Evaluating the Economics of Export Hay in Selected Farming Systems

By

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Executive Summary

This study assesses the economic role that the enterprise Export Hay has in the farming systems of two medium to high rainfall zones in Australia. The study focused on two Case Study farms, one at Narrogin WA and the other at Watervale SA.

The research methodology used meant that all the agronomic and economic assumptions were gathered from farmers and advisers who are actively involved with Export Hay. While it could be viewed that this approach is biased toward Export Hay, significant effort has been placed in gathering the necessary information for the two scenarios:

(1) 'With' the Export Hay enterprise, and

(2) 'Without' the Export Hay enterprise.

As few studies have attempted to quantify the economic business benefits provided from the Export Hay enterprise, the farm and adviser participants were also keen to see an unbiased assessment. The advisers chosen for this study had experience with farmers using both scenarios and were therefore judged to be able to provide balanced data collection.

The inclusion of the Export Hay enterprise in these respective farming systems helped manage business and agronomic risk in the following major areas:

- Improved 'Net Farm Profits' and efficiencies, as measured by 'Return on Assets Managed'.
- Competitive gross margins when compared to grain production and sheep.
- Economic balance to grain production as the financial performance had counter cyclical tenancies. For example, frost in spring resulted in poor grain production but tended not to impact on hay production.
- Improved gross margin on poorer land than grain production and so improved economic performance for the whole business.
- Agronomic benefits from a hay enterprise that assists with grain production by decreasing the cost of weed control.
- Hay is often seen as a risk hedge, taking on new risk (marketing and spring rainfall) and trading off old risks (lack of spring rainfall and frost).
- Improved management of soil moisture with a hay enterprise in the farming system.

It must be stressed that there are significant and specific farming skills needed to manage a successful Export Hay enterprise. If farmers are considering adding this enterprise to their farming system, it takes dedication over a period of seasons to perfect the necessary hay making skills.

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Export Hay should be viewed as a long-term farm enterprise rather than an enterprise that can be easily included or removed from the seasonal rotation.

It should be highlighted that while the same research methodology has been used for both regions studied, the results are specific to each region and do differ.

Introduction

Export Hay has been an evolving industry in Australia and is becoming a significant part of the farming systems of many medium to high rainfall areas. It has the ability to improve farm business risk management and control resistant weed issues in the farming system. The challenge for the Export Hay industry and Australian Exporters Company (AEXCO) is to continue to expand production to ensure a significant and constant supply can be made available for valuable Export Hay markets.

The challenge in attracting increased Export Hay production is to communicate to the farming industry the economic and risk management benefits that can be gained from including Export Hay in the farming system. While some current producers have indicated that Export Hay has provided a key financial benefit to their businesses over recent years, this has not been quantified. It is proposed that if this were more accurately measured, more producers may be attracted to the industry. Denis McGrath, Executive Officer of AEXCO, approached Mike Krause of P2Pagri to assess the economic and risk changes of including Export Hay in the farming system.

This study has been undertaken with significant farmer and adviser input to validate the results and provide important farm business management information to support the expansion of the industry. The assumptions used in both the WA and SA Case Study are considered conservative by the respective farmers and advisers.

Key Question for Research

What business benefits are being provided to farmers who have an Export Hay enterprise in their farming system?

Approach

A 'Farmer Case Study' methodology was used where a farm was financially modelled to compare the 'With' Export Hay versus the 'Without' Export Hay scenarios. Modelling helped clarify the important efficiency and risk management differences between the two scenarios.

The 'Farmer Case Study' methodology included:

- **Separate Farm Case Studies for WA and SA:** Each Case Study has been modelled, based on the input from selected farmers and an adviser from that state. This is to avoid any issue with confidentiality in using a real farm and to be more representative of the industry in that state. The two advisers used to guide the development of the modelled assumptions were Garren Knell (ConsultAg, WA) and Mick Faulkner (Agrilink, SA).

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- **Validation of Data:** A small group of farmers met in a half-day workshop environment, with the respective state adviser, to (1) agree on the case study farm data, and (2) outline both the farming systems benefits and costs of having an Export Hay enterprise in the farming business.

- **Data Collection Process:** One farmer from each state was initially interviewed and the base financial and physical data required for the respective Farm Case Study was collected. This data was then used by the respective farmer/adviser group to develop the final Farm Case Study.

- **Reporting Parameters:** Whole farm business measures and the scenario analysis approach outlined in the farm business management manual, 'Farming the Business' were used. This book was developed by Mike Krause and published by the Grains Research Development Corporation (GRDC). Results of gross margin analysis, whole farm profitability and return on management capital were all used to report results.

- **Risk Profiles Used:** A range of seasons (Decile 3, 5 & 7) was modelled to indicate the risk profile of each Case Study farm and the risk impact that the Export Hay enterprise has on the financial results of the business.

- **Software Used:** A commercially available whole farm financial modelling software platform called P2PAgri (www.P2PAgri.com.au) was used to model the financial impact of Export Hay enterprise on the respective farm Case Studies.

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The WA Study: Narrogin

The Export Hay industry in WA is serviced by 7 to 8 hay processors and unlike other parts of Australia, the market for non-Export Hay is not large. There are a number of regions within WA that produce hay, each being in different rainfall zone. Resources for this project were limited to studying only one region, so it was decided to focus on the Narrogin area as this region has the most experience with Export Hay production.

Rainfall

Narrogin receives an average annual rainfall of 490mm

Features of the WA Case Study

The farm Case Study area and farm enterprises are shown in Table 1.

Table 1: Area and enterprise selection

Enterprise	With Export Hay (ha)	With-out Export Hay (ha)
Oats	550	600
Barley	1,400	1,400
Canola	600	1,000
Export Hay	450	
Total	3,000	3,000

The major assumptions in modelling the WA Farm Case Study include:

A continuous cropping operation was selected. Although it was noted that a sheep enterprise would work well with a hay enterprise, it was felt that a continuous cropping farm was more typical of this area. A characteristic of the Narrogin area was that there were low lying areas that performed poorly when continuously cropped. This was due to a combination of water logging, frost and poorer soil fertility issues. Export Hay provided an opportunity for this land type to provide improved gross margins.

The issue of owning all the hay making equipment versus using contractors to undertake the hay-making operations was discussed. Both are legitimate methods for hay-making. One of the farmer participants suggested that a hay-making area of 350ha was the minimum size needed to warrant a farmer owning and operating all their hay-making equipment. It was decided that this Case Study farm would have 450ha of hay and own the necessary hay-making equipment. A subcontractor would be used in seasons when large hay yields were achieved.

If the 450ha of Export Hay were taken out of this farming system, Oats would increase by 50ha, Barley stay the same and Canola increase by 400ha. It was felt that the Export Hay enterprise provided good weed control and better gross margins on the poorer land. If the Export Hay enterprise was removed, variable costs for weed control would increase and yields would slightly decline as a result of the poor land being cropped and the weed control not being as good.

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The yield expectations for the Farm Case Study 'With' Export Hay are shown in Table 2 and 'Without' Export Hay in Table 3. There were expected grain crop yield differences between the two, as hay provides better weed control and leaves more soil moisture after harvest.

