

# FINAL REPORT

## 1C-102: The establishment of a viable pearl millet industry to support the Australian pork industry

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

By

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## Executive Summary

Pearl millet grain is an ideal feed for pigs, containing relatively high levels of energy as well as crude protein with a balanced amino acid profile that is worth a 5-15% premium over sorghum in least-cost pig diets. Pig feeding experiments have confirmed that very good growth performance can be achieved with the inclusion of pearl millet in diets of growing pigs. However the major constraint to the establishment of the pearl millet industry to supply nutritional valuable grain to the Australian pork industry is the necessary agronomic requirements to produce satisfactory and economic yields of pearl millet in cereal growing regions of SE Queensland and Northern NSW.

During the first year of the project, which encompassed the summer growing season (October, 2007 to January, 2008), the commercially available hybrid pearl millet was compared to sorghum at four different locations in Southern Queensland and Northern NSW. In addition, various agronomic factors were evaluated in their effect on the yield of pearl millet in these comparative field studies.

The yield of pearl millet ranged from 1.1 to 2.2 tonne/hectare and was between 52% and 78% of the yield of sorghum at the four sites. The sowing costs of pearl millet are about \$300/hectare and thus the minimum yield of pearl millet, just to cover sowing costs, is likely to be at least 1.5 tonne/hectare.

The yield of hybrid pearl millet was consistently lower than sorghum grown under the same conditions in these trials. In addition, hybrid pearl millet seems to have a very flat yield response to changing environments which is consistent with the previous Central Queensland data. This may indicate that the genetic ability of hybrid pearl millet is limiting yields in higher yielding situations.

The results of the qualitative studies on the four co-operating properties in the first year of the project failed to indicate any potential whatsoever for pearl millet to achieve competitive yields to sorghum. It was also considered that the existing variety of pearl millet would not be competitive against other crops in most cropping locations, including the more marginal areas of Southern Queensland and Northern NSW.

The project was terminated at the end of the first year of the project with the following conclusion:

**The consistently low and relatively constant yield of pearl millet compared to sorghum makes the growing of the commercially available varieties of pearl millet presently economically unattractive for most grain growers. The existing commercial varieties of pearl millet are unlikely to be a viable alternative summer crop for grain growers that wish to supply pearl millet as a feed ingredient to the Australian pork industry.**

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# 1. Introduction

Pearl millet grain is an ideal feed for pigs, being a high energy cereal as well as high protein cereal with a balanced amino-acid profile that is worth a 5 to 15% premium over sorghum in least-cost diets. Plant breeding researchers from Queensland Department of Primary Industries & Fisheries have recently identified new pearl millet hybrids that are suitable for growing in sub-tropical Australia. These hybrids mature in 85 days which is significantly earlier than sorghum, and hence offer a new cropping option for broad-acre farmers. Crop simulation modelling suggests that pearl millet is best suited to early spring or late autumn plantings and furthermore, it appears to be more heat and drought tolerant than sorghum when grown on deep sandy soils.

Pig feeding experiments have confirmed that very good growth performance can be achieved with the inclusion of pearl millet in diets of growing pigs. The pearl millet hybrid grain has already been assessed as a feed ingredient in pig diets through amino acid and energy digestibility studies and by a growth trial (APL Project 2017). In the latter, pigs in single pens and fed pearl millet compared with good quality sorghum had comparable performance, based on preliminary analysis (D.Singh pers comm.). The ileal digestible energy content of pearl millet was found to be 0.9MJ/kg higher than sorghum. Protein digestibility of pearl millet was 6% higher than sorghum whereas the fat digestibility was 20% higher. In addition, the digestibility of most essential amino acids was higher in pearl millet than sorghum.

