Enhancing Supplies of High Quality Barley to Meet Pork Industry Demands in Queensland and Northern New South Wales

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Co-operative Research Centre for an Internationally Competitive Pork Industry

By

John Sturgess

Plant Science, Agric-Science Queensland
Dept of Employment, Economic Development and Innovation
Hermitage Research Station, 604 Yangan Road
Warwick, Qld 4370

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Executive Summary

This project was funded because more reliable and consistent protein and energy supplies can reduce pork production costs. An improvement in the quantity and quality of barley available to the Pork Industry could help stabilise costs. Development of new feed barley varieties, utilization of recommended production practices, and efficient feed quality determinations for barley are the first steps in this process.

This project was designed to study management practices for production barley and to expand the variety development goals of the Barley Breeding Australia – North Region (BBA-North) barley breeding program located at the Hermitage Research Station, Warwick to include feed quality for pigs. Regional variety drill strip trials (up to 6 sites, including interstate) and agronomic studies were conducted, and grain samples from production experiments and BBA-North breeding trials were used to assess pig feed quality. Bulk grain samples of elite varieties were provided for pig feeding trials. Rapid assessment of feed value of barley samples from breeding and agronomic trials were conducted using near infra-red spectrometry (NIR) and appropriated calibrations.

Key findings of the project were:

1) Using ABS data, the regional production of barley and location and size of pig production throughout the northern region was analysed in order to select sites for establishment of replicated barley drill strip trials which would be relevant to the preferred grain sourcing area for the pork industry.
2) Good agronomic production practices were shown to produce more grain and improve the feeding value of barley. Maintenance of plump grain under heat/drought stress is a varietal trait.
3) The barley variety Shepherd was commercialised in 2008 and seed was available to growers in 2009. Recommended production practices for Shepherd were distributed and refined in 2010.
4) Further encouragement on the growing of Shepherd was a focus of this project in 2009 and 2010.
5) Utilisation of NIR screening of grain samples and calculated estimates of feed quality will make breeding barley varieties with good feed quality more feasible.
6) Breeding lines with consistently higher digestible energy (DE) levels and lower husk content were identified. One of them, ND19119 introduced from the USA, was recommended for release.
7) However, because of inconsistent and often low yield, commercialization of ND19119 was not continued.
8) Breeding material was identified that could rapidly improve the drought/heat tolerance of barley grown in the Northern region.

Potential users of information and research results on barley are:

1) Pig producers – the feeding value of barley was found to be variable across varieties and production areas. These differences could be rapidly estimated using NIR technology.
2) Barley growers – new varieties grown using recommended agronomic practices can increase returns.
3) Pork industry – improved barley varieties and production practices can contribute to the economic health of all sectors.

The value of these findings to the Australian Pig Industry depends on their uptake by components of the industry.

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1. Introduction

The research into suitable barley varieties for Pork production in the Northern Pork CRC grain production region focused on breeding and agronomic testing of new adapted barley varieties, looking for those which have significantly higher pork digestible energy than current popular barley varieties. The germplasm for the breeding of the varieties was sourced from material known to be adapted to the unique winter cereal environment of the Northern grain producing area of Australia. The Northern environment has the major constraint of early hot Spring temperatures during grain fill.

The project was also designed to support calibration and commercial adoption of Near Infra Red technology to establish a feed grain market, based on objective measurement of grain quality for the pork industry within the Pork CRC, and the feed market for pork production in general. Grain produced from the strip trial field research was tested for quality attributes using NIR technology, thus supporting calibrations used in the measuring process.

Large scale seed increases of potential new feed barley varieties were also carried out over five years to produce grain for investigation of significant differences in digestible energy levels of potential new barley varieties, using in vivo digestibility studies at the new CAAS research centre at UQ Gatton.

Significant improvements in barley production systems and barley varieties can be made, but those improvements should address also the specific needs of the pork industry.

In barley, faecal digestible energy (DE) levels for pigs vary by much as 15% over varieties and sources (Fairbairn et al. 1999). Significant differences exist among barley varieties for feed quality parameters and considerably more variation has been reported in world collections of barley (Bowman et al. 2001). More effective and efficient systems for measurement of barley quality would make utilisation of this variability in feeding systems and barley improvement more feasible.

Variety evaluation and breeding: This project evaluated the quantity and quality of feed barley varieties currently available to the Pork Industry in Queensland and Northern New South Wales. Agronomic practices that can optimise barley production in the region were examined. Breeding procedures were initiated to rapidly improve feed quality of barley for pigs. To do this, the project dovetailed with research being carried out by the Barley Breeding Australia – Northern Region (BBA-North) barley breeding program. The aim is to deliver to the pork industry improved varieties and recommended on-farm management practices for them as the varieties are ready for commercial release to industry.

