



Grazing crops to fill a winter feed gap in a changing climate

Dustin Pascoe, 2020 Scholar
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Scholar contact details

Name – Dustin Pascoe

Organisation – Pascoe Farms

Address – 2340 Bendigo-Pyramid Road, Raywood VIC 3570

Phone - 0417423305

Email – dcpascoe1@gmail.com

In submitting this report, the Scholar has agreed to Nuffield Australia publishing this material in its edited form.

NUFFIELD AUSTRALIA Contact Details

Nuffield Australia

Telephone: 0456 916 506

Email: enquiries@nuffield.com.au

Address: 38 Walker Drive, Worongary, QLD 4213

Executive Summary

Integrating livestock into a cropping scenario can have beneficial implications for a mixed farming business. This includes maximising profitability, manipulating planting windows, efficiently producing high quality feed, and reducing risk to a mixed farming business from both a cropping and livestock perspective.

In a broadacre cropping scenario, the use of livestock to graze the crops such as wheat, oats, barley or canola before removing the livestock and taking the crops through to the final harvest stage can have benefits to whole farm profitability and productivity while reducing overall risks.

This is done by establishing a crop early to gain early biomass and widen appropriate planting windows. Livestock are then utilised to remove the excess biomass and fill a critical feed gap, where pasture growth may be at a minimum. This can benefit the livestock by providing good amounts of high-quality, high-energy feed, generally at a time when seasonal conditions, such as cold and wet, can limit pasture growth on pasture paddocks. The livestock are then removed within an adequate time frame to allow the crop enough time to recover. This allows pasture that is growing slowly to be rested while reducing the requirement for supplementary feed for the livestock, as well as generally having positive outcomes for the livestock's condition and production and therefore improving overall farm profitability.

From a cropping perspective a widened planting window makes for easier time management at the time of establishing crops, without increasing the risk of having the crop flower too early. If a plant is exposed to frost at the point of flowering it can have detrimental effects on yield. Grazing crops has the potential to delay flowering by 7-14 days. In some cases, there is evidence showing that it was even possible to increase the final grain yield harvested.

Grazing crops has the added benefit of diversifying income streams across different commodities, as well as staggering the monetary benefit from the high up-front costs associated with a broadacre cropping scenario. If done well in the right season grazing crops can consistently be done without any negative effects on the yield of the crop. This has the overall effect of increasing farm profits, while reducing risks in varying climate scenarios.

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Foreword

Our family farm, Rosedale, located at Raywood, northern Victoria is a true mixed farming business comprising of 25-30% self-replacing merino sheep and a small feedlot, as well as 70-75% broad acre crops including wheat, barley, oilseeds and hay. The drive to maximise whole farm profitability in both the livestock and cropping areas, while balancing associated risks of our business, has led me to adopt the practice of grazing crops in the early stages of growth, before locking them up and taking them through to their final grain or oilseed form. This is especially important in a changing climate.



Figure 2. Dustin Pascoe in a Pacific seeds 970CL canola crop that has been grazed and taken through to grain (Source: Author)

In trials performed at Rosedale, the practice of grazing crops has had the effect of providing high quality green feed when cooler weather is inhibiting growth in pastures, limiting the amount of feed on offer (FOO). This is at a time when the megajoule (MJ) requirement for our livestock is at its peak during their reproductive and lambing cycle. This also has the added benefit of reducing our risk in the cropping side of our business by staggering flowering dates without the use of growth regulants, so that a smaller area of crop is exposed to damage by a single frost event in the Spring. Timing of sowing is critical to maximise grain yield but can create risk at the other end of the season when plants are flowering. When a severe frost event occurs during flowering the cost can be extremely large, reducing our grain yield, grain quality and financial returns. Grazing the crops in the winter months also has the benefit of cashing in early on some of the value from the high up-front costs of the broadacre cropping enterprise, rather than waiting until harvest to obtain all the monetary value. This again spreads the financial risk, while enabling a higher overall stocking rate.

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This integration of livestock into the cropping enterprise, above and beyond just grazing the stubbles that have been left behind once the crop has been harvested, has led me to research further the benefits of grazing crops. This includes looking at ways and techniques to maximise profitability, and to investigate the pros and cons of grazing crops. These include manipulating planting times to efficiently produce high quality feed at a time of year where pasture growth is at a minimum, while reducing risks in both livestock and cropping enterprises.

These topics have led me to research the grazing of crops throughout the world including Australia, New Zealand, Singapore, France, England, Ireland, Scotland, Canada and the United States of America. I also planned to look at alternative crops and techniques to feed livestock.

Acknowledgments

It is a huge endeavor to take the six months demanded by a Nuffield Scholarship out of a business that is essentially based solely around one person, especially in a business that crosses the line regularly between business and lifestyle. Nonetheless it is important to investigate any opportunity to improve the efficiency and profitability of our business. I sincerely thank all of those who have helped both at home and abroad both directly and indirectly, allowing me to chase this dream that is a Nuffield adventure.

