SRDC Grower Group Innovation Project
Final Report

SRDC project number:	GA615
Project title:	Development of a precision mill mud applicator for a new farming system
Group name:	Maryborough Advanced Growers Group (MAGG)
Contact person:	Jeff Atkinson
Due date for report:	
Funding Statement:	This project was conducted by Maryborough Advanced Growers Group (MAGG) in association with the Sugar Research and Development Corporation (SRDC). SRDC invests funds for sugar R&D derived from the sugar industry and the Australian Government.

Australian Government
Sugar Research and Development Corporation

The Maryborough Advanced Growers Group is not a partner, joint venturer, employee or agent of SRDC and has no authority to legally bind SRDC, in any publication of substantive details or results of this Project.

Body of Report

Executive Summary:

This aim was to construct an innovative mill mud spreader capable of accurately applying mill mud in a narrow band between 2m dual rows. The group postulated that applying mill mud in a band would increase the area that a load of mill mud would treat thereby making mill mud amendment cheaper per hectare in comparison to a broadcast application. Another way to explain this is that a load of mill mud applied on a band at 50 tonnes/ha would treat three times the area of a load of mill mud broadcast at 150 tonnes/ha. This was tested theoretically with a desk-top economic analysis and practically with a large scale replicated trial.

An economic analysis tool was constructed in Microsoft Excel by Trish Cameron from FutureCane (QDPI & F). The tool showed that if 50 tonnes/ha is applied in a band rather than 150 tonnes/ha broadcast there is a saving of $6.63/tonne of mill mud spread (provided the yield of the two practises is the same). The subsequent replicated trial showed that this was the case in the plant crop, with no significant difference in cane or sugar yield between the two practices. The yield will be recorded in next few seasons to ascertain if there is a difference in subsequent ratoons.

The project suggests that current practices of applying mill mud are wasteful, time consuming and expensive. Additionally the truck used to spread the mill mud rarely fits in with a controlled traffic system. By applying mud in a band with machinery that fits in with a controlled traffic system significant savings can be made. It could also be argued that applying mill mud between dual rows on a 2 metre bed system has potential to reduce the amount of off-farm nutrient loss although this was not tested in this project.

Background:

In Maryborough mill mud is given to growers at night time free of charge on a roster basis if they arrange collection. There is approximately 33 000 tonnes of mud produced each season. Grower uptake of mill mud is generally limited due to the economic constraints in carting a dense product long distances from the mill and broadcast spreading across the field. This project will analyse the yield and economic data when mill mud is precision band applied to the crop. Precision banding would ensure the product is delivered to where it can be utilised by the plant and not applied to the traffic area. The current method of application compacts the majority of the field by crudely dumping mud from a truck 2.4m wide on fallow ground and roughly spreading with a tractor with both vehicles traversing the field in multiple directions. This applicator would suit the 2 meter controlled traffic farming system.

Aims:

