

SRDC Grower Group Innovation Project

Final Report

SRDC project number: GGP026

Project title: Implementation of a 2m Farming System

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This project was conducted by the Singh Harvesting Group 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 Singh Harvesting 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:

The SYDJV with research conducted over some fourteen years, recommended the adoption of a new farming system based on controlled traffic, minimum tillage, and break cropping. Cane harvesters and associated haul out equipment have the highest axle loadings of any agricultural equipment resulting in severe compaction of cane growing land. The design of modern harvesters has focused on increasing throughput to contain costs. Unfortunately, this has resulted in a mismatch between row spacing and harvester wheel tracks.

While sugarcane displays environmental plasticity by adjusting to a range of row spacing without yield loss, research has shown that going to 1.8m row spacing and beyond is outside this range. Yield losses of 10% in plant cane for 1.8m rows have been shown except for some high input, irrigated cropping situations. Harvester design has placed constraints on the farming system where in fact the harvester should be built to suit the optimum row spacing necessary for a sustainable farming system where both economic and environmental factors are taken into consideration.

After listening to debates within the Tropical City Group regarding the relative merits of 1.8m singles and duals, 1.9m duals, and 2m duals the Singh Harvesting Group believed that the 2m/0.8m dual row system was the best option. The experience of the Petersens in Maryborough and Gerry Deguara of Mackay gave the group confidence that this configuration was worth testing in NQ. The group had prior experience with 1.8m/0.5m duals and 1.8m wide singles.

This decision to trial 2m was based on the following factors:

- Harvester wheel spacings are already at 1.9m; adopting 1.8m is already too narrow
- 2m spacing allows room for growth. Haul out capacity can also be increased when they are replaced. Most haul out bins are currently around 1.9m
- 2m is about the widest possible row spacing for the harvester to still be legal for road travel
- It's easy to set up tractors on 2m. This spacing provides better stability of harvester and tractors. Grain headers can be easily set up for 4m row spacing. Two metre row spacing is also suited to horticultural and cotton crops. The 2m spacing is very compatible with break crops
- 0.8m dual row spacing is possible so that thin stalks and the unhealthy competition associated with closer rows is eliminated. This is important in reducing cane losses and improving bin weights with green cane harvesting.
- Compared to 1.8m singles, earlier canopy closure with dual rows reduces the need for chemical grass control
- Planting dual rows eliminates the need to plant wide rows. Dual rows allow use of disc opener planting so there is minimal disturbance of the nitrogen fixed by legume crops. Planting a wide single row creates greater disturbance and therefore earlier mineralisation of fixed nitrogen.
- 1.8m single rows in low input (rain fed) farming systems have been shown to have a 10% yield reduction in the plant crop

In May 2006 the group planted its first block on the 2m/0.8m configuration. To effectively harvest this cane, modifications were required to the cane harvester. Widening of the basecutter box and the front of our 2005 Cameco 3510 harvester were carried out in time for the commencement of the 2006 season. The first season saw 106,000 tonnes of single row cane on 1.62m harvested with only minor adjustments required. A further 200,000 tonnes with increasing amounts of 2m/0.8m has been harvested in the following two years. The modified harvester has performed reliably over three seasons. It has succeeded in meeting this project's objective of modifying our harvester to handle a range of row spacing from 1.5m singles through to 0.8m duals on 2m.

Funding from SRDC GGIP (Grower Group Innovation Projects) and SIIF (Sugar Industry Innovation Fund) has allowed the group to achieve this. Harvester modifications were carried out in consultation with Cameco to ensure continuity of manufacturer warranty. It was hoped that Cameco would adopt these modifications at the factory so that further cost is not incurred by growers. However the message to harvester manufacturers from the Australian sugarcane industry is not clear. The economic benefits of controlled traffic are significant. As there are significant cost reductions with controlled traffic, current extension advice is aimed to encourage maximum adoption by moving to the least costly and easiest option which is 1.8m single row. Harvester manufacturers have interpreted this to mean that they do not need to change current harvester design.

