SRDC Grower Group Innovation Project
Final Report

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Project title:	Implementation of improved farming systems of sugarcane in the Clare area, Burdekin District, North Queensland.
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Australian Government
Sugar Research and Development Corporation

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Body of Report

Executive Summary:

The MIG was interested to quantify the benefits of moving from their current 1.52m row configuration to a row configuration that better matches tractors, harvesters and haulage equipment using GPS technology. As a result of conducting this project, the MIG has confidence that preformed beds will improve their long term sustainability and profitability by reducing input costs compared to the current system, at least for the plant crop. In particular, significant opportunities to reduce:

- land preparation costs, from $265/ha in the conventional practice down to $131/ha,
- general growing costs, from $209/ha down to $108/ha, and
- irrigation costs, from $394/ha down to approximately $305/ha, appear to exist.

In total, differences of at least $300/ha saving can be made by moving from the conventional system to the preformed mound system (see Appendix 1 for more detail). As a result, all members of MIG have moved over to planting into preformed beds; however some members of MIG prefer 1.52m singles over duals on 2.0m centres.

The group recognises that during the course of the project, several errors were made with the trial design; in particular there was no planting of the 1.52m conventional practice with the mound planted systems, no replication of treatments, and fertiliser rates were not the same in each treatment. This has been a great learning experience for the group, which is now better placed to conduct future on-farm research.

During this project several issues related to the height and width of the preformed bed were highlighted. Unexpectedly, the height of the preformed beds increased, and became too high, over the wet season due to the soil swelling as it became wetter. Modifications have already occurred to reduce the height of the bed from 175mm to 125mm, in preparation for the 2007 planting season. However, the whole group is undecided whether this height should be reduced further. Having a bed-former that can adjust row-spacing, bed height and width would solve this issue.

Getting the size and shape of the bed to fit 800mm duals is proving difficult. The top of the bed, currently at 1000mm, is not wide enough. However, going to a wider bed will cause issues with harvesting. Group members have started trialling dual row spacing of 600mm and 700mm. Having a harvester with a wider base cutter box and throat configuration should remove this as a problem (however, modification costs are quite expensive).

The change over from 1.52m to 2.0m has caused some inconveniences with equipment not suited to the 2.0m rows. However, this is becoming less of an issue as individuals have modified equipment and able to hire from each other.

This project has contributed to increased confidence within the MIG and other farmers across the district that the SYDJV research is applicable, at least in some part. Since this project started in 2005, the area of land that has been converted to a reduced tillage, mound planted system has increased dramatically across the both the MIG, MAFIA and Burdekin district as a whole. MIG has supported local initiatives, such as the Cane Productivity Initiative & FutureCane, and organisations, such as QDPI&F, BSES, CSR, BPS & AACC by attending grower meetings, field days, and hosting a number of farm visits that have showcased all aspects of the project.

Background:

The MIG was interested in adopting the Sugar Yield Decline Joint Venture (SYDJV) principles. Despite the confidence of researchers, the lack of commercial size demonstrations and generally low uptake by Burdekin farmers made MIG cautious of investing too heavily. On-farm demonstrations would provide the group with information on how to proceed.

Aims:

Project seeks to achieve:

- Improved sustainability and profitability for (initially) group members and secondly for the wider industry at a district level.
- Better adoption of BMP from SYDJV and more faith in research.
- Reduced cane loss and dirt at harvest
- To share the burden of trial work amongst a group and then communicate results honestly and openly, including failures as well as successes.

Methodology:
The project was conducted under a step process:

1. Learnt from others by visiting other farmer groups (in Burdekin, Mackay and the Herbert) who had experience with planting into preformed beds. In particular, MIG learned that the:
   - harvester throat needed to be widened from 0.9m to 1.3m to harvest 2.0m beds;
   - harvesting job was better if extra base cutters were added;
   - narrower beds may increase stool tipping;
   - better harvest results occur if beds have a flat surface with no ridges or hollows;
   - fertiliser chutes on DDOP should be strongly built;
   - DDOP should have extra water tanks attached.