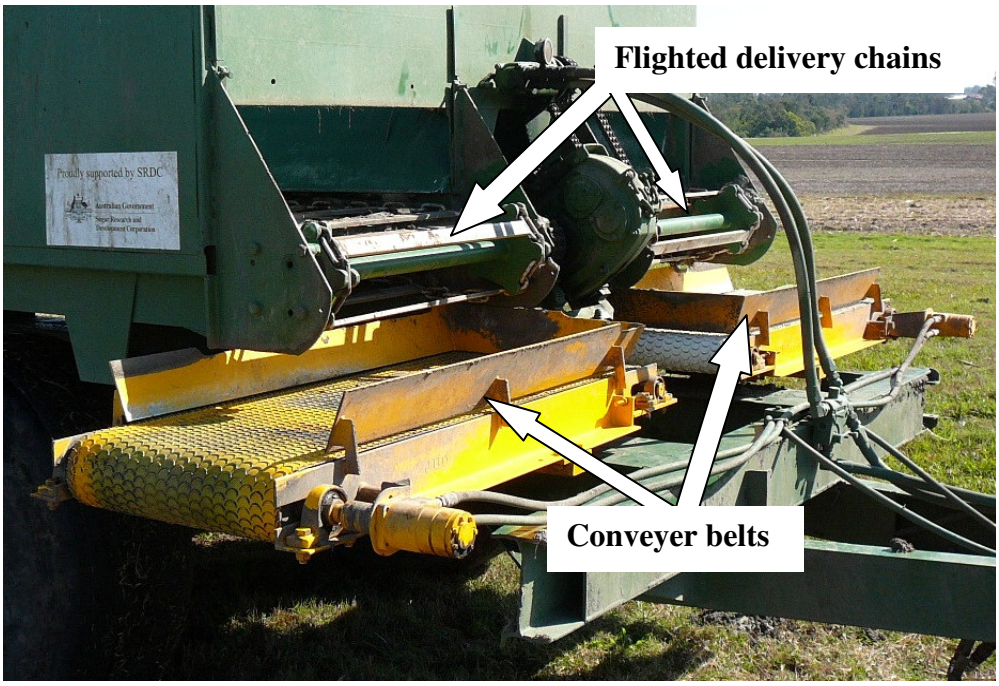
- Design and manufacture a precision applicator to apply mill mud in a band in between dual rows 800mm apart on a 2 meter control traffic farming system covering three complete beds and a swath width of 6m to overcome the current problem of inefficient application and field compaction.
- Evaluate yield data collected through a trial comparing varied rates of band application and convention practice.
- Evaluate the economics of band application compared to convention practice including results of the yield data.
- Communicate the outputs of the project to other growers in the region and to growers in other regions.

Methodology:

Construction of the spreader

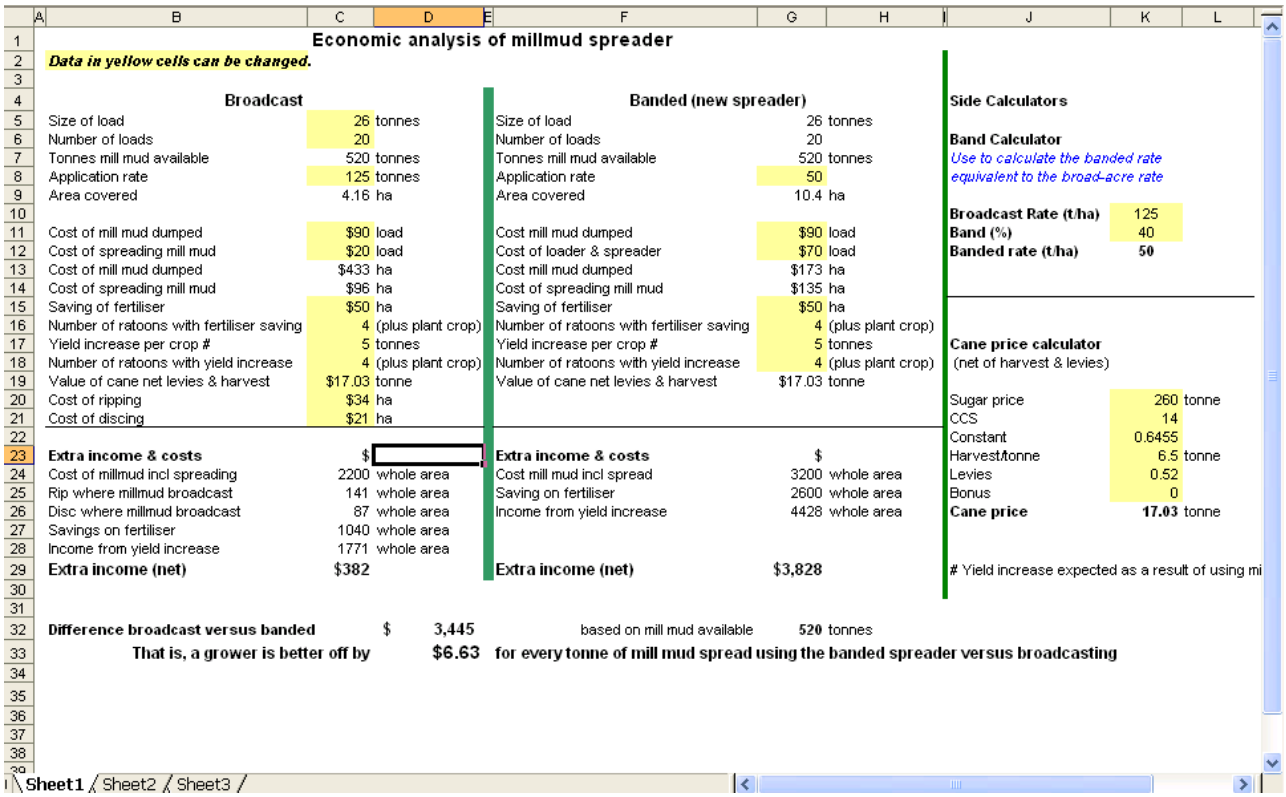
The group engaged a local engineer (John Ferguson of Ferguson Engineering) to assist with the project, John has had significant experience in modifying and manufacturing farm machinery. A haul out trailer was purchased which was stripped and modified to 2 m wheel spacing. A bin was installed on the trailer.