2. Methodology

In 2009 and 2010 replicated pork CRC strip trials were planted at four sites in Queensland, one in Southern NSW and one in South Australia. The four sites in Queensland are seen as representative of four different catchment areas for feed barley supply for the pork industry in Queensland. The established and proven protocol from previous trial work was followed. Trials were established and

maintained at Biloela in Central Qld, Lundavra in the Waggamba Shire on the western downs, Kingaroy in the Burnett and Pittsworth on the central downs.

The strip trials were positioned in accessible paddocks for ease of access during field days and pork CRC promotions. All trials had plots 50 meters by 2 meters with targeted plant populations of 1 million plants per hectare.

The design and analysis of these replicated trials was done by the DEEDI biometry staff in Toowoomba. Where possible close interaction took place between the DEEDI agronomist, John Sturgess and the agronomist from Mike Castor and Associates (MCA) who is employed by CHM at Lundavra (Stuart Thorne).

Seed increases of potential feed barley varieties up to a hectare were done in 09 and 10 for stockpiling at Narrabri pending future feeding trials. Varieties were Shepherd, Grout, Fleet and ND19119 under different growing conditions to target both sound and weather damaged grain.

These varieties were chosen for the following characteristics

- Grout- established variety , with 50% of Northern barley mid range DE
- Shepherd feed barley likely to replace Grout
- ND19119 high DE feed barley
- Fleet low DE interstate SA feed barley

Sound grain was harvested at physiological maturity while damaged grain was left exposed to weather in the paddock before it was harvested. In vivo pig digestibility studies at the new Centre for Animal Science at UQ Gatton were delayed because of postponement of digestibility studies by DEEDI. This occurred because of animal welfare protocols having to be drafted and approved before the research work actually is allowed to take place.

Agronomic studies: This project used two strategies to deliver the proposed outcomes. Firstly, trial management was used in conjunction with an investigation of on-farm agronomic practices to develop best practice protocols. These recommendations were designed to produce high yields of barley grain with optimum feed quality for pigs. The first stages of this work included interactive consultation with grain growers and pig producers to identify the key grain and quality needs for the Northern industry. This was done as far North as Biloela in Central Queensland. Consultation with the Grain Search project participants in Southern Australia was used to refine the consultation and extension methodologies. Data obtained from this activity were fed back into the breeding and pork barley agronomy program and made available to the Pork CRC, key industry groups and stakeholders.

Part 2 of the agronomy aspect of the project involved multiplication of selected breeding lines for intensive on-farm testing to develop optimum agronomic management practices that target grain production for the pig industry. The larger experiments were conducted in close collaboration with CHM and their agronomists. The aim of these trials was to identify varieties and management practices that could benefit the pork industry by improving barley supply and lowering grain production costs. Replicated drill strips (2 replications at each site) containing 10 to 12 entries were planted. Sites were chosen to distribute them over the Northern region based on pig and barley production (see Appendix 1). Agronomic production practices used were based on production recommendations

for barley in the region. Yield data were collected from each site and quality samples were submitted for NIR analyses of feed quality.

Agronomic studies conducted under the GRDC Agronomy Project for the northern region examining the time of planting, seeding rates and depth of planting were also conducted in 2009 through 2010 at a few locations using approximately 20 varieties. Yield data and quality samples were collected from these trials. In addition, trials and seed increases were grown to produce sufficient grain supplies of new barley lines to conduct extensive wet chemistry and live feeding trials in collaboration with the Pork CRC Subprogram 1B projects.

Guidelines for on-farm management practices and supply chain arrangements were published for new barley varieties as they were commercialised. Besides an outline of variety attributes, these guidelines included information management on planting times, soil type, nutrition requirements, and pest and disease risks. Promotion of the packages and management techniques was conducted to ensure maximum uptake of new varieties and management practices.

3. Outcomes

Summary

- Good agronomic production practices were shown to produce more grain and improve the feeding value of the grain produced. Maintenance of plump grain under heat/drought stress is a varietal trait that can be manipulated by planting date, soil moisture and seeding rate.
- Variety characteristics were found to play an important role in grower uptake of new barley varieties in the Northern region e.g. Grout.
- Shepherd barley was commercialised in 2008 and seed was available to growers in 2009. Recommended production practices for Shepherd were developed refined and distributed through 2010 and 2011.
- NIR screening can estimate the feed quality for pigs of barley grain samples rapidly and can be used as a tool in breeding for feed quality.
- Breeding lines with consistently higher digestible energy (DE) levels and lower husk content were identified. One of them, ND19119 introduced from the USA, was recommended for release.
- Two populations of doubled-haploid barley lines were developed and recommended for future genetic studies of pig feed quality parameters, foliar disease resistance and agronomic traits.
- The utilisation of introductions from North Dakota in the BBA-North breeding program will facilitate rapid improvements in agronomic traits, yield, foliar disease resistance and grain quality of barley varieties recommended for the northern region.

