SRDC Grower Group Innovation Project final report Development of a precision mill mud applicator for a new farming system
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.

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.

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.

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

*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 28\textsuperscript{th} 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

<table>
<thead>
<tr>
<th></th>
<th>Cane Yield (t/ha)</th>
<th>CCS</th>
<th>Sugar Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Mill Mud</td>
<td>101.3</td>
<td>14.2</td>
<td>14.3</td>
</tr>
<tr>
<td>Banded mill mud</td>
<td>109.6</td>
<td>14.0</td>
<td>15.4</td>
</tr>
<tr>
<td>Broadcast mill mud</td>
<td>106.7</td>
<td>14.1</td>
<td>15.0</td>
</tr>
</tbody>
</table>

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 share 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 1\textsuperscript{st} and 2\textsuperscript{nd} 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.
Mud, glorious mud, provides benefits to crops

The real value of mill mud

The benefits of mill mud

Mud from the mill can be a great source of income...
Local Canegrowers newsletter

Group 3 chemicals are any unapplied, unhandled, unstable, mixed, or out of the chemicals as labelled product produced by non-participating manufacturers. There is a fee for disposal of Group 3 chemicals.

The booking line will operate with registration. For further information on the program please contact:

Colin Hayes
Canegrowers/GPCRS Regional Consultant for Southern Queensland
Ph: 3294 8944

Murgon Canegrowers Services News

Andrew Dougall, Senior Extension Officer, MCPS (Ph: 4121 5647 or mobile 0412 720 689)

As many of you may know, I have taken over from Frank Simard 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 FarmCan agronomist position with QDAP in Bundaberg. Prior to this I spent many years in the cotton industry in western New South Wales, the Oodnadatta and Katherine. I grew up on a sheep and cattle cropping farm at Dunbibo in central NSW.

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

Some notes...

Last week I attended the McC3 group test over the plant crop of the banded mill and seed trial at Tanouma. The trial compared mill and seed banded at the rate of 0, 10, 20, 30 and 50 tonnes of PP/ha and natural mill and no mill seed. The results below show the yield advantage associated with mill seed can be achieved with less than half the normal rate provided it is banded near the seed (a difference between fertiliser).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>CCS</th>
<th>Seed YLD (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Mill/Seed</td>
<td>101.7</td>
<td>134.2</td>
</tr>
<tr>
<td>Banded mill and seed</td>
<td>139.6</td>
<td>148.4</td>
</tr>
<tr>
<td>Banded mill and seed</td>
<td>139.6</td>
<td>148.4</td>
</tr>
</tbody>
</table>

These results would also suggest that mill seed in the unapplied treatment is not soaked by the crop. When mill seed is banded, more than twice the area can be treated per week per seed. Given that, the capital expenditure of conversion of a banded mill and applicator would be quickly paid off. Give me a call if you want more information about this trial or the banded mill and applicator.

MCC3 mill applicator...

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