The bin was fitted with a flighted delivery chains to move the mill mud towards the front of the machine to feed two conveyer belts. The conveyer belts distributed the mud to the left and right of the machine. All belts and chains were powered by hydraulic motors.



Economic analysis

A screen image is shown below of the Microsoft Excel spreadsheet produced by Trish Cameron from QDPI & F is shown below. The spreadsheet allows the evaluation of various scenarios comparing broadcasting and banding of mill mud.



Economic analysis of millmud spreader

Data in yellow cells can be changed.

Broadcast			Banded (new spreader)		
Size of load	26	tonnes	Size of load	26	tonnes
Number of loads	20		Number of loads	20	
Tonnes mill mud available	520	tonnes	Tonnes mill mud available	520	tonnes
Application rate	125	tonnes	Application rate	50	
Area covered	4.16	ha	Area covered	10.4	ha
Cost of mill mud dumped	$90	load	Cost mill mud dumped	$90	load
Cost of spreading mill mud	$20	load	Cost of loader & spreader	$70	load
Cost of mill mud dumped	$433	ha	Cost mill mud dumped	$173	ha
Cost of spreading mill mud	$96	ha	Cost of spreading mill mud	$135	ha
Saving of fertiliser	$50	ha	Saving of fertiliser	$50	ha
Number of ratoons with fertiliser saving	4	(plus plant crop)	Number of ratoons with fertiliser saving	4	(plus plant crop)
Yield increase per crop #	5	tonnes	Yield increase per crop #	5	tonnes
Number of ratoons with yield increase	4	(plus plant crop)	Number of ratoons with yield increase	4	(plus plant crop)
Value of cane net levies & harvest	$17.03	tonne	Value of cane net levies & harvest	$17.03	tonne
Cost of ripping	$34	ha			
Cost of discing	$21	ha			
Extra income & costs	$		**Extra income & costs**	$	
Cost of millmud incl spreading	2200	whole area	Cost mill mud incl spread	3200	whole area
Rip where millmud broadcast	141	whole area	Saving on fertiliser	2600	whole area
Disc where millmud broadcast	87	whole area	Income from yield increase	4428	whole area
Savings on fertiliser	1040	whole area			
Income from yield increase	1771	whole area			
Extra income (net)	$382		**Extra income (net)**	$3,828	

Side Calculators

Band Calculator

Use to calculate the banded rate equivalent to the broad-acre rate

Broadcast Rate (t/ha)	125
Band (%)	40
Banded rate (t/ha)	**50**

Cane price calculator (net of harvest & levies)