Yield results and NIR quality results for 2009 and 2010 are presented in the Appendices.

Performance of Shepherd barley

Concentrated effort was put into promotion of Shepherd feed barley, in particular through Simon Crane, regional manager AWB, as a reliable feed for commercial pork production enterprises. AWB and DEEDI promoted Shepherd commercially in 2009 and 2010.

Development and encouragement of the growing of the Pork CRC barley variety Shepherd has been successful over the last two years. Shepherd is the preferred Northern Region barley variety for 2011 and has been widely planted from CQ to mid NSW. Shepherd has adult plant resistance to leaf rust, very useful in 2010 wet winter. The last season, 2010 was a good year for Shepherd, which performed well for barley growers under heavy pressure from winter cereal leaf diseases.

Yield figures from 2010 NVT trials show only average yields of Shepherd at most southern sites, and below average in WA. Shepherd is better performed than benchmark varieties in Northern NSW and Southern Queensland grain growing regions. The Victorian barley Hindmarsh was identified through strip trial research as having both a high DE and yield. Hindmarsh is better suited for Southern regions where it has become very popular.

Agronomic input and information in the new 2011 Barley Planting Guide supports Shepherd as the most reliable barley variety in Southern Queensland and Northern NSW. The Shepherd management package was refined as more trial data was gathered. Specific information tours and field days have been delivered to promote Shepherd as a very good alternative to Grout and Hindmarsh in the Northern grain production region. The Pork CRC agronomist has interacted with CHM agronomists and nutritionists to promote Shepherd as a reliable source of pork feed grain. Area of Shepherd is increasing with AWB figures showing an increase from 5,000 hectares in 2009 to 12,000 hectares in 2010. Currently all Shepherd seed available is expected to be planted in 2011.

Performance of ND19119

The variety ND19119 was a North Dakota line that contained an average of up to 0.5 MJ DE/kg greater than other varieties and lines of barley. Although ND19119 showed higher DE at all sites, yield was up to one tonne per hectare lower than commercial varieties at some sites. At western sites such as St George and Lundavra the yield of ND19119 was higher than most varieties because of the quick season.

A large amount of work had supported the pre commercialization process involving extensive testing and pure seed increases of ND19119. In 2009 large scale increases of the elite barley cultivar ND19119 were carried out at McLean's and Cameron's properties, both members of CHM. Over 30 hectares were planted at each site from pure seed produced at Biloela Research Station in 2009.

The variety management package for ND19119 was compiled but never released. Commercialisation plans for the variety were abandoned based upon the disappointing yield results in the field and the lack of a commercial partner. AWB Seeds were the most likely commercial partner, but they did not accept the offer of all the seed produced in 2010 and subsequent commercialisation.

Extension Activities:

Engagement with high profile barley growers and pork producers was actively pursued at a number of field days and extension forums. These days were in conjunction with Jon Thelander from AWB, or Kym McIntyre from DEEDI.

Specific field days attended were

- Tulloona Conservation field day
- Conservation field days at Warra, Dalby AACC and Lundavra
- Top Crop field days at Hermitage
- Field days at Tamworth Agricultural Institute
- Field days at Pittsworth strip trial site at McLean's property

4. Application of Research

- Potential benefits to cost of production in commercialization of a feed barley with higher pork digestible energy
- Reliable closed loop feed grain production for barley for the pork industry is unlikely to be a reality
- Ease of barley adoption by pork producers with release of adapted barley varieties in Northern Grain Region
- Management package released when variety was released, rather than a few years later
- Impact of the research supported NIR commercialization and adoption by grain handling authorities
- Unfortunately barley is not a preferred feed grain for pigs in Northern region unless it is significantly cheaper than wheat
- Sideline benefit of field peas more clearly defined as a realistic alternative to barley in the Waggamba Shire area of the Northern grain region.

Application of the research findings in the commercial world

1. Application of recommended production practices by individual barley growers could improve the probability of higher yields and better quality grain.
2. The NIR technology and the calibrations for estimation of feed quality for pigs were used in this study to determine the quality of barley grain samples. There exists a possibility this approach can be applied by pork producers to estimate feed values.
3. Shepherd, an advanced breeding line, was released in 2008 for commercial production in the northern region based on higher yields, better disease resistance, good physical characteristics of the seed, and greater performance stability.
4. The introduction from North Dakota, ND19119-5, was tested and recommended for commercialisation based on its large kernel size, higher DE content and the ability to produce good yields in marginal environments.
5. Improved barley varieties that can make barley production more profitable are being developed. The improved varieties will help keep barley as an

important crop in the northern region in the face of both climate change and pathogen evolution.