Australia's sugarcane industry accounts for only 2% of the world cane harvester market. Brazil accounts for 60% of the market. While Cameco have been supportive of the work carried out in this project they have decided to develop a 2.4m/0.9m dual row harvester which in their assessment is better suited to the Brazilian and world markets. While there are further efficiency gains in going to 2.4m; the difficulty in making the transition from current row spacings without a second harvester, the need to build new haul outs, and row space compatibility issues with break crops will be a barrier in the short term for Australia. Two prototypes were in service during 2008 and there will be 20 machines built for the 2009 season. The current standard harvester will also remain in

production. Cameco continue to be supportive of local manufacturers doing the alterations for the 2m/0.8m system.

This project has helped develop local expertise in building a harvester better suited to a wider range of row spacings. Research and redesign costs associated with this initial conversion means costs are higher. Since this initial conversion other groups have carried out the required modifications for \$50,000. If the increased yield in plant crops and savings in chemical use are taken into consideration a substantial return on investment will occur.

To aid harvester development and ensure sustainable farming it is necessary for the Australian sugarcane industry to reach consensus on row spacing. An initial move to 2m in the short term followed by a move to 2.4m in the medium term is feasible.

It is recommended that 2m row spacing be adopted to provide industry uniformity. In the short term, dual rows can be planted 0.65m to 0.70m apart to minimise harvester modification costs if this is seen to be a barrier. In the longer term, convincing the harvester manufacturers to adopt at least some of the changes required, at the factory is a better solution.

Experience has shown that 0.5m row spacing is too close. Our observation is that a uniform row spacing in the range 0.8 to 1.0m would be ideal as 1.2m appears to be wider than necessary with some of the new high yielding varieties. However, a minimum of 1.2m will be required for the wheel tracks. Therefore, the 2m/0.8m dual row is an extremely viable cane growing configuration that also complements the machinery requirements for a range of break crops.

The Singh Harvesting group has adopted this system entirely. Most group members will be 100% 2m/0.8m after 2009.

Background:

Commercially available harvesters are designed to cut single rows. However dual rows up to 0.64m apart can be harvested as the basecutter legs are 0.64m apart. Based on previous NQ experience of detrimental competitive effects of 0.5m duals and the positive experience of Tropical City Group members growing 0.8m duals it was decided to trial wider dual rows. Growers on the wider duals were using a separate harvester with four basecutters in front of the harvester tracks which had been designed by the BSES for their trials with quad rows on 2.3m. This was not an ideal setup as it is harder to control basecutter height. It also required a separate harvester for the 2m configuration.

There was a need for a single harvester that could harvest both single rows on 1.62m and dual rows on 2m row spacing so that growers could make the transition to 2m. This required development of a wider timed basecutter box, widening of the harvester front, and making the crop lifter width adjustable to suit different row spacing.

As a result of the research work conducted over some 14 yrs by the Sugarcane Yield Decline Joint Venture (SYDJV) the Singh Harvesting Group recognized the potential cost savings and longer term yield gains from the new farming system. In 1998 the group had invested in a dual row Moller billet planter and planted 0.5m duals on 1.8m row spacing. There were some issues with dirt flow on the planter plough and billet choke ups in the mouldboards with the 0.5 dual row setup. The harvester front also needed to be wider to prevent cane loss.

We found the close dual rows competed against each other resulting in a lot of dieback and thin stalks. Thin stalks resulted in higher harvesting losses and lower bin weights (up to 10% lower) which then flowed on to higher road transport costs. Also, when lodging occurred the two rows would lodge in opposite directions making harvesting difficult. This suggested that the interspace/ dual row ratio (1.3/0.5) was not ideal. The increased yields suggested by researchers were not obtained. After a couple of years the two dual rows became one wide row. After this experience we believed the best option was to plant a wide single row on 1.62m. We achieved good results with this configuration but the economic benefits of controlled traffic were not available unless we went to at least a 1.8m row spacing.

Research results show that for irrigated high input growing areas such as the Tableland, there is no yield penalty by moving to 1.8m single rows. In 2005 we planted wide single rows on 1.8m and 1.62m. We were able to confirm in 2006 that the yields of the two row spacings were similar. However, we could see further environmental benefits in reduced chemical usage due to faster canopy closure with closer rows.

Our involvement with the Tropical City Group (a group of innovative growers, researchers, and machinery manufacturers brought together by the Sugar Industry Innovation Fund) and our previous experience with 0.5m duals gave us confidence that the 2m/0.8m dual row configuration which had been adopted by some group members was the best option. John Irvin of Ingham had trialled different dual row spacing and his observation was that the dual rows need to be at least 0.7m apart as this was where the detrimental competitive effect between the rows stopped. The

Petersen's of Maryborough who had also experienced 0.5m duals were now planting 2m/0.8m as this was the widest configuration possible for the harvester to still be legal on road. They reported that bin weights were back to normal.