Firstly, thanks to Nuffield Australia and the Grains Research and Development Cooperation (GRDC) for giving me the opportunity and support to complete a Nuffield program. The patience required from all parties in the cloudy times of Covid made for some very difficult decisions on how to proceed forward in unknown circumstances. These decisions for good or bad have provided me with a fabulous experience like none I have had before. Specifically, I would like to thank Jodie, Nicola, Carol and their teams in Nuffield for their help and guidance.

To my wife and children who have done some very heavy lifting right from the first Nuffield interviews, supporting me all the way despite the study period being two and a half years longer than the expected eighteen months. Also, my heartfelt thanks to the community that helped and supported my family and wife while I was absent.

A huge thankyou goes to my father who has been a mainstay at home keeping the business afloat. He, as much as me, stepped outside of his comfort zone, kindly allowing me to chase my endeavors.

For the team at home including, but not limited to, Riley Nolan, Harlee Tuohey, Anton Mannis, Nigel Starick, Leigh Sargent, Brooke Nichol and Paul Hocking. Thank you all for stepping up and contributing your various areas of expertise while I was away. Again, the support from the broader community has been amazing and humbling throughout this experience.

Thank you to Chontell Giannini at ittravel Griffith, for making all my travels and hire seamless: this is an area that is clearly not in my area of expertise and I very much appreciate the ease with which she has organised my travel and the level of stress that she effortlessly removed.

While traveling it was humbling the amount of assistance, generosity and knowledge that I received from so many people from so many different walks of life. I thank all of those who met with me and shared information and hospitality so generously. There were a couple of key people in each country that really helped me, organising key contacts and putting me up, and gave me key local knowledge, for which I am extremely grateful. These include:

Bruce Thompson; Robbie Byrne - Ireland

Jimmy Stobart; Lucy McLennon; Alex and Jane Brewster – United Kingdom

Phillip Weir; Mac McArthur; Ed Pickney; James & Cate Hurley; Gavin Hurley – New Zealand

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An important component of my scholarship was the GFP group that made it a pleasure to travel around the globe and share the experience and knowledge, comprising Mitchel Henderson, Nick Krebs, Luke Cantrill, Billy Browning, Richard Quigley, Bruce Thompson and Ranga Huruba.

Abbreviations

COP	Cost of Production
DSE	Dry Sheep Equivalent
FOO	Feed on Offer
GFP	Global Focus Program
GRDC	Grains Research and Development Cooperation
Ha	Hectares
Kg	Kilograms
LTEM	Life Time Ewe Management
ME	Metabolised Energy
MJ	Megajoule
MJ/D	Mega Joule per Day
MM	Millimeter
T/Ha	Tons per Hectare
\$NZ	New Zealand Dollars

Objectives

The objectives of my scholarship were to study

- Production issues which affect feed supply and demand
- Different ways to feed livestock
- The benefits of grazing crops and where this system fits in mixed farming enterprises
- Risks of grazing crops both from a cropping and livestock perspective
- If grazing crops is financially viable
- Alternative systems which may be relevant in the future

Introduction

Many farm-based businesses around the world have more than one enterprise. Getting the most out of these enterprises to maximise productivity and remain viable in an ever-changing environmental, political and financial landscape is a constant battle.

In the case of a livestock and cropping enterprise, there are peaks and troughs throughout the seasons in cash flow, feed availability, plant growth and commodity pricing. In Australia specifically, (but acknowledging that it's becoming rapidly more prevalent around the world) climate has a very large influence on these peaks and troughs in cashflow and feed availability. Integrating livestock and cropping can have many benefits to both the cropping and the livestock enterprises, while mitigating an ever-increasing range of risks for a mixed business.

There are many ways to feed livestock. From high intensity supplementary feedlot or barned scenarios, or improved pastures designed for livestock with intense grazing, to low intensity native grazing. All of these options, and everything in between, have their place in a livestock system, as each of these systems have both advantages and disadvantages. The management decisions which influence the different livestock systems are influenced by the different business models, climates, food availability, costs of production (COP) and political systems associated with these systems.

In most grazing systems there is generally a time of impaired growth or a higher need for feed energy, creating a mismatch in the amount of feed available and the amount of feed required. This is also known as the "feed gap". Traditionally in an attempt to rectify any mismatch in the feed gap between supply and demand, management changes can include reducing livestock numbers to an extent where the feed available and the livestock requirements are matched. Alternatively, extra feed can be supplemented in some form, such as hay, grain or silage, to a point where there is adequate feed for the livestock or agistment onto other grazing land was obtained.

Another tool available to cope with this mismatch of feed required and feed available is to graze crops. There are many benefits being associated with grazing crops from both a livestock perspective and also a cropping perspective.

These include:

- Early sowing
- Reduced risk
- Reduced inputs
- High quality feed
- Increased stocking rate and body condition
- Manipulating flowering windows, reducing the risk of frost damage and allowing easier harvesting.

On the flip-side of grazing crops, there are also challenges that arise. Grazing crops has more implications than just providing good amounts of high quality feed in a time of need. There are many risks involved from increased animal management, weather risks and financial implications. Also, there can be a higher attention to detail required to manage both the crop and the livestock perspectives. In this situation this extra labor cost can be offset by the advantages of producing a high-quality grazing crop. There are commonly issues with animal health such as metabolic disorders associated with

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high quality feed, depending on the animal, type of crop and the growth stage of the animal also coming at an animal and financial cost.