Table 2: Yield expectations for the farm 'With' Export Hay

Enterprise	Decile 3 (t/ha)	Decile 5 (t/ha)	Decile 7 (t/ha)
Barley	1.8	2.8	3.6
Canola	0.8	1.25	1.5
Oats	2.2	3.0	4.0
Export Hay	3.5	5.0	6.5

Table 3: Yield expectations for the farm 'Without' Export Hay

Enterprise	Decile 3 (t/ha)	Decile 5 (t/ha)	Decile 7 (t/ha)
Barley	1.25	2.5	3.3
Canola	0.8	1.25	1.5
Oats	2.0	2.8	3.8

The group felt that if the Export Hay enterprise was taken out of the farming system, additional chemical would be needed for all crops to compensate for the weed control and root disease control provided by hay. The variable costs differences are shown in Tables 4 and 5.

Table 4: Cropping variable costs for the 'With' Export Hay option

Variable Cost	Oats ($/ha)	Barley ($/ha)	Canola ($/ha)	Cereal hay ($/ha)
Casual labour	20	20	20	40
Crop Insurance	5	5	5	5
Fertiliser	120	120	120	170
Fuel	40	40	60	40
Repairs and maintenance	45.70	45.70	40	60
Seed	34	34	12	60
Hay making				
Chemicals	65	73	92	35
Hay Freight				116
Total	**329**	**337.70**	**334.70**	**536**

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Table 5: Cropping variable costs for the 'Without' Export Hay option

Variable Cost	Oats ($/ha)	Barley ($/ha)	Canola ($/ha)
Casual labour	20	20	20
Crop Insurance	5	5	5
Fertiliser	120	120	120
Fuel	40	40	40
Repairs and maintenance	45.70	45.70	45.70
Seed	34	34	12
Chemicals	65	73	92
Added fertiliser	5	5	5
Added chemicals	15	15	15
Total	**349.70**	**357.70**	**354.70**

The farmer and adviser group provided their expectations on prices given the various seasons modelled. It was felt that there was a loose correlation with some commodities to seasonal outcomes. A summary of this discussion includes:

- Barley – It was felt there is little correlation of barley prices to seasons except in poorer seasons when low barley production means local feed requirements are not met. In these poor seasons, prices are expected to be higher.

- Oats – The oat market behaved similarly to barley as described above.

- Canola – As the Canola market is influenced by the world's soybean market, it was thought that there was no correlation between prices and local seasonal outcomes.

- Export Hay – Hay prices are affected by both local and overseas demand. It was felt that in poorer seasons when hay production is low, local demand and export demand would drive prices up. The opposite occurs in good seasons, when high production dampens local prices and there is more hay available for export. In these seasons, hay prices are poorer.

The commodity prices used in the modelling are shown in Table 6.

Table 6: Price expectations for the WA farm

Enterprise	Decile 3 ($/t)	Decile 5 ($/t)	Decile 7 ($/t)
Barley - Feed	$240	$200	$200
Canola	$500	$500	$500
Cereal Hay	$220	$165	$100
Oats	$250	$200	$200

Asset Values and Equity

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The asset values used for this case study are given in Table 7 and indicate a value of hay making equipment of $180,000, and associated grain and hay infrastructure (shedding etc.) of $500,000. Participants identified that the storage of hay, while associated with hay-making, was a separate profit-making activity. Since the shedding of hay was essential to maintain the necessary hay quality required for Export Hay, the industry provided financial incentive for producers to provide hay shedding. This investment can be significant and the financial rewards for this investment are currently good.

It was discussed what farmers would do if they moved out of hay production. It was felt that while the hay-making equipment would be sold, additional equipment would be needed to cater for alternative weed control and the added grain harvest. While hay balers would be sold, chaff carts, weed destructors and weed seekers would need to be purchased. The hay shedding could continue to provide hay storage for the industry, as it was a separate service to hay making. It was concluded that the assets used for both the 'With' Export Hay and 'Without' Export Hay would be identical.

Table 7: Asset Values of Case Study Farm

Asset Items	With Export Hay	With-out Export Hay
Land	$9,637,100	$9,637,100
Grain and hay infrastructure	$500,000	$500,000
General machinery	$415,700	$415,700
Hay making machinery	$180,000	
Additional grain harvesting machinery		$180,000
Total assets	**$10,732,800**	**$10,732,800**

Liabilities

ABARES reports from its farm financial surveys that the Australian farm business equity is around 85%. The liability for the farm Case Study is $1,609,900, which is 15% of the total assets for the Case Study farm. This was modelled as an interest only loan with a 5.0% interest rate. This was seen by the group as a typical lending facility and interest rate.

The farming system modelling results

These results of the whole farm business modelling indicate the economic benefits provided by the Export Hay enterprise. Including Export Hay in the farming system provided the farming business with improved financial performance across the range of seasons studied, indicating how Export Hay assists with managing seasonal risk.

The enterprise gross margins shown in Table 8 form the basic economic units in creating the whole farm net profits. The gross margin results are also given in Figures 1 & 2.

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Table 8: Expected gross margins for each of the enterprises in the different seasons modelled.

Season Type	Decile 3	Decile 5	Decile 7
Gross Margins $/ha			
With Export Hay			
Barley - Feed	$94	$222	$383
Canola	$65	$290	$415
Cereal Hay	$269	$289	$80
Oats	$220	$270	$470
Without Export Hay			
Barley - Feed	$2	$142	$302
Canola	$45	$270	$395
Oats	$150	$210	$410

These gross margins highlight:

- In the 'With' Export Hay scenario, the Export Hay enterprise provides the highest gross margin in average and poor seasons This indicates both its profitability and ability to assist with the risks associated with seasonal variation.
- All grain enterprise gross margins are poorer without the Export Hay because variable costs increase with added chemical for more weed control and fertiliser. Also, grain yields are expected to be poorer 'Without' the Export Hay enterprise.
- Of all the grain enterprises modelled, Canola performs the best.

