LIVESTOCK MANAGEMENT SYSTEMS

Adding value to grain and crops through the use of sheep and lambs

A report for

by Shannon Mayfield
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Foreword

The mixed farming model has proven to be very successful in Australia and around the world for a very long time. As we move into a time of high dependence on agriculture to provide food security to the world's increasing population, it is important that producers strive to increase production and make the most of all available resources. By making better use of the by-products of a broad-acre cropping system, we can go some way to achieving this. Incorporating livestock into a broad-acre cropping system will add value to these resources, and reduce business risk by providing alternative income streams.

The aim of my Nuffield study was to investigate livestock management systems internationally and in Australia, and bring home information, ideas and innovations that can benefit sheep and lamb producers both in paddock and feedlot situations.

It is hoped that this research will benefit farmers on Eyre Peninsula, and other regions in Australia that are grain export focused, by encouraging them to make better use of any grain that falls outside of export specifications. Having this information available to them will enable them to confidently assess the value that might be gained by putting that grain back into their own livestock enterprises.

Overall, making the most of the resources that are readily available in our local areas to increase productivity, and essentially, make our farming operations more profitable and sustainable was the major driver behind this study.

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Acknowledgements

I would like to thank all the people that have helped to make the opportunity of doing a Nuffield scholarship a reality. Firstly, I would like to thank Nuffield Australia for the opportunity they have given me to follow my passion of agriculture around the world. I have learnt so much about my study topic and world agriculture in general; it would be hard to put a price on the experience. I will forever remember the experience fondly.

I would also like to thank Nufarm for sponsoring my scholarship and supporting Nuffield. Without the generous support of organisations like Nufarm, Nuffield would not be able to operate at the level it does.

I would like to thank the many people who have hosted, housed and guided me on my travels around the world. It has been a highlight of my Nuffield scholarship to meet so many good people who were willing to give up their time for someone they had never met.

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A big thank you to by wife Shenae and daughter Asha, who keep the home fires burning while I was away. With the help of my life-time mate and now employee, Shane, they kept the business on track while I was away and for that I thank them very much.

To my neighbours; Trevor, John, Sned and their families, who have been there for us since we started farming six years ago, I would like to thank you for all your support. If not for your help and guidance we may not still be in agriculture and I would not have been able to leave the farm for this Nuffield journey.

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Executive Summary

Australian agriculture is in a period of great opportunity, with the demand for food production increasing dramatically in an effort to feed a rapidly growing and largely hungry global population. With this in mind, it is essential that farmers make the most of these opportunities by broadening their enterprises and making the most of the resources available to them. While this will mean different things for different producers, for some, incorporating livestock into a broad-acre cropping operation could have huge advantages for productivity and profitability if efficiently managed.

Background

Our current farming enterprise is located on an area of 2500ha at Kimba on Eyre Peninsula, South Australia. The Eyre Peninsula agricultural region is predominantly focused on grain production for export. There is a very small, almost nonexistent, domestic market for grain. We run a broad acre cropping enterprise along with a sheep and lamb trading (finishing) and lamb feedlot enterprise. After a series of poor cropping seasons in the mid-2000's, our only method of survival in the industry was to look towards other sources of income. This led our business to the finishing and trading of prime lambs, which provided a further stream of income, had benefits for the cropping enterprise, and made better use of the resources that were available to the area. Despite the benefits that our business has enjoyed from the addition of this enterprise, it has presented a variety of challenges – the main one being 'how can the available resources and livestock be managed efficiently to ensure optimal returns'.

Aim

The aim of this study was to look at ways of increasing profitability for the export grain growing areas of Australia through the use of livestock.

The focus of the study is the value adding of grain and crops on farm through the use of sheep and lambs. To thoroughly investigate this, research was required into the best livestock

management practices and infrastructure to make meat and wool production a more viable option for grain growers.

The idea of making better use of the resources available to us was the main driver behind the choice of study topic.

It is hoped that this research will not only benefit our own business, but also help other producers in regions similar to our own. Broad-acre cropping in marginal areas can prove to be a risky enterprise, but it is possible to manage this risk to an extent by broadening our enterprises. The findings that I have made will hopefully provide confidence, encouragement and validation to other farmers who are considering integrating livestock into their businesses.