The results of the pig feeding project show that the average composition of pearl millet was (g/kg on a dry matter basis):

Dry matter	900
Fat	30
Crude Protein	106
Lysine	2.0
Methionine	2.0
Threonine	3.6
Gross energy	17.5 MJ/kg
Digestible energy	15.6 MJ/kg

Furthermore, the ileal digestibility (%) of key nutrients was:

Dry matter	79.7
Energy	82.5
Crude protein	76.5
Lysine	87.8

The major constraint to the establishment of the pearl millet industry to supply nutritional valuable grain to the Australian pork industry is the necessary agronomic requirements to produce satisfactory and economic yields of pearl millet in cereal growing regions of South East Queensland and Northern NSW, as well as under irrigation in Southern Australia. This project will identify the appropriate agronomic requirements for pearl millet in several regions in Northern NSW and SE Queensland

The objectives of this project were to:

- Assess the suitability of pearl millet production in particular growing regions in Australia.
- Determine the agronomic requirements for economic production of pearl millet in particular growing regions in Australia.

- Develop an extension program to encourage grain growers in particular regions to grow pearl millet for the Australian pork industry.

## 2. Methodology

A project management group was established in July, 2007 to provide overall direction to a proposed project to investigate pearl millet as an alternative feed for pig diets. The project management group consisted of:

Ray King	Danny Singh	Robert Van Barneveld
Brian McLean	Ken Cameron	Peter Lawrence
Brenton Hosking	Michael Castor	Alison Spencer
Neil Gannon	Rodney Coe	

At this first meeting of the project management group on 13 July, 2007 this group decided that it would be worthwhile to prepare a project proposal to the Pork CRC for funding from 2007/08. This project was submitted to Pork CRC on behalf of Cameron Hall McLean Alliance with Michael Castor as the Principal Investigator and focussed on defining the most appropriate agronomic conditions in certain grain growing areas to optimise the yield and return from pearl millet.

### *Methods adopted for the project:*

During the first year of the project (2007/08), which encompassed the summer growing season (October to January) of pearl millet, the variety of hybrid pearl millet that was commercially available from HSR Seeds was sown in small (about 5 hectare) parts of paddocks on the properties of four cooperating sorghum grain growers. The remaining part of the paddock was sown to sorghum for comparative purposes. Based upon previous limited experience of pearl millet and more extensive experience with sorghum, various agronomic factors, including row spacing, soil type, planting date and plant density were evaluated. The effects of these factors on the growth and yield of pearl millet was observed and compared to the yield of sorghum grown under similar agronomic conditions in the same paddock to provide a much better idea of the main factors that may influence yield of pearl millet. In addition, much more intensive research type studies were also planned on two co-operating farms during this first summer of the project to begin to obtain some more quantitative information on the agronomic characteristics required for acceptable yields. However, after the poor start of the season, it was decided not to put resources into these more intensive and quantitative studies in the 2007/08 summer growing season.

On April 20, 2008, another Project Management meeting was held to review the results of these four qualitative field trials, as there was a NO GO/GO decision point at the end of the first year of the project. This meeting was attended by Avril Finn, Peter Lawrence, Alison Spencer, Ray King, Roger Campbell, Michael Castor, Brian McLean, Robert Van Barneveld, Neil Gannon, and Brenton Hosking, with apologies from Rodney Coe and Ken Cameron.

### 3. Outcomes

#### *Research results*

Pearl millet was sown at four sites in late spring/early summer (2008/09) and compared with the yield of sorghum at each site. The commercial trial sites were at North Star, Inglestone, Billa Billa and Westmar. The planting dates ranged from 12 November to 4 January, plant populations ranged from 30,000 to 110,000 plant/hectare and row spacings ranged from 1.0 metre out to 2.0 metre. The planned intensive quantitative trials on two co-operating properties were not conducted due to the very poor conditions at the start of the summer.

The yield results of the comparative study conducted at the four sites are shown in the Table 1.

Table 1: Yield of sorghum and pearl millet grown at four sites in SE Qld and N NSW.