Figure 1: Enterprise Gross Margins for the 'With' Export Hay Scenario

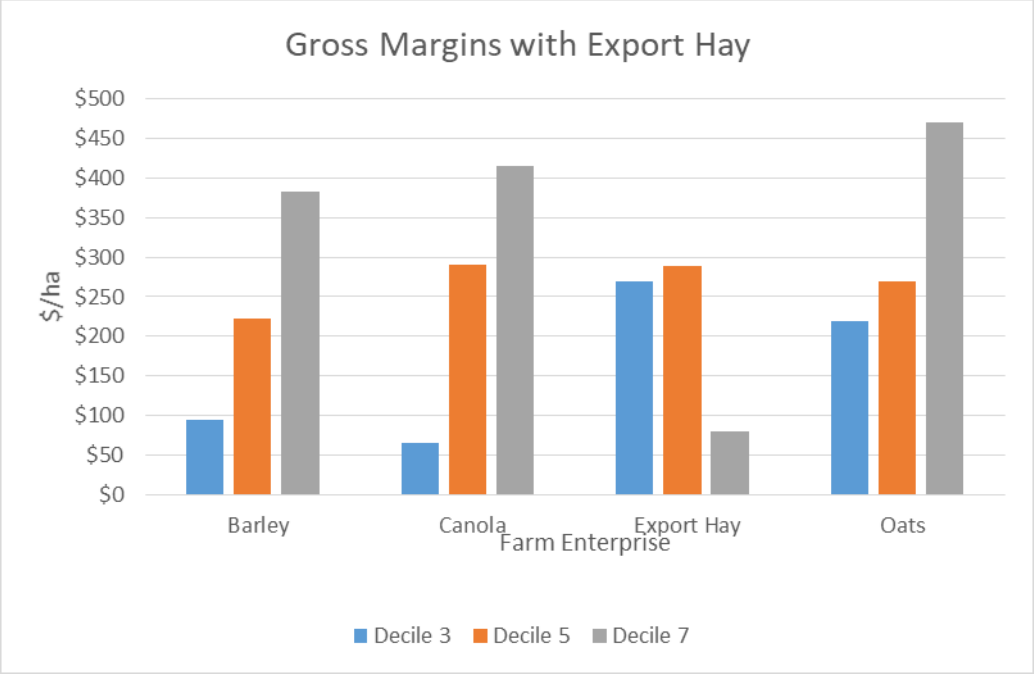

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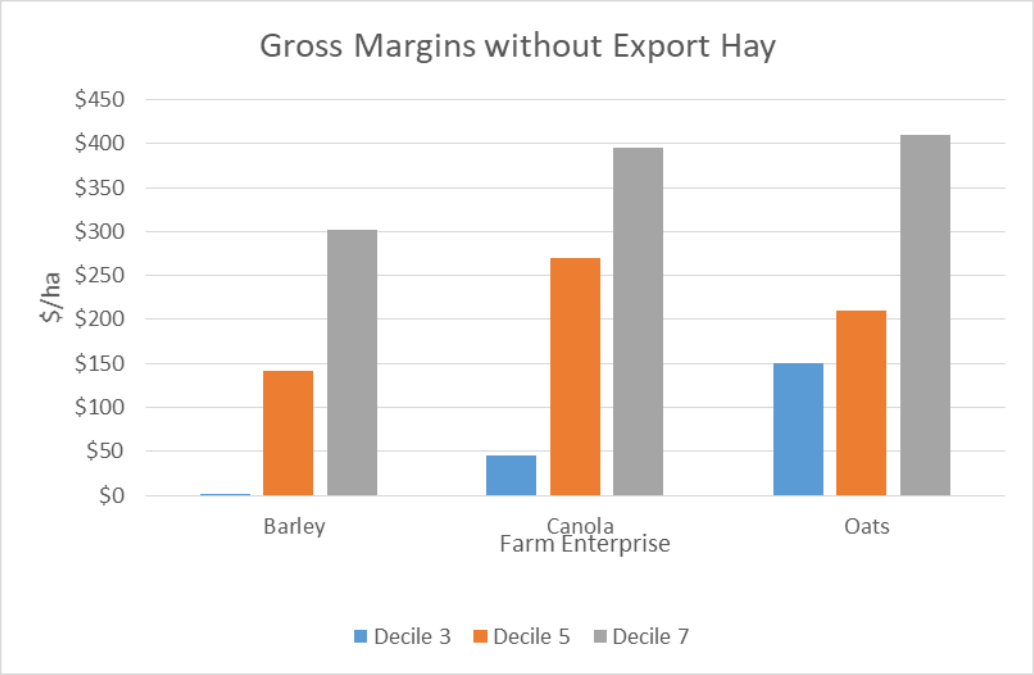
Figure 2: Enterprise Gross Margins for the 'Without' Export Hay Scenario



Whole Farm Profitability

Generating profits is one of the primary aims of a farming business. One of the tests when assessing the effect of any change on the business is to measure the effects on profits from that change. Farm profit in this case is measured by 'Net Farm Profits Before Tax' (Further information on this can be found in the GRDC publication 'Farming the Business'). Table 9 and Figure 3 show the modelled results of the financial effect of Export Hay on the WA farm Case Study given the effects of three season types.

Table 9: Net Farm Profit before tax comparing the 'With' and 'Without' Export Hay in the WA Case Study farm

Season Type	Decile 3	Decile 5	Decile 7
'With' Export Hay	-$72,933	$283,298	$603,466
'Without' Export Hay	-$347,558	$114,883	$589,101

These results show clearly that inclusion of Export Hay in this Case Study farm provided added income in all three of the season types modelled. The main observations:

- In an average season (modelled by a Decile 5 season), the Net Farm Profit was improved by 147%. This is a significant result.
- The inclusion of Export Hay meant losses were also minimised in a poorer season (Decile 3 season).

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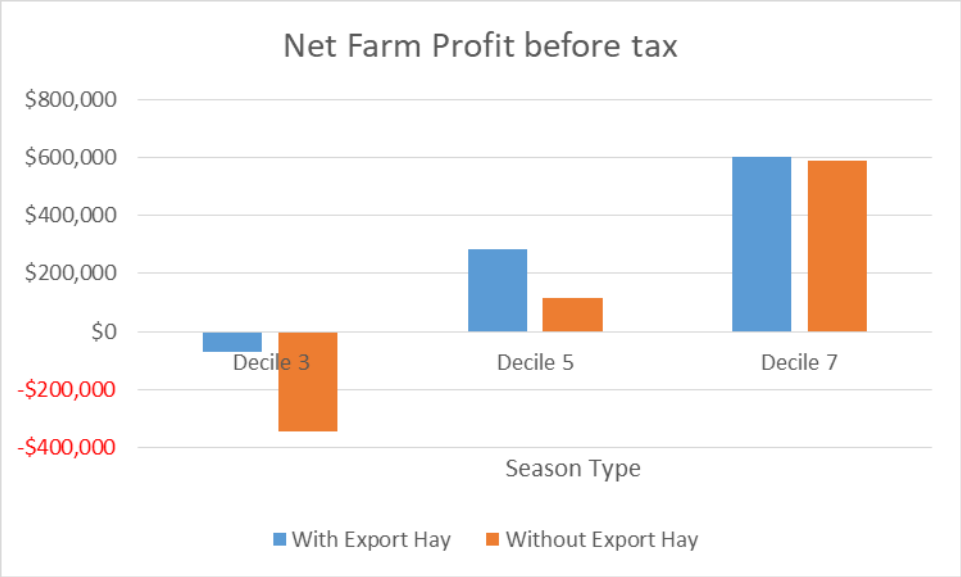
- These results show that there are measurable benefits from Export Hay when it comes to managing seasonal risks in poor to average seasons.
- In a high rainfall season (modelled by a Decile 7 season), the farming system also provided closer financial outcomes to the 'without' Export Hay scenario. This is because in a good season hay prices are expected to be poorer.

Figure 3: The Net Farm Profit results for both the 'With' and 'Without' Export Hay Scenarios



From a business perspective, it is important to assess the efficiency improvement that Export Hay provides the farm Case Study. Business efficiency is measured by Return on Assets Managed, with the highest value indicating the best result. Table 10 and Figure 4 indicate the efficiency result of this modelling:

- The efficiency results of both the 'With' and 'Without' Export Hay are poor. This is because profits are relatively low for the assets managed. The industry would say a 6% return on Assets Managed in a Decile 5 season would be more desirable.
- While poor results have been modelled, the efficiency is improved by the use of Export Hay in the season types of Decile 3 and Decile 5.
- There was a 68% efficiency improvement in the 'With' Export Hay scenario in a Decile 5 season. This improved the efficiency from 1.9% to 3.2%. While this is significant, the overall financial performance of this Case Study farm is considered poor.

