

Project 1A – 111: Dedicated Feed Grain Production Systems: An Assessment of Wheat, Barley and Triticale Systems in Australia

**Final Report prepared for the
Co-operative Research Centre for an Internationally Competitive
Pork Industry**

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Executive Summary

A major objective of the Pork CRC is in securing more reliable and consistent energy (and protein) supplies for pig diets that will cause: (a) reduced variation in the annual cost of pig feed, (b) reduced total cost of pig feed, (c) a wider range of feed ingredients available to more producers, and (d) a closer match of diet specifications to pig requirements. Subprogram 1A, *Innovative grain production*, is targeted towards delivering commercial quantities of cereals (and pulses) of high yield and high energy content and acceptable nutritional characteristics for pigs, with cost-effective agronomy, and appropriate marketing arrangements for grain and pig producers.

The objective of this study was to assess dedicated feed wheat, feed barley and triticale production systems in Australia by conducting social and economic research that extends and builds upon the findings of the established triticale and barley breeding projects in Subprogram 1A and more specifically, Project 1A - 109 0910 “Selection of feed wheat and /or barley varieties for the Australian pig industry”.

This study has provided an assessment of dedicated feed wheat, feed barley and triticale production systems in Australia using social and economic research extending upon findings of breeding projects in Subprogram 1A of the Pork CRC. The literature and survey with key stakeholders have disclosed findings that indicate that high-energy grains are of value to some pig producers. Depending on the price and availability of substitute energy sources, this value varies amongst producers as was found to be evident from modelling the energy value of wheat in pig diets. Further, grain producers’ predominately focus on profit and markets when making decisions about grain and variety selection. Whilst they are unlikely to grow a high-energy grain on that basis alone, they may consider it if it is high yielding and opens up an addition market for them. However, this decision is likely to be contingent upon region, as discovered from findings obtained from the gross margin model, whereby yield expectations differ. As the market place currently does not provide supply and demand signals to buyers and sellers then it is likely that communication amongst players wishing to participate in this market place will be of the utmost importance. Such markets may develop, at least in the short to medium term, in specific areas of the pig producing regions of Australia.

The findings of this research provide information that can be used to assist in decision making associated with projects in Subprogram 1A of the Pork CRC. While every effort was made to obtain a representative selection of literature to review and stakeholders to survey, these research findings provide only an indication of answers to the questions posed in this project. Hence they should be used as just one tool when making decision associated with projects in Subprogram 1A.

As a result of the outcomes in this study the following recommendations have been made:

1. Identify specific ‘champions’ in the grains industries who will promote high-energy, high-yielding grains to grain producers;
2. Identify ‘specific champions’ in the pig industry who will be willing to participate in a market for high energy grains;
3. Consider developing a system whereby seed producers of all new wheat, barley and triticale varieties, are invited to test their varieties using AusScan and if found to be sufficiently high enough in DE, the name of such varieties should be made known to the feed and pig industries.

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1. Introduction

A major objective of the Pork CRC is in securing more reliable and consistent energy (and protein) supplies for pig diets that will cause: (a) reduced variation in the annual cost of pig feed, (b) reduced total cost of pig feed, (c) a wider range of feed ingredients available to more producers, and (d) a closer match of diet specifications to pig requirements. Subprogram 1A, Innovative grain production, is targeted towards delivering commercial quantities of cereals (and pulses) of high yield and high energy content and acceptable nutritional characteristics for pigs, with cost-effective agronomy, and appropriate marketing arrangements for grain and pig producers.

The CRC's research activities in this area to date have focused on breeding suitable varieties of triticale, barley and peas for the pig industry. This study addresses CRC Outcome 1: Reduced production cost for high quality pork through more reliable and consistent protein and energy supplies via innovative grain production, co-product utilisation and quality assessment.

The objective of this study was to assess dedicated feed wheat, feed barley and triticale production systems in Australia by conducting social and economic research that extends and builds upon the findings of the established triticale and barley breeding projects in Subprogram 1A and more specifically, Project 1A - 109 0910 "Selection of feed wheat and /or barley varieties for the Australian pig industry".

2. Methodology

A methodology loosely based on that followed by Vanloqueren and Baret (2008) was adapted for this study. A multidisciplinary approach combining qualitative and quantitative activities was combined to study the reasoning behind growing and using high energy feed grains.

A desktop search of the literature aimed at providing background information on wheat, barley and triticale systems in Australia. In this search, relevant literature was reviewed with the aim of gaining a better understanding about dedicated feed grain production and use in Australia. Specifically it covered the current structures of dedicated feed wheat, barley and triticale markets in Australia and some changes in structure and the effect of these changes on production activities. The supply/value chains for dedicated feed wheat, barley and triticale that are currently in place were explored and a general supply chain was deduced from the literature. Some key attributes of a dedicated feed grains producer were identified and based on the literature a possible payment specification for dedicated feed grain was presented. This study did not repeat extensive work done by for example, Barbetti *et al.* (2005) and Spragg (2008, 2009a; 2009b; 2009c) but rather drew on such research and contributed to answering the questions put forward in this project. In essence, this background study provided the relevant literature for the computer modeling component of the project as well as supporting documentation for the interview studies.