Sugar price	260	tonne
CCS	14	
Constant	0.6455	
Harvest/tonne	6.5	tonne
Levies	0.52	
Bonus	0	
Cane price	**17.03**	tonne

Yield increase expected as a result of using mi

Difference broadcast versus banded $ 3,445 based on mill mud available 520 tonnes

That is, a grower is better off by $6.63 for every tonne of mill mud spread using the banded spreader versus broadcasting

Sheet1 / Sheet2 / Sheet3

Replicated trial

A large scale replicated trial was established on the 27th September 2007 with the following treatments:

1. No mill mud
2. Banded mill mud applied at 50 wet tonnes/ha
3. Broadcast mill mud applied at 125 wet tonnes/ha

All the treatments received 300 kg/ha of Nitra Phoska fertiliser at planting and 175 kg/ha of CK 50-50 top dressed prior to canopy closure. The final nutrient status the trial based on soil and mill mud analysis is estimated in the table below.

Nutrient source	Nitrogen (kg/ha)	Phosphorus (kg/ha)	Potassium (kg/ha)	Sulfur (kg/ha)
Soil (0 -10cm)	1.6 (Nitrate N)*	15.3 (BSES P)	26 (Nitric K)	1.2 (Sulfate)
Fertiliser (planting)	72		72	
Fertiliser (top dress)	38		38	7.5
Total soil and fertiliser	111.6	15.3	136	8.7
Mill mud (banded)	88	56 (BSES P)	61.5 (Nitric K)	2 (Sulfate)
Mill mud (broadcast)	220	140 (BSES P)	154 (Nitric K)	5 (Sulfate)
Total zero mill mud	111.6	15.3	136	8.7
Total banded mill mud	199.6	71	197.5	10.7
Total broadcast mill mud	332	155	290	13.7

*Does not include the nitrogen fixed by the preceding soybean crop which would be present as organic N

The trial was planted after a soybean fallow so there would have been a considerable amount of in the soil in organic material.

The treatments were replicated three times in strips 4 beds wide. The field was irrigated with a travelling gun type irrigator. The trial was machine harvested 28th August 2008, six stalks were collected from each treatment for CCS determination.

Results and Outputs:

Construction

Problem: Delivery chains on the internal section of the spreader were found to not be strong enough to move the product
Solution: A new internal delivery system was designed, new chains and sprocket were custom designed and built to handle the variable nature of the product and to operate surrounded by the product

Problem: The flights connecting the delivery chains were not strong enough and tried to move too much product
Solution: New flights were designed and built to be better suited to the characteristics of the product

Problem: Connecting axels were twisting under the strain caused by the chains and flights
Solution: Stronger axels installed.

- Following these modifications the mill mud spreader was proven to effectively distribute variable consistency mill mud (dry, semi-dry and wet)
- The mill mud spreader distributes product precisely and evenly along a row
- The rate can be field calibrated and easily varied according to requirements
- The spreader is easily loaded and product is very quickly distributed (a recent field evaluation showed that 50t/ha mill mud could be applied at 10km/hr. The spreader was filled to approximately 10t and was emptied in 7 minutes).
- A significant reduction in oil pressure to drive the feed out system has resulted in the new design and modification reducing the power needed from the tractor and less wear and tear and strain on the spreader components

Replicated trial

The results of the replicated trial are shown below. They suggest that in the plant crop there is little difference in cane and sugar yield between the broadcast and banded treatments

	Cane Yield (t/ha)	CCS	Sugar Yield (t/ha)
No Mill Mud	101.3	14.2	14.3
Banded mill mud	109.6	14.0	15.4
Broadcast mill mud	106.7	14.1	15.0

The results illustrate that a load of mill mud applied on the band can treat almost three times the area than a load that is broadcast.

Photos

Banded mill mud in the replicated trial

The machine in action

The completed machine

Loading the machine

Intellectual Property and Confidentiality:

N/A

Capacity Building:

The group now has experience with all phases of the research and development process thereby increasing their capacity for more research and development in the future.