Table 10: Return on Assets Managed of the 'With' and 'Without' Export Hay in the WA Case Study farm

Season Type	Decile 3	Decile 5	Decile 7
'With' Export Hay	0.2%	3.2%	6.6%
'Without' Export Hay	-2.4%	1.9%	6.4%

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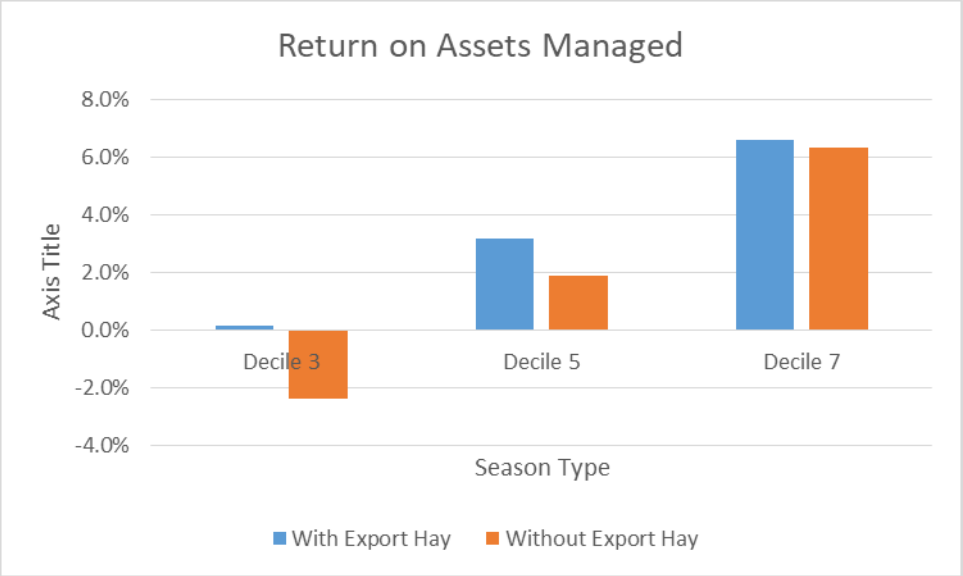
Figure 4: The Business Efficiency results for both the 'With' and 'Without' Export Hay Scenarios



Further observations from the WA Farmer and Adviser Workshop

1. Advantages provided by the Export Hay Enterprise

The discussion group identified the following advantages of including Export Hay in the farming business of this area in WA:

Improved Profitability

- The profits from hay-making can be significant. A farmer participant built a new house on the back of a good hay-making result after one excellent season.

Improved Risk Management

- Export Hay making is a natural hedge against a dry finish to the season, which has been quite common in recent seasons. Hay production can be good when grain production is not and can provide the business with a 'silver lining' in a poor season.
- Export Hay is a natural hedge against frost, which has also been quite common in the last few seasons.
- Having better weed control achieved by hay crops allows additional dry seeding. This is especially valuable in dry or late break seasons.

Agronomic Advantages

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- Early and dry sowing is very viable for an Export Hay enterprise. This means the sowing period of the farming system can be better managed.
- The crop following the hay year means the paddock is well prepared, making sewing easier.
- In the Narrogin area, 25% of land is low crop productivity and can provide better profits if used for hay production.
- Hay production significantly improves weed control for subsequent grain crops. Higher sowing rates for hay production means more weed competition during the growing season and the ability to mechanically control weeds (non-chemical weed control), which helps manage chemical resistance in the weed population.
- The hay year leaves soil moisture available for the following season.
- The hay enterprise leaves dry matter in the soil and decreases the need to burn stubbles for the preparation of the next season's seed bed.
- Hay production mean less reliance on selective herbicides.
- The hay enterprise provides a good root disease break for cereals.
- Hay handles water-logging and wet years better than cereals.
- The hay enterprise takes most of the stubble, so stubble management for the following year is improved.

Improved Labour Efficiency

- The production of hay helps to spread the farming system's demand for labour and farmers can better justify the hiring of permanent labour.

Complementary Grazing

- The hay enterprise can provide early grazing during a period of low dry matter availability for livestock. The hay is then 'shut up' and allowed to produce hay. The hay yields seem to be minimally affected by this early grazing. Also, stubble from hay is available earlier in spring than grain stubbles, helping with pasture management.

Maximising Returns on Poorer Land

- Export Hay production is a more profitable enterprise on poorer quality land than grain production. When poor land comes on the market, grain growers tend to avoid it as it may take them several years to return the land back to good grain production levels, whereas hay makers can generate good profits from the first year of purchase. This is because weeds can be better managed and dry matter production can be more easily achieved than grain production from this poorer land. Grain production has more challenges from water-logging, frost and weed populations.
- This means the hay maker is in a better financial position to buy poorer land, as they can generate better profits earlier than grain producers.

2. Challenges provided by the Export Hay Enterprise

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The following challenges for including Export Hay in the farming business of this area in WA were identified by the discussion group:

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Agronomic Challenges

- Soil compaction can be an issue during the hay-making process if there is significant soil moisture present, and the hay-making process means vehicles are less able to stick to existing wheel tracks.
- The GPS at seeding is useful, but GPS does not help with the hay-making process.
- Narrow tine spacing (6") is better for hay-making than the wider tine spacing (10") used for grain production. This is because slashed hay can be kept off the ground better for curing. This leads to more expenses for sowing, as you need either two sowing bars or time to change the tine spacing on the one machine.

Management Issues

Management Style:

- Farmers can be tempted to put too much hay into the system, which means the business and labour risks can be higher.
- The demands on management are higher for hay production than either grain or livestock production.
- Attention to detail and commitment are needed from day one if good quality Export Hay is to be achieved. All steps need to be followed through and monitored daily!

Managing labour requirements:

- Hay-making can compete with the Canola harvest as they can overlap, making the management of labour difficult.
- As hay-making is all about timing, strong leadership and decisions are needed to guide the hay-making process. Decisions need to be made correctly and not swayed because the labour on the farm wants to get on with the hay work. Sometimes waiting for the correct timing is very hard to do!
- The selection of machinery ownership versus hay contracting is important. If too much reliance is placed on hay contracting and they arrive too early or too late, the quality of hay may be negatively affected, and financial outcomes are likely to be poorer.
- Never assume the contractor knows what they are doing. Farmers need to be the master of their own hay making destiny.
- For hay growers, harvest starts in October with mowing. This can be tiring and put strain on labour units and family because the harvest period is extended.

Self-Management of Attitude

- Hay production does provide a mental challenge, especially during the hay-making season.
- Hay-making can be challenging. To cope with these challenges positively, management's attitude needs to be 'cup half full' rather than 'half empty'.
- The art of hay-making takes time to develop. Strategies to help develop these skills could involve using a mentor for hay making and remaining informed of recent technological developments.

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- There are mental challenges to balancing decisions with the need to be responsive to weather changes, especially through the hay making process.
- Farmers need a passion to become good hay makers. This passion can be critical in surviving the poorer times.