Method of Study

The main avenue of investigation for this study will be through travelling to countries with successful livestock industries and interviewing their leading farmers, researchers and organisations on issues relating to livestock management systems. Following this initial research, the study will need to assess their ideas and innovations and determine their relevance and adaptability to current Australian environment and farming systems and what benefits could be gained from the adoption of these practices.

Key Findings

- Livestock improve the risk profile of a business
- Livestock add to cropping rotation options
- Livestock add value to crop by making use of crop residue
- With good management, livestock can add value to crop through winter grazing without yield loss
- Genetic ability of livestock is a major profit driver
- Management of ewe nutrition through late pregnancy and early lactation is key to increasing lamb survival

- Keep sheep healthy, free from parasites and disease
- Ensure infrastructure is adequate for effective and efficient management practices
- Strategic grain feeding to improve nutrition in the paddock or finish lambs in confinement can have significant economic advantages

Recommendations

From these findings, I would make the following recommendations;

- Diversify businesses by incorporating other suitable enterprises to reduce exposure to risk.
- Continue to update and extend knowledge and understanding of both land and industry. This will increase confidence to implement new and innovative practices and systems, such as winter cereal and canola grazing, and enhance the use of crop rotations and sowing crop for feed.
- Employ the services of industry consultants to provide up-to-date advice about ewe nutrition and health to ensure optimal growth and returns.
- Invest in developing efficient management practices through the use of infrastructure, technology and other agricultural apparatus.
- Attract and retain young people to the agricultural industry as a means of moving the industry forward with vigour and enthusiasm so that it is competitive on an international platform.

Introduction

While the mixed farming model has enjoyed a long history on the Australian agricultural scene, low returns for livestock have seen it in a steady decline over the last 20 years, with farmers redirecting their businesses towards a more intensive cropping program in pursuit of better efficiencies and higher profitability. This was certainly the case on Eyre Peninsula in South Australia, where in the mid 1990's, livestock returns were minimal with a profound downturn in wool prices and sheep values, with the introduction of no-till systems to the area improving cropping returns. However in more recent years, a combination of poor seasons, volatile grain prices and higher input costs have meant that profitability from continuous cropping has been unpredictable for many farming businesses within this area. In this climate of instability, we must reconsider the part that livestock has to play within farming businesses. With improved markets for wool and sheep and lamb meat, and advances in our knowledge base through greater research, how can we use livestock **efficiently** to greatly increase the profitability and stability of farming business?

My wife and I farm at Kimba, which is located slightly to the east of central Eyre Peninsula, South Australia (see map 1a). We run a medium-size business for the area on approx 2500ha arable. Our main enterprises include the production of wheat, barley, lupins, canola, wool, sheep and lamb meat.

Map 1.a.

Location of Kimba, Eyre Peninsula

We took over the family farm in 2006, which was the first of three droughts. Due to these poor climatic conditions, we were finding it very difficult to move the business forward solely through grain production. We needed another income source. We started trading sheep and lambs and would run large numbers over the summer on our crop residue, as well as anyone else's that would allow us. We also built a feedlot for finishing the lambs ready for sale, feeding these lambs the grain not suitable for export, thereby adding value to the crops that had been too poor to harvest. The cash flow from this operation kept the bank happy and allowed us to expand through leasing land and employing a staff member. The success of this part of our business was the main reason behind choosing a study topic that looked at increasing the productivity of this farming system that we had implemented, and ensuring that we were achieving optimal returns for our livestock by enhancing their management systems.

This study has taken me on approximately forty different flights for a whirlwind tour of seven different countries – three of them twice! It has been an amazing and highly valuable journey from which I am taking away a number of incredible experiences. From a 10,000 head undercover cattle feedlot in Brazil to a 100,000 head lamb feedlot in Colorado; from a 55kg average dressed lamb carcass in California to intensive grazing systems and a 4,500 head outdoor piggery in New Zealand; from 1,000 head undercover sheep breeding operation in Alberta to 24 hour surveillance of lambing ewes in Scotland; I feel as though I have been fortunate enough to experience the international livestock, particularly sheep and lamb, industry in a variety of different forms. As a means of comparison, I also travelled within the agricultural regions of South Australia, Victoria and Western Australia, collecting a sound understanding of the domestic sheep and lamb industry, a variety of ideas and innovations that I could apply within my own business, and an appreciation for the hard work that is happening in Australia by the various sectors to improve our industry and promote it on an international platform.

