Production verses Marketing: where should Australian wool producers focus?

A report for Australian Nuffield Farming Scholars Association,

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Dedication

This report is dedicated to the life of John Ross Kelly (1931-2006). This extraordinary man was a loving father to me and was always a supportive role model as well as my mentor and friend. All the love and support my father has given me throughout my life has led to any accomplishments I have achieved. My achievements would have been much less without him in my life.

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Abbreviations

ASBV's- Australian sheep breeding values

AWI – Australian Wool Innovation

AWTA – Australian Wool Testing Authority

CC – Continuous grazing

CSIRO- Commonwealth Scientific and Industrial Research Organisation

DSE – Dry sheep equivalent

FECRT- Faecal egg reduction test

Ha – Hectare

IPMS – Integrated Pest Management Sheep

IRG – Intensive rotational grazing

Kg – Kilogram

MLA – Meat and Livestock Australia

Nkt – Newtons per kilotex

OM – Organic matter

RG – Rotational grazing

SGA – Sheep Genetics Australia

SOC – Soil organic carbon

SOM – Soil organic matter

SR- Stocking rate

WEC – Worm egg counts

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Foreword

Since the early 1990's wool prices have declined, leading to a reduction in farm income which is derived from wool. This has resulted in many wool growers becoming despondent and leaving the industry. They have moved into other areas of agricultural production, as they see the price of wool being unsustainable. A common line which I have heard from producers is that "wool prices are low but there is not much we can do about it". This attitude has spurred me on to challenge such an argument. I believe that as individuals we can take back some control and improve income generated from wool production.

Our family operation (Photo 1) derives 70 % of its income from wool so I understand the pressures faced by wool producers. There are a number of challenges facing wool producers in the future in order to ensure the long-term sustainability of the industry. My experiences over the last two years as a Nuffield scholar have enabled me to identify these challenges and possible short and long-term solutions for the wool industry.

The opportunity to travel and look at wool production throughout the production chain brought home to me some key messages. First, there are many factors influencing the marketing of wool and the setting up of alliances. Secondly, that as an individual it is hard to influence what happens in the marketplace, however, if I take a step back and look at the big picture I am in full control of what takes place on my own farm.

This report outlines how improving on-farm practices can increase on-farm production and gross margins thus taking away producers' reliance on a market which is very unstable. It will also show why adoption in the wool industry is required in the future to make wool a competitive fibre. Lastly, the report also outlines why producers need to focus on individual performance and use the industry for the marketing of wool.

Photo 1: Naturalised pastures on the Northern Tablelands of New South Wales, Mt William.

Executive summary

Australia produces 50% of the world's wool (ABARE, 2005). Despite our high labour costs and no government subsides to assist with production, Australian producers are leaders in the production of the world's wool. For this reason there has been major investment by industry to help wool producers improve their on-farm efficiency to retain their standard and ranking in the wool market. This being said, wool producers still fall behind in adopting new information and technology compared to other enterprises. To stay leaders in wool production producers need to embrace new technology and adapt their production systems and products to meet changes in the environment and marketplace.

At the Australian Wool Innovation AGM in Armidale, 2006 the wool poll vote led to the wool levy remaining the same at 2%. AWI at the 2006 wool poll pledged to spend 60% of grower funds on product development and marketing and 40% on research and development for wool production. Producers, however, who tabled questions at the meeting, suggested that all levies should go to marketing and none to research and development.

Wool is an inconsistent textile due to environmental factors (e.g., weather) compared with synthetic fibres which are more consistent. Wool is grown in a natural environment that changes dramatically from region to region. For this reason it is difficult to provide the marketplace with a consistent product, year in year out. In addition, wool producers can easily switch to other agricultural enterprises when market volatility intensifies. As a result of market and environmental volatility processors and retailers find it difficult to source a constant and reliable product. This reduces wool's competitiveness in the marketplace as the retailers source other products. Retailers need a reliable product with a constant supply which is a challenge the wool industry must address in the future.

This report outlines, first the reasons levies should be increased proportionately to research and development before additional funds are allocated to marketing. Secondly how adopting improved grazing techniques, new technology and advanced genetic evaluation developed in Australia and New Zealand will lead to increased on-farm productivity. Adopting such techniques will help to make wool a more reliable, consistent product which will increase its use in the textile marketplace.

Thirdly, with the majority of wool produced in Australia being exported in a raw state, the wool industry can benefit from forming alliances with wool processing operations in China and Italy. In Uruguay there is a close relationship between producers and processors. The Australian wool industry needs to look at how this has been formed to find solutions to increase the level of feedback received for Australian wool processed in overseas countries. More reliable feedback will enable wool producers to supply a higher quality more consistent product. The report will outline how industry can work with these countries to help further develop markets for Australian wool.

Lastly, the report outlines consumer sentiment towards wool. How an integrated approach to marketing wool can take advantage of the high level of disposable income in developed nations in particular North America. The wool industry can tap into this market by targeting these areas with high quality, high end fashions. The use of branding to distinguish between high quality, next to skin wear and outer garment clothing will play a vital role in the marketing of wool. As will the marketing of wool as a natural, clean green fibre as the world moves towards more natural products, especially in developed nations. To help gain an insight into the above mentioned aspects of wool production, some of the places I visited included various wool processing plants situated in China, Italy and Uruguay and retail outlets in North America, China and Italy.

The benefits of using technology on-farm will be of great advantage for the wool industry in the future. Being able to increase production with minimal additional infrastructure costs allows wool to be grown at a reduced cost. Adapting to new technology will not only help reduce the cost of production but will also aid the production of wool with a lower reliance on chemicals will allow wool to be marketed as a clean green product. This in turn increases the competitiveness of wool in the marketplace. The flow-on effect is that processors have more wool, which allows them to work on lower margins. Wool will then have an increased use in the retail sector. As we have increased the amount of wool, wool levies will be increased allowing more money to be available for marketing. Adopting these changes will allow producers to take advantage of possibilities in the future for carbon trading schemes. Such schemes will help the wool industry to remain sustainable in the future as it may generate another source of income. Adopting an integrated approach to wool production and marketing will contribute significantly to maintaining Australia's position as a world leader in wool production.

Aims and objectives

- To evaluate on-farm techniques and grazing practices which increase farm profits by increasing production and lowering costs.

- To assess the potential for genetic progress to increase on farm production. To determine how genetic evaluation of Merinos in Australia will aid wool producers to increase their incomes.

- To gain a better understanding of wool processing outside Australia with the aim of giving wool producers an insight into the stages of processing wool after it leaves the farm and how this may impact on their production systems.

- Evaluate current and future strategies for marketing wool including identifying new markets and determining whether the natural clean-green image of wool will be a successful marketing strategy in the future.

- To investigate possibilities for income derived by carbon trading in the future to counter the possibility of methane tax being introduced on animals to reduce agricultural greenhouse gas emissions.

Introduction

Growing up on our family's fine wool Merino farm I have certainly been part of the highs and lows of not only the wool industry, but also agriculture as a whole. With the inception of the reserve price (a guaranteed minimum reserve price for wool) in 1974, wool incomes rose until finally the volatility in the marketplace was reduced and wool growers could budget on expected incomes. Was this sustainable? Recent history would suggest not, interference in a free market alters the dynamics of supply and demand. In the late 1980's, sheep numbers, wool volumes and wool prices rose to unprecedented levels and supply was outstripping demand coupled with this was rising interest rates. As a result, the industry was faced with a stock pile of wool (4.6 million bales) purchased by the Australian Wool Corporation for which, due to the lack of demand, there were no buyers. The reserve price was no longer sustainable. Overnight the price of wool went from $8.70/kg to $4.70. (Radio National 2001). Imagine trying to do a budget when your income has been halved and interest rates are around 20%!! Consequently, wool growers and wool processors were forced to leave the industry.

Since the abolition of the wool reserve price scheme in 1991, wool production has been reduced and costs of production have continued to rise resulting in a decrease in farm incomes derived from wool. This has been reflected in a drop in sheep numbers from 163 million in 1991 to the lowest level since 1929, (86.3 million) in June 2007 (Gunning-Trant, 2007).

As sheep numbers reduced and the wool in the stock pile was sold in 2002 prices rose gradually over the period from 2003 until the present. Once again we have to ask the question: are current wool prices sustainable? We have seen rising demand in the manufacturing sector (for wool), particularly in China on the back of a much lower wool supply. Reduced wool volumes also means the possibility of a reduction in the market share of wool and less money being available for the promotion and marketing of Australian wool. So where should wool producers be focused; production or marketing and what does the future hold for Australian wool growers?

I have been very fortunate over the last six years, to be involved in a trial on our property, 'Mt William', funded by Meat and Livestock Australia (Management Solutions Project run by Dr Lewis Kahn). The trial is being run under commercial conditions and focuses on aspects of Merino ewe production to improve long-term sustainability. There have been various trials similar to this undertaken around the globe. The outcomes of such trials show a potential to increase production and profit by up to 60% which is both economically and environmentally sustainable. (Kahn 2005; Charlton, J. F. L., & Wier, J. H. 2001)

Producers can control on-farm production while the marketing of wool has many aspects out of the control of producers. If the industry becomes preoccupied with marketing it may loose sight of Australia's comparative advantage in wool production. Improved management will result in a more efficient production of wool. This will greatly reduce the wool producers' over-reliance on receiving a high price for their wool to make a profit, as they will have more wool to sell without the increasing costs of production thus they can increase profit even if the end price received is reduced. A lower reliance on market prices takes away associated risks of volatility of the wool marketplace. In addition, if the price of wool spikes, producers will be in a position to take maximum advantage of the price rise.

There is a great deal of information currently available to wool producers which gives rise to other issues: how many livestock producers use this information? Is the information readily available? Do wool producers adopt change? Can the information be collated in a manner easy for producers to find and use? After these questions have been addressed it becomes clear that the lack of adoption of current information and technology by producers is a major threat to the sustainability of the wool industry and will therefore be addressed in this report. I believe that the challenge for the industry is to increase the adoption of information and the willingness of wool produces to use new technology. If this can be achieved it will assist the wool industry to be a sustainable and viable industry in the world marketplace.