Aims:

- Firstly, to modify a 2005 Cameco 3510 cane harvester so that it was capable of harvesting a range of configurations from single rows on 1.5m to dual 0.8m rows on 2m row spacing. This was to be done in consultation with Cameco in the hope that the modifications would be adopted at the factory
- Secondly, to compare the 2.0m system with the conventional 1.62m single row system so that cost savings, yield gains, and other benefits of the 2m configuration could be identified in FNQ conditions .

Methodology:

R&D and construction of harvester modifications was carried out in conjunction with Steve Lawn and Eddie Sims of EHS Manufacturing of Mackay who are part of Tropical City Group. Other Tropical City group members including Gerry Deguara of Mackay and the Petersens of Maryborough provided input.

The comparison of the 2.0m system with 1.62m single rows was carried out by group member Nirmal Chohan on his Chettle Road farm. Two adjacent blocks with similar row lengths and soil types were established. Each block is 5.8 ha with 4.4ha planted to Q200 and 1.4ha planted to Q167. The soil is clay and furrow irrigation is used.

Results and Outputs:

1. **Harvester Development. Modifications were carried out on a 2005 model Cameco 3510 wheel machine to allow harvesting single rows on 1.5 m through to 2m/0.8m dual rows.**
 - A wide timed basecutter box to suit Cameco and Toft harvesters is now available from EHS Manufacturing. A new wider basecutter box shell and top cover were machined. Gears and legs from the old box were reused. Two new gears identical to the existing pinion and idler gears were required. All components are standard items.
2006 cost \$24,675 + GST
 - Widening of front feed area from 1.0m to 1.3m to allow for cane stooling out to 1.2m. The original mainframe was cut off just in front of the butt lifter roller. The new frame included manufacture of:
 1. Top mounts for lift cylinder
 2. Frame for lift cylinder rollers. The original wishbone suspension was replaced due to space constraints. To handle single rows on 1.5m, the outside of the front wheels remains inside the outer edge of back wheels even when they set at 1.8m.
 3. Mounts for basecutter box side plates
 4. Mounts and holes for basecutter feed roller
 5. Mounts for side shift cylinders allowing hydraulic adjustment of crop divider row spacing
Cost \$20,000 + GST
 - Crop divider hydraulically adjustable for row spacings of 1.5 to 2.0m. The double ended side shift cylinders seen in Figure 5 (Appendix 1) are the key to hydraulic adjustment of the crop lifters. These are not available off the shelf and were manufactured by EHS. The crop divider mounting frames were modified to take the mounting shields for the side shift cylinders. These cylinders work off the crop divider tilt circuit. The diverter valve seen in figure 5 is manually engaged to divert oil from the tilt circuit to operate the side shift cylinders. Figure 6 shows the completed crop divider mounting frame. Hydraulic adjustment allows the crop dividers to be quickly brought in for legal road travel.
Cost: \$11,116 + GST
 - Being a wheel machine, widening the front out to 1.3m required modification to the steering components. The original wish bone type suspension requires more room and allows the front wheels to come closer to the basecutter discs when turning or travelling over uneven ground. The earlier model cane harvester, Toft 6000, used a roller guide lift arrangement. It was decided to adopt that concept here as shown in figure 7. The trunnion on the bottom of the lift cylinders was cut off. A larger stub housing for the bottom of the cylinder was machined to take tapered roller bearings for the wheels. Vertical roller mounting arms were welded to the stub housing. Height gauge cylinders working off the wish bone were no longer suitable so new longer and narrower cylinders had to be constructed. The steering arms had to be lengthened. Front wheel track width has increased by 80mm to 2.080m. However, the outer edge of the front tyre is still inside the line of the rear wheel outer edge.
Cost: \$8,000 + GST
 - Modification to rollers. A new butt lifter roller was manufactured to mesh in with the wider basecutter discs. The knockdown and basecutter feed rollers were lengthened 150mm each side to fit into the

wider front. Spirals were added to the outside of the feed rollers to bring the cane in between the legs.
Cost: \$2,000 + GST