The group now has all operations in their farming system adhering to a controlled traffic system, i.e. all the machinery used on their farms has a 2 metre wheel spacing. It will be interesting to see the improvements in soil health that this will allow.

Outcomes:

The outcomes of this project are in line with what was proposed in the initial application, a profitable new farming practice has been developed. As a result, the cane supply to the Maryborough mill will be increased as will the profitability of the group and others who adopt the idea.

Construction of a second banded mill mud spreader would further enhance the new practice by allowing a greater utilisation of mill mud and by improving the economics (this is because the most time consuming part of the operation is loading the spreader). Funding for this could be sourced from the reef rescue initiative.

Environmental Impact:

Although no specific environmental studies were undertaken it is plausible that it could result in less off-farm nutrient movement. This is because mill mud is not applied in the wheel tracks where most water run-off occurs.

Communication and Adoption of Outputs:

Following is a summary of the communication activities associated with the project:

- Considerable interest in the project from both local growers and growers from other regions. MAGG members have regularly been contacted by growers across the state regarding information on the precision mill mud spreader. MAGG members are willing to sharer information regarding the spreader.
- The board of SRDC also visited the project and discussed the benefits of the project to the growing community.
- Economic data has been presented to MAGG members and Maryborough Sugar Factory staff. A number of MAGG members have used the economic analysis model to calculate the cost saving specific to their farms.
- A group of Isis growers visited Maryborough specifically to see the design and operation of the mill mud spreader. They viewed the spreader in operation and discussed economic benefits and cost savings of the precision system with MAGG members present.
- A group of 30 Bundaberg growers visited the Maryborough area with the purpose of gaining knowledge on control traffic farming systems. The group were presented details regarding the design and manufacture of the spreader and the economic benefits were discussed. Growers were impressed with the spreader and the cost savings it could provide.
- The Tropical City Group inspected the spreader. Approximately 40 growers from across the state viewed the progress on the spreader to date. All were impressed by the concept and were keen to hear more as the project progressed. SRDC was widely acknowledged as funding partner for the Precision Mill Mud Applicator Project.
- The results of the replicated trial were forwarded to all Maryborough growers in the local Canegrowers newsletter
- An article on the mill mud spreader appeared in the Canegrowers magazine.

Recommendations:

This project should be published in the Proceedings of the Australian Society of Sugarcane Technologists, this would be appropriate after 1st and 2nd ratoon yield data is gathered from the replicated trial.

Further research should examine the environmental effect of banding mill mud. It would also be pertinent to develop the technology for banding mill mud directly out of the delivery truck.

Publications:

Canegrowers magazine

Australian Government
Sugar Research and Development Corporation

SRDC Update

A progress report on industry research from the Sugar Research and Development Corporation

Mud, glorious mud, provides benefits to crops

Mud. Pigs love lying in it, kids love playing in it and cane growers love spreading it over their fields.

Mill mud and other mill byproducts enjoy a good reputation for being beneficial to the crop, and with the soaring price of fertiliser, more and more growers are turning to mill mud and other milling byproducts as a cost effective way to return nutrients to the soil.

For all these benefits though, there are several drawbacks, including the cost of getting mill mud from the mill to the farm, as well as the difficulties of application.

SRDC has invested in a number of projects which offer some promise to help counter these hurdles, and possibly value-add to turn this byproduct into a source of income.

Technology put through the wringer

Since 2006 SRI@QUT have been trialling two different types of filters with the aim to improve the cost-effectiveness of mud filtration. This project saw two alternative types of press installed and tested at the Broadwater Mill in northern New South Wales. Thanks to the technology, the team were able to achieve dry cakes with equipment costs significantly below the standard rotary vacuum filters currently in use in Australian sugar mills.

Project leader Ross Broadfoot said that they were able to produce cake with a moisture content ranging from 50 to 60% compared to the typical 75 to 80%.