<u>Site</u>	<u>Sorghum</u> (tonne/ha)	<u>Pearl Millet</u> (tonne/ha)
"Clearview", North Star, NSW	4.2	2.2
"Enarra," Inglestone, Qld	3.0	2.2
"Lundavra" Billa Billa. Qld	3.5	1.8
"Baquabah," Westmar, Qld	1.4	1.1

The sowing costs of pearl millet are about \$300/hectare and thus the minimum yield of pearl millet to cover sowing costs is likely to be at least 1.5 tonne/hectare.

Row spacing, and plant population density failed to significantly improve the yield of pearl millet and these further comparisons of agronomic treatments are shown in more detail in the Appendix. General observations on the growth and yield of pearl millet from these four trial sites included:

- Over 100,000 plants/hectare was unnecessary
- Higher plant populations produced plants with less tillers and more even head emergence and flowering.
- 2.0 metre row spacing was too wide.
- Row spacing less than 1.0 metre will help ground cover, but may not improve yield.
- Pearl millet flowered about 10 days earlier than sorghum
- Pearl millet was harvested about 20 days earlier than sorghum
- The use of pre-emergent herbicide Dual gold with concept Seed Safener didn't produce any negative impacts on pearl millet.
- Disc planters on lighter soil types gave the best establishment rates.

The percentage plant establishment of pearl millet ranged from 11-37% compared to sorghum (70-90%) which was much more consistent across sites. Planting equipment and soil types are likely to be important factors affecting plant establishment of pearl millet. However, plant population had little effect on yield as seen at the "Enarra" site at Inglestone.

The main conclusion from these field studies was that the yield of hybrid pearl millet was consistently lower than sorghum grown under the same conditions in these trials. In addition, hybrid pearl millet seems to have a very flat yield response to changing

environments which is consistent with the previous Central Queensland data. This may indicate that the genetic ability of hybrid pearl millet is limiting yields in higher yielding situations.

Approximately 1 tonne samples of pearl millet harvested from each of the four sites was sent to Narrabri for later inclusion in the *in vivo* digestibility studies in Pork CRC Project 1B-101. In addition, approximately 11 tonne pearl millet that had been harvested from the co-operators and was in excess, was transported to a poultry farmer north of Brisbane for inclusion into poultry diets after Ridleys at Toowoomba were unable to collect the excess pearl millet and include in their pig diets.

The main outcome of this project was to establish pearl millet as a viable alternative summer crop by grain growers. However the consistently low and relatively constant yield of pearl millet compared to sorghum makes the growing of the commercially available varieties of pearl millet unattractive for most grain growers that would consider growing pearl millet for the Australian pork industry.

## **4. Application of Research**

The end of the first year of the project in June, 2008 was a NO GO/GO point at which time the decision was to be made as to whether it would be worthwhile to fine-tune the agronomic requirements of pearl millet with more controlled studies in later years on co-operating grower properties. If the results of the qualitative study in the first year failed to indicate any potential whatsoever for pearl millet to achieve competitive yields, then the project may be terminated.

The results of the qualitative studies on the four co-operating properties in the first year of the project failed to indicate any potential whatsoever for pearl millet to achieve competitive yields.

The project was conducted in partnership with HSR Seeds, the seed company chosen by Qld DPI&F to commercially market the hybrid varieties of pearl millet once they are released. Data collected from the four trial sites in this project was consistent with the previous observations from Central Qld and from the observations of Rodney Coe and his colleagues at HSR Seeds. Rodney Coe felt that the genetic potential of the hybrid varieties had not yet been developed sufficiently to compete with sorghum and other crops in Northern NSW and SE Queensland. HSR Seeds will continue to conduct some small plot trials with different hybrids of pearl millet, mainly for the high price bird seed market. In addition, HSR Seeds will continue to supply the existing hybrid, as some grain growers who have tried pearl millet are willing to continue to experiment with pearl millet in their crop rotations.

