



THE UNIVERSITY OF  
**SYDNEY**

# **Pork CRC Final Report**

## **October 2011 – June 2014**

**Pork CRC 4B-113 1112: Grain collection,  
storage and distribution and data  
management for 4B subprogram projects**

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The main aim of the Pork CRC 4B group of projects is to improve the robustness and accuracy of NIR (near infrared) calibrations for predicting the feed quality of cereal grains for pigs. This is achieved by both increasing the number and types of grain samples that are included in the calibrations, as well as identifying sample selection criteria for grain samples lacking in the calibration dataset. It was determined from previous Pork CRC 1 projects that while unusual grains that will extend the scope of the calibrations should continue to be sourced, a large amount of more normal\* grains that make up the bulk of the feed grain available, should be included. The number of maize samples also needed be increased as they were underrepresented in the data set and were seen as an important grain type if the calibrations are to have international appeal. While the majority of past research has concentrated on, and done well in predicting grain energy content, the ability to estimate feed intake is also necessary in understanding the economics and management of pig production systems. Therefore, further research has been undertaken into the development of NIR feed intake calibrations.

The University of Sydney Pork CRC project 4B-113 has the pivotal role to collect, store and distribute grain, pelleted diets and animal samples, required or produced by other Pork CRC 4B projects, and to collect and store data produced, so that it can be made available for statistical analysis, data mining and for use in the construction of the pig feed quality NIR calibrations. This project was an extension to Pork CRC 1 project 1B-108 0809 and the first 12 months was spent organising the analysis of the final animal samples and the collating data for statistical analysis from Pork CRC1 experiments and the subsequent NIR calibrations. These experiments were conducted at the University of Queensland at Gatton and the data has been published in the University of Queensland project 4B-105 June 2013 final report.

No animal experiments that were needed for the improvement of the NIR calibrations were conducted within the first year of the project because completely different organisations were involved in conducting the research and analysis in Pork CRC 2 as compared to Pork CRC 1. In Pork CRC2 new researchers and facilities have been used in the production of the pelleted pig diets, in conducting the pig digestible energy experiments and the analysis of the animal samples created, as well as conducting the weaner experiments to determine feed intake of the grains fed in the digestibility experiments. The University of Sydney 4B-113 project played an important role in helping liaise with these new organisations (refer to table 1) to ensure that facilities and procedures were similar to those followed by previous Pork CRC 1 participants. Well defined procedures and protocols that have been developed by the University of Sydney in conjunction with other organisations were the key to the transition.

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\*Normal – grains that have been grown under average growing conditions and that have not been adversely affected by weather damage or moisture stress.

**Table 1. The role of different organisations involved in the updating of NIR calibrations in Pork CRC 1 & 2**

<b>role</b>	<b>Pork CRC 1</b>	<b>Pork CRC 2</b>
sub-program co-ordinator	John Black	John Black
statistician	Sharon Neilson & Simon Diffey	Simon Diffey
collection, storage & distribution of grain and data	University of Sydney	University of Sydney
creation of NIR calibrations	Peter Flinn	Peter Flinn
<i>making pelleted diets</i>	<i>Qld DPI, Redlands</i>	<i>Uni of Sydney, Camden</i>
<i>digestibility experiments</i>	<i>Qld DPI &amp; University of Qld</i>	<i>University of Melbourne</i>
<i>analysis of animal samples</i>	<i>Symbio</i>	<i>UNE</i>
<i>intake experiments</i>	<i>Qld DPI</i>	<i>WA DPI</i>

### **Collection, Storage and Distribution of Large Grain Samples**

Within the last 3 years between 1 -2 tonnes of 38 new large grain samples (15 wheat, 7 barley, 4 triticale, 2 sorghum and 10 maize samples ) have been collected from the University of Sydney farm at Narrabri and other commercial grain growers and merchants and were stored at Narrabri in pest controlled conditions. As per the objectives more maize samples have been sourced along with samples from the other main cereal feed grain types grown in Australia. The majority of these grains would be considered 'normal' but within each grain type varieties were also sourced that had different grain characteristics such as hard and soft wheat, waxy and non-waxy maize and naked barley. Sprouted or weather damaged grain was also sourced when available as the down grading of cereals to "feed" grade due to sprouting is common practice in Australia and at times can make up the bulk of feed grains available.

As part of their experimental design, all animal feeding experiments within the project include 33% of grains that have been included in one or more previous trials. These 'connectivity' grains allow for between experimental variability to be accounted for when data is statistically analysed across experiments. This connection between experiments has made possible through the long-term storage of grains at the University of Sydney, Plant Breeding Institute in Narrabri.