The aim of the survey of relevant stakeholders was to find what was actually happening in industry now. Taking a similar procedure employed by Bardsley and Thomas (2005), a semi-structured interactive open-ended interview approach was used to record respondents' perceptions to issues such as the introduction in Australia of new high yielding, high energy grain varieties and the feasibility of establishing a closed-loop marketing system or a more controlled marketing system for dedicated feed grains. Following Vanloqueren and Baret (2008) the series of questions were common to all interviews but allowed for secondary in-depth questions depending on the answers given by the interviewees. Ethics approval was granted from the Murdoch University Research Ethics Office. In total 25 people from across

Southern Australia participated in the interview process. Interviewees were involved in one or more of the enterprises identified as being important in the grain/pig supply chain (grain producers; feed manufacturers; pig producers; additional players in the supply chain).

The third activity involved developing a gross margin model to understand economically rational behaviour of grain growers. The model was developed in Microsoft Excel[®]. Parameters pertaining to seed, fertilizer, spray and general requirements as well as grain premiums can be selected as necessary. In addition, the user can alter application rates, prices and other variables. Based on the assumptions imposed on the model, gross margins for up to 13 yields and 9 grain prices (as stipulated by the user) can be generated. Gross margins were found given a range of wheat prices and yields. Comparisons were made when the price of seed was increased from \$400/t to \$800/t and when a wheat premium of 5% or 20% was imposed to simulate the value of high-energy wheat.

The final activity used a feed formulation model to help understand economic decisions made by pig producers. A feed formulation package devised and made available in the public domain (see Thomson and Nolan 2001) was used to find the effect of DE of wheat on decisions regarding feed formation for grower pigs. The package was slightly altered to include triticale and parameter values were updated where possible. While it is noted that these values are not necessarily accurate, they are used consistently across the analyses so for the purpose of comparison they are sufficient. The analyses were completed using the grower pig as a model and by assuming a standard diet. To enable comparisons to be made when just one parameter was altered at a time, it was assumed that the quantity required of eight other dietary components remained fixed. The quantity of wheat, tallow and triticale were the only dietary components that were allowed to vary in the analyses.

3. Outcomes

3.1. Desk-top study

The literature reviewed in this study has provided reasons for the behavior of players in the supply chain for feed grains through to pig production. Primarily due to deregulation in the grains markets, the feed grain market structure on the supply side has moved towards perfect competition and therefore the market may determine price. On the demand side the structure varies from a monopsony to almost perfect competition depending on the players in the market and hence a few individuals or the market determines price. Having representatives of the grains and animals industries working together on improving communication and marketing should enable markets to be more transparent and improve competition. For economically viable dedicated feed grains to be available in the long term, plant breeding associated with these varieties needs to be an ongoing process. A positive step has been the cooperation of grains and animal industries research groups and further cooperation throughout the supply chain will aid in increasing supply of and demand for these grains. It was suggested that with regard to feed quality standards, the importance of characteristics, such as energy and protein, should be clarified and the measurement process defined by industry so that there is a rational basis for fair trading of dedicated feed grains.

Overall the availability of grain marketing tools enables grain buyers and sellers to consider a range of options to reduce price risk associated with grain and hence this may influence expectations associated with determinants of supply and demand, such as price, and hence alter the grain market. For some producers the Internet may improve efficiency within a business and make it easier for producers of specialty grains to market their produce. In Australia the domestic feed grain market is often viewed as a secondary market with a lack of consistent demand in many areas that may contribute to poor expectations about demand and hence hinder an increase in supply. However, given that grains are a major component of

animal feeds and there is a relatively inelastic demand with respect to price for grains, there is perhaps a lack of communication within the supply chain.

In addition to stigmas associated with producing feed grain as opposed to food grain, segregation of dedicated feed grains for quality may be a challenge limiting production of these grains. While it was expected that key attributes associated with a producer's decision to grow dedicated feed grains may have included resource availability, the literature indicated that yield and price were the primary drivers of grain supply.

Apart from the payment specifications for grains in general, the literature did not divulge any widely used specific criteria for valuing dedicated feed grains in Australia. However, it has been mooted that a payment specification based on Mega joules of energy may be an option providing measurement is fast and straightforward.

3.2. Stakeholder interviews

In this study semi-structured interviews were completed with 25 key stakeholders from within the grains/pig supply chain. While this sample was a representative sample, these results provide only an indication of the overall attitudes of the supply chain.