Opportunities uncovered by the research

1. Replicated barley drill strips grown in farmers' paddock through out the northern region have provided information on production of barley varieties and estimates of the risks associated with each variety. Data from the limited number of yield trials grown during variety development are not adequate to sample the range of northern region environments, which are highly variable from year to year and location to location. Therefore, the drill strips can provide another source of information available to barley growers.
2. Barley varieties bred specifically for pork producers will be very challenging because marketplace incentives are needed to make barley production economically viable for growers. Many quality attributes of good feed barleys such as high starch content are similar to those requested by maltsters and brewers. Since increased production of barley is a common interest of both industries, new barley varieties for the northern region may need to serve both purposes to be attractive to barley growers.
3. The ability to obtain estimates of feed quality attributes using a non-destructive procedure (NIR reflectance and appropriate calibrations) reduces the cost of data collection. This makes a concentrated effort on breeding for those attributes feasible.
4. The incorporation of introductions from North Dakota into the BBA-North barley improvement program has created an opportunity to rapidly improve barley varieties for the northern region. Key attributes included: a) improved grain size and feed quality for pigs; b) better tolerance to heat and drought stress; c) improved yield stability in less productive environments; d) multiple resistances to at least five foliar diseases; and e) improved tolerance to lodging.
5. Two doubled haploid populations were generated in part to facilitate future studies on the inheritance of feed quality parameters and to identify molecular markers for the controlling elements. This resource will facilitate development of barley varieties better matched to needs for pork producers.

Commercialization/Adoption Strategies

Barley production in the northern region lacks the volume and reliability needed to entice more pork producers to regularly use barley in rations for pigs. Improved varieties and specific management recommendations have been and will be developed to address the issue of price dockage based on receival standards. Barley varieties having better feed quality are possible, but price incentives are needed to ensure that grain growers produce high quality barley for the pork industry.

- **Potential benefits to cost of production:** More barley production near pork producers' operations can be encouraged by using improved varieties and better production practices. Reducing the frequencies of crop failure in local areas would benefit both grain growers and pork producers by cutting transportation costs.

- **Ease of adoption by producers:** Utilizable energy measured as DE in part determines the profitability of pork production. The utilisation of barley varieties with high DE values offers the possibility of lower costs. However, growers may pay higher seed costs and better management practices may needed.

Impact of the research: This project has provided additional information about barley production practices and the potential for barley varieties. Two improved varieties were recommended for commercialisation. Estimations of feed quality using NIR will make improving the feed quality of barley a realistic goal.

5. Conclusion

It was unfortunate the funding had to be reduced following the first three year project, and staff numbers significantly cut back. Good research was done on identifying high yielding barleys with high digestible energy such as the Victorian feed barley variety Hindmarsh. Important research was completed on how to fit the feed barley variety Shepherd into the environment of the Northern grain region, as a profitable option for dedicated barley producers. Each year the required quality and volume of feed barley increases was successfully grown and dispatched to a storage depot at Narrabri in Northern NSW.

A huge amount of work was done by the agronomist increasing seed of ND19119 and handing all the seed to AWB through the Pork CRC. Unfortunately this resulted in a dead end with regard to the commercialization process.

6. Limitations/Risks

Research findings from the project only support recommended barley variety adaptability in Northern NSW and Southern Queensland.

The model of a closed loop production and marketing system for a pork barley variety is difficult to sustain within the vagaries of the climate in Northern Queensland.

7. Recommendations

Shepherd has specific use if grown in the Northern region and the price is lower than wheat. Further research has not been funded. Overall wheat has been identified as the preferred winter cereal for pork production.

8. References

References in this update are limited to the same as the ones in the Final report on project 1A-101.

Appendices

2010 NVT Yield Figures

Site	Yield	Hectolitre weight	Protein	Screenings	Plump Grain
Frankland (WA)					
Shepherd	2.03	65.08	16.9	6	71.3
Hindmarsh	2.49	61.66	22.7	30.8	31.2
Paruna (SA)					
Shepherd	3.53	64.6	8.9	0.4	98.2
Hindmarsh	3.5	65.4	9.4	0.5	96
Condobolin (Cent NSW)					
Shepherd	4.65	66	13.4	0.8	93.9
Hindmarsh	4.57	66	12.4	0.6	93.3
Brookstead (Qld)					
Shepherd	3.55	65.6	13.3	2.3	97.7
Hindmarsh	3.39	63.9	13	9.1	90.9
Tamworth (NNSW)					
Shepherd	4.68	64.9	9.5	1.1	93.5
Hindmarsh	4.86	65.1	9.9	2.5	91.8
Tulloona (NWNSW)					
Shepherd	3.64	64.7	10.1	0.7	96.4
Hindmarsh	2.86	64.3	10.6	1.6	91.3
Wagga Wagga(SthNSW)					
Shepherd	2.48	64.2	9	1.1	92
Hindmarsh	2.94	65.4	10.6	1	91