From these experiences, as well as other more locally sourced research, I have been able to make a number of observations about means and methods employed by farmers to increase the productivity of sheep and lambs. I have found vast differences in livestock management systems throughout my travels. While not all means and methods that I have observed are applicable to our situation or local area for a variety of reasons, I have consolidated many ideas and also formed a number of new ideas about managing our own livestock within our farming system.

Objectives

As with any business, the question of increasing productivity and profitability by making the most of the available resources is always at the forefront. While the answers to this question will be different for all businesses, implementing efficient management systems will always be an integral part of optimising success. With the cropping component of our farming business continuing to have unpredictable returns, the focus turned to ways in which livestock, in particular sheep and lambs, could be of higher value. What was initially obvious was that the key to enhancing the livestock was to make them grow bigger, and this led to an interest in studying the feeding systems that are being used around the world to increase the growth rates of livestock. However, it was soon discovered that isolated feeding systems would not have added advantages for the cropping enterprise, and adequate feeding systems could not operate without the use of appropriate management systems. The study topic soon developed into a much broader but more relevant focus for research, and I went about investigating 'Livestock Management Practices: adding value to crops and grain through the use of sheep and lambs'.

The research for this study topic was achieved by;

- Travelling both internationally and throughout Australia with the intention of visiting leading livestock farmers and conducting case studies on their businesses in an effort to gain further insight into the ways that they use their resources to operate productive and profitable livestock enterprises.
- Attendance at sheep workshops, forums and field days to research the latest information and innovations that are available within the industry

The findings of this study are targeted at other producers who are looking to diversify their continuous cropping systems to incorporate livestock. It is hoped that these findings will provide them with information about the benefits of integrating sheep and lambs into their cropping systems, and also some essential considerations when it comes to efficient management practices, to ensure that they can establish and maintain productive and profitable businesses.

Discussion

This is an exciting time to be involved in the sheep industry, particularly in Australia. With the world's population set to continue increasing at a relatively rapid rate, there are enormous opportunities for food producers as they work to keep up with feeding a hungry world.

In 2010 the Australian sheep flock consisted of 68 million head, exporting AU$987 million in sheep meat (lamb and mutton) to the world. Of this amount, AU$341 million was exported to North America, AU$217 million in to the Middle East and AU$157 million to Asia including China. In comparison to these figures, in 1990 the Australian flock stood at 170 million head, but with a total export value of AU$25 million (MLA, 2010), demonstrating a considerably large increase in the value of every kilogram of sheep meat produced in this country.

The US is currently a major importer of Australian meat products. Kim Holzner of JBS Swifts has been directing the importation of beef, goat, sheep and lamb meat from Australia and New Zealand since 2008, importing a massive 3800 container loads in 2010 alone, and averaging 15,000 to 20,000 lambs per week, making them the third largest lamb importer in America. Kim commented on the decline of the US sheep and lamb flock, which was at around 20 million head after WW2 and now stands at only 6 million head, due to problems with predation (by coyotes), competition from cropping and cattle enterprises and previously poor terms of trade (Holzner, 2011).

Export markets around the world are growing at the same time as the world flock is decreasing in size. Every country has its own reasons for the decrease in flock size, ranging from environmental issues and labour shortages to poor terms of trade for meat and wool producers, which has caused a large number of producers to move to other enterprises. Many of these producers have not returned to the industry. ABS census data showed that there were 54,000 primary producers running sheep in 1997, compared to 45,000 in 2007 in the same area, demonstrating a definite downward trend in producers (Curtis, 2009).

Due to this decrease in world production, there has been a recent spike in demand for mutton, lamb meat and wool, which has major implications for sheep producers in Australia. With the world's population predicted to reach 9 billion people by 2050, this demand is expected to grow, and Australian farmers are well placed to take advantage of this growth.