   As a result of these visits, MIG:
   - made the top of their beds wider in an attempt to reduce the chance of stool tipping;
   - modified the harvester fronts so they can hydraulically adjust from 1.65m to 1.95m row spacing (but could not afford modifications to the base cutter);
   - incorporated the ideas for planter design into their planter purchase; and
   - attempted to create a flat bed at planting.

2. Purchase required equipment. MIG farmers agreed that modifications to second hand equipment, to create a planter with the required planting configuration versatility was going to be too expensive, and so decided to purchase the following equipment:
   - a bed former with the capability to form beds between 1.5 and 2.0m centres,
   - a Hodge double disc opener planter (DDOP) with the ability to plant a number of different configurations (1.5m singles through to 800mm duals on 2.0m centres).

3. Plant trial comparing mound plantings of 1.52m single row and 800mm dual rows on 2.0m centres.

4. For the above trial, collect information (e.g. input costs and yields) for economic assessment using QDPI&F FEAT program and compare to conventional system costs and production.

Results and Outputs:

Trial results:

In 2006, a paddock was planted into two strips (no replication). The whole paddock had been prepared prior to the wet season and beds at 1.52m and 2.0m formed. The conventional practice was not tested in this trial, however for the purposes of this project it was assumed that the cane yield and ccs would be equal to that of the mound planted 1.52m single row (see Table 1).

Soil type: heavy cracking clay
Variety: Q183

	Preformed beds		Conventional System
	1.52m	800mm Dual @ 2m	1.52m
Plant date	22/05/2006	6/06/2006	
Harvest	10/08/2007	11/08/2007	
Age at harvest (days)	438	425	
Tonnes	1255	1303	
Area (ha)	8.5	8.9	
Cane Yield (t/ha)	148	146	148
CCS	15.0	14.3	15.0
Sugar Yield (t/ha)	22.2	20.9	22.2

Table 1: Information for the 1.52m & 2.0m preformed bed trial plus assumed yields for conventional system.

An economic analysis (see Appendix 1, for the full analysis) was prepared comparing the trial results above to the standard conventional practice of the group, using the QDPI&F FEAT program.

There is now confidence that preformed beds will reduce input costs compared to the current system, at least for the plant crop. In particular, significant opportunities to reduce land preparation costs and general growing costs appear to exist. All members of MIG have moved over to planting into preformed beds; however some members of MIG prefer 1.52m singles over duals on 2.0m centres. While some errors were made with the trial design, differences of at least $300/ha saving (see Table 2) can be made by moving from the conventional system to the preformed mound system.

Table 2. Economic comparison of plant cane treatments in 2007 (assumptions)

Plant Cane - 2007	Twin Row Mound System	Single Row Mound System	Conventional System
Price per tonne sugar (AUD)	260	260	260
Mean yield cane (t/ha)	148	148	148
CCS	15	15	15
Mean sugar yield (t/ha)	22.2	22.2	22.2
Net Revenue ($/ha)	3811	3811	3811
Growing costs ($/ha)	1906	1845	2127
Harvesting costs ($/ha)	888	888	888
Gross margin ($/ha)	1017	1078	796
Gross margin with labour ($/ha)	912	970	587

The FEAT analysis and associated report (Appendix 1) focuses on the economic results of a plant cane crop and further analysis of the following ratoons is required to provide a more accurate picture of true profitability. The economic analysis poses several questions that the group will need to consider for future plantings, these include, 1. nutrient management practices 2. replication of future trials to determine if yield and CCS variation is real 3. harvesting costs and 4. validation of irrigation savings.

Capacity Building:

Through the course of the project the grower group:

- Realised how important good record keeping system is. Better information leads to better decision making.
- Improved skills in setting up on-farm trials. The group now better understand that conducting a good trial is more involved that initially seems (e.g. we needed to consider more than only bed forming, planting and harvesting but also nutrient rates, irrigation management, etc).

Outcomes:

This project has provided MIG farmers with confidence and faith to support the principles promoted by the SYDJV. Going to pre-formed beds and disc opener plantings has made considerable savings in land preparation compared to the conventional practice. MIG farmers have adopted the preformed bed system for planting. In 2007, no land was planted using conventional ground preparation methods (see Table 3 below); the group anticipates that this will also be the case in 2008. It is worth while noting that within MIG there is a planned increase in controlled traffic planting for 2008.