The potential of pearl millet in the Western wheat growing areas of Northern NSW was also discussed with the Landmark Agronomist at Goondiwindi. There was general agreement that the commercial varieties of pearl millet that are available to grain growers are unlikely to provide competitive yields to other grain crops in the Northern NSW and Southern Queensland grain growing regions. The potential for pearl millet in more marginal situations in Southern Queensland and Northern NSW, either with earlier or later plantings as well as in the central wheat growing areas in Northern NSW was also discussed at the Project management meeting on 20 April, 2008. However, further discussions concluded that any further investigations with pearl millet did not warrant continued Pork CRC funding.

## **5. Conclusion**

The main finding from the field studies conducted in this project was that the yield of hybrid pearl millet was consistently lower than sorghum grown under the same conditions in these trials. In addition, hybrid pearl millet seems to have a very flat yield response to changing environments which is consistent with the previous Central Queensland data. This may indicate that the genetic ability of hybrid pearl millet is limiting yields in higher yielding situations.

The consistently low and relatively constant yield of pearl millet compared to sorghum makes the growing of the commercially available varieties of pearl millet presently economically unattractive for most grain growers. The existing commercial varieties of pearl millet are not likely to be a viable alternative summer crop for grain growers that wish to supply pearl millet as a feed ingredient to the Australian pork industry.

## **6. Limitations/Risks**

The results and recommendations from this project apply to the existing commercially available hybrid variety of pearl millet.

## **7. Recommendations**

As a result of the outcomes in this study the following recommendation has been made:

The project be terminated at the end of the first year of the project and that the Pork CRC conduct no further agronomic studies with pearl millet until varieties of pearl millet with greater potential yields become available for commercial release in Australia.