If grain producers were able to successfully segregate high-energy grain and sell it to buyers able to handle it (i.e. have the segregation capacity and testing facilities), then niche markets could develop. With deregulation, some farmers have improved on-farm storage and so may be in a position to negotiate effectively with grain buyers. However, grain producers will seek to maximise profit and so will not produce such grain varieties unless they can negotiate a price to cover the additional costs or the varieties yield more than alternative varieties that could be produced and sold in the existing marketplace. Dual-purpose varieties may be an attractive alternative.

When considering pig producers, it should be noted that they might be efficient but not necessarily require high quality grains but rather that which they consider to be 'fit for purpose' according to their least cost formulation results. Hence a high energy feed grain may be attractive to them only if it suits their least cost feed formulation. Alternatively, producers who rely heavily on grain for energy are likely to be more receptive to a high-energy grain variety.

Supply in WA can be unreliable not due to the quantity of grain produced but due to the large export market for milling grain that increases competition. In the Eastern States grain for feed is largely sourced from local sources and hence is generally more readily available.

Given that the majority of respondents didn't think grain growers would enter into formal contracts, communicating to growers that a reliable market for a high-yielding, high-energy variety exists will be important, should such a variety be released. At least in the short term, implementing premiums may be difficult and hence for grain growers to consider a new grain variety, it must be high yielding so that profit is comparable or better than alternative varieties.

Targeting specific individuals (e.g., agronomists) to promote any new variety may be more efficient than targeting grain producers *per se*, at least in the short- to medium-term. In addition, specific regions in Australia would be more suited to growing such varieties and strategically extending a new variety as opposed to extensive extension programs may be more effective for the pig industry. Hence a functional dedicated feed grain supply chain is likely to involve the seed breeder and supplier, an agronomist (or equivalent), particular grain producers and grain buyers (most likely directly associated with a pig producer that produces feed on-farm).

3.3. Gross margin model for grain

The gross margin model developed as part of this study has been designed in such a way that inputs and input quantity, grain prices and yields could all be altered to suit the question of interest. To demonstrate its capability, a particular scenario provided the gross margin for just one scenario along with the implications of a change in seed price or market price premium. As was evident, gross margin analyses are useful for comparison between enterprises but do not give information pertaining to profit and hence expected behavior associated with whole-farm decision making. Whilst a lower yield and gross margin may be economically viable for one region it may not be viable for another where for example, input costs are higher. Therefore what is deemed to be an acceptable yield and market price is likely to vary between regions and hence will have a bearing on the decision that a grain producer makes with regard to a new variety.

While the seed price in terms of total input costs may be relatively small it does have a bearing on the economic outcome associated with growing a particular variety. End-point royalties will do likewise and therefore a breeding program should consider both especially with respect to such costs associated with competing wheat varieties.

A premium on market price removes part of the cost associated with the risk of growing a new variety. If a grain producer knows that no matter the market price or yield there will still be some premium for a particular variety then they may be inclined to grow it. In the base case scenario presented in this analysis, a 5% price premium would be the difference between making a loss or breaking even. A 20% price premium certainly compensates for much of the production risk and cost associated with changing varieties. However, such a premium may be too high for pig producers to contemplate. The objective of a price premium on a variety is to give incentive to a grain grower to grow that variety. If the market price is already high or the yield of the new variety is comparable to that of alternative varieties then an incentive may be unnecessary. Therefore to determine the value of an acceptable premium, the region where the crop is produced should be considered along with the yield and market price.

There are many scenarios that could be generated to answer specific questions in a study such as this and documented is just one scenario to show how grain producers might respond to a new variety that has an enhanced yield or price premium.

3.4. Assessing the energy value of wheat

In this study scenarios show how the digestible energy (DE) value of wheat as well as price of wheat and tallow can alter decisions regarding ingredient combination in grower diets.

Based on the assumptions stipulated for these analyses, the higher the price of the substitute energy, in this case tallow, then the greater the economic value of DE in grain. In general, as the DE for wheat increased the marginal cost of the diet, associated with a one unit increase in DE, decreased to zero. This result occurred in part due to the constraints imposed upon the analyses. Nevertheless, based on these results it could be argued that very high levels of DE in wheat may not be captured effectively in grower diets.

Based on the assumptions of this study, it would be economically rational for a producer to pay a “premium” of 5% only for wheat with particular DE values. In practice though, the rationale of paying a premium for wheat will depend on availability and price of substitute grains and other energy sources as well as the ability to both accurately and efficiently measure DE values and then segregate such grain. It is therefore more likely that price premiums for wheat, at least in the short term, will be negotiated between specific parties rather than within the general market place.