In dryland systems there are also risks that there will be not be adequate conditions to finish the crop or maximise the crop growth. As climatic conditions become more erratic, this risk becomes greater. There are also generally higher input costs such as fertilizer, resulting in a direct financial cost associated with producing the extra feed. If the higher costs are not mitigated by higher returns the exercise of grazing crops is null and void. Associated infrastructure requirements such as fencing should also be allowed for and costed.

When examining the financial implications of grazing crops, the benefits can be great if it is done well; some of these direct financial benefits that will be explored in this report can include but not limited to the following:

- It can be possible to increase overall crop growth opportunities by taking advantage of different planting windows without the use of costly growth regulants.
- Increased stock condition that has a direct dollar per weight unit value,
- Increased stock condition that can increase fertility or offspring survival.
- Cycling nutrients from ruminant excretion that can be used by the crop,
- Widening marketing opportunities by not having to sell stock,
- Possibly to increased yield of the grazed crops,
- Ability to maintain an increased stocking rate over whole farm,
- Increased pasture growth in non-cropping areas because they can be rested.
- Easier harvesting, resulting in reduced machinery costs.

Looking at feed supply and demand

Looking at feed supply both internally and externally within a farm system has an effect on the decisions made around how to feed animals. The amount of feed on offer (FOO), the number of animals that are required to be fed and the energy requirements of these animals (in megajoules per day (MJ)) can vary greatly throughout the year. Adding the market, political and climate influences into this equation creates an ever-changing target for the farm manager to achieve.

On-farm supply of pasture feed is seasonal as outlined in the Victorian pasture growth curve

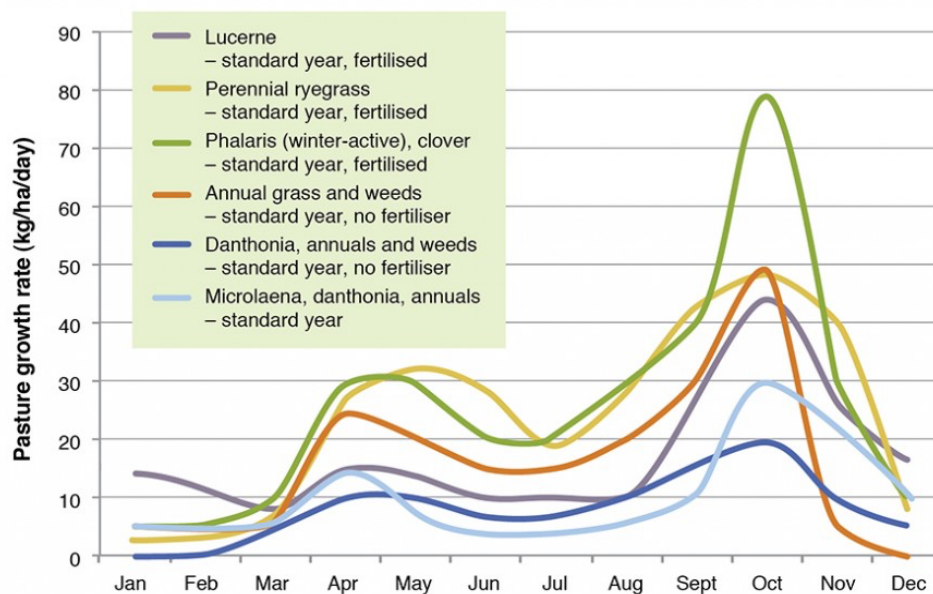


Figure 2. Pasture growth curve for North East Victoria (Source: Evergraze project, 2023)

This pasture growth curve, showing the typical FOO, is simple to follow in an average year, but seasons and climate are not always predictable or consistent, especially if you live in Australia.

On our farm alone last year in the three months of summer we measured 311mm of rainfall with zero measured in February. This year we measured 18mm of rain also with zero in February. This highlights the variability involved in predicting the amount of feed that may or may not be produced. So, while the average seasonal feed curve for feed is a great guide, it does have limitations.

The one thing that the feed curve does highlight is that in an average year across several different species of pasture there is minimal growth throughout the summer months where there is insufficient moisture to grow pasture. The graph also shows across all species studied that there is a drop in the amount of pasture that can be grown throughout winter due to the cold conditions inhibiting growth. Whilst irrigation can be used to mitigate the lack of moisture in summer, and pasture growth regulants such as gibberic acid can be used to increase pasture growth in the colder months by

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tricking plants into growing while cold conditions prevail, this was not the primary focus of my study.

The energy required by livestock varies throughout the year: this can vary depending on the age and the size of the livestock and the condition score (fat cover) and the pregnancy status of the livestock. There are some great resources to easily calculate the MJ requirement for livestock quite accurately.