Further modifications, and testing, to the bed former to determine the best mound shape and width for these soils is required. While all group members agree abed height of 175mm is too high, not all are convinced that 125mm is appropriate. Perhaps too much dirt may still be above the planted sett; perhaps 100mm would be more appropriate. If plantings of 800mm duals are continued, then there is some thought that the width, of the top of the bed, should be increased. However this may have harvesting issues (see comments below re dual row spacing).

Row spacing – individuals are undecided about whether to move from 1.52m singles to 2.0m duals. These growers have experienced yield decreases when planting 2.0m duals when compared to 1.52m singles. As these trials were not replicated it is difficult to pinpoint the reasons for the yield reduction. MIG will continue to plant trials at both row spacings. .

Dual row spacing – what's best? For those that have moved to 2.0m duals, the issue about the correct spacing between the duals remains. The current setup of harvesters, and the cost to modify, is heavily influencing their decisions on how to proceed. Going narrower (600mm or 700mm) is being trialled but there is concern that competition between the rows will increase and cause other problems (such as smothering and thinner stalks).

Environmental Impact:

While a move to mound planting will result in less ground cultivation, during both land preparation and weed control, no direct measurement of environmental impact was measured.

Communication and Adoption of Outputs:

Communicaton

Ongoing
The number of informal visitors, although not all were recorded, was in excess of 100. These farmers had been encouraged, through the various industry bodies and word of mouth, to visit at anytime.

Through the CPI, project awareness was raised and invitations issued. In both the CPI meetings and all farm visits, SRDC funding has been acknowledged.

25/08/07 Australian Agricultural College Corporation Open Day
Invited by the AACC to showcase equipment used to implement the controlled traffic farming system.

Equipment taken for the display:

- Bed forming equipment,
- planter, and
- variable rate fertiliser box.

03/08/07 MIG Field day
Through the sugarcane network (BSES, BPS & DPI&F FutureCane) a field day was advertised to coincide with the harvesting of the 2.0m trial on Mulgrave Road. Wet weather disruptions made advertising through the print media impossible. However, over 40 people attending representing both farmers and agribusiness (see Figures 1 & 2).

Figure 1. Harvesting dual row crop in damp conditions show no signs of compaction or stool damage.

Figure 2. Farmers inspecting the ground job at MIG field day.

Farmers from a range of groups (CPI and farmer groups) attended, including:

- Leichardt
- MAFIA
- MIG
- Dalbeg
- Osborne
- Iona
- Mona Park
- Upper Haughton
- Kalamia Young Farmers Group

Agribusiness representatives from:

- Australian Agricultural College Corportion
- CSR Ltd
- BPS Ltd
- BSES Ltd
- CSIRO
- QDPI&F FutureCane & ReefPlan
- Suncorp
- EHS (company responsible for harvester modifications, based in Mackay)
- Honeycombes
- BMS (Trimble agent)

29/03/07 Mossman GenNext Farmers

MIG hosted approximately 20 farmers from the Mossman GenNext group (including Gerard Puglisi & Gerard Padovan) along with Rob Shoyer (BSES) toured the new farming system trial and equipment (see Figure 3).

Figure 3. Mossman GenNext Farmers talking to MIG about disc-opener planting.

13/03/07 Combined with the Precision Ag Forum
As part of the Precision Ag Forum, held at the AACC, approximately 110 attendees were provided with a farm visit to highlight the trial progress. Visitors were shown the 1.5 and 2m plantings and discussed how precision agriculture (GPS and variable rate technology) was being used to implement the 2m new farming system (setting up the beds, planting, and fertiliser application) and maintain control traffic at all times. Mike Hanks (QDPI&F, Future Cane) helped with the bus tours (see Figure 4).

Figure 4. Growers from the Precision Ag Forum bus tour inspect the crop and machinery.

Adoption:

Table 3 below shows the rate of adoption for MIG, into the mound planting system. There has been mixed response between farmers, with some members undecided between 1.5m single or 2.0m duals. All MIG farmers have adopted the pre-formed bed mound system.

Planting year	Single row Conventional system (ha)	Single Row Mound system (ha)	Dual Row Mound system (ha)
2006 (actual)	121	76	37
2007 (actual)	0	246	53
2008 (proposed)	0	202	138

Table 3: MIG adoption of preformed beds over conventional system.