My Nuffield experiences

The Nuffield scholarship has given me the opportunity to access information and gain experiences which have been invaluable in expanding my knowledge base of the wool industry. My travels have enabled me to identify key aspects of production and issues relating to the processing and marketing of wool which I believe will be vital in ensuring the sustainability and profitability of the wool industry in Australia.

1. Production

Through my experiences I believe that there are many aspects of production which influence the productivity and therefore profitability of the wool industry. These include stocking rates, grazing management, pasture and livestock budgeting, decreased reliance on chemical anthelmintics for internal parasite control and the use of genetics. Increases in on-farm gross margins by up to 60% (New Zealand and Australia) (Kahn 2005; Charlton, J. F. L., & Wier, J. H. 2001) have been achieved by implementing such strategies.

Stocking rate

A key to increasing profit in any industry is to lower the cost of production. The best way to achieve this in the sheep industry is to lift productivity with only minimal increases to the costs of an operation. Lifting stocking rates (total number of dry sheep equivalents (DSE*) per ha) will increase production with minimal costs. Stocking rate refers to the total number of grazing animals on a DSE basis that can be carried on a given area of land averaged over a 12 month period. If we are able to efficiently utilise our pasture and enhance pasture growth we are able to lift stocking rate. Lifting stocking rate may in some cases reduce individual animal performance but will increase per hectare production which is the major component of profitability. Minimal risk grazing practices that help to lift stocking rates are outlined below.

*A DSE is one 50 kg wether. The notion behind this is that one 50 kg wether will eat 1kg of dry matter per day. This can then be expressed across all species of livestock, (eg a cow and calf is 15 DSE).

Grazing management

To fully understand the principles behind effective grazing management it is important to understand the history of animal behaviour. Before mankind began to farm animals for his own needs, animals grazed unrestrained all around the world in different environments. As grazing animals were preyed upon, they tended to stay together in herds or flocks for protection. Once they had grazed and fowled-up an area they would move onto a fresh area, leaving the grazed area to regenerate. This pattern continued until they would move back to the original area. The animals would remain in a group and move together to water.

This herd movement around grazing areas and to water points trampled the longer dead pasture into the ground increasing soil organic matter and hence soil fertility. The removal of longer dead pasture allowed sunlight into the pasture sward, helping to regenerate young plant growth. This increased soil fertility favoured the growth of a sustainable system of perennial, deep rooted pastures. These deep rooted perennials could reach water lower down the soil profile, which assisted growth especially under drought conditions. The level of grass on top of the soil is equivalent to the root mass under the ground. Thus, when the grasses are grazed shorter some of the root reserve dies off adding organic matter and nutrients to the soil which encourages vigorous pasture regrowth once it is allowed to regenerate.

This historical grazing pattern was a highly sustainable system, as nutrients entered and left the system at a similar rate. This form of grazing also provided the grasses with a sufficient rest period to fully recover from the previous grazing period. As a result, perennial species dominated such systems which were evident throughout the prairies and open savannas around the globe.

Historical grazing patterns were interrupted by the introduction of man into the ungulate's world and domestication resulted. Controlled grazing was used to manage sheep to provide farmers with an income and food. The first systems operated by man were the nomadic grazing systems (Zimmer 2006). Here the animals were protected from predators by shepherds or herdsman. The animals were moved from one area to the next to graze on the highest quality pasture available. These nomadic grazing systems are very similar to rotational grazing (RG) which are gaining popularity in the agricultural world and is outlined below. Nomadic grazing is still in operation in many countries.

As labour costs have increased coupled with the time consuming task of moving and protecting animals from predators, new techniques in western civilisation have emerged. Fencing was used to confine livestock and water was made available in these confined areas. The result was an easy low cost system of grazing management which kept the predators out and the livestock in. This was the inception of the continuous graze (CG) system described below.

Chemical fertilisers were then discovered which increased pasture growth rates and short-term productivity. The major disadvantage of the CG system was that pastures which were sustainable in their natural environment and had evolved and adapted over many years had become unproductive under CG and were eventually grazed out. New grass species then evolved and, in addition, some were introduced.

The two main techniques used in grazing management today are CG and RG, both of which will be mentioned throughout this report. An Australian farm survey conducted in October 2005 by integrated pest management-sheep (IPM Sheep), showed that 38% of respondents use RG, with only 6% using Cell Grazing (a form of intensive rotational grazing, IRG) and 48% of respondents used CG.

Continuous Grazing

Continuous Grazing is often referred to as *'set stocking'*. This is a simple, conventional system which has emerged since farmers were able to confine domesticated grazing animals (sheep, cattle and goats). The system allows livestock to graze a fixed area (paddock or field) of pasture throughout the year. The number of animals in the paddock generally remains the same throughout the year. The benefits of the system are lower inputs of infrastructure (water and fencing) and lower labour costs as the animals are moved infrequently. Disturbance of the stock during critical times in their lifecycle i.e. lambing ewes or calving cows, is minimised as the animals are left alone most of the year.

In a CG system animals have access to the entire paddock therefore they are able to select where they graze. This can help individual animal performance as they are able to selectively graze plant regrowth which is of a higher nutritional value. The downside of selective grazing is that it may lead to overgrazing of the most palatable species which may result in them being removed from the pasture sward altogether. This may allow non-palatable weeds to occupy the grazed area. The selective grazing of animals may lead to overgrazing of some areas and under grazing of other areas. The result is reduced grass productivity, as the over-grazed areas have reduced foliage to photosynthesise. The under-grazed areas become less productive as the young growth becomes shaded from sunlight by the older, taller foliage. This reduces the plants' ability to produce young, highly nutritive tillers which are most palatable to stock.

Continuous grazing encourages the uneven transfer of nutrients in a paddock. When animals are allowed to graze the whole paddock they eat pasture on any given area, then travel to a preferred area (generally around water) to camp. They defecate on this area and once rested move out to graze again and repeat the process. Research from CSIRO, Australia in the late 1960s suggested that 40% of faeces ended up on 4% of the paddock under CG. This means that a small area of a paddock has a greater than average level of nutrients and the remainder of the paddock is lower than average. A greater application of fertiliser is then required than would have been required if the nutrients had been evenly distributed as the amount of nutrients being transferred to one small section of the paddock far exceeds the amount removed from the paddock when the produce (wool and meat) is harvested.

Rotational grazing

A RG system involves the division of a paddock into smaller areas, where sections are grazed for a short period of time (1-5 days) and then rested for a longer time (40-140 days). The greater the number of paddocks, the shorter the graze period and the longer the rest period, the more intense the system becomes. Very intensive systems are often referred to as IRG (Intensive rotational grazing). There are various forms of rotational grazing (cell, strip, time controlled, block and TechnoGraze™). In contrast with CG, RG has greater inputs; more labour is required to move the livestock and there are greater infrastructure costs as more watering points and fences are required. With intensive rotational grazing (IRG) these costs are greater still, but the productive and financial benefits from such systems are also increased. There are generally fewer mobs of a greater size and smaller paddocks than with CG. The animals are rotated from paddock to paddock to access fresh pasture. The rest period or rotation length is generally determined by the pasture growth rate. Movements are made quicker through high growth and slower when the growth is low.

Research in New Zealand (Photo 2) and Australia has shown that RG has the potential to increase pasture growth compared to conventional grazing systems by 30-50%. Kahn (2003-2005); Charlton, J. F. L., & Wier, J. H. (2001). RG, therefore, has the potential to lift stocking rates by at least 20%. In many cases it is higher than this. The reason for the increase in pasture under RG is that the system allows greater control over the management of grasses and increased pasture utilisation over the grazing area. This allows the pasture to be kept at a more even level and consequently a higher level of digestibility as the grasses remain in a vegetative state for longer. There is, therefore, plenty of leaf area for maximum photosynthesis and reduced older growth thus young foliage is not shaded out so it continues to grow. A higher percentage of green material leads to higher digestibility in the sward increasing productivity.

Photo 2: Intensive rotational grazing in New Zealand improves pasture quantity and quality.

Due to a shorter graze period there is less selective grazing of desirable pasture species and a greater period of recovery before they are grazed again. This is more conducive to the persistence of perennial grasses than in a CG system. Perennial species are desirable as they have a deeper root system to access water further down the soil profile thus prolonging their growing season. Perennial species have a short period of reduced growth or dormancy, during this period as the pasture is spelled annual species will grow and provide valuable feed. RG results in an even grazing pattern; therefore, there are fewer invasions from non-desirable species as they have greater competition from the rested pasture. RG also increases ground cover which contributes to better water usage. All of these advantages add to increased productivity and sustainability.

One disadvantage sometimes seen in RG is that individual animal performance can be reduced even though the pasture in the RG maybe of a better quality. The reason for this is that CG animals can selectively graze the paddock, allowing them to continuously graze the higher palatable species, with a higher nutritive value. This however, results in less desirable pasture species reaching maturity. When grasses reach maturity they are often less palatable to stock as their digestibility and protein content is low. The ability to increase stocking rate in RG systems more than compensates for the reduction in individual performance as RG increases profitability on a per hectare basis.

The distribution of nutrients is much more even in RG systems. As animals are moved around they excrete evenly throughout the system, hence there are normally no stock camps. This even distribution of nutrients in the RG system means the whole area has a more even fertility and fertiliser requirements maybe reduced.

Australia has such a diverse range of climate, rainfall, topography and temperature conditions, so RG systems need to be flexible. Different areas will use different systems; however, they can be adapted to work in all environments. The benefits of the RG seen throughout trials in Australia and New Zealand are increased production, sustainability (environmentally and economically), ground cover, litter (leading to higher organic matter), animal health, gross margins, reduced parasite infections and reliance on chemicals for their control.

Pasture quality is able to be more finely controlled in an IRG system. The sheep will, therefore, be on a more even plane of nutrition throughout the year. An even plane of nutrition has a positive affect on wool quality as staple strength will vary less, resulting in a stronger overall staple strength. Wool quality is also increased by a reduction in vegetable matter in the wool; this is due to a lower quantity of woody weeds such as thistles and burrs. As the sheep are keeping the grass in a more vegetative state, there are less mature plants with seed heads to contaminate the wool.