Table 1. Life Time Ewe Management (LTEM) Metabolized Energy (ME) calculator (Source: Life Time Ewe Management)

Table 1 ME Requirements (MJ/day)

Pregnancy			Lactation		
Day of Pregnancy	Single	Twin	Day	Single	Twin
Dry	8.3	8.3	1	12.5	14.4
10	8.3	8.3	10	18.7	23.4
20	8.4	8.4	20	20.7	26.6
30	8.4	8.4	30	20.2	25.8
40	8.5	8.4	40	18.6	23.4
50	8.6	8.5	50	16.7	20.6
60	8.7	8.7	60	14.9	18.1
70	9.0	9.1	70	14.1	15.8
80	9.3	9.3	80	13.4	13.9
90	9.5	9.8	90	11.0	12.4
100	9.5	10.5	100	10.2	11.2
110	10.0	11.2			
120	10.6	12.1			
130	11.2	13.1			
140	12.0	14.0			
150	12.7	14.8			

Table 2. Requirements Multiplier for Different Liveweight Ewes

LW @CS 3	40	45	50	55	60	65	70
Multiply By	0.84	0.92	1.00	1.08	1.16	1.24	1.32

Figure 2. Life Time Ewe Management (LTEM) Metabolized Energy (ME) calculator (Source: Life Time Ewe Management)

An example of the MJ requirement for a 65Kg ewe, in condition score 3 that is not pregnant can be calculated from the table above:

Feed requirements = 8.3MJ (dry 50kg ewe) x 1.24 (Condition score 3 weight multiplier for 65kg ewe) = **10.29MJ/ day** to maintain a ewe at this weight.

If that same ewe was pregnant with twins, at 140 days from joining or 10 days away from lambing down, the energy requirements required by the animal are greatly increased to maintain body weight. This can be calculated by the following.

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14 MJ (day 140 pregnancy requirement for a 50kg ewe) x 1.24 (Condition score 3 weight multiplier for 65kg ewe) =**17.36MJ /day** is required to maintain a ewe at this weight and pregnancy status.

For example, it would need 1.6kg of wheat or barley each day to maintain her weight.

As these two examples highlight, there can be a great difference in the amount that is required by the same animal depending on the animal's pregnancy status, let alone the variance between different classes of livestock. This is why it is important to know the livestock requirements before implementing changes to farm management to see if they are appropriate for each system.

Looking at different ways to feed livestock

There are many different ways to feed livestock and many different factors that affect the way we achieve this. Some of these factors include the value of the livestock and the costs involved with supplying extra feed, the geographical location and terrain, climate, the amount and type of livestock, as well as the type of nutrients they require at that time, the type of feed that is available and the quality of the feed available.

Intensive supplementary feeding systems such as feedlots require infrastructure dedicated to feeding livestock, as well as being labor intensive. A supply of high-quality feed is required, that can be transported to the animals, such as hay, grains and silage. With any intensive feeding system animal health issues can be exacerbated quickly due to the high populations of animals in a confined area.

The benefits of intensive systems are that the results are generally consistent and value and costs are able to be calculated easily. This also allows producers to predict costs to get animals to target weights and accurately predict when those weight targets may be met. This allows the use of forward marketing to lock in prices of livestock to mitigate risk of not having the financial reward of finishing stock.

Agistment, or obtaining further land is an easy way to feed livestock. Again, costs can be calculated easily, including rates per head and transport, but growth rates of pasture are less consistent and harder to calculate.

In-paddock supplementary feeding is a very common practice. This includes supplying some kind of extra feed such as hay, grain or silage when the amount or quality of FOO is reduced. The advantage is there is little need for extra infrastructure and the animals can utilise low quality feed, which reduces the costs of the supplementary feed. The major disadvantage is the damage that can be caused to paddocks from overgrazing or machinery in adverse conditions such as wet paddocks.

Intense grazing systems such as techno-grazing, which is intense rotational grazing where stock are contained to smaller areas and rotationally grazed on more regular intervals, with longer rest periods in between, had been observed especially in Scotland, England and New Zealand. I observed this on many farms including Jimmy Stobarts farm in the Northern parts of England. Jimmy ran a mixed cropping, cattle, sheep and Agro-tourism farm. Jimmy had divided his grazing paddocks into much smaller areas than traditionally used in his locality. They were designed in a way that he could use an electric fence to easily move his cattle on a regular interval. Water was relocated, so that each time he moved the stock he could easily tap into secure water. This grazing system results in better grass utilisation and increased growth by leaving higher residual leaf area behind to act as solar panels to kick start the grass growth again. The downside of these systems is the labor involved. Moving fences and stock on such short time frames can become more costly than the gains achieved by the increased grass growth. A balance needs to be found between getting the most out of the pasture and the costs involved.

Other intense grazing systems that were observed were on Alex and Jane Brewsters' farm in Scotland. Using a similar system of intense grazing, with electric fences, which gave the added benefit of weed control in an unimproved pasture on difficult terrain.

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This gave extra grass growth from the rotational grazing and also improved weed control from the intense grazing pressure. He had observed better water infiltration, higher grass yield, and better weed control with this system. He was in the process of converting other large “set stocked” paddocks to this rotational grazing system to improve their overall stocking rate and hopefully improve the return from obtained from their business.

In general terms cropping systems are much more advanced than pasture systems in knowing their costs and managing inputs to maximise financial potential. Treating pastures with the mindset of cropping as well as growing intensive grazing crops generally has a positive effect on financial outcomes. Intensively grazed crops have high up-front input costs, such as spraying, sowing, seed and fertiliser, but can provide high quality feed with some possible additional infrastructure. The feed from grazed crops is generally more consistent and costs can be calculated. This feed supply becomes more consistent with irrigation, mitigating the risks of a variable climate.