"Obviously the reduction in moisture content of the filter cake will mean cheaper transportation costs, with savings estimated for an average sized factory of $100,000 a season," he said.

"The drier mud also spread very easily and uniformly onto the cane fields.

"The reduced transportation costs should lead to reduced accumulation of heavy metals in the cane fields near the mill as the drier filter cake can be transported more economically to more distant fields.

"The findings of this study are now with the mills that helped fund the research. We hope that those mills which need to upgrade their mud filtration stations will look closely at these results and assess the commercial application," he said.■
SRDC Project Code: QUT012

Maryborough Advanced Grower Group members Jeff Atkinson (centre) and Ashley Petersen (right) give SRDC Chair Ian Knop a closer look at the mill mud spreader developed as part of a Grower Group Innovation Project.

Making mill mud application easier

The Maryborough Advanced Grower Group has spent the last two years working on a Grower Group Innovation Project to develop a precision mill mud spreader.

The group is nearing the end of their project and project member Jeff Atkinson said everything has been going smoothly. The focus of their recent work has been to undertake an economic analysis of the trial.

"Mud is such a scarce yet valuable product – the main idea behind this project was to make it go further by getting application rates down," he said.

"The analysis we did shows that their banded spreader saved over $6 for each tonne of mill mud when compared to a conventional spreader. We also estimated that over 10.5 hectares, there would be savings of $2,600 on fertiliser by applying mill mud."

Costs included in the conventional system were the transport of mud from the mill, levelling once dumped on the paddock from the truck and ripping and disking the ground to incorporate the mud. The costs of the system using the mill mud spreader included transport of the mud from the mill, dumping in a stockpile, loading into the spreader and spreading. The mud need not be spread any further once on the ground.

"Now we just have to wait to harvest the trial in September to see how the figures all stack up, but on paper it is all looking really good," he said.

"Down the track it would be great to see the unit fitted to the trucks that bring ▶▶

the mud from the mill. With the unit in place it would be really hard to top this system. And because you wouldn't have to unload and reload the mud you would be able to save so much time.

"We've had a lot of interest in the project, and we've met with growers who have given us feedback that they were impressed with the spreader and the cost savings it could provide."

Jeff said that the Maryborough Advanced Grower Group is more than happy to talk to anyone who is interested in finding out more about the spreader and its place in a controlled traffic farming system.■
SRDC Project Code: GGP015

Investigating a new commercial product

Up north, the Tully sugar industry is looking for ways to capitalise on mill mud and ash by pelletising it and turning it into a commercial fertiliser. Tully Sugar is partnering with SRI@QUT in the SRDC funded project.

SRI Researcher Geoff Kent said that if the production of a complete pelletised fertiliser product incorporating mill mud and ash (and possibly other nutrients) is technically and economically feasible there will be financial and environmental savings, and the possibility of a new source of income.

"The project is still in its early days and we are investigating a number of issues involved with pelletising mill mud and ash," he said. "It isn't as simple as copying how it is done by other similar pelletising operations, due to the high moisture content of mud and ash."

Reducing the high moisture content is something that researchers are currently addressing. The ideal moisture content for pelletising operations is about 20%, but there is a cost to getting mud and ash that dry. The project team is well aware of the significant rewards if they can achieve their goal.

Early market analysis suggests that there could be a market for the pelletised mill mud not just with the sugar industry, but also within the banana industry and other local producers. Given the soaring price of commercial fertilisers, this is easy to believe.

Mill mud is a scarce, yet valuable product – this spreader is making it go further by reducing application rates.

The real value of mill mud

So you know mill mud is a great source of nutrients, but do you know how much money you could save by using it?

While growers have learned over time how to ballance the application of mill mud and commercial fertilisers, researchers working on a CSIRO Sustainable Ecosystems-led project are hoping to develop a better understanding of the real value of mill mud.

SRDC Investment Manager Les Robertson said that this project has already contributed a wealth of information to the industry about nitrogen replacement.