Thirty-one (31) of the new grain samples collected (15 wheat, 7 barley, 2 triticale, 1 sorghum and 6 maize) have so far been fed in energy digestibility experiments along with 8 connectivity grains stored at Narrabri from previous Pork CRC experiments. Ten (10) of the grains fed in the digestibility experiments (4 wheat, 3 barley, 3 maize) have also been fed in weaner experiments to try and understand differences in intake between these grains. Table 2, outlines the grain type, variety and grain characteristics used in these digestibility and intake experiments.

**Table 2. Grain Samples used in Pork CRC experiments from October 2011 to June 2014**

Grain Sample Information						digestibility experiments						Intake experiments
Sample ID	Grain type	year	variety	sample condition	variety characteristics	MU001	MU002	MU003	MU004	MU005	previous expts	WA001
1770_RAW0	wheat	2006	Sunco		hard, bread	MU001			MU004	MU005	DS004, HR001, NG001, NG002,	
1774_RAW0	wheat	2011	Gregory		hard, bread			MU003				WA001
1776_RAW0	wheat	2012	Qal2004		soft, biscuit			MU003				WA001
1777_RAW0	wheat	2012	AGT line		hard, bread				MU004			
1779_RAW0	wheat	2013	Kidman		hard, specialty bread				MU004			
1780_RAW0	wheat	2013	Gregory		hard, bread					MU005		
1781_RAW0	wheat	2013	Sunvex		hard, bread					MU005		
1782_RAW0	wheat	2013	QT3333		hard, bread					MU005		
1783_RAW0	wheat	2013	Jandaroi		very hard, pasta				MU004			
1785_RAW0	wheat	2013	Bellaroi		very hard, pasta					MU005		
1887_RAW0	wheat	2009	Zulu		very hard, feed quality	MU001					NG001	
1895_RAW0	wheat	2012	Sunvex		hard, bread		MU002	MU003	MU004	MU005		WA001
1896_SPROUT	wheat	2012	unknown	sprouted	hard, bread		MU002					WA001
1897_SPROUT	wheat	2012	Bolac	sprouted	hard, bread		MU002					
1898_SPROUT	wheat	2011	Sunvale	sprouted	hard, bread	MU001						
1899_RAW0	wheat	2011	Sunbrook		hard, bread	MU001						
3760_RAW0	barley	2011	Grout		two-row, feed	MU001						WA001
3761_RAW0	barley	2011	Fitzroy		two row, malting	MU001						WA001
3762_RAW0	barley	2012	Grout		two-row, feed			MU003				WA001
3763_RAW0	barley	2012	Shepherd		two-row, feed		MU002					
3764_RAW0	barley	2012	Shepherd		two-row, feed		MU002					
3766_RAW0	barley	2013	Finniss		naked (hulless)				MU004			
3785_RAW0	barley	2013	Shepherd		two-row feed				MU004			
3871_RAW0	barley	2006	Gairdner		two row, malting	MU001		MU003	MU004		DS004, HR001, NG001, NG002	
3934_SPROUT	barley	2012	unknown	sprouted	unknown			MU003				
6859_RAW0	triticale	2009	Bogong		early-season variety	MU001			MU004		NG001	
6867_RAW0	triticale	2012	Canobolas		mid-season variety				MU004			
6868_RAW0	triticale	2013	Berkshire		high energy digestibility				MU004			

Grain Sample Information						digestibility experiments						Intake experiments
Sample ID	Grain type	year	variety	sample condition	variety characteristics	MU001	MU002	MU003	MU004	MU005	previous expts	WA001
7786_RAW0	sorghum	2011	Buster		red	MU001						
7855_RAW0	sorghum	2006	Maxi		red		MU002				DS002, DS004, NG001, NG002	
7869_RAW0	sorghum	2008	Karper 669		large grain, yellow	MU001					HR001, NG001	
8084_RAW0	corn	2010	36G66		unknown	MU001				MU005	NG001, NG002	WA001
8090_RAW0	corn	2011	32P55		processing grade	MU001					NG001	
8101_RAW0	corn	2011	34N41		waxy starch					MU005		
8102_RAW0	corn	2012	34N43		feed grade					MU005		
8103_RAW0	corn	2012	34N41		waxy starch			MU003				WA001
8104_RAW0	corn	2012	33T39		waxy starch	MU001	MU002			MU005		WA001
8105_RAW0	corn	2012	32P55		processing grade					MU005		
8110_RAW0	corn	2014	unknown		unknown					MU005		

**Note:**

Digestibility experiments MU001, MU002, MU003, MU004 & MU005 were conducted by the University of Melbourne at their Parkville campus  
Weaner intake experiment WA001 was conducted by the WA Department of Agriculture at their Medina research station.