- Modification to hydraulic components. The wider basecutter box uses 725mm discs compared to the original 580mm diameter discs. To maintain the original tip speed of the blades it was necessary to reconfigure the original Rexroth drive motor from 107cc to 125cc. Existing hydraulic hoses had to be repositioned and new ones made.
Cost: \$6,005 + GST
- Miscellaneous Costs including dismantling components, manufacture of basecutter box side mounts, modification of floating shoes, reassembly, and painting amounted to \$8,001 + GST
- Rear wheel spacers. The Cameco 3510 is manufactured with the back wheel spacings at 1.88m. To achieve 2m spacing required the insertion of a 60mm spacer on each side as shown in figure 10. A locating ring was welded on to the wheel rim to accurately position the wheel. This is shown in figure 11. Wheel bolts 60mm longer are required because of the spacer.
Cost: \$1,972 + GST
- Elevator extension. The existing elevator had a 300mm extension built in to it. The need to cater for different row spacing means an extension that can be quickly installed or removed is required. An extension previously used for 1.8m rows was modified and installed as shown in figure 12. One end of the extension hooks into a lug on each side of the elevator while the other end is held in place by the bar which normally holds the elevator flap. EHS have also built a removable extension to suit 2m rows. The rear end hooks on to the bin flap ram which allows bins to be filled better. The cost of this extension is currently \$ 9,925 + GST
- Yield Monitor. As part of this project a BMS Lasersat yield monitoring system has been installed on the harvester. The hardware used includes Ag GPS 170 field computer, Ag GPS 252 receiver and a Spectra Sensors differential pressure sensor. Auto steer is also fitted as the crop is now planted using GPS to 2cm accuracy. Relative chopper pressures are recorded as the crop is harvested along with GPS location. BMS Lasersat of Ayr have the software program which uses the data to produce a relative yield map. The map is calibrated using the total tonnes for the block as weighed on the mill weighbridge.
Cost:\$46,000 + GST

The modified harvester has now completed three seasons, harvesting a total of 300,000 tonnes. All those who have viewed the machine have commented on the high quality of workmanship carried out by EHS. Consequently, the harvester has operated with very high reliability easily handling cane grown on single 1.5m rows to 0.8m duals on 2m row spacing. Some minor adjustments were required.

In the first season dirt ingress was causing a problem in the stub housing on the bottom of the lift cylinder. The stub housing had been made wider than the cylinder barrel to accommodate larger bearings. However, the pivoting motion of the steering was allowing small quantities of soil into the stub housing. The original bearing and seal failed. This problem was overcome by fabricating a grease labyrinth on top of the stub housing.

Towards the end of the 2008 season the check valve in the basecutter motor failed, releasing metal into the basecutter and chopper motor circuit. This caused damage to the basecutter motor and pump. Further investigation has shown that this problem has also occurred or is close to occurring on standard harvesters fitted with the same basecutter motor. Therefore, the problem was not caused by the wider basecutter box.

After completion of the 2008 season the basecutter box has been dismantled and reassembled with new bearings and seals. The ball bearing races in the idler bearings were beginning to fail. These have now been replaced with self aligning bearings that have a dual race. The wider box is subjected to greater flexing, so self aligning bearings will perform better. Nevertheless, the basecutter box has performed extremely well in achieving 300,000 tonnes without incident.

The shape of the bed is particularly important in achieving a good ground job as the dual cane rows are on the edge of the bed. The desired bed shape as shown in figure 3 needs to be flat and 1.2m wide on top. The wheels require 0.6m and 0.2m is allowed for the side slopes of the bed. Bed height around 150mm is ideal. Disc opener planting can cause the centre of the bed to be higher than the edge. Unless this is corrected, the basecutters will need to go deeper and therefore shovel more dirt through the harvester.

With wheel harvesters, the weight of the elevator does impact on the ground job. The elevator has to be slewed to one side to fill the haul outs. The dual row which is furthest from the haul out tends to be cut a little higher. However, there has been no evidence of stool damage on crops which are now second ratoon. EHS are working with other groups in the Burdekin on a harvester levelling arrangement which will work off one of the rear wheels.

The harvester is more stable and does a better ground job when row spacing and harvester wheel tracks are matched. On narrow rows the performance of the modified harvester is similar to the original machine as the only difference is that the front wheels are an extra 80mm further apart.