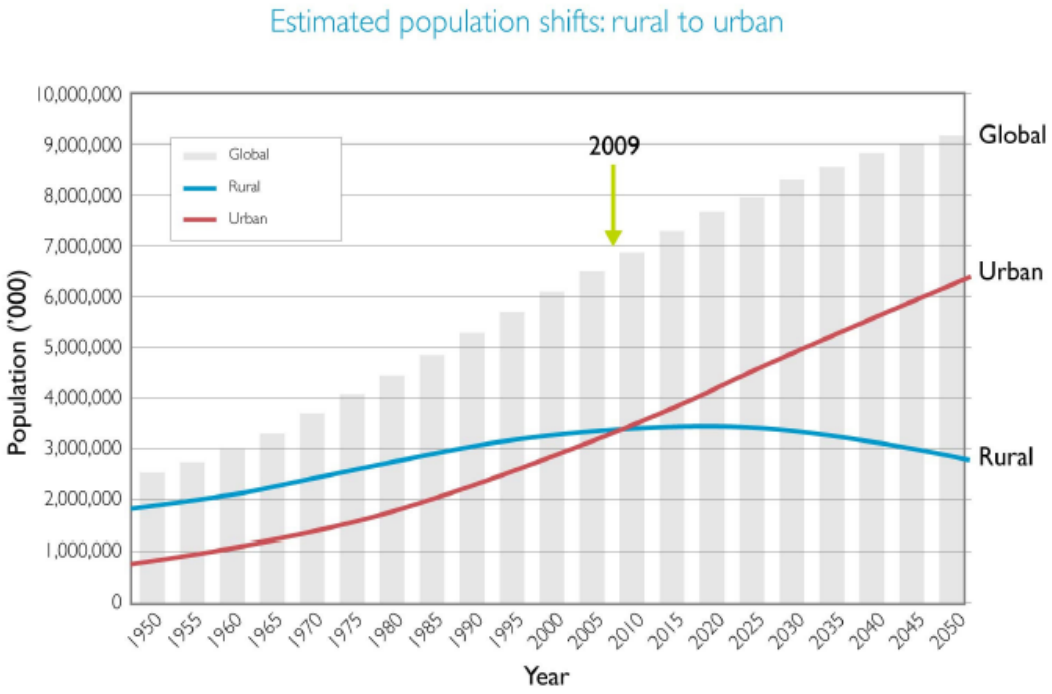

Figure 2. Global population trends and forecasts (1950 – 2050). After Deutsche Bank (2009). Data Source: FAO PopSTAT.

With these opportunities on offer, it is essential that producers are able to optimise their farming systems. A method by which they may be able to do this is by the operation of a mixed farming enterprise, attracting income through the production of both crops and livestock, both of which, if produced efficiently, can provide valuable sources of income at a time when these products are in high demand.

In areas such as the Eyre Peninsula, where the climate and landscape is conducive to both cropping and livestock, it is possible to attract high returns from both enterprises. With the correct management systems in place, livestock can efficiently be used as a major profit driver within a farming business.

The following are key findings from my study highlighting the benefits for farming operations in areas such as ours of incorporating livestock, namely sheep and lambs, with broad acre cropping rotations, and the considerations required to efficiently manage livestock within the business to ensure optimal returns for input.

Risk Profiles

As an industry, agriculture is one of the most volatile in Australia. Productivity and profitability are highly dependent on factors such as export markets and seasonal conditions, both variables which primary producers have little control over. With this being the case, relying too heavily on one sector to provide entire incomes can be a risky practice. As we have seen recently in marginal areas of the Eyre Peninsula, many continuous croppers who have experienced poor seasonal conditions and unstable grain markets have been left in an uncomfortable, and often grim, position when returns on their grain harvest have failed to deliver, having put 'all their eggs in one basket'..

Incorporating livestock into the farming operation can improve the risk profile of a continuous cropping enterprise by adding alternative income streams. This is of particular importance in marginal cropping areas, with variations in seasons having a major impact on grain production. The sale of surplus sheep, lambs and wool makes the business less reliant on grain income to cover the overhead costs of the business.

Historically, livestock markets, while still experiencing their ups and downs, have not shown the volatility of world grain markets, especially now with fund managers investing in grain futures markets, which can cause large swings in the market without actual significant changes to the fundamentals of the world grain market. On the other hand we have a lot more options when it comes to marketing sheep and lambs. Australian domestic consumption of sheep and lamb in 2010 was 237,600 tonnes with a value of AU$2.3 billion (MLA, 2010). So with a strong domestic market and a strong export market, producers have a lot more marketing options for sheep and lamb in comparison to grain.