Kahn (2003-2005), showed that Techno Graze™ an IRG system on the Northern Tablelands of NSW increased pasture growth rates by 30%, stocking rates by 40% and gross margins by 46% compared to CG. This gross margin was 47% higher than the NSW DPI average for a self-replacing Merino flock. Environmental indicators also showed positive results from the IRG system. There was 5% less bare ground, 7% less woody weeds and an increase in water infiltration rates of 27%. The IRG had reduced run-off and lower evaporation which would improve ground water quality and leave more available moisture for transpiration (plant growth).

In New Zealand using the Techno Graze™ system, the following results on several cattle production enterprises have been recorded: (Charlton, J. F. L., & Wier, J. H. 2001).

- Jamie Gunson doubled stocking rate (12 stock units to 25 stock units) and live weight gain per hectare (550 kg/ha to 1190 kg/ha)
- Angus Mabin showed increases from 1.9 bulls/ha to 3.7 bulls/ha
- Nick Prendergast showed increases from 1.5 bulls/ha to 3.7 bulls/ha
- Andy Scoular showed increases from 540 kg liveweight gain/ha to 900 kg liveweight gain/ha

These systems are starting to be implemented in Argentina and Uruguay (Photo 3). As these systems are still very new it is hard to quantify production increases as producers are still fine turning their systems.

Photo 3: Intensive rotational grazing system in Uruguay. Paddocks on the left are about to be grazed, paddocks on the right have just been grazed. The system was under a rotation of a 2 day graze with a 50 day rest period.

Grazing case study from North America

In the North American state of California originally the prairies were filled with native perennial grasses (predominately prairie grass). These grasses had deep roots which had become adapted to the environment and supplied plenty of high quality feed to the native animals. Over-time, with stock being confined to and grazing the same area continuously the perennial species gradually became less dominant until they were eventually grazed out. Today, these areas are comprised of short-term annual species as they have adapted to the new grazing system. These annuals have increased productivity over a short period of time during the wet season; however, their long-term productivity is greatly reduced. Annuals have shallow root systems which are unable to access water deeper in the soil profile; therefore, they only grow when rainfall occurs. This has lead to a problem now faced by many producers where the prairies are only grazed for the growing season (winter in California), the stock are either sold and bought again in six months or trucked to other states during this time. This is a substantial cost and is seemingly unsustainable given the recent increases in oil prices.

The belief among Californian producers is that there are no perennial species left in the seed bank and that current grazing practices have dominated for so long that the original perennial pastures will not return. This, however, may not be the case. In some of the regions I visited in California where RG was being used there were large stands of perennial grasses (Photo 4B). With their deeper roots these grasses were still green and growing, even under severe summer conditions (low rainfall and high temperatures) while the areas which were under a CG system had barely any ground cover or growth (Photo 4A). The increased ground cover under the RG also resulted in less evaporation, leaving more available water for transpiration, further increasing pasture production. In addition, some producers were sowing introduced perennials 'large pular grass', known in Australia as phalaris. Large pular grass was performing well during the summer months when annuals had ceased to grow. The pular grass had an estimated yield of 10 tonnes per ha compared to annuals which produced 4 tonnes per ha. California was also a centre for research in carbon sequestration using deep rooted perennials which will be discussed later in this report (B. Burrows 2007, pers. comm., 21 September).

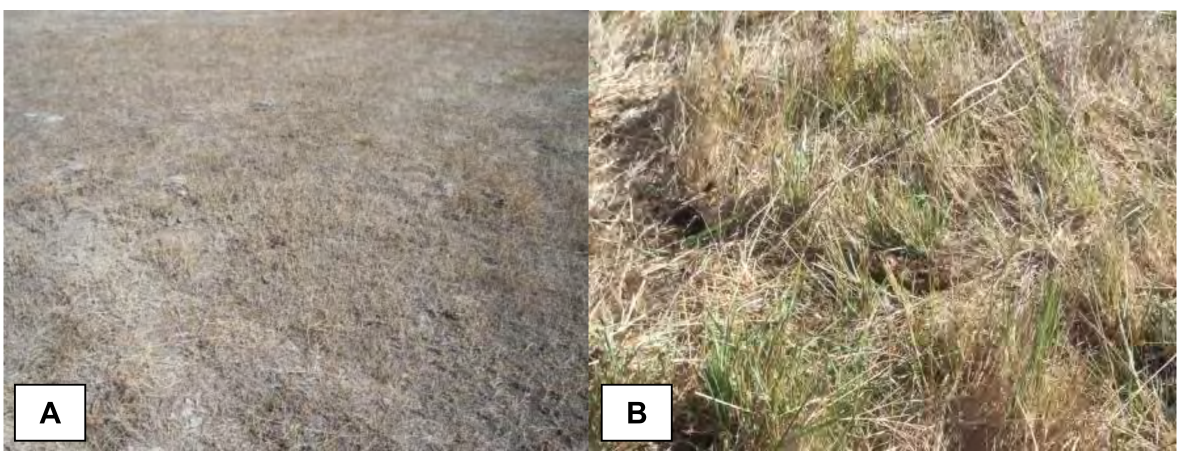

Photo 4: Grazing management in California A.) Continuous grazing resulting in dominance with annual species and low ground cover B.) Intensive rotational grazing resulting in the dominance of perennial species with very high ground cover.

With such results from RG the question then needs to be asked, why are only 38% of wool producers in Australia using RG systems, with only 6% using cell grazing (Australian Wool Innovation, 2004)? The importance of adoption will be discussed later in this report. Other advantages of RG, which will also be discussed, include parasite management, the possibility of carbon trading, sequestration and the marketing of natural products.

Pasture budgeting

Pasture budgeting is an extremely important tool used to manage pasture for livestock requirements. In its simple form you measure the height of the edible pasture in centimetres, to the top of the leaf area. This is what would normally be consumed by the animal. This measurement equates to the amount of grass available to stock per hectare. This estimate will change depending on the species and density of pasture (Table 1).

Table 1: Estimation of pasture density (Kahn and Earl, 2005)

Pasture density (kg DM/ha/cm)	**Description**
150	Ground readily seen through sparse pasture
200	Ground seen through sparse pasture
250	Ground occasionally seen through average pasture
300	Ground not visible through average pasture
350	Good pasture density
400	Dense pasture
450	Very dense pasture

Using the DSE rating of the animal and the amount of grass that will be eaten per day it is possible to budget for the amount of feed that is available and SR can be adjusted accordingly. This is essential as pasture growth rates are frequently changing depending on rainfall and temperature. In the best conditions where water is unlimited and temperatures are warm pasture can grow faster than 150 kg/ha/day, under stressful conditions (e.g. no water and extremes in temperature), pastures may not grow at all. This is particularly important when assessing how many stock can be carried through the non-growing season. The result of pasture budgeting is that producers are able to make informed decisions on the SR of particular pastures and when to de-stock or buy more stock.

Livestock budgeting

Budgeting livestock is an extremely useful tool and works hand in hand with pasture budgeting. Budgeting allows producers to take advantage of critical times when pasture growth is high or low. Producers will aim to match pasture growth rates with critical periods in the animal's lifecycle e.g. late pregnancy and lactation. Using pasture budgeting, it is possible to match livestock requirements to pasture quality and quantity. For example, prior to joining, ewes need to be on a raising plane of nutrition to reach a target fat score* of 3+ to achieve a maximum fertility. By evaluating rainfall, temperature and the available feed it is possible to prepare pastures in advance for such a period to insure adequate nutrition is available to meet an animal's nutritional requirements.

During the non-growing season it would be best to graze animals which have low feed requirements e.g. dry animals (not pregnant), as the pasture will be lower in quality. If the pasture quality and growth rates start to decline earlier than expected producers can use their budgeting to make informed decisions on destocking before the stock or pastures are jeopardised.

*Fat score is a subjective measurement based on the actual soft tissue depth at the Greville site which is situated 110 mm from the midline over the 12th rib.

Parasite management

Infections from gastrointestinal parasites are one of the major economic constraints to the Australian sheep industry, due to production losses and costs associated with their control. It has been estimated by McLeod (1995) that internal parasites cost the sheep industry $A 222 million a year, with the Australian sheep flock close to 120 million. Holmes, Sackett & Associates (2006) estimated the cost of internal parasites to the sheep industry to be close to $A 369 million with a sheep flock of 90 million. This is a large increase in cost, with lower sheep numbers. This will continue to pose a major problem to the sheep industry. Below are methods which will help producers over come the problem.

Traditionally, producers have used drenches (anthelmintic based compounds) to control internal parasites. This has led to an over-use of drenches and parasites have become resistant to all classes of drenches available, thereby reducing their efficiency. Currently, many producers are waiting for a new drench, of which there are none in the foreseeable future, so the sheep industry needs to move towards a more integrated approach to parasite management, which will lessen the dependence on chemicals.

Strategies which can be incorporated into an integrated approach include grazing management, alternating grazing between species of livestock (e.g. sheep and cattle), worm egg count tests and drench resistance testing to minimise the use of drenches, the use of grass species containing secondary derived tannins known to be effective in the control of parasites, protein and energy supplementation and genetics.

Grazing management

Grazing management can easily be incorporated into an integrated approach for parasite management and is important for two reasons; first to provide animals with adequate nutrition to withstand infection; secondly, to reduce pasture contamination by parasitic larvae.

As animals graze they expel worm eggs onto the pasture through faeces. Under the right conditions (temperature and rainfall) the eggs hatch into larvae and when the animals graze on the pasture they become infected and the cycle starts again. In the CG system the animals are grazing the same area constantly so worm eggs are being deposited and then ingested continually. This allows the cycle to continue on for most of the year while conditions are favourable. To reduce the parasite infection we need to break the cycle. The most common approach is to drench animals with anthelmintic compounds. The problem with this is that the animals continue to graze and pick up more larvae, so producers continue to drench to control infections. This continued use of drenches has resulted in the development of resistance in parasites to all classes of drench currently available.

