. 1 Grade for foreign material and that no admixture or blending has been added at load; and

   - the grain loaded on the MV……(*vessel name*)…… was received from railcars/trucks/barges loaded at ………(*elevator/city/state/date*)……… under the supervision of GIPSA authorised/licensed personnel.

   NOTE: AQIS will not accept blended grain and grain must be Grade 1. for foreign matter.

10. The importer must provide AQIS with a gas free certificate from a licenced fumigator or industrial chemist, prior to AQIS inspection of the consignment.

11. On arrival, and prior to any discharge, the consignment must be thoroughly examined by an AQIS officer for the presence of arthropod pests, contamination with prohibited seeds and weed seeds, contamination with ruminant derived material and other material of quarantine concern, including soil and plant debris, etc. The AQIS officer may direct treatment as necessary following inspection prior to permitting any discharge of grain from the vessel.

    If *Trogoderma* spp. is detected or suspected, the discharge must be stopped and the AQIS Entomologist contacted for advice on the action to be taken.

    If insects other than *Trogoderma* spp. are found, the discharge is to be stopped and the AQIS Entomologist contacted for advice on the treatment to be applied.

12. The AQIS inspecting officer must draw bulk samples of the grain for on forwarding to:

    AQIS-approved ISTA seed laboratory for a bulk seed analysis; and the AQIS Plant Pathologist for analysis for pathogens.

13. The AQIS officer may direct treatment as necessary following inspection prior to permitting any discharge of grain from the vessel.

14. If the above conditions are met the consignment may be discharged from the ship and transferred to AQIS-approved storage premises or direct to the AQIS-approved processing premises.

15. The vessel must discharge at berths in ***«Place and Company»*** under AQIS supervision. Any dust extracted at any stage of the import process must be disposed of by:

    (a) deep burial under AQIS supervision; or
    (b) incineration under AQIS supervision; or
    (c) any other AQIS approved method under quarantine supervision.

For all of the above options, movement of dust prior to destruction must be in transport approved by an AQIS officer.

## Discharge from Ship and Transfer to AQIS-Approved Storage Premises

1. For the purpose of storage of the grain upon discharge from the vessel, the following premises must be approved by AQIS prior to import:

   «Name of Premises must be supplied prior to importing»

2. All consignments are subject to full AQIS supervision during discharge from the vessel and during receival at an AQIS-approved storage premises and or the AQIS-approved processing premises.

3. The importer must ensure that all precautions are taken to minimise spillage during discharge at the wharf and at the AQIS-approved storage premises. Spillage at any point must be recovered by the importer and destroyed under AQIS supervision unless taken directly into approved storage at the AQIS-approved premises. In the event of a road or rail accident, the importer must have a contingency plan in place to deal with the collection of any spillage. Details of this contingency plan must be discussed and finalised with the AQIS Senior Import Inspector.

4. Only bulk grain type and tanker-type trucks or rail wagons that have been approved by AQIS may be used for the transport of grain from wharf discharge area to the AQIS-approved storage area. Before moving from the wharf area each truck/wagon must be cleaned to remove grain from ledges. The trucks/wagons must then proceed directly to the AQIS-approved storage premises. Details of the routes to be taken must be discussed and finalised with the AQIS Senior Import Inspector.

5. The importer must maintain records of all transfers and receivals of the grain from the wharf area to the approved storage area.

6. Discharge from wharf, transportation (including checking trucks for spillage), cleaning and movement into AQIS-approved storage must be carried out to the satisfaction of an AQIS officer.

7. Upon discharge at the AQIS-approved storage area, all trucks/wagons must be inspected to ensure freedom from any grain or grain residues prior to leaving the AQIS-approved storage area. Any contamination must be removed. All trucks/wagons must be cleaned upon completion of last load and presented for inspection by AQIS.

8. Wharf equipment and wharf is to be cleaned at the cessation of each day's discharge to the satisfaction of an AQIS officer. The residues must be disposed of by an AQIS approved method at completion of discharge, or as, and when directed by AQIS staff.

9. The bulk grain is to be stored under the control and to the satisfaction of an AQIS officer at the AQIS-approved storage area prior to the movement to the AQIS-approved processing premises.

## Movement to Approved Processing Premises

1. For the purposes of processing the grain by means of hammer milling followed by steam pelleting, the following premises must be approved by AQIS prior to import:

   «Name of Premises must be supplied prior to importing»

2. All consignments are subject to full AQIS supervision during discharge from the AQIS-approved storage area and during receival at the AQIS-approved processing premises.

3. The importer must ensure that all precautions are taken to minimise spillage during discharge at the approved storage area and at the AQIS-approved processing premises. Spillage at any point must be recovered by the importer and destroyed under AQIS supervision unless taken directly into approved storage at the AQIS-approved processing premises. In the event of a road or rail accident, the importer must have a contingency plan in place to deal with the collection of any spillage. Details of this contingency plan must be discussed and finalised with the AQIS Senior Import Inspector.

4. Only bulk grain type and tanker-type trucks or rail wagons that have been approved by AQIS may be used for the transport of grain from the AQIS-approved storage area, to the AQIS-approved storage area at the AQIS-approved processing premises. Discharge of grain into trucks/wagons for movement must be done under AQIS supervision. Before moving from the AQIS-approved storage premises, each truck/wagon must be cleaned to remove grain from ledges. The trucks/wagons must then proceed directly to the AQIS-approved processing premises. Details of the routes to be taken must be discussed and finalised with the Senior Import Inspector.

5. The importer must maintain records of all transfers and receivals of grain from the AQIS-approved storage area to the AQIS-approved processing premises.

6. Upon discharge at the approved processing premises, all trucks/wagons must be inspected to ensure freedom from any grain and grain residues prior to leaving the approved premises. Any contamination must be removed. All trucks/wagons must be cleaned upon completion of last load and presented for inspection by AQIS.

7. The grain must be held and hammer milled under AQIS supervision at the AQIS-approved premises and shall not be removed from these premises without prior approval from AQIS. The grain must be hammer milled to the extent that no whole grain or other seeds are present in the hammer-milled product. Following hammer milling, the milled product is to be steam pelletised at 100KPA – 200 KPA steam pressure at 88oC – 100oC for 10-20 seconds. The mill and associated equipment are to be cleaned to the satisfaction of an AQIS officer at the completion of processing.

8. All screenings, contaminant seeds and other contaminating material removed from the bulk grain must be incinerated, deep buried, or heat treated in a manner approved by an AQIS officer.

9. All processing by-products (ie pollard, bran, offal etc) must be used and/or treated in a manner approved, in writing, by AQIS. Written applications for the intended use/treatment of any milling by-products must be forwarded to AQIS Canberra for approval.

10. Detailed records of all grain held and processed in the AQIS-approved premises must be maintained. Records must be maintained for:

    (a) all transfers and receival of grain from the AQIS-approved storage area to the processing plant.

    (b) records of processing at approved processing premises.

    (c) records of waste disposal.

    Records must be maintained to such an extent that AQIS is able to accurately trace the fate of all the imported material and it's derivatives. These records may be subject to audit by AQIS.

11. Supervision by an AQIS officer is to be carried out as necessary in accordance with directions made by an AQIS officer who may release the goods from quarantine at the conclusion of processing.

12. AQIS reserves the right, at any time, to (a) apply further controls on the use of prohibited seeds; and (b) rescind the right of individuals to process prohibited seeds.