While poor seasonal conditions will still impact on livestock returns, the seasonal outlay of input costs associated with the cropping enterprise means that there is a much higher likelihood of negative returns when things go wrong.

Risk is an aspect within any business – large or small – and minimising it as much as possible is integral to its success. Very few businesses can afford to rely on income from one product

alone. Since the global financial crisis, banks around the world, including Rabobank, a leading financial institution in Australian agriculture, have become a lot more risk adverse. On many occasions throughout this study, they have expressed concern at risk levels in agriculture. Because of the sensitivity that financial institutions now show towards the level of risk within a business, if primary producers wish to access finance in the near future, they must be able to demonstrate their ability to mitigate the risk in their business. Spreading the risk is an effective way to achieve this.

Crop Rotations

Within all broad-acre cropping enterprises, the rotation of crops and paddocks is an important consideration. Much time and effort is devoted by both farmers and agronomists alike to achieving a balance that will facilitate optimal returns for a particular crop. For continuous croppers, cropping rotations are mainly worked around keeping pests, diseases and weeds at sustainable levels so that the crops grown are profitable. Within mixed farming operations, integrating a pasture phase for livestock in a cropping rotation is a valuable way of gaining control over these problem pests, diseases and weeds. Over time, pests, diseases and weeds can build up in a cropping system that is running a tight rotation. Giving paddocks a rest from continuous cropping will reduce the pressure on following crops from these pests, diseases weeds that would otherwise continue to build in numbers.

Planting legume based pastures, such as Medic, can have a great influence on soil health and fertility by fixing nitrogen to the soil. Medic pasture will regenerate after several years of cropping, so there is little establishment cost. Legume or broad leaf crops grown for forage can be sprayed with different chemical groups to control grass weeds, which can help combat resistance issues within grass populations, and also serves as a nutritious food source for growing lambs and sheep (Dickson, 2011).

Adding Value to Crop

After a crop has been harvested, there is still potential for producers to gain financially from what it left. Value can be added to the cropping system by making use of crop residue to produce meat and wool through grazing the remaining crop with livestock.

The residue left behind after a crop has been harvested will usually make a very good food source for sheep or lambs. Un-harvested grain and leaf that remains in the paddock can be cleaned up by the sheep and turned into a marketable commodity.

Not only will livestock increase the income from each hectare of land, they can also add benefits to the cropping system by controlling summer weeds, which in turn will conserve moisture for the following crop.

Grazing Practices

Grazing growing cereals is a relatively new but now quite common practice in Australian agriculture. A significant number of successful trials have been conducted into this procedure, and the resulting information now available to producers should give them confidence to implement it into their own farming operations. Cereals can be sown with either the intention to harvest after grazing or be left for grazing as a standing crop to fill a feed gap prior to harvest or in late autumn the following year. Along with achieving positive results in livestock growth, the opportunity to then harvest these crops at maturity and sell as a profitable commodity increases the productivity of the crop.

The major reason behind the practice of grazing cereals is to allow pastures more time to grow and establish before grazing. This in turn allows for more pasture growth for the year. As a result there is more feed available at the end of the growing season to carry stock through. Cereals have good early vigour and can produce more feed earlier than annual pastures.

All cereals have benefits for grazing from a nutritional perspective, with adequate metabolic energy, crude protein and are highly digestible (Dickson, 2011). Grazing cereals can start once the root systems have properly anchored the plant and the sheep cannot pull it from the

ground. This is normally at early tillering, or four to six weeks after emergence. Yield loss can be expected if grazed past stem elongation or plant growth stage Z30 (Dickson, 2011). Crops should be grazed with a high stocking rate to keep grazing as even as possible, this will help with even crop maturity at harvest. This is common practice in New Zealand through the use of temporary electric fencing, or 'hot wires' to control grazing pressure. The best varieties to grow are usually the highest yielding ones for your area. Longer growing varieties can give a longer grazing window. Barley and oats have better early vigour than most wheat varieties and can therefore be grazed earlier in the season. Grazing of cereal crops can also have benefits for the crop itself. The removal of foliage from a plant can reduce the amount of moisture transpired by the crop which may leave more moisture available at grain fill.