3.5. General outcomes and project outputs

Should a new high-energy grain variety become available for use in pig feed it is not likely to be available in all regions nor is it likely to a requirement in all pig diets. Generally the market is not currently sophisticated enough to ensure that the value of DE is reflected in prices. Hence any premiums are likely to arise only by negotiation of individual parties. Should such negotiations arise, supply of a particular variety would be more secure and pig producers may benefit from the higher energy.

This project has delivered a:

- Desktop report on the current structures of a dedicated feed grain markets in Australia (Appendix 1);
- Report detailing an assessment of the dedicated feed wheat, barley and triticale production systems in Australia based on the findings from face-to-face interview studies with stakeholders. The key drivers that motivate grain producers to grow dedicated feed grains and for pork producers, the determinants of demand for dedicated feed grains, have been identified in this report (Appendix 2).
- Report detailing the findings from the gross margin calculator for wheat to show the effects an increase in yield and an example of a DE premium on the gross margin for a grain variety (Appendix 3)
- A Wheat Gross Margin Calculator;
- Report on the marginal value (\$s) of protein and energy for typical diets containing wheat and triticale with different energy contents (Appendix 4).
- One-page paper submitted to the Australasian Pig Science Association Thirteenth Biennial Conference to be held in Adelaide, SA, 27 – 30 November 2011 (Appendix 5).
- Two-page summary sent to participants in the face-to-face interview studies with stakeholders (Appendix 6).
- Presentation in each of: the 2011 Australian Agricultural Economics Society (WA Branch)/ School of Agricultural and Resource Economics (UWA) Seminar Series; the Australian Grains Industry Conference, 25-27 July 2011, Crown Conference Centre, Melbourne, Australia.

4. Application of Research

This project will contribute towards the commercialisation/adoption strategies of all cereal grain breeding projects in Subprogram 1A of the Pork CRC. Findings from this project indicate that high-energy grains are likely to be grown in some regions of the pig producing areas in Southern Australia providing grain producers can obtain acceptable profit and marketing opportunities.

Findings from this project indicate that pig producers can benefit from obtaining high-energy grain but it is likely that they will have to develop communication strategies with grain producers if they are to secure a consistent supply of such grain. Development of high yielding grain varieties that are also high in DE will make this process easier for pig producers. In the short to medium term it is unlikely that markets will provide appropriate signals to influence demand and supply.

5. Conclusion

This study has provided an assessment of dedicated feed wheat, feed barley and triticale production systems in Australia using social and economic research extending upon findings of breeding projects in Subprogram 1A of the Pork CRC. The literature and survey with key stakeholders have disclosed findings that indicate that high-energy grains are of value to some pig producers. Depending on the price and availability of substitute energy sources, this value varies amongst producers as was found to be evident from modelling the energy value of wheat in pig diets. Further, grain producers predominately focus on profit and markets when making decisions about grain and variety selection. Whilst they are unlikely to grow a high-energy grain on that basis alone, they may consider it if it is high yielding and opens up an addition market for them. However, this decision is likely to be contingent upon region, as discovered from findings obtained from the gross margin model, whereby yield expectations differ. As the market place currently does not provide supply and demand signals to buyers and sellers then it is likely that communication amongst players wishing to participate in this market place will be important. As a consequence such markets may develop, at least in the short to medium term, in specific areas of the pig producing regions of Australia.

6. Limitations/Risks

The findings of this research provide information that can be used to assist in decision making associated with projects in Subprogram 1A of the Pork CRC. While every effort was made to obtain a representative selection of literature to review and people to survey, these research findings provide only an indication of answers to the questions posed in this project. Hence they should be used as just one tool when making decision associated with projects in Subprogram 1A.

7. Recommendations

As a result of the outcomes in this study the following recommendations have been made:

1. Identify specific 'champions' in the grains industries who will promote high-energy, high-yielding grains to grain producers;
2. Identify 'specific champions' in the pig industry who will be willing to participate in a market for high energy grains;
3. Consider developing a system whereby seed producers of all new wheat, barley and triticale varieties, are invited to test their varieties using AusScan and if found to be sufficiently high enough in DE, the name of such varieties should be made known to the feed and pig industries.

8. References

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9. Appendices

Appendix 1: Dedicated feed grain production systems: A desktop study of wheat, barley and triticale systems in Australia

Appendix 2: Dedicated feed grain production systems: Stakeholder interviews pertaining to wheat, barley and triticale systems in Australia

Appendix 3: Gross margin analyses for high energy wheat: A note

Appendix 4: The marginal value of energy derived from wheat and its significance in a pig diet: A note

Appendix 5: One-page paper submitted to the Australasian Pig Science Association Thirteenth Biennial Conference to be held in Adelaide, SA, 27 – 30 November 2011

Appendix 6: Dedicated feed grain production systems: Stakeholder interviews pertaining to wheat, barley and triticale systems in Australia (*Summary sent to participants*)