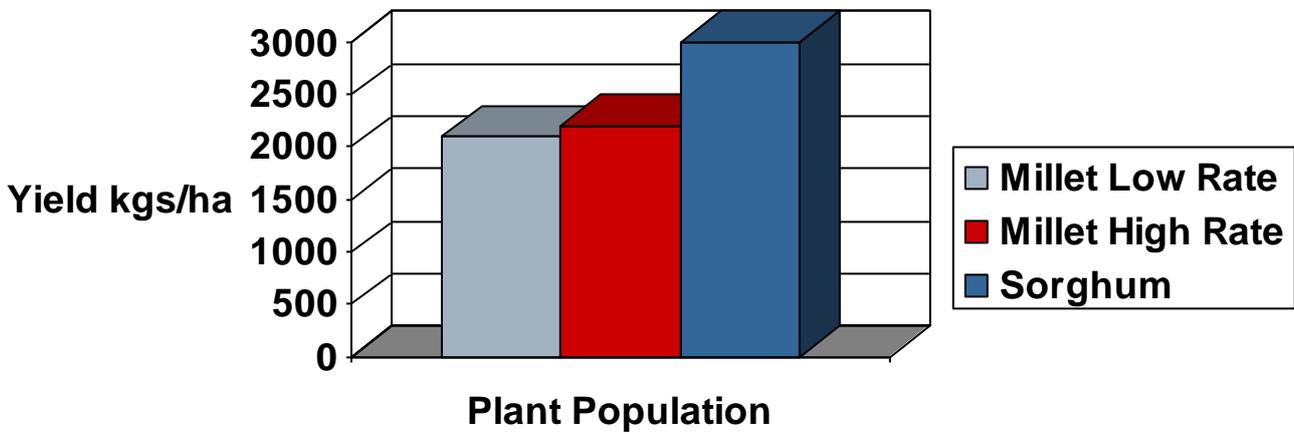
## **8. References**

Nil

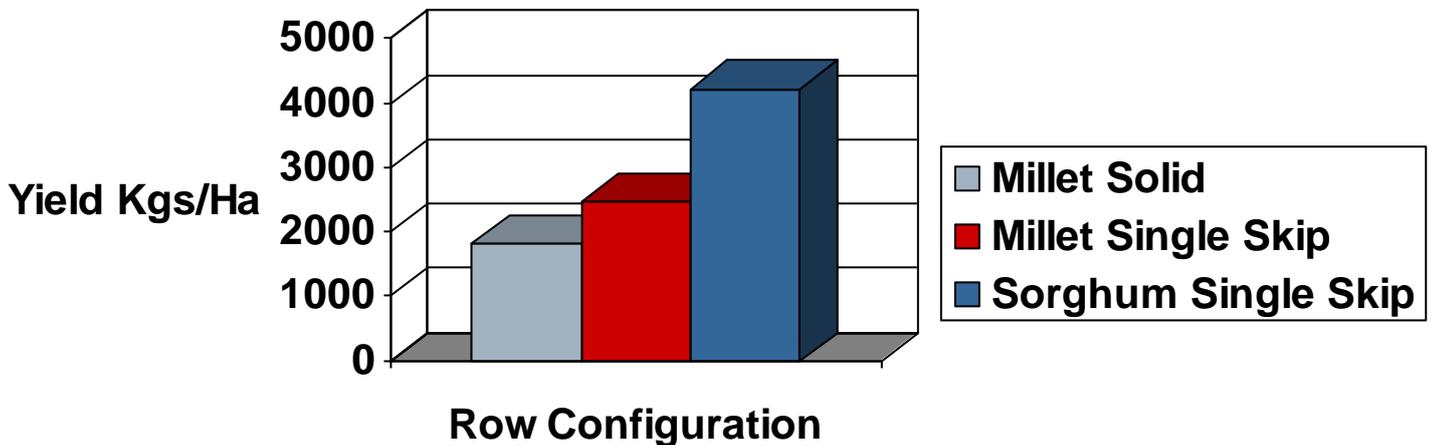
# Appendix 1

## RESULTS OF FIELD STUDIES ON FOUR CO-OPERATING GRAIN GROWING PROPERTIES

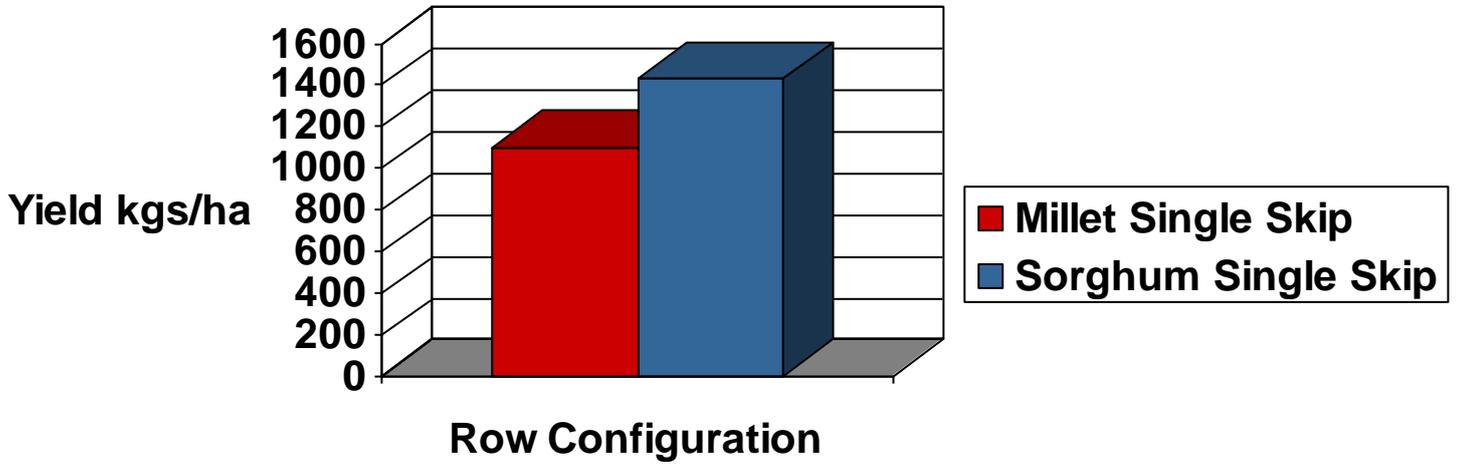
### "Enarra"



### "Clearview"



## "Baquabah"



## "Lundavra"