Risk

- While hay production does provide a good risk reward for profitability, it also means significant losses are possible.
- It is still possible to have frosted grain crops and rain on the hay. However, this is a rarer event than these two risks occurring individually.

Secretive and Competitive Industry

- There tends to be a 'don't share information among farmers' when it comes to hay making, as personal hay making IP is important. This is a disadvantage when hay-making skills can be so specific and take time to develop. Learning from others experience may not be available!

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The SA Study

Export Hay is grown in various regions within SA including the Mid-North, Upper South East and Upper Eyre Peninsula. Each area has different rainfall zones meaning their farming systems are different. As this project only had resources to undertake this methodology in one region, it was decided to focus on the Mid-North region, particularly the Watervale area. This is because this region has the most experience with Export Hay production.

Rainfall

Watervale receives an average annual rainfall of 620mm.

Features of the Case Study

Farm Case Study area and farm enterprises are shown in Table 11.

Table 11: SA Case-Study Farm Area and Enterprise Selection

Enterprise	With Export Hay (ha)	With-out Export Hay (ha)
Faba Beans	420	460
Barley	175	200
Wheat	525	600
Canola	280	280
Export Hay	300	
Pasture/Self-replacing Merino	300 (non-arable)	400 (includes 300 ha non-arable)
Total	**2,000**	**2,000**

Following are the major assumptions in modelling the SA Farm Case Study:

The mixture of hay, cereal grain, oil seed and grain legumes were seen to be typical of this area. It was felt that if Export Hay was removed from this farming system, pasture, oil seed and grain legumes would take up most of the difference as farmers needed break-crops to maintain cereal production.

The yield expectations for the SA Case Study Farm 'With' Export Hay are shown in Table 12 and 'Without' Export Hay in Table 13.

Table 12: Yield expectations for the SA Case Study Farm 'With' Export Hay

Enterprise	Decile 3 (t/ha)	Decile 5 (t/ha)	Decile 7 (t/ha)
Faba Beans	1.5	3.0	4.0
Barley	3.5	5.0	6.0
Wheat	3.3	4.8	5.8
Canola	1.2	1.8	2.2
Export Hay	5.0	7.0	10.0

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Table 13: Yield expectations for the SA Case Study Farm 'Without' Export Hay

Enterprise	Decile 3 (t/ha)	Decile 5 (t/ha)	Decile 7 (t/ha)
Faba Beans	1.5	3.0	4.0
Barley	3.5	5.0	6.0
Wheat	3.3	4.8	5.8
Canola	1.2	1.8	2.2

There were no expected grain crop yield differences between the 'With' hay versus 'Without' hay. However, to compensate for some of the weed control benefits that the hay enterprise provides, variable costs for the 'Without' hay option are higher. These are shown in Tables 14 and 15 below.

The group felt that if the Export Hay enterprise was removed from the farming system, additional fertiliser and chemical would be needed for the barley and wheat enterprises to maintain grain production. This is to compensate for the weed control, improved fertility and root disease control which hay provides.

Table 14: Cropping variable costs for the 'With' Export Hay option

Variable Cost	Faba Beans ($/ha)	Barley ($/ha)	Wheat ($/ha)	Canola ($/ha)	Cereal hay ($/ha)
Chemical	150	150	160	150	50
Crop Insurance	9	9	9	9	9
Fertiliser	50	160	160	160	100
Fuel	40	40	40	40	60
Repairs and maintenance	45	45	45	45	50
Seed	40	25	25	25	30
Sundry	25	25	25	25	25
Total	**359**	**454**	**464**	**454**	**324**

Table 15: Cropping variable costs for the 'Without' Export Hay option

Variable Cost	Faba beans ($/ha)	Barley ($/ha)	Wheat ($/ha)	Canola ($/ha)
Chemical	150	150	160	150
Crop Insurance	9	9	9	9
Fertiliser	50	160	160	160
Fuel	40	40	40	40
Repairs and maintenance	45	45	45	45
Seed	40	25	25	25
Sundry	25	25	25	25
Added fertiliser		10	10	
Added chemicals		20	20	
Total	**359**	**484**	**494**	**454**

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The farmer and adviser group provided their expectations on prices given the various seasons modelled. It was felt that Faba Beans and Canola prices were not correlated to local seasonal outcomes, as they were very dependent on export market conditions. Local production levels do not influence price.

However, Barley and Export Hay were seen to be affected by local production levels. While Malt Barley production is preferred, Feed Barley was more likely to be produced, as grain quality was very seasonally dependant. The Feed Barley market was significantly dependant on local stock feed demand - the higher production levels typical of a Decile 7 season generally lead to lower prices.

Similarly, farmers would prefer to sell all their hay to the higher priced export market. However, the reality is that quality of hay could not always be maintained due to seasonal vagaries and so significant hay is sold for stock feed. Like Feed Barley, the higher the local production of hay, the lower the hay prices.

Tables 16 and 17 indicate the farm gate prices of the various grains and hay grown by the Case Study farm.

Table 16: Price expectations for the farm 'With' Export Hay

Enterprise	Decile 3 ($/t)	Decile 5 ($/t)	Decile 7 ($/t)
Faba Beans	$320	$320	$320
Barley	$215	$200	$170
Wheat	$255	$240	$210
Canola	$450	$450	$450
Export Hay	$210	$180	$140

Table 17: Price expectations for the farm 'Without' Export Hay

Enterprise	Decile 3 ($/t)	Decile 5 ($/t)	Decile 7 ($/t)
Faba Beans	$320	$320	$320
Barley	$215	$200	$170
Wheat	$255	$240	$210
Canola	$450	$450	$450

Livestock

As the SA Case Study farm had 300ha of non-arable land, a self-replacing merino enterprise was run. Details of the self-replacing merino enterprise are shown in Table 18. The group said that livestock goes well with a hay production enterprise as it enhances the flexibility to manage seasonal variations. When Export Hay is removed, 100ha of arable land became available with improved pasture, which has a significant carrying capacity of 20 dse/ha.

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Sheep were also shorn twice each year to assist with sheep husbandry and increased wool production.

In the Decile 3 season, 12.5t of Barley and 12.5t of Hay were added as supplementary feed for the sheep enterprise in the 'With' Export Hay. However, an added 20t of Barley and 20t of Hay were used as feed in the same season for the 'Without' Export Hay scenario, as more sheep are being carried.

The asset value of 'Without' Export Hay is higher because more ewe breeders are carried. The farmer group said the added capital needed for this livestock enterprise would come from the sale of surplus hay equipment.

Table 18: Self-replacing Ewe Enterprise

	'With' Export Hay Enterprise	'Without' Export Hay Enterprise
Grazing area		
Non-arable (ha)	300	300
Arable (ha)		100
DSE carrying capacity		
Non-arable (DSE/ha)	11	11
Arable (DSE/ha)		20
Breeding Ewes	1,003	1,680
Flock DSE	3,213	5,252
Livestock Asset Value	$311,310	$510,730

Asset values and Equity

Table 19 shows the asset base of the SA Farm Case Study. This uses the size of the property with recent market values for the land, machinery and livestock. The group felt that about 20% of the total machinery value represented the value of the hay making machinery. In the 'Without' Export Hay enterprise, the hay making machinery would not be needed, but that the header would need to be upgraded as more grain would be harvested.