Grazing of canola can provide another option as a forage crop with the opportunity to harvest if the season permits. The grazing of canola is a relatively new concept in Australian agriculture, but has huge potential for both crop rotations and livestock nutrition. Planting canola as a forage crop gives the ability to control grasses and cereal disease; while producing good quality feed on which positive livestock growth rates can be achieved. (Crawford, 2011)

Sowing crops with the specific intention of feeding livestock has also become common practice in Australian agriculture. The major benefit of this practice is the low input cost required, with commodities such as rye, medic, barley and oats often sown without the additional fertiliser and herbicides that a cereal crop would require. This low input cost increases the potential of the crop to produce good returns through the production of quality meat and wool from the sheep that graze it. The climate, rainfall and landscape in New Zealand have allowed farmers in both the North and South to achieve good success through crops sown for feed. At Stuart Wright's mixed farming property in the Canterbury region, consistent results in prime lamb production had been achieved through the finishing of lambs on white clover and rye grass which is then taken through and harvested.

Knowing how much food is on offer for sheep and lambs, and its nutritional value, is an important planning tool for establishing good stocking rates and supplementary feeding programs. Different agricultural regions, and indeed, different properties within a region, will vary in their potential to produce and maintain quality food on offer. Developing a sound understanding of the carrying capacity of their land could potentially give sheep and lamb

producers the confidence and ability to carry stock at optimal rates, and also take advantage of trading opportunities that may arise.

The utilisation of pasture in New Zealand is an area of farming from which Australian graziers, especially those in mixed farming enterprises on Eyre Peninsula, could take note. Many of the sheep and cattle producers on both North and South Islands, including Roger Barton at Greytown on the North Island, make optimal use of their pastures through the use of temporary electric fencing. This allows larger numbers of stock to graze on smaller areas, consuming a larger portion of the food on offer, before shifting them on to another small area of the paddock by re-zoning the electric fencing. Despite the greater levels of management that this requires, Roger said that it had 'proved to be an effective way for producers to make the most of out their pastures' (Barton, 2011). This is in comparison to the typical management practices of producers on Eyre Peninsula, where cattle, sheep and lamb flocks graze on larger paddock areas in a set stocking system, often not making optimal use of the food on offer.

Genetics

Breeding livestock with genetic traits that suit our environment, management practices and marketing opportunities can have a huge impact on production, and essentially, our bottom line. Achieving the optimal genetic balance has the potential to lift lamb survival rates, increase growth rates and even improve feed conversion rates. The consideration of genetics within the sheep and lamb flock is becoming increasingly popular amongst Australian producers, and importantly so, as they work to establish themselves within a competitive market.

Australian sheep and lamb producers are in an advantageous position, with the opportunity to use Australian Sheep Breeding Values (ASBVs) to assist with sire selection. ASBV's are delivered through Sheep Genetics, and run under the LAMBPLAN & MERINOSELECT services for the Australian sheep industry. An ASBV is an estimate of the genetic potential a sheep will pass on to its progeny. They are available for a range of economic important traits and are designed to be used in conjunction with visual assessment (A Pocket Guide to ASBVs, 2010). Some traits that producers can target to improve their productivity;

- Live weight traits

- Carcase traits
- Fleece traits
- Reproductive traits
- Disease resistance traits

With the use of ASBVs, selecting the right rams is a lot simpler and more accurate than relying on visual assessment. For example, if farming in an area where worms are a problem, rams can be selected with a genetic resistance to worms and these rams will pass their genes through the flock over time. (Ashton, 2011)

Ewe Nutrition

Within a competitive livestock market, more and more emphasis is being placed on enhancing the nutrition of the ewe flock as a means of increasing productivity. Though regions can record great variations in the resources that are available to them to achieve positive nutrition, it is essential for farmers to understand the importance of making the most of these resources.

Management of ewe nutrition is critical to weaning more lambs at higher weights. Having ewes in CS3 (condition score 3) at joining will dramatically improve conception rates. A trial conducted by the Life Time Wool project found that, on average, for any condition score gained above CS2, twenty percent more lambs were conceived. It has also been shown that it is more cost effective to maintain condition scores with supplementary feeding than it is to increase condition score once condition is lost (LTW, 2008).