Grazing crops can fill the lack of supply in the winter months when pasture shuts down. is a common practice, especially in the south of New Zealand, where the winter period of impaired grass growth is generally estimated to be 100 days. Animals are grazed on the higher slopes while dedicated grazing crops such as turnip, beets or kale are sown on the areas that have water or are able to be traversed by machinery on the flatter ground. These crops are grown as a “standing haystack” for the wintering period when grass growth is minimal. The crop is grazed through the winter months, with the use of electric fences to allocate access to only an appropriate amount of feed. This has the effect of utilising the feed better with less loss due to trampling or spoiling feed. This practice also keeps the feed available to the animal consistent, rather than having a huge spike at the beginning and losing quality by the end. By grazing the crops, rather than converting them to silage, a reduced machinery cost is observed, making the feed more cost-effective overall.

In parts of New Zealand, they also put haylage (low moisture content silage) in specific areas of the paddocks while the crop is still growing, so a tractor does not have to enter the paddock in the winter months. This has the added benefit of not damaging paddocks with machinery in the wetter periods. In this system, especially with irrigation, they are able to budget their feed very effectively. Firstly, they calculate the amount of feed in the crop in kilograms or tons per hectare and allocate area depending on the requirements of the type of animal and the number of animals requiring feed.



Figure 3. Bales of haylage laid out in a grazing crop in New Zealand (Source: author)

By calculating the amount that is in the paddock and that the animals require an effective feed budget can be calculated to get through the low feed period.

The first major question that is posed to the livestock farmer is if it is worth feeding the livestock further? This is affected by many different factors. It may be that the livestock values simply do not have enough upside to warrant feeding. In this case the livestock are sold on.

I have also seen in many cases where the location of the property may rule out the ability to feed livestock in certain ways. In areas such as outback Australia, distance and lack of rainfall can prevent intensive feeding, when it becomes less costly to move the livestock to the feed rather than try and create extra feed or transport bulky feed for the livestock. This was observed on Tweed Pastoral, where cattle from their northern blocks in southern Queensland were transported 1,450km to finishing farms or a feedlot in Victoria. It was a cheaper option to truck the cattle to the feed source rather than truck the feed to the cattle.

In New Zealand, where domestic grain supplies are limited and relatively expensive due to the lack of appropriate grain growing land, coupled with the high transport costs due to the terrain and high fuel costs, makes feed lotting a less desirable option and the transport of hay economically unviable over larger distances

The benefits of grazing crops

There are many benefits to grazing crops from both a livestock perspective and cropping perspective. One farm that was doing it successfully was Balgay Farms in Scotland, where I was lucky enough to meet the manager of the farm, Ian Wilkinson. Here they have been conducting on-farm, like for like, controlled trials for many years with their own sheep and cattle on their winter oat, barley and wheat crops.

Balgay Farms had initially started grazing crops after a severe drought caused a large feed gap for their farm. This prompted them to look at other ways to feed their livestock and consider grazing the cereal crops they had traditionally grown for grain.

Balgay set up a trial that consisted of two-hectare sized parcels of land, side by side in the same crop divided up by portable electric fencing. This ensured that the grazed and non-grazed areas had the same paddock history and the same environmental factors such as frost, rainfall and timing of cropping operations.

At the beginning of the trial Ian had thought that they had caused detrimental damage to the crop, thinking that he had grazed it too hard. It was not until harvest when the results showed that the grazed areas actually had increased grain yields than the non-grazed area. Specifically in barley this grazing resulted in 0.5-0.75 tons/ha yield increase in the grazed area. It was also noted that the harvesting was easier due to less biomass being left in the paddock for the harvester to process and they felt that the sheep had added extra biology to the field by adding manure to the paddock.



Figure 4.A grazed wheat crop at Balgay Farms that was estimated to yield 14T/Ha (Source: author)

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Since the first trials at Balgay they have continued to graze crops. This allows them to sow the crops three weeks before they would traditionally sow. This gave them opportunities to widen the sowing window, spreading the workload and sowing the crop in a mostly drier environment before the fields became wet, which would make it hard to put a crop in and do irreparable damage to the soil structure.

Overall, at Balgay they found that the livestock did better when provided with a high energy green crop rather than the barned winter system of intense feeding. This gave them confidence to maintain a higher stocking rate than before they started grazing crops. They found that there was upside to yield potential that they put down to increased soil biology and more aggressive tillering by the plant post-grazing.

The grazed paddocks were also observed to be more manageable at harvest because the crops were less bulky and more upright. In their opinion there were no detrimental down-sides to the grazing of winter cereal crops. It is with this outlook that they are continuing to trial and graze crops into the future.

From a cropping perspective the ability to get on the ground earlier to plant crops can spread the workload in a busy time of year, which is a very large advantage. With most things in farming, timing is everything. This gives the added advantage of a jump start to growth when soil temperatures can be more favorable for growth.

Easier harvesting of cereal crops is another advantage that has been observed by many farmers who graze their crops. They put this down to less extra biomass in the form of leaf matter to go through the harvester. This in turn speeds up the harvest program at a critical time of year when time is in short supply. Early sowing also saves on fuel from running less hours.