Lessons learned:

1. Bed former
    - Bed dimensions – particularly the height is critical
        - Original height of beds was 175 – 200mm, which was too high for MIG soils.
            - Bed forming occurred on dry soil, prior to the wet season. During the following wet season, the soil consolidated and the beds swelled in size (group members had thought that the height would reduce as it consolidated over the wet season).
        - Modifications now create beds with height of 125mm. This will be reviewed to determine whether it is still too high.

2. Dual row dimensions
    - 800mm dual rows were used in first plantings
        - Harvesting issues.
            - The positioning of the harvester to cut 800mm duals created issues. Ideally, the harvester requires modifications (widening of the walls and throat and repositioning the base cutter box). Group members believe that these harvesting issues will only increase in ratoon crops. Current harvester setup is more suited to dual rows less than 800mm.
            - Currently the base cutter angle is set at the standard factory position. The group believes that an improvement would be seen if this angle was reduced.

Figure 5. Dirt ridge in the centre of the 800mm duals, and the sloping edges are clearly evident.

        - Mound profile.
            - Width of the top of the bed is too narrow for 800mm; soil on outside edges falls away after planting, leaving a ridge in the centre of the hill (see Figures 5 & 6). To reduce harvest losses, base cutters are cutting well below the top of the mound. The ratooning also appears to be happening on the outside edge (side) of the bed which may have issues when harvesting the ratoon crop.

- MIG farmers have initiated trial plantings at 600 and 700mm duals on 2.0m centres.

Figure 6. MIG farmer, Mark Hatch highlights the bed profile in the newly emerged 800mm duals. Notice the closeness of the tillers to the edge of the mound.

- Dirt levels & cane loss
  - An aim of the project was to reduce cane loss and dirt at harvest. As mentioned above, the mound profile was not flat and base cutters were cutting below ground level and as such dirt levels were not recorded. Issues with potential for cane loss, particularly in ratoon crops need to be tested further (as mentioned above).

3. Compaction
   - While no measurements were taken using a penetrometer, it was observed that the soil around the stool in the mound planted dual row was considerably more friable and less compacted than the single row mound planted.
   - Dual row crops were harvested in damp conditions where some compaction would have been expected in 1.5m row spacing. In these conditions it is felt that hauling cane using the trucks, rather than the harvester itself, would have caused considerable compaction around the stool in the 1.5m row spacing compared with the 2.0m. Harvesting and hauling in the 2.0m rows caused much less damage in and around the stool, in these conditions (Figure 1).

Recommendations:

- Harvesting 1.52m with GPS. There were some issues with the harvester wanting to move jerkily and over-correct as it harvested 1.52m rows. It is believed that this was caused by the mismatch between the harvester wheel centres and the 1.52m row spacing. Whenever the harvester rocked from side to side, the GPS would react and tend to overcorrect. The current position of the GPS receiver is on the top of the harvester; perhaps it should be

moved to a lower point, closer to the machine's centre of gravity. In this way even if the top of the harvester was to rock, the GPS auto-correction would be minimal. This problem was not evident while harvesting the 2.0m rows.

- Harvesting – filling bins. The current harvester elevator only allows filling of bins by "half-siding" in 2m, compared with "full-siding" in the 1.5m (see Figure 7). MIG is considering an appropriate modification to the elevator to allow easier filling of the bins.
- In future, MIG will consult with BSES to measure harvester losses (conduct tarp tests) between the different row spacings.

Figure 7. 'Half-siding' while cutting the 2.0m rows makes filling bins difficult. Notice how close the elevator gets to the bin.

R&D recommendations:

- Development for the design and manufacture of a multi-row bed former (ideally 4 beds) that can have variable row spacing, and bed profile (width and height).
- Developing cane harvesters with adjustable front end to accommodate the different row spacing and planting configurations (e.g. dual rows or single rows with variable row spacing i.e. 1.5 to 2.0m).
- Harvester base cutter angles – more research to determine the optimal angles under these row spacings and bed profiles.
- Further measurements to assess harvester cane loss and dirt levels in these new farming systems should be conducted.

Publications:

none