The University of Sydney 4B-113 project also looked after the logistics of freighting the grain from Narrabri to Sydney for diet manufacture and then from Sydney to Melbourne and Perth for the animal experiments. The main problem that we have had to overcome in this project has been that of mould occurring in pelleted diets. This problem has been solved by liaising with the Camden feed mill and Melbourne University to minimising the amount of water added to the diets when pelleted, while at the same time trying minimising the dustiness of the feed. A mould inhibitor was added to the diets during pelleting and the diets have been kept in a refrigerated container after manufacture until they were transported via refrigerated truck or train to Melbourne and Perth. These measures have added to the cost but have overcome the mould problems and thus not compromised the experimental outcomes or animal health.

Other 4B Pork CRC experiments that are not involved with improving the NIR calibrations have also benefited for the University of Sydney 4B-113 project's grains sourcing and logistics connections. Three (3) tonne of both field peas and sorghum were sourced for the University of Queensland Pork CRC project 4B-108. These grains were freighted to 2 different milling facilities in Queensland and once milled were freighted back to Narrabri for storage until require by the Camden mill for diet manufacture. The mash diets were then transported from Camden to intake experiments at Rivalea at Corowa. After these intake experiments were completed another 1 tonne each of peas and sorghum were sourced and sent to a Queensland mill. The ground grain was then freighted directly to Camden for diet manufacture and to Melbourne for immediate inclusion in a digestible feeding trial.

1 tonne each of wheat and sorghum and 400kg of field peas were also sourced for Pork CRC project 4B – 108 to look at the effect of subtilism on wheat and sorghum when fed in combination with different protein sources. These grains were transported to Camden for inclusion in steam pelleted diets, which were then sent to Melbourne University of inclusion in pig feeding experiments.

### **Collection, Storage and Distribution of Small Samples**

All representative 2kg sub-sample of all grains that have been fed in pig experiments has been kept in Narrabri for NIR scanning to create calibrations and for any future analysis. A 500g sub-sample of all the pelleted diets for both the digestible energy and intake experiments are also maintained at Narrabri as a reference for any further studies.

During the experiments conducted at Melbourne, ileal (small intestine) and faecal samples are collected for analysis so that the energy digestibility of the grains can be calculated. Once the animal samples are taken they are frozen until freeze drying and are then sent to the University of Sydney at Narrabri for storage and distribution to the analysis laboratory at the University of New England (UNE) in Armidale.

## **Collection, Maintenance and Management of Data**

The University of Sydney 4B-113 project receives data from the chemical analysis of ileal, faecal and diet samples conducted at UNE and the experimental measurements made from the intake trials conducted by the WA DPI. Data is checked and collated before energy digestibility and intake calculations are made and send to the Pork CRC statistician for statistical analysis. All raw and statistically adjusted data is stored in purpose built database at Narrabri.

Data from the first intake experiment conducted by the WA DPI has been checked, analysed and stored, however very little data has been made available from the digestibility experiments conducted in Melbourne due to a number of problems that have been experienced. One of the main issues has been the inability of the University of Melbourne to freeze dry the animal products produced from the pig experiments as a result of losing access to the Vic DPI freeze drier at Werribee. This has mean that products from only 2 of the 5 energy digestibility studies completed have been freeze dried and sent for analysis. This problem will soon be rectified as the University of Melbourne has purchased a freeze drier and will train staff to use it. It is not expected that more freeze dried animal samples will be received by the University of Sydney however, until early 2015. The other problem that has been experienced has been the slow processing of samples by the University of New England and the breakdown of a vital piece of their analysis equipment. This problem has been partly solved by purchasing 2 grinders for the purpose of grinding the ileal, faecal diet samples before sending to UNE for analysis, thus speeding the processing of the samples through the lab. It is expected that the UNE bomb calorimeter that broke down a number of months ago and is used for measuring the gross energy of the ileal, faecal and diet samples will be fixed by early 2015. Unfortunately there are only a few laboratories that have this machine and it was one of the main reasons for moving the analysis to UNE.

The University of Sydney 4B-113 project is essential to the operation of the other 4B Pork CRC sub-programs through the collection and distribution of grains and data. It is also continued its vital role in maintaining and co-ordinating the flow of information, including experimental methods and designs between the different research organisations, managers and statisticians.