2. Performance of 0.8m dual rows on 2m row spacing

A trial to compare single rows on 1.62m row spacing to dual 0.8m rows on 2m spacing was planted on Chohan's farm in August 2006. The dual rows were planted with a billet disc opener planter into preformed beds whilst the single rows were planted with a conventional wide furrow billet planter. Fertilizer rates were the same. The only significant difference was that one was planted into preformed beds while the other was planted into a furrow.

Furrow irrigation was used. It was noticeable that the cane on the preformed beds was growing better than that in the conventional furrow as there was no water logging reducing growth. With the preformed beds there was also no disruption to growth caused by the hilling up operation. This did translate to higher yields for the dual row in plant cane.

Crop Class	2M/0.8m Dual Row		1.62m Single Row	
	Q200 (t/ha)	Qi67 (t/ha)	Q200 (t/ha)	Q167 (t/ha)
Plant	135	148	122	130
1 st Ratoon	93	93	93	93

The increased yield was not seen in the first ratoon crop. Yields dropped off significantly for both treatments in the first ratoon crop due to some missed waterings during the growing period. In contrast, the experience with 2m dual row on Singh's farm has resulted in first and second ratoon cane yields being similar to or greater than the result for plant cane.

On the Tableland, it is possible to meet the nutrient and water requirements of the crop. Sunlight hours is the limiting factor. We believe that the dual row will out yield single rows in drier years as cloudy weather associated with the wet season is less.

Operating Efficiencies

The change from 1.62m rows to 2m rows creates improvements in productivity and therefore a reduction in costs in the order of 25%. Controlled traffic and planting into preformed mounds offers savings of 50% in establishing a plant crop. (MIG GGP004).

Most of the reduction in operating costs on 2m is based on the wider working swath which occurs without an increase in labour and fuel costs.

- Planting – area planted increases by 25%/day. For row lengths greater than 600m and the planter travelling at 8 km/hr, a planting rate of 1ha/hr is easily achieved with 2m rows.
- Harvesting – with dual rows the harvester does need to slow down about 2 km/hr in green cane but this is compensated by less turns/ha required. In Chohan's trial plot 1st ratoon cane averaging 93t/ha, the harvester speed was 6.8km/hr for both plots. Harvester fuel usage was 58L/hr and the haulouts averaged 12.5L/hr. Row lengths were 900m. There was a 20% saving in time to cut the same number of bins.
- Furrow Irrigation – for 900m long rows it takes 24 hrs for the water to flow through to the end for 1.62m rows compared to 33 hrs for the 2m rows. With a larger area being watered in the 2m setup, we would have expected an increase in time of 25%. The actual increase in time is 37.5% indicating that the soil is absorbing more water in the 2m block. This can be explained by the wider uncompacted crop area available with 2m rows. Other researchers have shown that it takes only one pass of traffic for the soil to achieve 60% to 80% compaction. The drying off period required for 2m cane before harvesting is also an indication of the increased water holding capacity of the 2m beds. An extra two to three weeks is required compared to 1.6m rows. With 2m there is also a labour saving in that fewer cups need to be changed per hectare. Tail water can also be better managed.
- Other operations such as fertilizing and spraying are achieving savings in the order of 25% as that is the increase in area covered in the same time as previously. With spraying we are actually able to travel at faster speeds comfortably as the wheel tracks match row spacing on 2m.
- Fuel savings. Other than the fuel savings achieved by covering a wider swath in the same time, the nature of controlled traffic provides further savings by separating the crop zone from the traffic zone so that

compaction in the right area is used to advantage. Agricultural engineers have shown that 25% of the tractor's power is required to overcome rolling resistance. Also to drag a tyne through compacted soil requires 25% more power than through uncompacted soil. Tractors work best on compacted soil. Crops grow best in uncompacted soil. Controlled traffic farming is making use of this to reduce costs.

Intellectual Property and Confidentiality:

R&D associated with the harvester modifications was conducted by EHS Manufacturing. They have developed the engineering drawings and procedures for the modifications. Not all of this cost was charged to this project.

Capacity Building:

This project has allowed a group of growers to share their resources and test research findings at a local level. Capital costs are shared between members and the interaction with other innovative growers through the Tropical City Group and the GIVE expos has given group members the confidence to make the investment that is required to ensure a sustainable, environmentally friendly farming system. A close link with researchers and machinery manufacturers is important.