Table 19 provides a comparison of the Case Study farm's assets in the 'With' and 'Without' Export Hay scenarios. The total assets do not change greatly between the two scenarios as money saved by not having hay making machinery approximated the increased assets needed for livestock purchases.

Table 19: Asset Values of SA Case Study Farm

Asset Items	**'With' Export Hay**	**'Without' Export Hay**
Land	$20,237,000	$20,237,000

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Land related	$1,465,000	$1,465,000
General machinery	$1,202,400	$1,352,700
Hay Making machinery	$300,600	
Livestock	$311,310	$510,730
Grain and hay on hand	$125,000	$125,000
Total Assets	**$23,641,310**	**$23,789,730**

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Liabilities

ABARES reports that Australian farm business equity is around 85%. The liability for the Farm Case Study is $3,546,200, which is 15% of the total assets. This was modelled as an interest only loan with a 5.5% interest rate and was seen by the group as being a typical lending facility and interest rate.

The farming system modelling results

This modelling has resulted in measuring the whole farm benefit coming from a farming system that has Export Hay as a part of the enterprise mix. This result is shown across a range of seasons and indicate how Export Hay assists with managing seasonal risk.

The enterprise gross margins form the 'engine' to create whole farm net profits. Table 20 and Figures 5 & 6 below show the modelled enterprise gross margins for each enterprise for both the 'With' and 'Without' Export Hay enterprises.

Table 20: Expected gross margins for each of the enterprises given the different seasons modelled.

Season Type	Decile 3	Decile 5	Decile 7
Gross Margins $/ha			
'With' Export Hay			
Faba Beans	$121	$601	$921
Barley	$299	$546	$566
Wheat	$378	$688	$754
Canola	$86	$356	$536
Export Hay	$726	$936	$1,076
Self-Replacing Merino	$550	$550	$550
'Without' Export Hay			
Faba Beans	$121	$601	$921
Barley	$269	$516	$536
Wheat	$348	$658	$724
Canola	$86	$356	$536
Self-Replacing Merino	$763	$763	$763

These gross margins highlight:

- The Export Hay enterprise provided the highest gross margin in each season type in the 'With' Export Hay scenario. This indicates both its profitability and ability to assist with the risks associated with seasonal variation.
- The cereal grain gross margins are poorer without the Export Hay because variable costs are higher with added chemical needed for more weed control and fertiliser to deliver the same yield expectations.

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- The Self-Replacing Merino gross margin, while not providing the highest gross margin, was least affected by the seasonal variations. Also, with the current good wool and livestock prices, this enterprise provided the third highest gross margin of all the enterprises studied.
- The Self-replacing Merino enterprise provided higher gross margins per hectare in the 'Without' Export Hay scenario as 100ha of arable land was used for improved pasture, which provided a significant increase in livestock production.

Figure 5: Enterprise Gross Margins for the 'With' Export Hay Scenario

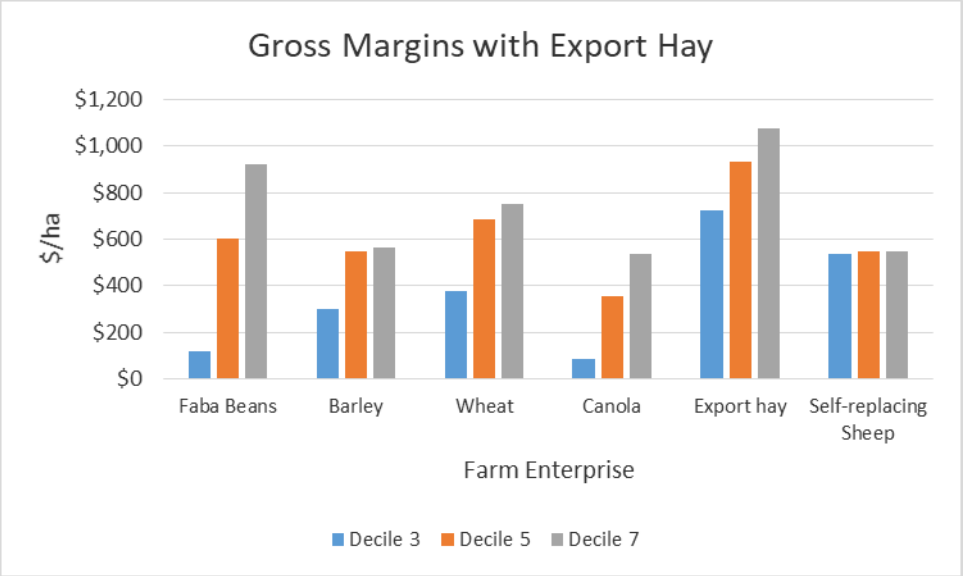
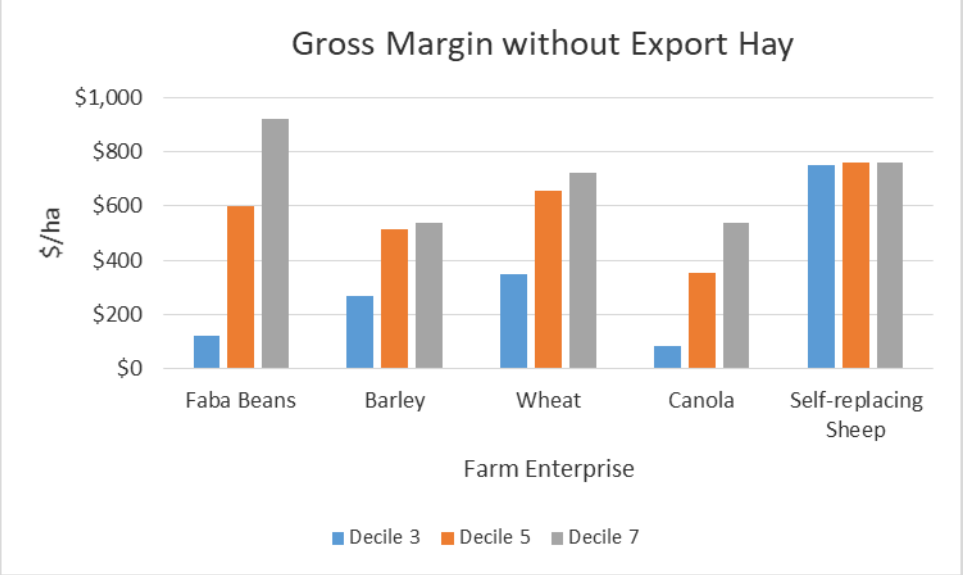


Figure 6: Enterprise Gross Margins for the 'Without' Export Hay Scenario



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Whole Farm Profitability

A primary aim of business is to generate profits. One of the business tests when assessing the effect on the business of any change is to measure the effect on profits from that change. Table 21 and Figure 7 show the modelled results of the financial effect of Export Hay on the farm Case Study in the three season types.