STRIP TRIALS 09

Genotype	Kingaroy	Lundavra	Pittsworth	SA	NSW	Biloela	Average
Commander	1.0	2.1	2.7	2.7	2.1	6.1	2.8
Crusader	0.4	3.3	2.8	3.1	1.2	6.2	2.8
Fitzroy	0.9	1.7	3.5	3.0	1.6	5.5	2.7
Grout	0.8	1.8	4.1	2.7	2.1	6.9	3.1
Hindmarsh	1.0	2.7	3.2	2.5	2.3	6.4	3.0
ND19119	0.8	3.3	3.4	2.8	1.8	5.6	3.0
Roe	1.1	2.2	3.6	2.7	1.8	7.0	3.1
Shepherd	1.1	2.3	2.9	2.7	1.8	6.6	2.9
Skiff	0.8	1.7	3.1	2.6	2.1	6.5	2.8
Average	0.9	2.3	3.3	2.8	1.9	6.3	

STRIP TRIAL YIELD 2010

Year	Site	Genotype	Yield t/ha
2010	NSW	Commander	5.52
2010	Pittsworth	Commander	1.75
2010	SA	Commander	3.85
2010	NSW	Crusader	4.54
2010	Pittsworth	Crusader	1.69
2010	SA	Crusader	3.65
2010	NSW	Fitzroy	5.22
2010	Pittsworth	Fitzroy	0.51
2010	SA	Fitzroy	3.30
2010	NSW	Forage	3.57
2010	Pittsworth	Forage	0.44
2010	SA	Forage	2.30
2010	NSW	Forage2	3.25
2010	Pittsworth	Forage2	0.60
2010	SA	Forage2	2.55
2010	NSW	Grout	6.11
2010	Pittsworth	Grout	0.45
2010	SA	Grout	2.95
2010	NSW	Hindmarsh	7.08
2010	Pittsworth	Hindmarsh	1.44
2010	SA	Hindmarsh	4.20
2010	NSW	ND19119	4.29
2010	Pittsworth	ND19119	0.98
2010	SA	ND19119	1.75
2010	NSW	Roe	5.40
2010	Pittsworth	Roe	0.76
2010	SA	Roe	3.40
2010	NSW	Shepherd	5.82
2010	Pittsworth	Shepherd	1.64
2010	SA	Shepherd	2.20
2010	NSW	Skiff	5.34
2010	Pittsworth	Skiff	0.82
2010	SA	Skiff	3.25