Outcomes:

R&D outcomes include:

- Local expertise developed by EHS Manufacturing to carry out required modifications
- A timed wide basecutter box with legs at 0.775m available for all harvesters
- Expertise developed in widening harvester fronts from 1.0m to 1.3m
- Development of crop dividers for hydraulically adjustable spacing of 1.5m to 2.0m
- Slide system developed for front wheels to allow basecutter height control
- Spacers developed for 2m rear wheel spacing
- Removable harvester elevator extension developed
- 2m/0.8m dual row system proven to be a good option with group members moving towards 100% adoption.

Environmental Impact:

This project is focused on implementing a new farming system based on controlled traffic, minimum tillage, closer cane rows, bed forming, and disc opener planting. All of these elements have a positive environmental impact in terms of reduced energy consumption and chemical usage.

Controlled traffic isolates compaction to the wheel tracks which reduces energy requirements for field operations. Further energy savings are due to the wider working swath adopted. The reduced compaction in the crop zone allows better soil structure thereby increasing the water holding capacity of the soil which reduces runoff with the first rain event. Closer row spacing allows faster canopy closure thus reducing the need for chemical grass control.

Communication and Adoption of Outputs:

From the outset there has been significant interest from NQ growers in the viability of the 2m system. Growers from the Burdekin north have been to the farm to view the harvester modifications and examine cane growing in the 2m system. In May 2006 a busload of Babinda/Innisfail growers viewed the new farming system as part of their productivity services tour to the Tableland.

In December 2006, a meeting of Tropical City Group members in Innisfail was given a presentation on harvester modifications by Steve Lawn of EHS Manufacturing. In February 2007, the FNQ agricultural publication TABLELANDS TODAY communicated project outcomes and objectives in their feature story.

April 2008 saw Tableland growers visit the farm to view controlled traffic on 2m as part of a productivity tour conducted by Tableland Sugar Services on Tableland farms. In July 2008 a field day was organized with the assistance of Drewe Burgess, BSES senior extension officer, for growers to inspect the 2m harvester operating.

Bill Kerr, writer/photojournalist has communicated aspects of our farming system in Queensland Country Life. We are currently working with Bill to communicate project outcomes in an upcoming edition of Australian Canegrower

magazine. Our harvester modifications have previously been highlighted in the SRDC section of Australian Canegrower by Dr Les Robertson.

The ability for growers to view locally, cane growing on the 2m system has given growers the confidence that the 2m dual row system is a good option. The main barrier at present is the existing harvesting equipment. Large growers harvesting their own cane find it easiest to change. The Brooks family of Silkwood are one of the few who have gained the confidence to change after viewing what we and other growers on the 2m system are doing. All members of the Singh Harvesting group have adopted the 2m configuration.

Recommendations:

(What recommendations would you make as a result of the project, including suggestions for further research and development?)

Controlled traffic and wider swath harvesting is important for the future viability of the Australian sugarcane industry. The industry needs to reach consensus on row spacing so that harvester manufacturers can be directed to build a machine to suit.

The best option appears to be a move to 2m/08m in the short term followed by a move to either 2.4m/0.9m or a 4m harvester in the medium term.

Publications:

(List and attach copies (electronically if possible) of all articles, newsletters and other publications from the project.)

APPENDIX 1



Figure 1 Gear positioning of new base cutter box.



Figure 2 New base cutter box ready for painting and installation into harvester

Basecutter Ground Profile

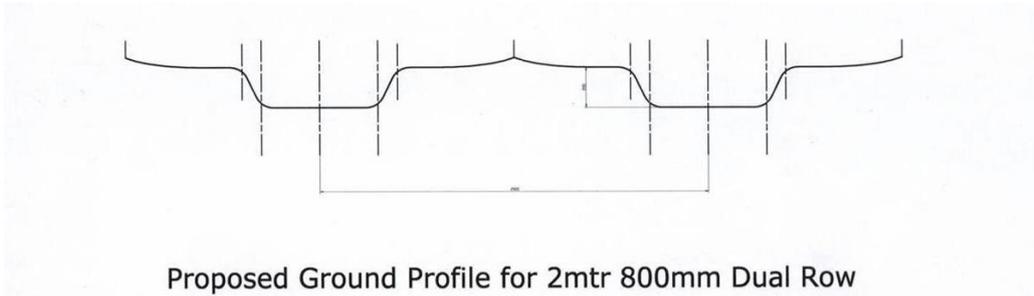


Figure 3

The ground profile shown in figure 3 is best for the new base cutter box. A flat top 1.2m wide and wheel tracks of 0.6m are allowed for. On each side of the bed 0.1m is allowed for the slope from the wheel tracks to the top of the bed. Bed height between 0.15m and 0.2m is good but can be higher or lower depending on local conditions.

