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

http://hdl.handle.net/11079/12846
Downloaded from Sugar Research Australia Ltd eLibrary
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: This project was conducted by Maryborough Advanced Growers Group (MAGG) in association with the Sugar Research and Development Corporation (SRDC).

Funding Statement: 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 - 10 cm)</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>
</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 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

<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 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.
Canegrowers magazine

SRDC Update

Mud, glorious mud, provides benefits to crops

Mud: Not how farmers like to think of it, but in one situation this isn’t so bad. Dune mud can be a valuable addition to the soil, improving its structure and water and nutrient retention. In 2003, the Sugar Research and Development Corporation (SRDC) undertook a project to investigate the use of mill mud as a soil conditioner. The project found that mill mud had a number of beneficial properties, including improved soil structure, water and nutrient retention, and reduced salinity. The results of the project were published in the SRDC Update, a publication that provides timely and relevant information to the sugar industry.

Making mill mud application easier

The Sugar Research and Development Corporation (SRDC) has developed a new method for applying mill mud, which is easier and more efficient. The new method involves using a slurry of mill mud and water, which is applied to the soil using a sprayer. This method reduces the amount of mill mud that is lost to the atmosphere, improving the quality of the soil and reducing the environmental impact of mill mud application.

Investigating a new commercial product

The Sugar Research and Development Corporation (SRDC) has investigated a new commercial product, which is made from mill mud. The product is a powdered form of mill mud that can be applied to the soil, improving its structure and water retention. The powdered form of mill mud is easier to apply and has a longer shelf life than the traditional slurry form.

The real value of mill mud

Mill mud is a valuable resource that can be used in a variety of applications, including soil conditioning, water and nutrient retention, and salinity reduction. The real value of mill mud lies in its ability to improve the quality of the soil, making it easier for plants to grow and produce a higher yield. In addition, the use of mill mud can help to reduce the environmental impact of sugar production, reducing the need for additional fertilizers and pesticides.

SRDC contacts

For more information, contact the Sugar Research and Development Corporation (SRDC) at info@srdc.com.au or call 07 4123 6666. For general sugar industry news and events, visit the Sugar Australia website at www.sugar.com.au.
Local Canegrowers newsletter

Collin Shy
Chief Canegrowers MCPS Regional Consultant for Northern Queensland.

Maryborough Canegrowers Services News

Andrew Dougall, Senior Extension Officer MCPS (Ph: 1800 667 067 or mobile 0401 701 697).

As many of you may know I have taken over from Frank Small 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 PestCan cooperative position with QDPI A P in Bundaberg. This is the Queensland sugar industry in eastern New South Wales, the Gold and Katherine. I grew up on a sheep and wool cropping farm in Deniliquen in central NSW.

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

Some notes...

Last week I conducted the MCPS group banded strip and non-banded strip at Thagoona. The trial consisted of a 6 and 12 metre wide strip of 38 tonnes with broadcast until treated at 38 tonnes and no mill mill. The results below show the yields obtained with all kill and as you can see with less than half the normal rate provided it is banded near the root. (All these are between 24.5c x)

<table>
<thead>
<tr>
<th></th>
<th>CCS</th>
<th>Segs YSH</th>
<th>(tonnes)</th>
<th>(tonnes)</th>
<th>(tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Mill Yield</td>
<td>196.7</td>
<td>14.1</td>
<td>13.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banded Mill 12</td>
<td>199.6</td>
<td>14.8</td>
<td>15.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banded Mill 6</td>
<td>196.7</td>
<td>14.1</td>
<td>13.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These results would also suggest that mill seal in the experimental situation is not needed for the crop. When mill seal is banded, more than twice the area can be treated per pass load. Given this, the capital expenditure of commission 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 band mill and applicator.

MCPS pest management...

Most of you would have received the MCPS pest management 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.