Maintaining CS3 or greater into late pregnancy also has major benefits, such as heavier lamb birth weights and survival. Ninety percent of lamb mortalities occur in the first forty eight hours from birth. The optimum birth weight for lamb survival is between 4.5 and 6 kilograms, with the lower birth weight expected with twins (LTW, 2008). The lamb should have a higher growth rate due to more milk from the ewe and better muscle development because of adequate nutrition through pregnancy. Having the ewe in CS3 at point of lambing can also reduce the risk of pregnancy toxaemia. Better nutrition during pregnancy can also reduce fibre diameter and increase fleece weight of the lamb for its life time due to the lamb having more secondary wool follicles.

Ewes can lose condition quickly during late pregnancy and lactation. The energy requirements of a ewe increase by 50% for single bearing ewes and 80% for twin bearing ewes by the time they reach point of lambing. Without adequate nutrition, and hence energy stores, at this time, ewes will experience a much more difficult birth and recovery period, making it much more difficult to 'bounce back' to an adequate condition score needed to support offspring (LTW 2008).

Flock Health

The dominant driver in increasing productivity in livestock is the management and maintenance of good flock health. Over time, a great deal has been learned about practices necessary to sustain the health of sheep and lambs, and farmers need to be vigilant to ensure that unnecessary losses are not incurred through poor animal health.

Every year it is estimated that Australia's sheep industry loses three hundred and sixty nine million dollars to the burden of worms (MLA 2006). Drenching sheep to control worms is more effective when used in conjunction with other management practices, such as low worm risk pastures. Low worm risk pastures are pastures that have been managed in a way to reduce worm egg numbers for sheep and lambs to utilise after drenching.

This can be achieved in several ways,

- Freshly sown pastures
- Cropping
- Grazing cattle through the paddock rotation
- Using hay or silage paddocks
- Spelling pastures

Freshly sown pastures and crops typically have low levels of worm larvae. Larvae numbers are reduced by long duration between grazing, soil disturbance and an unfavourable environment produced by crops.

Grazing cattle through the rotation can also help lower worm larvae numbers because most worms are only hosted by either sheep or cattle. Therefore the paddock can continue to be grazed and the life cycle of the worms is broken.

When hay or silage is made, large numbers of worm larvae are removed from the paddock and killed and the reduction in ground cover exposes the remaining larvae to sun light and heat, which reduces their survival rates (MLA, 2010).

The effect of spelling pastures on worm larvae numbers depends on the time of year and the type of pasture being spelled. Worm larvae are killed off quickly in hot and dry conditions but can survive for long periods in cool and wet conditions. (Dickson, 2011).

Infrastructure

Effective livestock management is achieved through the efficient use of available resources, and this is particularly significant when referring to the use of quality equipment and infrastructure. A major concern for many Australian livestock farmers is the workload required when it comes to successfully managing stock, often creating great pressures on time, money and labour. These pressures can be successfully minimised and livestock managed more efficiently, effectively and consistently by ensuring optimal use of infrastructure, equipment and technology.

Sheep and lamb producers in New Zealand are taking great advantage of the new technologies and advances in sheep handling equipment that are available to them, with all operations visited employing the use of sheep handlers. These handlers varied in make, model and features, but most had the capacity to weigh the animals and subsequently auto-draft them, as well as restrain them for crutching and drenching purposes. With high stocking rates and large volumes of sheep to be handled, farmers like Duncan Smith in the Hawkes Bay region, viewed sheep handlers as a necessary investment in enhancing the efficiencies in their operation and keeping labour costs low.

Crutch & Weigh Combo from Hdale Engineering at Duncan Smith's property, Hawkes Bay, New Zealand
www.hdaleengineering.co.nz

Australia has many challenges to face when it comes to efficiencies in labour. Internationally, we are one of the few countries that do not have access to 'cheap labour', with stringent minimum wage conditions. On the other hand, Canada, the US and Europe have access to an inexpensive labour force through government policies that allow the use of foreign labour, while developing countries such as Brazil, China and India have large labour resources within their own countries. This puts Australian producers at a significant disadvantage when competing on a world stage. Issues with labour also exist within Australia, with agricultural producers often competing head-to-head with the currently booming mining industry for the same labour source. Both of these issues provide very good reasons for Australian producers to invest in infrastructure that reduces the businesses need for additional labour.