Gareth Culligan from Louth in Ireland is a pure arable crop farmer but introduced livestock to his arable crop area in the form of agisting animals from other farmers and using electric fencing to control the movement of the stock. He did this because he found the benefits of having a ruminant livestock in the cropping rotation for his soil health. He also found benefits in being able to spread his planting windows across different locations of farms resulting in better time management. Grazing also resulted in less leaf biomass resulting in easier harvesting for his contract business. There was also a tangible financial gain from the income from agisting sheep.

Grazing crops has the added benefit of being able to manipulate flowering windows to mitigate frost risk. GRDC has done a lot of work in this area, citing frost damage at flowering as a major risk to broad acre crop producers. GRDC has found that grazing crops for 14 days can delay the flowering window by 7-10 days; this can stagger the flowering windows reducing the overall risk to a mixed business.

One of the large benefits of grazing crops is the ability to obtain cash flow before the end date of harvest. This is obtained by converting the biomass to meat and selling the livestock. This mitigates the high upfront costs of putting in a crop and also reduces the risk of a total wipeout from events such as a flood. An example of this is Rob Coleman that farms in Cork, southern Ireland. He was able to reliably predict that he would have surplus biomass to graze due to his grazing of crops and was able to buy lambs in to take advantage of this. He would sow early and then buy lambs when others were forced to sell due to cropping land being tied up with the crop enterprise, reducing the amount of area available for them to graze. He would then lock in a price

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and date so he had secured the returns from grazing the crops. He said that in some cases he had made more from the grazing of the crop than from the grain.

Grazing crops also has the benefit of reducing financial risk by getting some financial gain earlier in the season, rather than waiting till harvest to obtain all the monetary benefits. An example of this can be seen in the 2023 cropping season at Pascoe Farms, where crops that were grazed realised some financial benefit before getting washed away in flood later in the season. This flood resulted in a complete loss of harvestable crops in that area of the farm. On the crops that were not grazed a larger financial loss was observed due to the high upfront costs of a broadacre cropping scenario.



Figure 5. Sheep Grazing a Planet barley crop at Pascoe Farms (Source: author)

From a livestock perspective, the benefits of grazing crops include providing a high-quality feed to livestock at a time when feed availability has traditionally been low. This high-quality feed can have the benefit of increasing the condition of the livestock, such as in Rob Coleman's case, where he was able to fatten livestock on high quality feed to convert the extra biomass of cereal crops to meat for a monetary gain.

Another benefit to the livestock can be shown in the case of our farm, where the high quality, fresh growth of the crops can be matched to the large MJ requirement of the sheep during lactation, where the MJ requirement of our pregnant ewes can exceed 30 MJ/day, when other pastures have shut down. By matching this high-quality feed to the high feed requirements of sheep we have seen a benefit of better conditioned stock coming out of winter and also potential for higher lamb weights and higher lamb survival rates. In most seasons we only aim to graze our crops once before taking them through to grain. Generally speaking, the dryer the season, the less pasture that

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is available from a farm perspective. This translates to a greater need to graze crops, but this also means that there is less moisture available to grow the crop out. It can be very much an individual's risk appetite and seasonal outlook that influences the decisions made at this point.

Wider market opportunities including more kilograms (KG) of meat to sell and wider timeframe to finish stock or buying in or agisting stock when there is an excess of feed can be another benefit of grazing crops. An example of how a grazing crops widened markets can be observed in the south of New Zealand.

Here lambs are traditionally taken as far as the pasture will last in grazing areas and then sold when everyone else is selling and the market is generally subdued due to oversupply. The livestock generally are sold to mid-South Island farmers to finish the lambs on stubbles and pastures before cropping starts: the profit for the mid-South island farmers was much larger, being up to \$100NZ per head by taking the advantage of the cheaper flush of supply in the markets to buy lamb and getting them to a heavier finished weight.

Ed Pickerney, a farmer at Jericho station in the far south of New Zealand that I visited, was using dedicated grazing crops to create a feed wedge giving him a greater feed budget that enabled him to finish his own lambs, sending them straight to the abattoirs rather than sell to mid-South Island farmers to finish his stock.

This enabled Ed to maximise his profitably, by being able to hold the stock longer and hit his target weights, rather than sell on the lambs as well as losing the lion's share of the profit. Ed also enjoyed higher overall stocking rates due to the grazing crops. He had a focus on improved pastures that were treated as intensive pastures regardless of the terrain involved and good fencing that gave him smaller paddock sizes. This intense focus in turn allowed him to create grazing pressure and manage pastures better.

A similar technique was observed at Alex and Jane Brewsters place in Scotland. The improved pastures also benefited from innovative management and fertilizer, resulting in higher overall stocking rates, higher land values and higher profits.

Overall, there are many benefits to grazing crops, in a variety of environments. As outlined above there are different factors at play which determine why people use grazing crops. There are potential considerable benefits for both the cropping enterprise as well as the livestock enterprise of a mixed business.