Rotational grazing offers a strategy to break the parasite breeding cycle without using chemical drenches. Results as early as 1933 (Robertson and Fraser) have shown that having a 10 day graze and 90 day rest reduced infestations of *Haemonchus contortus* by 99.2% and *Trichostrongylus circumcincta* by 80.8% in ewes rearing twin lambs in the north of Scotland. The reason for this early success was that the long rest period resulted in a substantial decline in the number of infective larvae on the pasture before it was re-grazed.

Healey (2004) showed benefits of RG on parasite infections of Merino weaners on pasture in a summer rainfall environment in the New England region of New South Wales. RG was shown to lower worm egg counts and required less drenches compared to that of CG Merino weaners. The typical grazing pattern was a 3 day graze followed by a 108 day rest.

Kahn (2003-2005), showed differences in worm egg counts in Merino ewes and weaners grazing in the New England region of NSW. In 5 out of 6 years the animals in a RG system had 10-50 fold less worm eggs in their faeces than those grazing in a CG, system. The grazing pattern for the RG system was 2-5 days grazing and a spell period of 40-90 days.

The effectiveness of RG systems to reduce worm burdens is due to the rest period being long enough to cause infective larvae to slowly die out. The rest period prevents infective larvae being ingested by stock and therefore the parasite cycle is broken. Another critical factor to the success of RG is the length of the graze period. It is important that the graze period is short enough to prevent auto-infection within a single grazing, a graze period of less then 4 days is ideal. Temperature and rainfall greatly influence the survival of larvae on pasture (Figure 1). The success of RG to control parasites can be partly attributed to the rest and graze periods utilising the parasites inability to survive certain temperature and moisture levels as seen in figure 1 a rest period of 50-90 days greatly reduced the chance of infective larvae surviving.

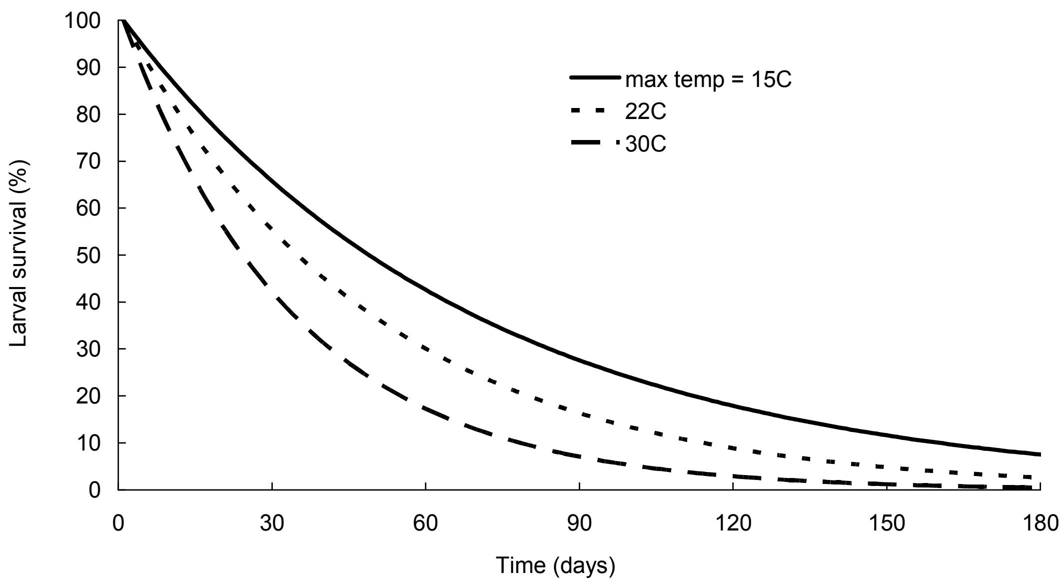

Figure 1: Survival of *Haemonchus contortus* on pasture as influenced by temperature (calculated from Barger et al, 1972).

IRG is starting to be accepted but is slow to be adopted in Australia for parasite control. In New Zealand and Uruguay, while their climate differs, grazing management is not used as a form of parasite control. Producers in these countries feel that there are other methods for parasite control more suited to their production systems, the most common being drenching. Despite the lack of agreement, grazing management could be adapted to suit such production systems and lessen the dependency on chemical drenches and therefore alleviate the increasing problem of anthelmintic resistance in New Zealand.

My experiences in Australia, New Zealand and South America has shown that producers claim parasite control as a major reason for changing livestock enterprises away from sheep, however, grazing management for internal parasite control is seldom practiced or explored as an option before such changes occur.

Refugia

Refugia refers to the practice of increasing the number of parasitic larvae which are susceptible to drenches in the environment with the aim of decreasing resistance to chemical drenches. This can be achieved in two ways: first the growing of larvae susceptible to chemical drenches and introducing them onto pastures. These larvae will dilute the resistant larvae present as the resistant and susceptible larvae will breed together allowing the level of resistance to drenches to decrease. The second is to leave a proportion of the flock un-drenched (10-20%). This reduces the amount of parasites being exposed to the drench, so there is a greater level of parasites sensitive to drenches remaining on the pasture. This is being explored in New Zealand and currently has much more attention than rotation grazing for parasite control in the country (D. Leithwich 2007, pers. comm., 13 September).

Using pastures to control parasites

New Zealand researchers have shown that sowing pastures with a mix of herbs can help reduce worm burdens and improve productivity. These pastures are alternative forages containing secondary compounds which aid in the control of internal parasites (Ramirez-Restrepo and Barry, 2005). The forages used in New Zealand were the herb chicory (*Chicorium intybs*) and a legume *Lotus corniculatus* which contained levels of condensed tannins. The research showed that animals grazing on these species had increased growth rates and reduced parasite infections by up to 50%.

The internal parasites suppression occurs due to the presence of the secondary compounds, condensed tannins and sesquiterpene lactones which have anti-parasite properties (Molan et al., 2003). These two secondary compounds occur in many temperate pasture species. Of the two components condensed tannins are seen as the main reason for the reduction in parasite infection. The condensed tannins form a pH reversible reaction with forage proteins, which reduces the degradation of protein to ammonia by rumen organisms and the release of proteins at low pH in the abomasum (Jones and Mangan, 1977).

The herb based pastures can be incorporated in grazing systems throughout temperate zones of Australia to aid in the control of parasites and to increase productivity. The main draw back is that they need to be sown and are managed more easily when grown as a mono-culture. Theses species are mainly summer active, so unless they are given an increased rest period over winter their persistence and therefore sustainability will be greatly reduced. In the Australian environment these species may need to be re-sown every 4-6 years. It may, however, be possible to incorporate these species into a RG system by introducing them into part of the system e.g. 1/3rd. This area could be rested over the winter months and grazed through the growing season. The growing season generally coincides with the lactation period. As lactating animals are more susceptible to internal parasites the incorporation of these pasture species may be profitable in certain production systems to reduce parasites and improve the growth rates at susceptible stages of their lifecycle.

Smart graze

'Smart graze' is a method of grazing management developed in Victoria to control parasites (Niven et al., 2002). It has, therefore, mostly been used in winter rainfall areas (Worm boss, 2008), but recently has been trialled in summer rainfall areas with encouraging results (Bailey et al., 2007). 'Smart graze' combines both IRG and drenching to control parasites. The sheep are drenched with an effective drench and then put in a paddock at high stocking densities for no more than 30 days. As the drench kills the adult worms in the stomach of the sheep and it takes three weeks for the worm larvae to develop into an egg laying adult, this drenching/grazing regium will prevent re-contamination from parasitic larvae. The pasture is then spelled and given time to re-grow. Stocking rates on the smart grazed paddocks are 3 times the density of CG systems. Once the pasture has re-grown the animals are then drenched and returned to graze the paddock again, for no longer than 30 days. The animals are then removed. After another spell the pastures are generally free of parasites. Using this technique worm counts of sheep moving onto the clean pastures were half those of animals grazed under conventional CG systems.

Worm egg monitoring

Worm egg count (WEC) tests are simple inexpensive tests performed on the faeces of sheep to determine their level of parasitic infection. The test can be done on an individual or flock basis and is currently acknowledged as the best method available. The technique involves collecting faeces and counting the number of worm eggs under a microscope. The number of eggs counted can be converted to the number of eggs per gram of faeces. The faeces are cultured for two weeks to allow larvae to hatch and determine the genera of parasites present. Both the number of eggs and genera present is important to determine: first, whether drenching is required; secondly, the most appropriate drench to use for the parasites species present.

In an Australian farm survey in October 2005 (AWI, IPMS) 44% of respondents used WEC to monitor whether drenching was required, however, only 18% used professional advice to interpret these results. This is important as consultants can help design a program which will aid in slowing down the onset of resistance. WEC also saves money as the costs of using trained technicians is lower than the cost of using drenches that have reduced efficiency and may not be required in the first place. Producers often drench animals when they look ‘wormy’, in most cases sheep do not have high infection levels and do not require a drench. Judging an animal’s level of parasitism by sight is not an effective method of determining whether a drench is required or not, however, anecdotal evidence suggests that this is common practice. While 44% of respondents claimed to use WEC, on average three times a year, I believe that this is not a true reflection of what is occurring. Many producers will often drench before sending a WEC away for analysis when sheep look poorly.

Drench resistance testing

Drench resistance tests determine the efficacy of drenches being used on an individual property. There are two main ways of testing for drench resistance; the faecal egg count reduction test (fecrt) and more recently Drenchrite™. The fecrt involves selecting a group of young animals that have been grazed together that have a parasite infection. The animals are identified individually then have individual egg counts taken, this is recorded and then the animals are treated individually in groups with a different drench type per group (around 15 sheep per group), with one group remaining un-drenched (control group). The animals are grazed together then re-mustered 10-14 days after the treatment. Individual egg counts are then taken. The eggs are counted and the efficiency of each drench is obtained by comparing the number of eggs present after drenching with the pre-treatment counts. The average of eggs present from each treatment is then compared. If there are eggs present then there is a certain level of resistance to the drench. The resistance is calculated by comparing results from the treatment groups to the control (untreated) group. If this is the case drenching the animals with the ineffective drench is not only costing producers money but will also reduce production.