"Their research comes at a time when growers are looking for ways to counter the soaring costs of commercial fertiliser," he said. "The objective of this project is to reduce nitrogen fertiliser applications on sugarcane farms to decrease production costs to growers and decrease losses to the environment while still maintaining high productivity.

"One part of their work is to develop methods for accounting for nitrogen contributions from organic sources, such as mill mud or fallow legumes. "This will help you work out how much and when you should apply commercial nitrogen fertiliser if you have applied mill mud." ■
SRDC Project Code: CSE011

The benefits of mill mud

Did you know: For 150 wet tonnes/ha of filter mud:

- About 100kg of nitrogen is available for cane growth in the year it is applied. The remainder of the total nitrogen becomes available slowly as the organic material breaks down.
- This is about 65-80% of the nitrogen fertiliser requirements of plant cane and 40-60% of replant and ratoon cane.
- Enough phosphorous for at least one crop cycle of plant and four of ratoons is supplied.
- 80kg of potassium is immediately available
- One application supplies the calcium equivalent of about 1.5 tonnes of agricultural lime per hectare. ■

Source: *Manual of Canegrowing*

SRDC contacts

For more information about any of the information contained in SRDC Update, please contact an SRDC Investment Manager or visit www.srdc.gov.au.

Dr Diana Maldonado Ph 07 3225 9443
Dr Les Robertson Ph: 07 3225 9442
Dr Robert Troedson Ph: 07 3225 9441
Bianca Boseley Ph: 07 3225 9415

SRDC Contact:
Executive Director, Dr Frikkie Botha
Phone: 07 3225 9446
Facsimile: 07 3210 0506
Email: srdc@srdc.gov.au

Group 2 chemicals are any deregistered, scheduled, unknown, unlabelled, mixed, or out of date chemicals or chemical products produced by non participating manufacturers. There is a fee for disposal of Group 2 chemicals.

The booking line will assist with registrations. For further enquiries or information on the program please contact:
Colin Hoey
ChemClean/*drumMUSTER* Regional Consultant for Southern Queensland.
Ph. Mob. 0428 964 576.

Maryborough Cane Productivity Services News

Andrew Dougall, Senior Extension Officer MCPS (Ph 4121 3897 or mob 0408 740 891)

As many of you may know I have taken over from Frank Sestak as the MCPS Senior Extension Officer and as Frank has done in the past, I hope to make a regular contribution this newsletter.

For those who don't know me, I previously held the FutureCane agronomist position with QDPI & F in Bundaberg. Prior to this I spent nine years in the cotton industry in western New South Wales, the Ord and Katherine. I grew up on a sheep and cereal cropping farm at Dunedoo in central NSW.

I am pleased to be working in Maryborough as I believe it is the most progressive cane area in southern Queensland. I hope to work with Penni to further improve the productivity and profitability of the Maryborough supply area.

Some news….

Last week I assisted the MAGG group harvest the plant crop of the banded mill mud trial at Tinana. The trial compared mill mud banded near the stool at 50 tonnes/ha with broadcast mill mud at 125 tonnes/ha and no mill mud. The results below show that yield advantages associated with mill mud can be achieved with less than half the normal rate provided it is banded near the stool (in this case between dual rows).

	Cane Yield (t/ha)	CCS	Sugar Yield (t/ha)
No Mill Mud	101.3	14.2	14.3
Banded mill mud (50 wet tonnes/ha)	109.6	14.0	15.4
Broadcast mill mud (125 wet tonnes/ha)	106.7	14.1	15.0

These results could also suggest that mill mud in the compacted inter-row is not accessed by the crop. When mill mud is banded, more than twice the area can be treated per truck load. Given this, the capital expenditure of construction of a banded mill mud applicator would be quickly paid off. Give me a ring if you want more information about this trial or the banded mill mud spreader.

MCPS text agronomy…..

Most of you would have received the MCPS 'text agronomy' messages they are a quick and easy way of letting everyone know what is going on. If you did not receive them let me know and I will add your number to the list.