Site	Variety	Scr	Ret	Protein dry basis	HLW	FDEGAR	IDEGAR	PIG FDE INTIND	ENG NDF DM	TOT ST DM	TOTINS-NSP DM	TOTSOL-NSP DM	ARA XYL DM	BGLUC DM	CF DM	ADF DM	HYDCAP
SA	Commander	9.27	68.97	11.80	63.90	12.66	10.79	61.31	28.03	50.49	15.30	3.75	9.36	3.50	6.96	8.62	48.52
Kingaroy	Commander	2.18	88.05	13.69	62.55	12.35	10.62	89.03	23.30	58.35	8.06	3.29	5.03	3.33	4.68	6.45	26.35
Lundavra	Commander	1.08	88.49	15.46	69.10	12.82	10.83	70.65	21.39	51.88	12.36	3.11	5.82	2.77	5.97	7.26	41.94
Pittsworth	Commander	1.36	88.70	14.81	69.25	12.98	11.27	84.12	19.97	55.47	11.93	3.05	6.55	2.77	5.13	6.38	38.09
NSW	Commander	13.36	55.08	14.47	62.40	13.40	11.79	74.94	21.51	61.23	10.72	2.31	6.53	1.41	4.52	6.01	44.08
Biloela	Commander	3.83	75.11	15.17	65.75	12.72	10.76	77.87	25.02	55.22	12.11	3.70	6.29	3.49	5.64	7.18	38.05
SA	Crusader	27.70	18.98	14.17	68.85	13.87	12.96	69.63	15.58	65.21	9.36	1.01	5.11	-0.59	3.34	4.22	54.34
Kingaroy	Crusader	6.52	62.22	12.09	74.80	13.55	12.14	76.27	18.64	71.22	4.95	1.81	3.36	0.78	2.43	3.41	38.77
Lundavra	Crusader	4.83	53.86	21.22	81.75	14.35	12.85	55.32	14.64	64.84	7.23	0.86	3.17	-0.12	3.58	4.44	50.13
Pittsworth	Crusader	4.34	62.02	17.32	83.55	14.13	12.69	67.29	14.97	67.78	6.94	0.86	4.35	-0.10	3.16	3.88	45.38
NSW	Crusader	13.34	41.56	15.72	72.20	12.71	10.95	69.13	25.85	52.15	14.47	3.51	8.98	3.29	6.23	7.98	48.77
Biloela	Crusader	21.13	21.50	14.07	81.80	12.63	10.67	77.22	22.67	55.33	12.25	3.97	5.69	3.56	5.35	6.36	33.77
SA	Fitzroy	24.79	17.06	12.29	65.20	12.52	10.64	60.58	30.26	48.81	15.68	4.10	9.97	3.92	7.05	8.87	55.22
Kingaroy	Fitzroy	2.33	79.30	12.99	60.45	12.47	10.66	85.50	24.57	57.15	10.40	3.69	5.99	3.15	5.34	7.28	35.27
Lundavra	Fitzroy	4.01	57.50	15.31	68.35	12.76	10.70	64.71	22.17	51.62	12.00	3.48	5.72	3.49	5.86	7.07	43.18
Pittsworth	Fitzroy	2.27	68.86	14.20	68.55	12.83	11.12	75.36	24.60	54.15	12.24	3.80	7.75	3.46	5.60	7.44	39.67
NSW	Fitzroy	20.78	40.10	14.07	57.55	12.60	10.92	69.07	28.12	49.43	15.86	3.76	10.04	3.39	7.00	9.12	51.32
Biloela	Fitzroy	5.66	60.34	12.20	63.90	12.73	10.57	79.85	23.70	57.20	12.04	3.26	6.86	3.43	5.60	6.94	35.83
SA	Grout	10.71	34.33	11.60	64.00	12.44	10.57	66.84	27.23	51.54	14.69	4.08	8.21	3.70	6.55	8.04	42.47
Kingaroy	Grout	2.67	61.65	13.05	62.90	12.59	10.79	75.79	25.41	52.66	12.72	3.38	7.15	2.90	6.00	7.35	42.64
Lundavra	Grout	3.22	55.55	14.77	67.15	12.71	10.61	71.91	21.67	51.63	13.03	3.45	5.81	2.86	5.83	6.98	43.06
Pittsworth	Grout	1.20	83.79	13.61	67.25	12.64	10.83	84.10	22.07	54.67	11.94	4.17	6.63	4.06	5.05	6.47	36.59
NSW	Grout	7.69	69.40	15.80	63.80	13.17	11.65	67.40	21.47	56.87	12.03	2.41	7.13	1.84	5.42	6.82	48.32
Biloela	Grout	4.59	67.55	11.17	67.25	12.70	10.74	69.20	24.74	54.45	11.90	4.01	5.91	3.78	5.70	7.04	42.60
SA	Hindmarsh	16.21	58.24	12.94	63.20	12.72	11.12	66.75	27.90	51.64	15.38	3.73	8.99	3.32	6.65	8.49	44.11
Kingaroy	Hindmarsh	2.47	75.39	14.32	61.70	12.74	11.16	82.87	26.97	55.31	11.68	3.74	6.86	3.38	5.48	7.59	34.38
Lundavra	Hindmarsh	1.11	68.28	16.15	69.95	12.85	10.71	75.88	22.81	53.24	12.11	3.42	6.96	3.27	5.61	6.96	38.45
Pittsworth	Hindmarsh	1.14	87.43	16.00	70.70	13.18	11.31	77.59	20.91	56.75	10.88	3.39	6.30	3.34	4.99	6.44	36.74
NSW	Hindmarsh	6.93	71.88	15.20	63.00	12.56	10.81	67.51	27.51	50.85	15.06	3.68	8.94	3.44	6.72	8.65	51.34
Biloela	Hindmarsh	7.03	58.82	13.50	67.70	12.76	10.72	76.60	26.43	52.59	13.61	3.92	8.28	3.90	5.99	7.85	42.25