The Drenchrite™ product allows assessment of resistance to the Bezimidazole (BZ), Levimosle (LEV) and BZ/LEV combination products by measuring the effects of these products on the ability of eggs to develop into larvae. This test is not as reliable in detecting resistance to Macrocyclic lactone (ML) drenches. The test involves placing worm eggs into wells on a microtitre plate which contain different concentrations of drenches. The numbers of eggs which develop into larvae are then measured. This gives the efficiency of the drench tested.

The results from the national survey for IPMS (AWI, 2005) show that 48% of producers have done a drench resistance test, with only 23% testing in the last two years. The survey, however, showed that only 33% of respondents used the drench resistance tests methods described above, which are the only certified options. Drench resistance testing is an important step which enables producers to make an informed decision on which drench or drenches to use and rotate within a drenching program designed to prolong the life of drench groups and to maximise the efficiency of drenches.

Grazing with different livestock classes

The main livestock used for this alternation are sheep and cattle. This is an effective strategy as most internal parasites are host specific. This means that most parasites will only infect either sheep or cattle, not both. The ingestion of parasites by a non-specific host will kill the larvae and prevent it being ingested by a specific host.

Grazing cattle for six months prior to grazing of sheep has shown to reduce the numbers of *Haemonchus contortus* and *Trichostrongylus spp,* by at least 94% (Wormboss, 2008). While a longer period between grazing sheep and cattle is desirable, results have been shown using periods as short as six weeks. When using such a system you can prepare paddocks for the most susceptible livestock on a property (e.g. weaner sheep and pregnant ewes). If cattle are grazed on pastures prior to weaner sheep there is less chance of the animals becoming infected by internal parasites.

Genetics

The major issues of genetics relating to sheep production will be discussed later in this report. Resistance of sheep to parasites has a heritability of .25 which is classified as moderate to high heritability. It is, therefore, possible for producers to select rams for their ability to resist parasitic infections. This is fairly new technology and current research suggests that only 14% of producers use this tool when selecting rams for breeding. This is a long-term proposition as it can take up to 18 years to breed animals that require nil drenches (CSIRO, 2000). The major limiting factor contributing to its lack of adoption is that producers put a greater emphasis on breeding for direct production characteristics rather than parasite resistance (S. Gill, SGA 2008 pers. Comm., 18 January).

Protein and energy supplements

The animals that are most susceptible to parasitic infections are weaner sheep and ewes prior to and during lactation. These are critical times for growth; therefore, parasite infections can greatly reduce their production. Increasing the energy and protein supply to an animal can enable them to better withstand parasite infections. (Kahn, 2003-2005) showed that ewes fed 200 g/day of cottonseed meal pellets (a protein source) in the last six weeks of pregnancy had reduced WEC by 31% compared to the non-supplemented ewes. Supplementary feeding at this time also increased the number of lambs weaned in single-bearing ewes by 5%.

In New Zealand, nitrogen based fertilisers are applied to the pasture to increase pasture quality and quantity. This gives similar results to supplementing animals directly, the current practice used in Australia. For the nitrogen to work in a beneficial manner rainfall soon after application and warmer temperatures are required. For this reason and due to the increased cost of chemical based fertilisers this practice would be limited at certain times of the year in Australia.

Using one or more of the techniques mentioned above will not only help reduce the need for drenches to control internal parasites but also will also help improve animal performance. When a combination of techniques is used, the result will be increased control of parasites and a lower dependence on chemical drenches. Not only will this help delay the onset of drench resistance, producers can also promote a clean green image. Integrated programs are flexible and can be adapted to suit all environments and production systems. Utilising aspects of production can reduce the cost of production, while increasing productivity and increasing the clean-green image of Australian agriculture.

Genetics

Genetic selection by objective measures of profitability has been widely used in many livestock industries to increase production and profitability (dairy, poultry, pork, beef and lamb). The move from animal breeding as an art, to breeding as a science has been slower in the Merino industry than in the pork, poultry and dairy industries. For instance, turkey breeding has been concentrated into just two companies worldwide, with a clear focus on improving the profitability of commercial birds. The picture in the Merino industry was quite different, until 2005; there were numerous different groups providing genetic evaluations of Merinos. In 2005, the industry moved to a single genetic evaluation, with the data compiled into a single database with Australian Sheep Breeding Values (ASBVs), this allowed commercial producers to select the best rams across flocks for particular traits. The database is maintained by Sheep Genetics Australia (SGA) and it contains genetic information on all the major sheep breeds.

The Merino industry has long used objective measurements for fleece weight and micron. These have been measured for individual animals and have been extremely useful in increasing productivity. These individual measurements can only be used to compare animals within one flock that have been run under the same conditions. There will be differences across years that are not related to genetics that will be reflected in these results. The use of Best Linear Unbiased Prediction (BLUP) genetic evaluation allows the industry not only to be able to compare animals on one property but across flocks and in different environments as long as there is sufficient linkage between the pedigrees. From this it is possible to further increase the potential for genetics of animals for selected traits over time. With the low wool prices and high meat prices of recent years there has been a push for better carcass traits in Merinos. In response to this, MLA has put together the Merino Validation Project. The project provided funding for Merino producers to test for eye muscle area, fat depth, carcass weight, scrotal circumference and parasite resistance. As a result, producers could select for a dual-purpose Merino with both meat and wool traits. It also showed that selecting for worm resistance without losing productivity of other traits was achievable. Staple strength measured in Nkt makes up 38% of price variation in wools less then 18.5 micron. This equates to $5.00 /kg in the price differentials between similar wools.

SGA evaluations have shown that there has been variation between different sires run under the same conditions of up to 50 Nkt, the range being 70 Nkt to 20 Nkt. Staple strength can be built into a selection index and is highly heritable. Genetic progress in Merinos, has shown that at the current rate of progress an increase of $1.40 in gross margin per year per ewe joined can be achieved (A. Ball, SGA, 2008 pers.comm., 21 February).

New Zealand Merinos are now registered with SGA which shows that using ASBV's we are now able to compare sheep from different countries. Producers in Uruguay and Argentina are now selecting Australian Merinos using this selection tool to improve the production of their sheep.

Genetic improvement is much faster in other industries. For example, there are two seed stock turkey companies in the world, providing turkeys to commercial breeders. "High Bred" turkeys are situated near Kitchener, Ontario Canada. They are currently gaining 0.45 kg of breast meat per hen per year; this has a flow on effect of 1.7 million tonnes of turkey meat worldwide. The focus of the breeding program is to develop pure-bred lines that when crossed will maximise profitability. As the pure lines bred in Kitchener are used as grandparents they breed separate male and female pure lines that have selection indices designed for a particular purpose. They put different selection pressures on each of the lines. The male turkeys (toms) are utilised for meat production whereas the females (pullets) are used for reproduction (egg laying). The end product for their customers is increased breast meat yield (B. Wood, High bred turkeys 2008, pers. comm., 2 October).

Rissington Breedline is New Zealand's biggest beef and lamb genetics company. It is privately owned and has operations in the UK and South America. The primary focus is to supply superior genetics for replacement ewes for meat production. They have developed a line of maternal and terminal sheep. The maternal being the Highlander and the terminal being the Primera. Both lines are composite breeds matched for the environment and markets. In collaboration with landholders they have developed a line of sheep with high fertility (175%), weaning weight and carcase growth.

Rissington Breedline have a nucleus in which progeny testing is carried out, from which rams are selected then sent out to the breeders. All animals are DNA tested for paternity. They have a young sires project; in this they join all the young sires to flock ewes. All the lambs are slaughtered and carcase traits measured (weight, fat and muscle depth). As all the lambs have been DNA tested this information can be directly linked to the performance of the sires. This is a very good system for selecting the best sires based on performance and carcase traits. With the consistent high quality product that Highlander and Primera produce they now have signed a contract with Marks and Spencer supermarkets in Britain. They will supply Marks and Spencer with lamb for 6 months of the year. This is worth an estimated $NZ 10 million per season to New Zealand producers. While marketing has helped with this contract, the consumers want a consistent, high quality product and this is what these two breeds of sheep offer (J. Absolom 2007, pers. comm., 14 September)

In parts of Ontario, Canada, there are only limited areas for grazing animals. The weather also plays a big part, as animals have to be housed for long periods of the year due to the very low temperatures. Mr Vince Edwards has a lamb growing operation; he collaborates with a group of producers to supply Canadian lamb to supermarkets. With the animals being in-doors, the most cost effective way to provide lamb is through increased fertility. With more lambs per ewe there is less room taken up in the barns by breeding animals. All females are genetically evaluated on litter size and the number of litters they produce per year. Only females with high fertility are kept as replacements. A ewe's reproductive potential needs to be known at a young age before the animals are sent to slaughter. Typically the ewes have 3 litters every 2 years with 2.5 lambs per litter, this gives 3.75 lambs per ewe/year. The average litter size of fine wool Merino ewes in Australia is about 1.1 lambs per ewe/year (V. Edwards 2007, pers. comm., 5 October).

Even though there has been a lot invested in the science of breeding, the uptake has been slow. Of the results available, only 15% of Merino breeders use ASBV's when selecting animals and the rate of genetic improvement at the industry level is much lower than what is possible. Wool has many traits to select from which slows the rate of genetic progress compared to single gene selection. The main variables in wool selection are micron ranges, environments, dual purpose Merinos and the target markets. For this reason different selection indices are available depending on the producer's goals. Producers need set a goal towards the market they want to supply and use the index that best suits that market.

I believe there are three main reasons the use of genetics is slow. Traditionally, wool has been classed subjectively (by appearance) and many producers believe that this is still the best way to base their breeding program. It is my belief that many producers feel that setting genetic aims in breeding selection is too daunting because of all the potential traits to select for. Also, in an industry where practices are so firmly set in tradition, it is difficult to introduce something new.