Looking at the risks of grazing crops

Grazing crops is not always as easy as the above benefits may suggest: close management from both a cropping and a livestock perspective is required to maximise the practice. Issues with metabolic disorders, an increased requirement for infrastructure, potential for higher inputs, physical damage to the crop as well as potential to negatively impact yield are some of the risks involved.

From the crop perspective there is a risk that the crop is grazed too early, creating issues of pulling out plants as well as not getting the benefit of a good amount of biomass to graze. A standard rule of thumb is the twist and pull test, mimicking the grazing action of the livestock. Likewise, if the crop is grazed too late, the first node (which is developed around Zadok growth stage 30) can be removed by grazing. This has detrimental effects on the potential yield of a cereal crop.

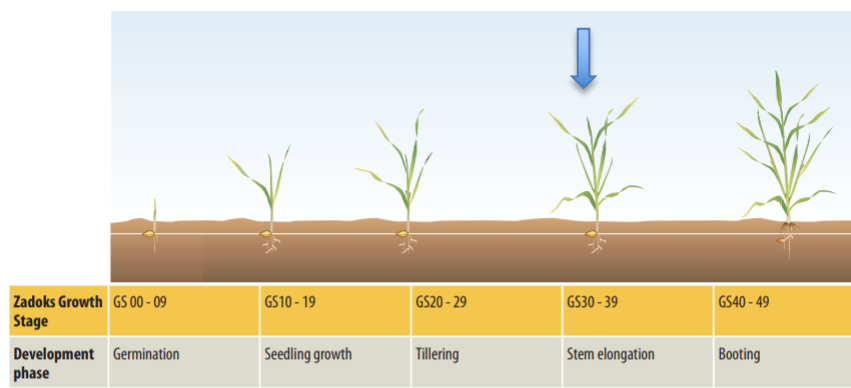


Figure 6. Zadok's Growth stage chart (GRDC, 2004, Cereal Growth Stages)

Increased costs of more inputs can be observed in some cases. A reduction in biomass can have the effect of reducing weed competition resulting in further management and costs to control these weeds. Also, there is potential for an increased use of fertiliser to compensate for the amount of biomass that has been removed in grazing period, resulting in a direct cost.

Physical conditions need to be considered as well, such as if it is too wet, pugging of the ground can occur, resulting in a poorer crop. If the conditions are too dry the crop may not have enough time to recover. While grazing the crops can delay flowering of the crop, late frosts can still be a risk to the potential yield.

With any intensive farming system there is an increased requirement for close observation of livestock. Grazing crops can have negative outcomes on an animal's health. Introducing livestock to a rich, high-energy feed can create metabolic disorders such as Pregnancy Toxemia, Hypocalcemia, red gut and nitrate poisoning to name a few, as well as physical issues such as mismothering in bulky crops where a lamb physically cannot follow its mother.

Hypocalcemia specifically is caused by a lack of calcium in the diet, commonly around pregnancy and can be exacerbated by a flush of lush green feed and having imbalance of electrolyte intake (Agriculture Vic., 2023). Pregnancy toxemia is a reduction in blood glucose, also common in late pregnancy and can be triggered any stressful event such

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as shearing, trucking, lambing or excessive movement causing the animal to use its glucose reserves too rapidly. Red gut is another major issue with a rich, green flush of feed, leading to a low fibre diet creating excess distention which causes the gut to twist. Careful management of livestock, such as low stress stock handling, avoiding musting, trucking and yarding can help and feed supplements such as hay, straw and supplement licks can help reduce the effects of these disorders (NSW government, 2024).

Nitrate poisoning is another disorder that needs to be considered, this is particularly common when grazing canola crops. This occurs when there are high nitrate levels in the plant that is consumed by the animals, this is common when the use of nitrogen is used to feed crops. Feeding roughage like straw can help alleviate these symptoms.

Another risk that should be considered is the possibility of extra costs required for infrastructure such as livestock-proof fences, electric fences and animal handling facilities. An example was observed at Gareth Culligans place in Ireland where the long-term intense cropping enterprise had not required fences or the infrastructure to load or yard the animals. This created extra cost and logistical issues when setting up to graze crops on his farm.

Look at financial implications of grazing crops and where to from here

One of the biggest problems that I found in my travels was the lack of a standardised way to value the amount of gain or loss from grazing crops. I observed cases I would suggest either over-inflated the value of the crop as well as some of which discounted the value of the crops. The conclusion often depends on the perspective of the farmer.

Rob Coleman from southern Ireland bought in lambs to graze crops in lieu of using growth regulants. He was easily able to calculate his costs and benefits by knowing his buy-price and sell prices, as well as the saving on the growth regulants. He was confident that he was making good money by grazing crops and commented that in some years he had made more out of the livestock grazing the crops than out of the crops themselves.

Ian Wilkinson at Balgay in Scotland, ran side-by-side controlled trials of grazed versus non-grazed found an increased yield benefit of 0.5 -0.75 tons per hectare, which can easily be valued.

Gareth Culligan benefits were harder to quantify. He believed that his biggest benefits were the speed and efficiency of his harvest, when he was time poor, and the benefits to his soil. The value of his agistment was easy to calculate.

For Ed Pickering in New Zealand the grazing crops gave him opportunities for better markets for his lambs, with the financial benefits depending on the year and markets that were available.