Site	Variety	Scr	Ret	Protein dry basis	HLW	FDEGAR	IDEGAR	PIG FDE INTIND	ENG NDF DM	TOT ST DM	TOTINS-NSP DM	TOTSOL-NSP DM	ARA XYL DM	BGLUC DM	CF DM	ADF DM	HYDCAP
SA	ND19119	3.67	85.18	12.77	63.25	12.87	11.27	61.31	25.33	50.60	15.72	3.34	9.62	3.41	6.58	7.99	43.37
Kingaroy	ND19119	0.70	96.99	12.90	63.10	12.79	11.34	86.02	24.23	56.74	11.97	3.55	7.44	3.08	5.32	7.02	34.93
Lundavra	ND19119	0.44	95.63	13.72	67.70	13.04	11.35	74.94	20.70	53.93	13.54	3.01	7.77	2.85	5.63	6.38	38.55
Pittsworth	ND19119	0.83	95.88	14.66	71.25	13.12	11.34	83.49	19.45	58.44	11.07	3.19	5.80	3.17	4.69	5.86	33.47
NSW	ND19119	2.78	91.34	14.70	60.90	12.65	10.85	67.04	28.80	49.26	15.73	3.61	10.17	3.38	6.94	9.00	54.31
Biloela	ND19119	0.55	98.39	12.72	62.30	13.24	11.68	79.29	20.84	61.12	10.36	2.70	6.22	1.99	4.21	5.30	41.66
SA	Roe	3.71	88.20	12.09	65.85	12.60	10.77	63.28	26.73	51.32	15.44	3.58	7.95	3.10	7.11	8.66	42.37
Kingaroy	Roe	0.94	87.32	13.27	65.60	12.50	10.66	76.94	25.49	52.01	13.59	3.42	6.82	3.43	6.50	8.07	36.50
Lundavra	Roe	1.42	78.93	16.48	70.15	12.65	10.44	63.33	22.81	49.85	13.43	3.27	6.37	2.92	6.55	7.88	45.30
Pittsworth	Roe	0.98	78.73	16.48	70.21	12.64	10.44	74.29	20.86	54.49	12.17	3.35	6.66	3.54	5.63	6.69	34.72
NSW	Roe	6.37	78.61	15.72	62.70	13.17	11.85	65.37	22.42	56.96	12.07	2.45	7.10	1.56	5.20	6.73	53.18
Biloela	Roe	2.56	83.53	11.90	68.65	12.92	11.28	80.62	24.14	54.35	13.14	3.70	7.61	3.25	5.46	6.83	39.25
SA	Shepherd	22.77	41.87	13.28	61.95	12.59	11.02	65.63	28.68	49.51	16.10	4.16	10.16	3.72	6.88	8.75	50.16
Kingaroy	Shepherd	1.27	84.72	13.67	63.90	12.72	11.31	80.21	25.43	51.48	13.87	3.44	8.12	2.89	6.12	7.74	39.37
Lundavra	Shepherd	2.16	74.52	17.90	70.15	12.91	10.99	69.54	22.87	48.21	13.90	3.43	8.06	2.92	6.31	7.73	46.87
Pittsworth	Shepherd	0.85	84.87	16.77	70.56	12.92	11.11	73.74	22.21	50.33	13.69	3.43	8.01	3.04	6.08	7.47	44.42
NSW	Shepherd	11.50	72.86	15.78	64.45	12.71	11.01	67.41	27.21	50.88	14.87	3.46	9.20	3.47	6.67	8.63	51.54
Biloela	Shepherd	4.42	66.70	15.03	64.51	12.75	10.98	75.15	25.58	51.73	13.79	3.62	8.34	3.36	6.07	7.86	47.24
SA	Skiff	18.25	22.33	12.93	63.15	12.77	10.92	69.49	26.40	51.17	14.54	3.68	8.58	3.35	6.53	8.23	44.82
Kingaroy	Skiff	3.73	45.76	15.69	64.00	12.69	10.84	79.05	24.85	54.11	12.00	3.55	7.49	3.55	5.82	7.68	34.84
Lundavra	Skiff	3.37	37.13	19.06	70.00	12.97	10.74	57.39	22.92	49.02	13.00	3.34	6.73	2.99	6.40	7.99	45.75
Pittsworth	Skiff	1.99	61.37	18.02	69.20	13.18	11.40	77.07	20.24	56.00	12.38	3.13	7.19	2.88	5.16	6.44	37.18
NSW	Skiff	18.67	42.85	15.44	58.90	12.63	10.83	70.07	27.63	49.65	15.76	3.73	10.32	3.39	6.86	8.90	52.09
Biloela	Skiff	12.27	25.13	14.26	64.70	12.70	10.67	78.80	24.12	55.11	11.44	3.99	6.37	3.96	5.32	6.71	42.79