Modification to rollers

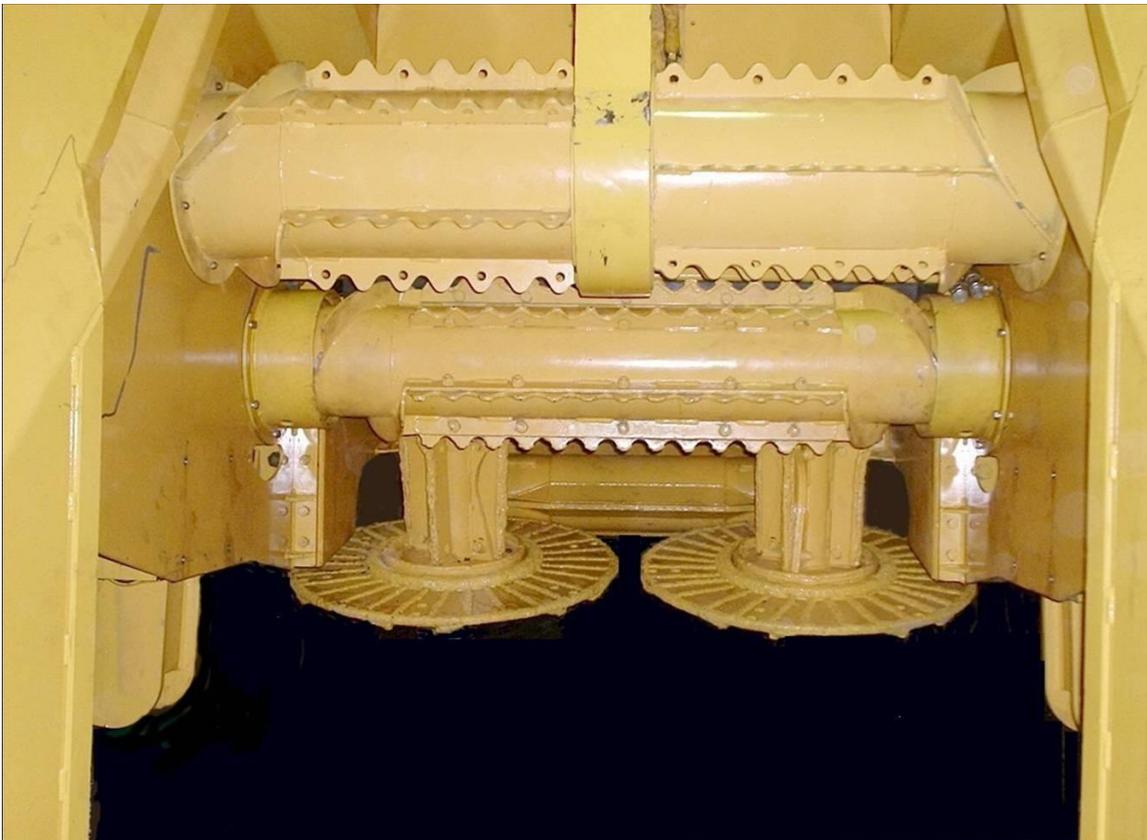


Figure 4 Widened rollers

A new butt lifter roller was manufactured to mesh in with the wider base cutter discs. The knockdown and base cutter feed rollers were lengthened 150mm each side to fit into the wider front. Spirals were added to the outside of feed roller to bring the cane in between the legs.



Figure 5 Side shift cylinders and diverter valve for crop dividers



Figure 6 Reconstructed front end with new base cutter box fitted



Figure 7 Roller guide welded to stub housing on bottom of lift cylinder



Figure 8 Cameco 3510 harvester suitable for row spacings up to 2m



Figure 9: Spacer located on back wheel hub



Figure 10: Spacer sitting inside locator ring which is welded onto wheel rim



Figure 11: Elevator extension for 2m rows



Figure 12: Growers inspecting 2m harvester



Figure 13: Growers inspecting 2m beds



Figure 14: Close up of basecutters on 2m harvester