Recommendations

Based on the key findings of this study, it seems important to make the following recommendations;

- Relying on a single enterprise to produce income in a business increases its exposure to risk. Diversifying the business to integrate a number of different enterprises, such as incorporating livestock into a continuous cropping business, reduces the risks that come from having 'all eggs in one basket'. Livestock can add flexibility to a business at a time of increasingly unpredictable commodity markets, allowing for a change of systems if one should be required. Farmers trying to survive and move forward in a volatile agricultural industry should consider diversification as an option, particularly in the current economic climate.

- While no two farming properties are identical, most common grazing practices could be successfully used by farmers to complement a continuous cropping system. Crop rotations that include a pasture phase for livestock grazing can allow for the management of pests and diseases that can build up in a continuous cropping system. Farmers need to consider and have confidence to grow winter cereals and canola that can grazed in the early part of the growing season and harvested at maturity, thereby adding value to both crop and livestock. In addition to this, identify suitable paddocks that could be sown to a feed crop for the sole purpose of feeding livestock. With low input costs, the growth that can be achieved on these crops will considerably increase the potential returns through wool and meat.

- Employ the services of industry consultants to assist with developing the knowledge needed to make decisions about ewe nutrition and flock health and care, as opposed to relying only on the advice of local stock agents. While they do have a great deal of knowledge to impart about sheep and lambs, this is often no competition to the modern knowledge and advice of researchers and consultants. Seeking this will optimise results in the operation. Test pastures regularly to achieve a sound understanding of the

nutritional gains that sheep and lambs are receiving from it. This will increase the relevance of the information and make it specific to your own individual circumstance.

- Invest money in achieving efficient management practices. With the user-friendly information now available for farmers to select suitable genetics for their progeny, producers now have the option to confidently make choices when it comes to sire selection, ensuring they will achieve the best results for their money. Establishing and maintaining quality infrastructure will also reduce many of the inefficiencies associated with livestock production. Maintaining good yards and fencing and using modern sheep handlers and equipment will increase the likelihood that producers will make the livestock aspect of the business more efficient, and hence, more economically viable.
- Embrace new technologies – they are the way forward in all business and with a well developed understanding, can be an efficient and effective way of keeping up with an ever evolving industry.

- As a final recommendation for the agricultural industry, in particular the livestock sector, must find ways of attracting and retaining young people to ensure it continues to develop and move forward. Young people have the potential to bring with them fresh ideas, energy and enthusiasm, which the industry is in need of, especially in a time when markets are increasingly competitive, public perception is waning and Australian agriculture needs to push itself on an international platform to ensure its success. Providing motivation and support for young people to 'have a go' at farming is imperative to its survival.

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Plain English Compendium Summary

Project Title:	Livestock Management Systems: adding value to grain and crops through the use of sheep and lambs
Nuffield Australia Project No.:	
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Objectives	With good management, livestock can add a productive and profitable enterprise to a farming business. The aim of my study was to investigate some of the best management practices being used by the world's leading livestock producers, and how to make the most of the resources that are available to us.
Background	Significant downturns in the livestock industry encouraged many farmers to re-direct their businesses towards continuous cropping systems, which increased their vulnerability to poor seasonal conditions and volatile commodity markets. With the potential of returns on livestock improving and providing increased stability, opportunities for producers to take advantage are also increasing.
Research	International and domestic travel to interview and discuss livestock management practices with leading farmers, consultants, agricultural corporations and industry experts. Attendance at livestock forums and workshops within the local area and discussions with local agricultural consultants and experts. Review of the current literature on livestock management and nutrition.
Outcomes	Along with providing a sound risk management tool for an agricultural business, livestock has a great number of benefits for broad-acre cropping – it varies cropping rotation options and adds value to crops through winter grazing and, following harvest, crop residues. Sound management of livestock is the key to success, with genetic ability a major factor. Management of nutrition, flock health, and paddock and confined feeding systems will also increase productivity, as will the use of quality infrastructure. With these management practices in place, producers may take better advantage of the opportunities that livestock and cropping offer.
Implications	Using livestock as a way of adding to value to crops and grain requires a great level of management, but with appropriate practices in place, can enhance and diversify farming businesses. Farmers must continue to update and extend their knowledge and understanding of the land that supports them to make the most of its potential. They must also have the confidence to implement new practices and systems, and invest in infrastructure that optimises efficiency. Enhancing the sustainability of individual farming enterprises will go a long way to ensuring the survival and success of the Australian agricultural industry.
Publications	Nuffield Australia