2010 NIR QUALITY STRIP TRIALS

TRIAL: Pork CRC Strip

Year	Site	Genotype	HLW	Scr	Ret (>2.2+>2.5)	Protein DB	PIG FDE INTIND	ENG NDF DM	TOT ST DM	TOTINSNSP DM	TOTSOLNSP DM
2010	Biloela	Commander	60.00	5.47	71.29	14.28	48.08	23.16	51.03	15.46	3.62
2010	NSW	Commander	60.85	5.36	79.21	15.58	35.20	19.45	50.48	14.58	2.96
2010	Pittsworth	Commander	57.10	34.74	30.14	17.12	75.16	21.02	55.91	11.54	2.86
2010	SA	Commander	59.75	2.30	93.42	13.91	66.86	21.88	55.12	13.26	3.34
2010	Biloela	Crusader	76.45	12.04	39.85	16.48	65.49	15.27	66.96	8.03	0.94
2010	NSW	Crusader	73.00	14.29	39.44	18.28	51.96	12.27	64.38	8.31	0.61
2010	Pittsworth	Crusader	75.85	15.01	36.47	17.05	84.28	12.53	71.56	5.82	0.65
2010	SA	Crusader	75.50	4.20	75.61	16.67	75.78	13.30	67.79	8.16	0.91
2010	Biloela	Fitzroy	58.45	15.73	41.89	14.20	53.25	23.51	51.74	14.69	3.72
2010	NSW	Fitzroy	60.00	5.54	73.17	15.72	43.93	21.64	51.87	13.96	3.25
2010	Pittsworth	Fitzroy		77.78	4.05	18.78	53.22	23.02	53.08	11.65	2.74
2010	SA	Fitzroy	61.95	1.89	84.57	14.12	74.81	21.78	57.65	11.54	3.71
2010	Biloela	Forage	64.50	4.09	74.21	16.20	52.71	18.78	51.98	15.43	3.76
2010	NSW	Forage	61.60	9.08	67.30	17.43	40.33	18.10	51.62	13.89	3.04
2010	Pittsworth	Forage	51.00	61.68	8.47	18.23	62.48	17.02	53.87	12.52	2.45
2010	SA	Forage	60.80	2.40	90.85	15.54	74.45	22.56	55.48	13.27	4.12
2010	Biloela	Grout	58.70	26.80	14.75	14.51	53.78	22.73	50.73	15.35	4.12
2010	NSW	Grout	61.75	4.50	77.32	14.92	45.10	19.50	51.80	13.92	3.31
2010	Pittsworth	Grout	53.05	59.95	6.07	16.22	66.14	21.04	55.20	11.72	3.01
2010	SA	Grout	61.30	1.74	85.82	13.09	71.78	23.22	55.79	12.66	4.03
2010	Biloela	Hindmarsh	62.00	11.84	50.80	15.83	51.86	20.61	53.29	14.56	3.43
2010	NSW	Hindmarsh	63.70	7.26	64.94	16.67	44.54	19.50	52.52	13.37	3.33
2010	Pittsworth	Hindmarsh	55.95	52.42	11.86	18.30	84.57	21.17	58.40	10.17	3.11
2010	SA	Hindmarsh	63.50	4.39	88.29	16.39	81.61	23.45	57.51	11.67	3.72
2010	Biloela	ND19119	63.05	4.39	88.83	15.91	53.33	21.14	51.88	15.69	3.36
2010	NSW	ND19119	66.80	1.00	95.04	14.98	60.44	19.90	56.78	12.26	2.72

Year	Site	Genotype	HLW	Scr	Ret (>2.2+>2.5)	Protein DB	PIG FDE INTIND	ENG NDF DM	TOT ST DM	TOTINSNSP DM	TOTSOLNSP DM
2010	Pittsworth	ND19119	59.60	14.02	57.02	15.50	96.72	19.00	59.69	11.14	2.91
2010	SA	ND19119	60.50	0.32	98.50	13.82	75.00	24.99	55.80	12.99	3.49
2010	Biloela	Roe	62.90	6.11	62.66	14.95	49.89	21.48	52.66	14.70	3.58
2010	NSW	Roe	60.95	5.90	75.72	16.13	34.24	19.94	49.15	15.62	3.22
2010	Pittsworth	Roe	54.75	52.29	9.75	16.06	68.77	22.78	55.18	11.54	3.16
2010	SA	Roe	62.35	2.42	94.19	14.61	70.66	23.63	55.30	12.28	3.64
2010	Biloela	Shepherd	64.40	4.49	66.90	16.55	50.77	21.50	52.09	14.94	3.88
2010	NSW	Shepherd	63.25	5.53	77.20	17.00	41.47	19.67	50.68	14.47	3.47
2010	Pittsworth	Shepherd				15.07	109.12	16.28	58.80	10.05	2.45
2010	SA	Shepherd	64.05	0.89	96.67	14.47	75.18	24.16	54.26	13.95	4.18
2010	Biloela	Skiff	62.40	14.81	40.09	14.88	54.44	23.83	51.57	15.20	3.84
2010	NSW	Skiff	63.05	9.16	57.20	16.47	39.69	22.15	51.19	14.02	3.30
2010	SA	Skiff	62.75	4.10	87.57	15.48	71.37	23.65	54.75	13.28	3.69
2010	Biloela	Forage2	62.25	4.22	81.55	14.25	51.13	20.68	50.02	16.28	3.54
2010	NSW	Forage2	62.60	4.27	79.30	15.18	50.36	19.73	51.93	14.29	3.12
2010	Pittsworth	Forage2	60.60	16.85	50.08	15.00	100.94	16.38	63.18	9.43	2.60
2010	SA	Forage2	57.30	3.66	89.34	14.26	79.96	23.88	53.89	13.27	4.04