2. Marketing

Wool currently makes up 2.5% of the total world fibre use and 3.5% of the apparel fibre market (AWI, 2004). Wool competes in a marketplace where it can be price sensitive and replaced by fibres such as synthetics and cotton. Price competitiveness of wool is measured by comparing the price of synthetics to wool with a fineness of 21 micron. The result is a ratio of the price of wool compared to the price of synthetics. Gunning- Trant (2007) reported that wool is now at a ratio of 4:1 which is 33% above its long-term average of 3:1. This indicates that wool is less competitive, which could lead to a decline in the price of wool. The long-term real value pricing of synthetics has been falling over time. The assumption, therefore, could be made that wool will also fall to maintain the synthetic to wool ratio. Recent increases in cotton prices has dropped the wool cotton ratio from the high of 6.8:1 to 5.3:1, which is around the long-term average, thus wool is more competitive against cotton. It must, however, be stated that as cotton and wool can not be spun on the same machinery there is less chance of wool being substituted for cotton compared with synthetics.

In 1993, superfine wool between 15.6 and 18.5 micron made up 2.2% of the Australian wool clip. Currently this micron range makes up 15.6% (AWTA, 2006). There are two reasons for this change in the supply of superfine wool. First, during the mid 1990's there was a large price differential between superfine and medium wools, this encouraged producers to reduce the micron of their wool clips. Secondly, with the recent drought, the clip has become finer as the environment has a big affect on wool quality. This has led to a reduced price being paid for superfine wools. Currently, the 16-18.5 micron wools are trading in the 50th percentile and wool from 19-25 micron are above the 85th percentile. If we include the exchange rate in $ US it shows that medium wools are trading at levels equal to or above previous levels.

One of the most difficult aspects in the marketing of wool is the variability of the product, not only between years but also within each year. Synthetic fibres are less variable, making marketing strategies easier. Wool is affected by the environment, climatic changes within years and from region to region. These environmental effects can greatly influence the quality and quantity of wool produced. For this reason it is hard to provide the same quality of fibre year in, year out. These inconsistencies make it hard to form workable relationships between producers and processors as the latter need a stable and consistent product. Production strategies may be implemented to help overcome such inconsistencies. Intensive grazing helps lessen the effect of the environment which enables producers to have additional control over the nutritional requirements of the sheep, which will help stabilise micron and increase staple strength, the two main contributors to price variation in fine wools. This allows production and marketing to work in conjunction with each other to improve the sale of wool to consumers.

I have taken the opportunity to walk into various international retail outlets and talking to consumers, the general feeling I received was that wool is a fabric to be worn in winter; generally prickly, not suitable to be worn on the skin and was not easy to care for. Fortunately, I was wearing woollen shirts most of the time. Many consumers couldn't believe my shirts were made from wool, particularly when I mentioned that the shirts were machine washable. With this in mind it seems that there is a greater need to market the natural side of wool, re-educating consumers that wool is a textile for all seasons and was now being made easy care.

During my travels I had the opportunity to talk to many consumers, associates of the wool industry and wool processors. There are many aspects to wool which our marketing should focus on in the future. These include niche markets, value adding, and wool as a natural clean green product. Below are various case studies where I saw such aspects of wool production.

Case studies of marketing diversity

North America

There is a big shift amongst consumers in North America for natural products. Consumers like the idea of products produced on pasture and which are produced with the environment in mind. If a consumer is able to trace a product back to its origin, they feel a sense of ownership that they are purchasing something which will benefit the world as a whole now and in the future.

I met with Wes and Jane Patten who are sheep and cattle producers from California. They have made a niche market by selling sheep and cattle for meat straight off their farm to consumers. The beef enterprise uses Dexter Angus cattle which have a lower mature weight than traditional Angus cattle. The idea of being a smaller animal appeals to many people who have limited cold storage facilities. They also run Dorper sheep, which are a breed of sheep which do not grow a fleece of wool, therefore, they appeal to people on small blocks as they do not have to shear them. Professor and Mrs Patten set a price for their animals and the consumers either pay the price or go home empty handed. In other words, they are price givers not price takers. Being price givers they set a price that allows them to make a comfortable living (W. Patten 2007, pers. comm., 20 September).

When comparing this setup to the Australian wool industry it is clear to see that the industry is structured around price taking; this is a result of producers working as individuals rather than together as an industry. An individual producer may accept a lower price than another which results in overall lower prices for wool.

Professor Patten is retired from Chico University in California. He brought to my attention the following research. The University of California, Chico showed that grass fed ruminant animals have 2-4 times more omega-3 fatty acids and a more balanced ratio of omega-3 to omega-6 fatty acids than grain fed animals (Daley et al, 2007).

Mr Tim Koopmann from San Francisco is a watershed resource specialist. Mr Koopman has helped develop a relationship between the water users, environmental groups and graziers to develop a grazing plan that enhances water quality. This relationship means that farmers are able to graze land surrounding the catchment areas. The grazing regime consists of a RG program at medium stocking rates. The grazing system has resulted in the establishment of healthy pastures. Run off is slowed, with the roots acting as a water filter and the pasture bulk catching animal defecation. This also helps to slow down the water flow, reducing erosion. Some people believe that grazing livestock increases bacterial levels in waterways; however, this work has shown that grazing domestic animals resulted in no increase in cryptosporidium levels in the waterways.

Mr Koopman introduced me to “conservation easements”. With so much development occurring in California the government introduced a plan by which development had to be off-set by developers purchasing land that could not be developed in the future i.e. if a golf course was to be built the developers would have to pay a land holder on another area not to develop the land in the future. This provides two benefits: First, an income stream in the initial period to the land holder and secondly, in the future as the land is unable to be developed on it must be utilised for agriculture. The aim is that this will eventually put a cap on land prices, thus allowing producers who wish to stay in farming the opportunity to purchase land at a realistic price (T. Koopmann 2007, pers. comm., 19 September).

Bill and Kay Burrows on “Burrows Ranch” have changed the structure of their business from farming to eco-tourism and hunting. This was my first introduction to the potential of carbon sequestration in agriculture. A study being carried out at the Plants Material Centre, California showed perennial grasses had a total of 33600 kg/ha of biomass. On average this equates to the perennial grasses adding 7000 kg/ha of carbon to the soil (Beardsley and Dyer, 2001). This is valuable as carbon is important to soil fertility and there is a possibility of producers utilising this carbon in carbon trading schemes in the future (B. Burrows 2007, pers. comm., 21 September).

So what does the above information have to do with marketing? In summary, the Australian wool industry has a natural product, not only for clothing, but a food source which can maintain healthy waterways, may improve human health and also aid in carbon sequestration. Not too bad for the humble Merino. I believe that this gives the wool industry a big advantage in the marketplace given that personal and environmental health are of major ongoing concern in developed nations. All these factors can be used to promote wool as a healthy and sustainable product in the future.

In New York, I met with AWI representative Stuart McCullough and designer Richard Goodstein. Amongst high income earners 25% of their disposable income is spent on jewellery. The feeling here is that we need to tap into the top end market as there are greater margins to be made in this area. A high quality, fashionable product can be sold at an increased price to the high end wearers. My attention was drawn to a set of single woven cashmere sheets, manufactured by Italian knit producer Manrico. The sheets retail for $US 6000 and are machine washable for 100 washes, that equates to $US 60 a wash. While cashmere is finer than wool, it shows what margins are achievable with a high quality product and effective marketing strategies (S. McCullough 2008, pers. comm., 24 September).

To help tap into such market there is a need to create a sourcing pipeline with superfine wool, around 17 micron which is natural or organic, that is machine washable. This has the potential for wool to become a cult product. Being able to follow wool through the pipeline allows consumers to be more closely aligned to the product. The main difficulty with this is being able to forge these alliances with wool processors as they like to keep their business dealings to themselves (R. Goodstein 2007, pers. comm., 24 September).

Italy

In Italy wool's share in the textile marketplace is 30%. Compare this to America where wool has a total share of 5%. What drives the difference in the use of wool? Italy has a tradition of manufacturing and wearing wool products as it is seen as very fashionable. AWI has recently opened an office in Treviso in Northern Italy. The feeling in Italy is positive, however, the younger generation is moving away from wool. Wool needs to be revamped and a new market will be opened for the younger generation with new generation brands, such as Diesel and Beneton which are highly fashionable among younger people, but still maintain relations with Armani and Zenga for the high end users. For the younger generation there also needs to be a focus on light weight summer garments and sports wool (D. Dotto 2006, pers. comm., 31 July).

I travelled to Biella, home to some of the world's top spinning mills, which produce some of the best wool fabrics in the world. In recent times due to the inception of the euro this has doubled production costs in Italy. In addition, competition from China has resulted in a shift away from wool being processed in this area. The September 11 attacks in America have also caused consumers to work more from home and therefore the purchasing of woollen suits has decreased. While the spinning plants are staying put, top makers have been moving to China where the cost of production are a quarter of that in Italy. This shift has caused reduced competition in the marketplace for the higher quality wools which has led to a reduced price at the farm gate. Although these spinning mills at the minute are not in direct competition with China, the top making plants with higher production costs have seen the margins greatly reduced by competition from China, even though the products from this area are superior and more consistent. This has seen some of the top making plants move from Italy to China. At the end of the day consumers always want to pay less for their apparel, therefore, promotion of these higher quality products is essential. Branding the products can play an important role in differentiating between the qualities of products. Branding allows consumers the opportunity to make the choice between price and quality. The real positive is that the processors are extremely passionate about wool and will be there for the long-term.

The relationship between the Italian processors and AWI in the past has been indifferent. The processors feel let down by the promotion of their products by AWI. With the increase in the volume of fine wool in Australia this needs to be addressed. There is great potential to increase the market share of wool by an integrated approach to marketing by both parties. Processors need to keep producing high quality wool and use AWI to assist in marketing the products produced (M. Ferrarone and F. Botto 2006, pers. comm., 26 July).