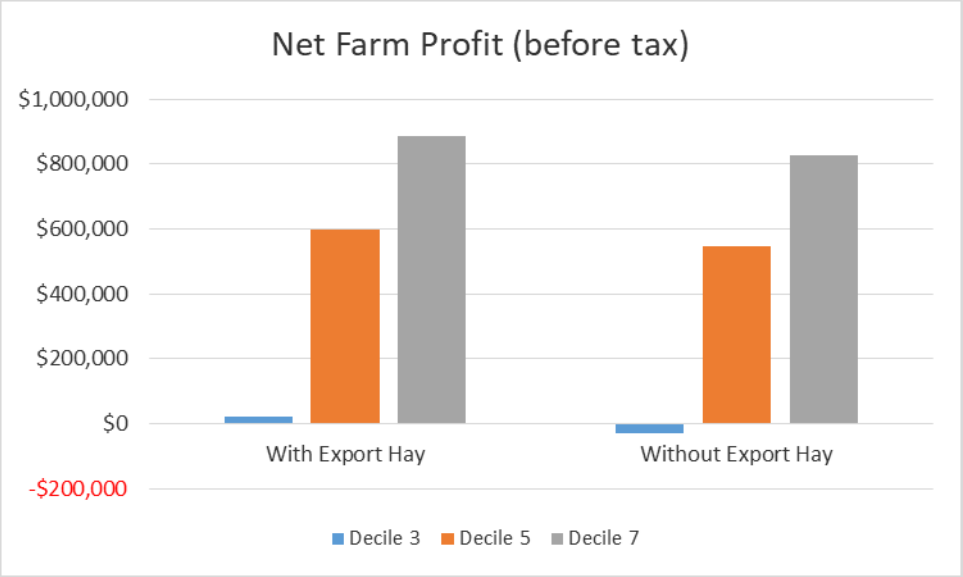
Table 21: Net Farm Profit Before Tax comparing the 'With' and 'Without' Export Hay in the Case Study farm

Season Type	Decile 3	Decile 5	Decile 7
'With' Export Hay	$21,567	$596,687	$1,058,770
'Without' Export Hay	-$31,200	$546,900	$828,189

These results indicate that the inclusion of Export Hay in this Case Study farm provided added Net Farm Profit across the three season types modelled. The main observations:

- The 9.1% increase in Net Farm Profit in an average season (Decile 5) is significant.
- The inclusion of Export Hay meant that profits were improved in all seasons assessed. There are measurable benefits from Export Hay when it comes to managing seasonal risks.
- In the scenario of 'Without' Export Hay, the farm Case Study made losses in the Decile 3 season, while in the same season, the 'With' Export Hay provided a small Net Farm Profit.

Figure 7: The Net Farm Profit results for both the 'With' and 'Without' Export Hay Scenarios



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Whole Farm Efficiency

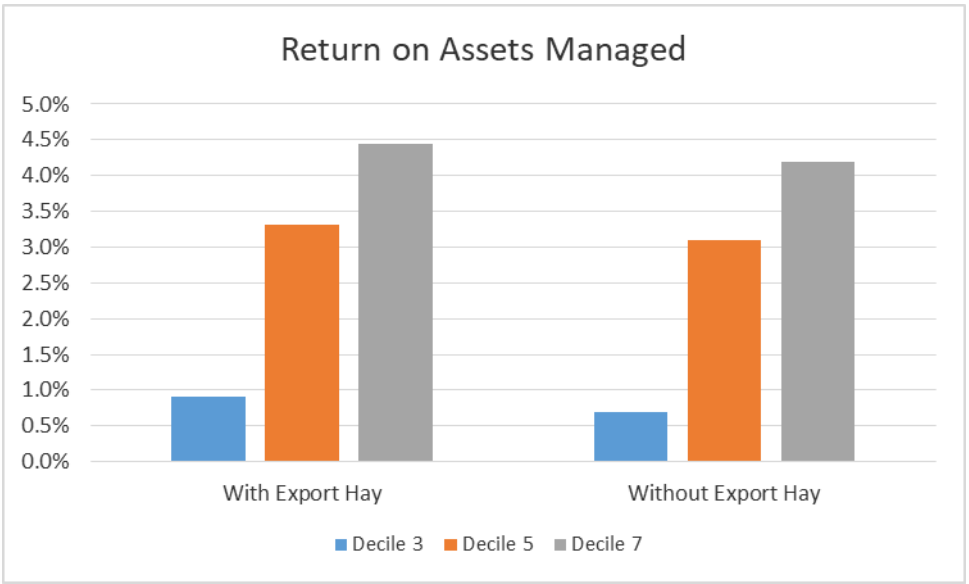
It is also important to assess the efficiency improvement that Export Hay provides the farm Case Study. Business efficiency is measured by Return on Assets Managed, with the highest value indicating the best result. Table 22 and Figure 8 indicate the efficiency result of this modelling:

- The efficiency results of both the 'With' and 'Without' Export Hay indicate relatively low returns for the industry. These results are reflective of the high land values of the SA farm Case Study of $4,500/ac for the arable area. Industry would say a 6% Return on Assets Managed would be more desirable.
- Efficiency is improved by the use of Export Hay in all season types studied.
- The 'With' Export Hay Return on Assets Managed of 3.3%, represents a 7.4% improvement in efficiency compared to the 'Without' Export Hay scenario.

Table 22: Return on Assets Managed comparing the 'With' and 'Without' Export Hay in the SA Case Study Farm

Season Type	Decile 3	Decile 5	Decile 7
'With' Export Hay	0.9%	3.3%	4.4%
'Without' Export Hay	0.7%	3.1%	4.2%

Figure 8: The Business Efficiency results for both the 'With' and 'Without' Export Hay Scenarios



Further observations from the SA Farm and Adviser Workshop

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1. Advantages provided by the Export Hay Enterprise

In the discussion with the farmers and adviser, the following advantages were identified from having Export Hay in a farming business of this area in SA:

Improved Profitability

- There is a good balance of risk and financial reward. There are instances when strong profits can occur and other times when significant losses occur. It was generally agreed that the higher risks were matched with the higher rewards.

Improved Risk Management

- The group felt that the Export Hay enterprise offered greater risk management of dry finishes and frost. This gave a business balance: when a season was good for grain production, the farm profits came from this, and when the season was not favourable for grain production, the farm profits came from hay.

Agronomic Advantages

- Improved the management of resistance in rye grass in the farming system.
- Improved the ability to conserve moisture for the following year.

Responding to Climate Variability

- The hay enterprise tended to do better in a dryer finish.
- The effect of frost is minimised as it does not tend to affect hay yields and quality.
- The hay enterprise gives flexibility in managing climate variation. Hay can be cut in a season that finishes early, or the crop could be left to grain production in a good season. This tended to be a comment on hay production and not specifically Export Hay, as Export Hay was seen as a speciality enterprise that cannot be managed opportunistically.

Labour Utilisation

- The month leading up to the grain harvest can be quiet on a farm, so hay-making provides permanent staff with significant work in this period of the year.
- Hay making, while a hectic period, helps to spread the work load more evenly through the year.
- As hay making requires less spraying, this reduced pressure on the farm's workforce.

Grazing Capability

- Hay making paddocks can be grazed early in the season, before the paddock is shut up and grown out for hay harvest. This allows more grazing to be available at a time when there may be lean pasture supply.