One thing that was common on all farms was that there was a measurably higher overall stocking rate, coupled with improved condition of the livestock. The financial benefit was heavily dependent on the commodity prices for feed and meat at the time.

I personally found the fairest way to value the grazing of crops by calculating the number of grazing days on a crop and comparing this value to feed lotting the stock for the same period at current grain prices. Sheep consume on average around 1.2kg of feed per DSE. This can be shown in a real example from our farm on a 970 grazing canola.

540 ewes weighing 65Kg (equivalent to 1.24 DSE rating) = 669.6 DSE

X 31 grazing days =20,757 DSE grazing days

X 1.2KG of feed per DSE =24,909 kg of feed consumed

@ \$300/ton = \$7,472.70 worth of feed off a 16 Ha paddock

=\$467/ Ha grazing value

This method does not value the improved condition of the livestock, but only gives the maintenance feed value. This method could be improved by valuing the improvement in the sale value of the livestock. Personally, I think this inflates the true value. I think

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further research into a more standardised way to value grazing crops is required to compare different crops and make a more informed decision about what might be best for a situation.

I also think that further research is required into which years are the best years to graze crops or avoid grazing crops. This is a hard question to answer because of the variable results of grazing crops in different seasons, given a range of commodity prices and costs of available infrastructure and labor at the time of grazing.

A further question that needs evaluating relates to the best use of land: Is the land best used in some other way such as high value seed crops, agrotourism, or more intense development? This is a very large topic which is outside the scope of this report, but none the less needs to be noted.

An example of this was observed on a farm in New Zealand that I had visited where they had taken dry land, had then improved the value of the land using irrigation. Then used the irrigation to grow high value grazing crops for both a dairy and beef enterprise to keep up with the returns required for the increased value of the land. Further development was being explored as an option in the form of a housing development or agro tourism.

This was also evident at Jimmy Stobart's farm in the UK, where agrotourism had been successfully developed and integrated into their farm business and is now the major component of their farm enterprise.

Research into grazing crops is an ongoing and live topic. New varieties to graze are coming out all the time selected for their specific grazing ability, and this process is likely to improve with time.

Also new technology is being developed to improve the efficiencies of grazing. Opti weigh is an example of this, where in-paddock real time weights and livestock gains can be measured daily without the need for mustering or yarding stock.

Another technology that I see as being a game changer, if it is perfected, is virtual fencing. If in our situation we were able to have larger paddocks to get the efficiency on the cropping side but the ability to graze in small areas without the labor of erecting temporary fencing, the profitability of grazing crops could be amplified.

As with any developments in farming in Australia, further technology or varieties will only be adopted if they pay.

Conclusions

Grazing crops is a viable way to boost whole farm productivity and profitability in a mixed farming scenario. It has the ability to open up sowing windows and allow for the use of multiple varieties of crop, allowing for improved time management at the point of establishing crops where time is limited.

Grazing crops also can have the effect of reducing whole farm financial risk of both cropping and livestock enterprises, while having the potential to sustain an increase in the overall stocking rate in nearly every business that I observed.

Integrating grazing crops can have the effect of reducing the risk of a cropping business financially, by diversifying the timing of income derived from a crop and also diversifying the commodity type from which the income is derived. As well as giving the added bonus of delaying flowering and reducing the overall frost risk of a crop at the vulnerable flowering stage.

Grazing crops has been identified as a very effective way to fill feed gaps in the winter period when grass growth is at a minimum, whilst providing a high quality, energy rich food source allowing for a better match to the livestock energy requirements. This in turn can have a positive effect on the condition and productivity of the livestock that graze the crops.

Crops that have been grazed have the added bonus of easier management of stubble loads. This has been observed to have a direct influence in the speed and ease that a crop can be harvested, again at a time of year when time is in short supply.

Over all the practice of grazing crops can have a positive on whole farm productivity and profitability while reducing whole farm risk in a mixed farming business, as long as the grazing crops are well managed.

Recommendations

When implementing grazing crops into a mixed broadacre cropping, livestock business there are some simple ways to increase the chances of maximising the positive results from the practice.

The first step is to establish crops early to give the maximum window of growth, increasing the biomass that is able to be utilised from the practice.

If possible, graze the selected crops with high stocking rates for a shorter period of time giving an even graze, this results in easier crop management and consistent high-quality feed for the grazing animals. Also, if possible, graze the crop early in the season, before Zadok growth stage 30, to ensure adequate recovery time and minimal risk to a negative yield response. This has found to be especially true in a season with a dry finish.

Do not compromise on timing. The crop should be treated as a crop first and a feed source second. If the crop needs action taken, such as weed control, or nutrition added, this should take precedence over the grazing of livestock on the crops.

Staggering the grazing windows and sowing dates as well as crop varieties that are grazed has been found to have the overall effect of staggering the vulnerable flowering window. This in turn has the potential to minimise the level of overall frost damage to the whole farm crop.

When implementing the practice of grazing crops, it is imperative to closely monitor both the livestock and crop to minimise negative outcomes and promote the likely hood of a positive outcome.

Most of all, enjoy what you are doing. If the practice of grazing crops ceases to be profitable or fun, you should look for other ways to boost the whole farm profitability.

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