Milan is the fashion capital of Italy. In the main shopping area you will find busy department stores, supporting most brands from the trendy (Diesel and Replay), to the discounts (Hand M) and the discounted top line brands (Armani and Zenga). The majority of shoppers are teenagers and mothers with children looking for bargains. The top line brands had only a small amount of wool which is poorly advertised. Top range products could be found in San Bibla. The shoppers in San Bibla know exactly what they are after. Outlets stock the highest quality of the biggest names (Armani, Zenga and Stefenl). The suits are pure Australian wool (below 16 micron). You will be measured and the suits will be made to fit. They have a great display of both summer and winter fashions. Amongst all the woollen suits, however, there were no woollen shirts, all the shirts are made from cotton. For a top of the range cotton business shirt; don't expect to pay less than 150 euro dollars ($AUD 240). At this price range wool would be a strong competitor against cotton. Shoppers come here from every part of the world to buy these high quality branded products. The customers were mostly middle to later aged males. Glancing at the amount of through put this is definitely a small, high value niche market but one that the Australian wool industry can further utilise.

South America

Argentina and Uruguay have a comparative advantage over Australia in wool production due to the low cost of labour reducing the cost of production. The average cost of shearing in Argentina is 1.9 pesos/hd in Australian terms this equates to $AUD 0.35 in Australia it is roughly 20 times this price at $AUD7.00. Workers are on 300 pesos a month ($AUD 50). This is somewhat off set by the price received for wool, 20 micron wool in Argentina is around $US 3.50 greasy, and in Australia it is currently at $US 6.80. Australian producers need to focus on clip preparation and increasing efficiencies in production to help maintain competitive advantage. Currently in Uruguay wool processors are going against the trend of industry movement to China as they only export 10% of their wool unprocessed whereas Australia exports 96 % of its wool in the raw state (I. Abella 2007, pers. comm., 16 September).

I had the opportunity to visit one of the mills in Uruguay, Fray Marcos Pty Ltd Top Making Plant. The plant was founded in 1986 and produces, 3.5 million kg in wool tops per year and are looking at increasing this capacity in the future. The plant is looking at moving inland from Montevideo, they are citing pollution problems and rising rental costs as the main reasons. Their main expertise is in the blending of woollen tops, where they have a balance between labour and machinery. The mills have a close relationship with the producers and purchase their wool direct. They also offer producers cash advances, prior to shearing, helping to insure the supply and maintain close relationships.

The Chinese import 28.8 million kg of wool tops and of this 12 million comes from South America of which Fray Marcos exports 525000 kg. This is roughly 15% of their tops; the remainder is exported to Europe. The majority of tops are 28.8 microns, the aim is to make finer tops but the availability of wool is very limited. The main problem they face in quality control is contamination of black fibres. Part of the reason for this problem is that the main focus of producers is on meat rather than on wool. There is a 3 tired classification of the wool (Photo 5). They have unclassed wool, which has no label. The next is a blue label for semi- classed wool. The wool is partly skirted and sorted into 2 to 3 lines with stained and dark fibres seen in the skirtings. The top label for wool is a green label. This wool is well skirted and classed into types depending on colour, staple strength, wool types with the dark fibres being removed.

This is a good system; the only problem is the premiums being paid for the green label equates to only $AUD 0.04/kg. If this was lifted I feel that producers would take more care in the preparation of their wool and more would have their wool classed in the green label standard and the problem of dark fibres would be significantly reduced (R. Facundo 2007, pers. comm., 17 September).

Reduced wool production and the price top makers are receiving is making production difficult for top makers in South America. With the reduction in wool production over the past few years coupled with low wool prices and the drought in Australia, there has been a large reduction in wool supply to the combing and top making plants. This means that the plants are not running at capacity and competition between top making plants has increased; this is one reason for the recent price recovery in Australia for 19.5 and broader micron fibres.

The Uruguayan Wool Secretariat is a grower organisation. The main role it plays is research for sheep production, developing sheep breeding programs, shearer training courses and wool market analysis. Probably the biggest role it fills is running a wool testing laboratory, which is responsible for servicing wool growers, exporters, top-makers and research programs (I. Abella 2007, pers. comm., 16 September).

While the wool volumes in Uruguay are smaller than in Australia, the above shows what is achievable when alliances are formed. As the processors and growers are in the one country, alliances are formed between growers, top-makers and processors. This allows feed back to each individual on ways that they may be able to improve aspects of their production, this in turn helps the industry as a whole produce a better, more competitive product.

Photo 5: Wool classification system in Uruguay. Green labelled wool is well skirted with above average colour and staple strength.

In contrast, Australian wool in the majority of cases is sent overseas for processing. Thus the feed back is very disjointed. A possible way to improve this is to follow the Uruguay model and bring the processing industry back to Australia. This will not be possible in its current form due to the high costs of labour and the overall cost of manufacturing. Through new technology, we may be able to bring processing back to Australia. This is something the wool industry needs to work towards, a way of processing wool without the reliance of water. As technology becomes more advanced and scientists learn more about wool I am sure that this can be achieved.

China

China currently imports 65% of Australian wool of which 60-70% is processed for domestic use. Thanks to Mr Jeff Zhu, Chief Representative AWI Shanghai office I was able to visit 3 of the leading mills and the Shanghai Inter-textile fabric show in Shanghai.

Chargeurs Wool Zhangjiagang Yangtse Wool Combing Company Ltd employs 200 staff, produces 7000 tonnes of woollen top/year averaging 25 tonnes/day. The average micron of the tops is 19 micron and 60% of tops are exported. The combing machines are operating 24 hrs/day 5 days a week.

They would like to operate seven days a week to increase efficiencies, but wool supply is currently too low for this to be achievable. It is interesting to note that the majority of wool is imported from Australia and the orders for the blends of wool to make the tops are organised in Australia, thus Chargeurs in China are making no direct decisions on how the tops are put together (F. Chen 2007, pers. comm., 10 October).

Helian Group employs over 10000 employees and produces 15 million meters of worsted fabrics. The Helian Group has 250 retail outlets in China in which they supply all textile fabrics. Recently, in collaboration with AWI they have developed a machine washable suit (Photo 6). The suit is a 50/50 blend of polyester and 20 micron wool. In the initial period they made 65000, of which 35000 had been sold when I was in China. The two main selling points of the suit are that it is machine washable and therefore better for the environment, with less chemical needed to wash the suits than with traditional dry cleaning. Secondly, with everyone leading a busy lifestyle machine washing is easy (J. Zhu 2007, pers. comm., 11 October).

Photo 6: Advertisement in China for the Helian Group/AWI machine washable suit.

Ningbo Youngor Worsted Spinning Weaving & Dyeing Co., Ltd. is a joint-venture vertically integrated company established by the Youngor Group. The company finishes 155 tonnes of tops/year. Of this 80% of the tops produced are pure wool with 20% being wool rich blends. The average micron is 20.5 with the finest being 16.5, 75% of tops are exported. The company invests in the latest technologies which gives them a strong foundation for the production of a raw material to fabric. This results in 5 million meters of worsted wool fabric being produced each year which is mainly sold to the high end of the market. The Youngor Group in co-operation with AWI has developed a 100% Australian Merino wool travel suit, which is crease-resistant (Photo 7). Part of the advertisement of this suit shows a picture of Australia pasture so customers get a feel for the natural aspects of Australian Merino wool (J. Zhu 2007, pers. comm., 12 October).

Photo 7: Ningbo Youngor/AWI travel suit A.) Promotional material in China advertising an easy care travel suit B.) Promotional material illustrating the design of the suit.

The common attitude among the mill managers visited was that the price for Australian raw wool was very expensive. At the current price levels coupled with reduced volumes the processors are substituting wool with synthetics to help reduce the impact of diminishing gross margins. The reduced volumes mean that mills are not able to function at maximum capacity and are in competition for the wool that is available which is pushing up the price for raw wool. At the moment we are seeing mid level micron wool at the highest level in 10 years, while the superfine wools are still lagging behind the long-term average. This may result in wool processors closing down or wool producers shifting into other areas e.g. sheep meat or cattle.

The Chinese government has introduced a quota system. The quota was designed to limit the amount of wool individual processors were processing. When the quotas were re-allocated Chargeurs wool mill only received half the quota they wanted, which has left concern for their future as their mill is not running to maximum capacity. This leads to an increase in the cost of production which may jeopardise their long-term sustainability. The mill owners believe that within 5-10 years these government regulations may result in a shift in processing out of China to countries where processing is cheaper.

Evaluating aspects of marketing, in particular during my visit to China allowed me to step back and look at the bigger picture. From fibre to fabric, wool is a complex system and there are many owners of wool from start to finish. This makes it hard for individual producers to market wool. Producers may not be able to control the market but they can control what happens on their farms and this is where I believe producers should focus. Marketing of wool should be done on an industry level. Wool producers pay levies to AWI for this reason.

3. Carbon sequestration

Carbon sequestration is defined as the removal and long-term storage of carbon dioxide from the atmosphere through the use of natural carbon sinks, primarily in forests in the form of increasing plant biomass (Parliamentary Commissioner for the Environment, 2008). The on-going debate over global warming and the impact agricultural practices have on carbon emissions and sequestration are topical issues. The level of carbon dioxide in the atmosphere has risen by 25% in the past 40 years; prior to this it was stable for thousands of years (Yeomans, 2005). Whether you believe in global warming or not, would it hurt to remove some of the carbon from the atmosphere, especially if you were being paid to do it? Improved grazing management, not only can improve production but also increase the potential for an income from carbon trading.

Previously mentioned at "Burrows Ranch" was the study carried out on carbon sequestration. The study showed perennial grasses can add 7000 kg/ha of carbon to the soil. The perennial pastures have been established only through careful grazing. Annual grasses cover most of California. This has occurred due to poor grazing strategies. The data collected from annual grasses shows their total bio-mass is 3000 kg/ha/year. This is only 625 kg/ha/year of carbon being sequestered into the soil. The major reason for this is that the root mass of the perennial species is much greater.

Reeder and Schuman (2002) showed that excluding grazing from rangelands in North America caused carbon stored in above ground plant litter to become immobile. This has led to an increase in annual grass species. Increases in annual grass species, which have a lesser amount of dense fibrous roots, are not conducive to the formation and accumulation of organic matter. Using grazing techniques, which enhance forage production, also has the potential to increase soil organic matter and carbon sequestration.