Improved Pest Control

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- It has been reported that a hay enterprise encourages less slugs in the farming system.
- Less mice have also been reported as hay means less grain is spilled at harvest, leaving less food available for mice after harvest.

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Technological Improvements

- Improvement in technology has significantly helped with hay making to produce better bales, which has improved freight handling and lowered freight costs.
- There are now improved weather warnings which greatly help with the hay making process.
- In-field weather stations now measure weather more accurately, which means the art of hay making can be further improved.
- The technology of mower conditioners has greatly improved, leading to better quality control.
- The technology of balers has also improved, leading to improved labour efficiencies.

2. Challenges provided by the Export Hay Enterprise

Agronomic Challenges

- It creates poor management of the following weeds: barley grass, resistant wild oats and brome grass.
- Hay making and carting machinery can be heavy. In moist soil conditions at hay making, there may be significant compaction issues.
- The process of hay making means within paddock operations do not maintain 'control traffic' paths.

The Cash Flow challenge

- There is a monthly income to the business, which was seen as useful. However, it was mentioned that grain payment for cash flow was better as money comes in within 2 months of harvest, whereas hay payments may take up to 10 months after harvest.

Management Issues

Management Style:

- This was listed as critical, as management needs to be fully committed in order to achieve the quality needed for Export Hay. This enterprise will not be profitable if it is not managed to a high standard.
- Farmers who do not manage stress well may find operating a hay making operation very difficult. This is due to the effects that weather has on both production and quality of hay. Weather events through the hay making period can occur quickly, and require quick decision making and follow through of those decisions.

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- If the farm management does not handle stress well, then hay making can add to increased personal risk.

Managing Labour Requirements

- There is significant lack of sleep due to the intensive work-load at times required to make high quality Export Hay.
- There are difficulties managing a worker's 8-hour day when baling can occur anytime in a 24 hr period. This can lead to OH&S issues of fatigue management.
- Due to the '24hr hay making cycle', lifestyle is challenged for the 4 weeks of hay making.
- This can be a strain on family relationships.

Production Issues

- The levels of both quality and production are greatly affected by weather events through spring. For example, a rain at the wrong time can spoil hay in the processing period. If drying conditions do not occur after these rain events, then the value of this hay will be significantly affected.
- Hay is a bulky product, so farmers need expensive equipment to transport and handle the hay, otherwise there will be OH&S issues.
- As the hay making process is very time sensitive, the reliability of machinery is very important.
- Hay making starts earlier in the season, which means the overall harvest period, including grain, is quite an extended period. Sound fatigue management is needed.
- Poor management during the hay making period can lead to hay stacks spontaneously combusting, and significant financial loss.
- Contamination of hay with unwanted weeds, vermin and snakes can reduce quality, Export Hay rejection issues and OH&S issues.
- The stacking of bales can be challenging and lead to OH&S issues.

Disease

- Different diseases can be introduced to the farming system, including stem nematode and bacterial blight.

Marketing Issues

- Farmers have experienced payment issues in the past from some hay processors. This risk seems to have decreased as the industry has matured but can still be an issue.

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- Farmers need to develop rapport with the hay processors and need to manage this relationship. If farmers do not wish to manage this marketing relationship, then selling hay can become more difficult resulting in poorer prices or produce not being accepted.
- The commitment to Export Hay is needed over many seasons to both master the quality requirements of Export Hay and demonstrate to the hay processors that the farmer's hay will be supplied through both good and poorer times.
- The Export Hay market does not reward those farmers who speculatively produce.

Key observations from the combined workshops

In facilitating the WA and SA workshops, observation of skills and strategies required to successfully produce Export Hay appeared common to both:

Hay Marketing Skills

The quality of hay is largely a subjective judgement coming from the market. It is heavily driven by both the supply of quality hay and the size of demand. When supply is tight, the quality required for Export Hay is more easily met. The reverse also occurs. This means that the Export Hay farmer needs to have developed some relationship and good negotiation skills in selling their product, as there are no advertised market prices such as occur in the more mature industries of grain and wool.

Most farmers in the industry will sell to a number of hay processors, as a means of spreading their risks and not being totally dependent on one processor. However, a number of farmers will provide hay storage services to selected processors, which helps with their quality control and negotiation ability.

Hay Storage

It was widely agreed that an effective part of Export Hay production is to use hay storage. Storage is useful for:

- Risk mitigation as farmers can get all their undercover quickly.
- The hay processors will pay well for the shedding of their purchased hay. In a number of instances, farmers have built hay sheds to house significant quantities of hay for the processors. This hay shedding service is seen as a separate profit centre for the farm business from the hay making, but there is a synergy with producing good quality hay.
- Stored hay assists the farmer in marketing their hay and managing cash flow, as the hay does not need to all be sold at harvest.

Risk Management

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These observations on risk management came from both the WA and SA case studies:

- Since a cereal crop can end up being either a hay or grain crop, there is flexibility to react to the end of season conditions. If it is a dry finish or frost, hay can be a better financial option than letting the crop be harvested for grain.
- Hay offers a good hedge to grain production. In a dry seasonal finish, the Export Hay enterprise can help carry the farm business, as grain production will be lower. However, in a good seasonal finish, the grain enterprises can help carry the farm business.
- The Export Hay enterprise provides a good weed management option to the farm. When weeds are well managed, the sowing time for crops and hay can be more optimal, as more crops can be dry sown into a relatively weed free environment.
- The Sheep enterprise has a significant synergy with hay production as hay crops can be grazed early when feed is short, then 'shut up' to produce hay. Poorer quality hay can also be fed to sheep when needed. The stubble remaining after hay is carted is useful to fill the feed gap before stubbles become more available after the grain harvest.
- Export Hay production is very susceptible to weather conditions during the hay making season. A significant rain event at the wrong time can cause a quality drop of at least $30/t and in some cases $100/t, resulting in financial losses. There can be significant psychological pressures on farmers through the hay making season that need to be managed.

Experience

It takes skill to produce the quality hay needed for Export Hay and this skill development takes time and experience. It is an enterprise that requires long-term persistence and dedication and is not well-suited to farmers coming into and out of the industry regularly over seasons.

Capital required for Hay Making

In this study, the 'With' Export Hay enterprise used hay making equipment to the value of $160,000 for the WA Case Study and $300,600 for the SA Case Study. It was noted that if these farms had cropping only, they would sell the hay making equipment to purchase the added grain harvest and weed control equipment. If a continuous cropping farm were to move into Export Hay, then there might be significant added capital investment required, if the grain harvesting and weed control were not downsized.

Fertiliser Requirements

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It was noted that the fertiliser variable costs were higher in the WA Case Study compared to the SA Case Study. This is because WA soils are generally lower in potash, so added potash input was necessary.

Conclusion

This study has provided a comprehensive analysis of the economic role that an Export Hay enterprise provides to farming systems in two regions: (1) Narrogin WA and (2) Watervale SA, both considered medium to high rainfall zones. While these economic results are specific to the regions selected for this study, elements of the discussions can be used as general observations for other hay-making regions of Australia. While these results are relevant for 2018, the range of seasons modelled make these results applicable to a wide range of seasons. It can be concluded that Export Hay provides both improved financial performance and a significant strategy to manage business and agronomic risks.

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