With RG practices plant growth is stimulated. Below ground root mass is equivalent to above ground foliage mass. As leaf area is eaten root mass is shed and becomes a food source for micro-organisms. As the micro-organisms die or are eaten by others in the soil they feed the plant roots encouraging new growth. With the higher stocking densities of RG systems, the older dead grasses are trampled into the ground allowing microbes quicker access to the material to break it down.

When the paddock is destocked forage growth is stimulated and as the plants re-grow they withdraw carbon dioxide out of the atmosphere. Some of the carbon is respired, but the remainder is stored. This also has a flow-on effect. Soil organic matter, which is 58% carbon, is the building block for the formation of humus. By increasing the level of humus, more water can be held and supports better soil structure and provides an increased level of food for micro-organisms. Hence the soil can support greater numbers of beneficial micro-organisms resulting in increased biodiversity. This increases nutrient recycling and availability and hence soil fertility and reduces the need for applications of chemical based fertilisers.

There is no exact science detailing how carbon trading may work. A few assumptions are made in working out potential incomes from carbon trading and sequestration based on the Carbon Link Producer Information Pack (www.carbonlink.com.au) (R. Rush 2008, pers. comm., 21 January):

- It is possible to sequester 1% organic matter over a 10 year period, an average increase of 0.1% /year in the top 10 cm 0.63%/ year in the next 20 cm of the soil profile;
- Soil organic carbon (SOC) makes up 58% of the soil's organic matter;
- 58% SOC is equivalent to 16 tonnes of carbon based on a bulk soil density of 1.2 g/cm^3 (this is average soil density), equates to 16 tonnes of SOC/ha;
- 16 tonnes SOC/ha is equivalent to 58 tonnes CO_2e/ha (this is the carbon dioxide equivalent, which is the trading unit);
- Price paid of $25 /tonne of CO_2e;
- If the area is 500 ha, CO_2e = 58*500; 29000 tonnes of CO_2e;
- Assume 67.5% of total CO_2e is saleable, the remainder is taken up and held over for various reasons;
- The remainder 19575 tonnes has a sale value of $489375;
- Sequestered over a 10 year period;
- 40% is paid in commission and future payment pool;
- Providing a net income of $293365 over 10 years;
- Providing an extra income of $29336 /year over 500 ha;

As mentioned this is based on assumptions, however, it gives an idea of the possibilities of additional income by adopting improved grazing management. Having practices in place to take advantage of in this in the future is something that needs to occur now.

4. Adoption

Australia is at the forefront of wool production. Due to high labour costs and no government subsidies, the industry has invested in research to help producers become more efficient and more competitive internationally. This needs to continue in the future to further improve efficiencies. Improved grazing management strategies, which increase SR and help to reduce internal parasite burdens, have shown increases in gross margins by 50%. Currently 6% of producers use IRG with 48% using CG (AWI IPMS, 2005). There have been many trials run both by industry and private organisations to encourage producers to adopt new technology.

So why is the wool industry slower than other industries to adopt new technologies? The wool industry is a very traditional and conservative industry with each generation following in the footsteps of its previous generation. This, coupled with the rising age of producers makes for slower change. While the price paid for wool is volatile, it provided a stable income in the past until the abolition of the reserve price scheme. Since then the average price for wool has dropped until recent years. The result of this volatility is that as price drops producers seek out new technology. In the meantime, the price may rise and the adoption of such technologies is put on hold.

Annual wool output is variable due to the various choices of micron range and climatic changes that alter the quality of the product. For this reason, producers tend to put aside new ideas stating that "this is a good approach, but it will not work in my environment or for my management practices". With attitudinal changes technology can be adapted to most grazing activities. The key is to be flexible and possess a willingness to try. Wool producers tend to adopt a 'wait and see' approach. If a concept works, other producers will take note and consider its application and, in many cases, continue with the age old practices that have stood the test of time. Innovative producers may be judged harshly by their counterparts for their willingness to try new ideas; others seem to be waiting to see them fail. This leads to younger producers not implementing new ideas for fear they may be ridiculed by older generations.

Increasing SR has been shown to increase gross margins. This will not happen overnight and a long-term plan needs to be in place in order for it to work. As results are not seen immediately, it takes fortitude to put in infrastructure that may be seen to reduce income in the initial period before a profit is earned. If producers pursue this course of action and fall on hard times in the short-term; rather than holding their nerve they revert back to the use the old tried and true methods.

So how do we help change the uptake of new technology?

Industry has invested large amounts of funding for new technology. Of this new technology only a limited amount is being implemented on farm. If this is the case, it could be reasonable to conclude that there has been a breakdown in how the information is transferred from scientists to producers. One possible solution is to carry out more research on commercial properties so that producers can see new approaches working in the environment in which they live. There has been much duplication of research projects by different funding bodies. This information needs to be compiled in a simple format which producers can understand and utilise. This is one of the reasons producers believe that their levies through AWI have not been efficiently utilised.

In the past, emphasis has been put on the production of larger sheep, wool cut per head, 1st place at wool and sheep shows and the price received for wool and stock. In many cases, however, price has been mistaken for profitability. As with any business enterprise the aim should be to optimise profit rather than maximise profit per head. Historically, these factors have been used to judge how good a producer is perceived. This is not however, a commercial reality and this thought process in producers needs to be changed. Production per hectare is the most significant determinant of farm production efficiency. Why go to the expensive of buying more land when for a substantially reduced cost you can increase the productivity of your existing land and, probably, increase your Return on Investment (ROI). Producers who are achieving increased per hectare production may not be getting the top price for wool or livestock, they may not be winning ribbons in the show but they are making greater profits at the farm gate. Producers need to ask themselves if they want to win the ribbon at the show or make money!!!

By investing in young producers who are willing to adopt new ideas and technology, progress is highly probable. This investment could be made by way of funding to assist with infrastructure costs and covering costs of consultants who can help adapt to changes. This investment will be recouped in the long-run. As wool producers pay levies to AWI and MLA an increase in production and profit will mean an increase in money flows to these organisations. Other young producers are also more likely to take notice of their peers and, in the end; it is the younger generations who are the face of the future of Australia's wool industry.

Conclusion

Production verses marketing: where should Australian wool producers focus?

Producers and statutory authorities should re-direct their focus onto production. This is not to suggest that marketing is not a powerful influence on the outcomes for wool producers. Australian producers work hard to be successful at producing wool. Anecdotal evidence suggests that producers believe for the Australian wool industry to be sustainable the price received for wool must rise. But, how many more wool producers will go out of business waiting for the price to rise? If this happens there will no longer be an Australian wool industry to market. If producers focus on production and incorporate new technology into their production systems profitability is likely to increase, therefore reducing the need of many producers to wait for a rise in the price of wool.

It could be suggested that the world can go on living without wool. Being a natural product, however, wool appeals to consumers. This is likely to increase over time as consumers' focus shifts to the need for sustainable and environmentally friendly natural products. In addition, if the costs of production can be decreased, while oil prices continue to rise, wool will become more competitive against synthetic fibres and consumers will then start to increase their consumption of wool. The multiplier effect of higher production and higher returns to the wool grower will further increase the future benefits to the industry. This will increase the sustainability of the wool industry and ensure its long-term position in the world's fibre market. This will come about as the result of producers focusing on production, providing the market-place with a high quality, natural product at a competitive price.

Focusing on marketing rather than production can take producers' focus away from what should be happening on-farm, viz the ever present need to improve productivity. Markets are constantly changing and are generally out of producers' control. Producers' belief that marketing holds the key to improving profitability in the wool industry simply implies that producers want something for nothing. Simply put, my thesis is that an increase in productivity must precede or accompany any marketing thrust.

On-farm production is in the control of each individual and remains constant and changeable. Too often producers rely on the price of wool to ensure profit. Increasing on-farm profit by adopting new technology to improve productivity can reduce the cost of producing wool, making it more competitive in the market-place. That said, marketing still has a major role to play in insuring the sustainability of the industry but there is a lot that producers can contribute to the industry without relying on marketing.

Recommendations

My recommendations for the wool industry based on the findings from this report are outlined below:

Marketing

- Branding of products made from wool will be vital to the sustainability of the wool industry. Items on retail shelves currently have the logo “pure new wool” which is the generic advertisement for all wool. The industry needs to move towards a more in-depth approach, incorporating information on the micron of wool, the comfort factor, whether or not the garment is suitable for next to skin wear and what season the garment is most appropriate for e.g. winter or summer.
- Wool is moving into a new generation of fibres. Education of consumers and retailers is needed to enable wool to move with the textile market so consumers will know the benefits of wearing wool and be willing to pay a premium for it.
- The ‘clean and green’ image, this is how wool needs to be described in the future. Consumers need to know that wool is grown under conditions that benefit the environment through improved land management, reduced chemicals and pollutants and can act as a tool in helping to cool the globe by reducing CO_2 emissions.
- The Australian wool clip has been decreasing in micron; for this reason AWI needs to forge closer alliances with Italian spinning plants. The Italians are masters in producing high quality products made from finer wool. AWI, working in conjunction with the Italian plants, will help to develop new products and markets for top quality wools destined for the top-end market.
- In the future there will be a need to bring wool processing back to Australia. This will help to the wool industry in Australia to gain some degree of independence from overseas processors. Research needs to be undertaken on the processing of wool with less reliance on water. This will help overcome current issues with processing in Australia

Production

- Encouraging young producers to adopt and use new ideas to help increase on-farm performance is needed to ensure the sustainability of the wool industry. This may be achieved by providing support in the form of funding, consultants and infrastructure costs for new ideas and the development of young producer groups. With the consultants documenting the management and financial information. Farm visits could also be arranged for all interested parties.
- Encouragement of young producers to take on leadership roles within the wool industry will also contribute to the wool industry.
- More on-farm research needs to be carried out on commercial properties. Commercial research enables producers to see new ideas working on a commercial basis and within their local environment. They will, therefore, be more likely to adopt new research.
- Collation and dissemination of existing information is needed to allow the information to be easily found and in an easy to read format.

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