

SRDC Grower Group Innovation Project

Final Report

SRDC project number: GGP022

Project title: Optimising Benefits of GPS Integration into Controlled Traffic Farming (CTF) System

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Due date for report:

Funding Statement: This project was conducted by *Deguara Harvesting* 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 *Deguara 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 modification of the haulout has been completed and been in operation for the 2007 harvesting season. The aim of the project was to primarily reduce the compacted area on the ends of the rows during the turning around phase of harvesting. The secondary aspect was to greatly improve the manoeuvrability of the unit and allow for reverse filling of the haulout by only having to keep the tractor straight. A second hand McLean 14tonne elevating bin was chosen for the modification.

The original tandem suspension was removed to allow the chassis to be trimmed up to allow room for the ball race bearings to fit. EHS Manufacturing was commissioned to fabricate the two individual subframes to house the BPW air bag suspensions. EHS also constructed the trailer mounting plates which were welded to the chassis. A ram mounted to the chassis was used to turn the front axle with a tie rod to make the rear axle turn. Hyteco Hydraulics, based in Brisbane, was commissioned to design the electronics and hydraulics to make the unit functional.

An EPIC controller, in conjunction with two potentiometers was used to use the angle at the hitch to steer the rear axles as required. Also when reverse on the tractor is selected the system steers the unit so it stays in line with the tractor.

A trial, with the assistance of BSES and MAPS was set up to demonstrate and evaluate the unit. A fallow paddock was marked out to represent two metre beds. Measurements were taken off a controlled width headland turning in as if the field was being harvested. A significant reduction in the compacted area was noticed.

Local farmers, contractors, BSES and MAPS staff were invited to a field day at the trial site. EHS staff also observed the demonstration and steering is now available as an optional extra on new haulout units.

The modification has been successful in that all the aims have been achieved and in the long term the project has demonstrated that it will be a necessary tool in the move to a zero till farm.

Background:

The Deguara Harvesting Group has been formed to harvest sugar cane for a group of growers who have a commitment to CTF at a two metre row interspacing as part of a farming system that accepts all the principles of SYDJV research. All harvesting equipment is on two metre centres with 500 ml tyre section width giving a theoretical 25% compacted area. The main concern has been the length of the tractor trailer combinations which has caused the wheels of the haulout to ride on the growing zone for up to 40 metres before aligning with the lead wheels. Also it was hoped that the electronics could be manipulated to allow the trailer to steer itself ahead of the tractor in reverse.

Aims:

The project aims

- To maximize CTF system by improving haulout operation to ensure trailer unit travels on compacted interspace from immediate point of block entry and maintains this path until trailer unit exits the block
- To decrease the 40 metre delay that occurs when the tractor enters/exits block and when the trailer unit follows in a straight line thus decreasing the distance that trailer unit travels across beds before aligning directly behind the tractor
- To design, construct and trial innovative mechanics allowing the trailer unit to be steered independently of tractor thereby allowing haulout unit to travel on compacted interspace from immediate point of entry and maintain this path until point of exit
- To develop skills by interacting with those external resources engaged to participate in project activities

Methodology:

The design was based on turning the two axles separately but linked with a large tie rod.

The McLean 14 tonne haulout was chosen for the conversion. The existing axles and suspension were not suitable and were removed.

A BPW air bag suspension was chosen as it enables load sharing without a mechanical link.

100 ml had to be removed off the 250x150 ml RHS to accommodate the one metre diameter ball race turntables.

Plates were constructed by EHS Manufacturing to weld to the chassis with holes to accept the turntables.

EHS were also commissioned to build two axle suspension modules to bolt onto the other side of the bearing.

A ram was mounted between the chassis and the front module to give a 40 degree lock to lock on the axle and a rod then joined the other axle.

Hyteco Hydraulics designed an electronics system to coordinate the various functions.

Two potentiometers were mounted-one on the hitch and the other on the first axle. Their role is to provide feedback to the EPIC controller as to their position.

The hitch makes an angle with the tractor.

The controller activates the valve to steer the wheels to a certain angle.

The controller in the tractor cab has three modes

- 1.off
2. manual – where a joystick can be moved left or right to turn the axles to the required position
- 3.automatic – where the EPIC controller is responsible for all controls

In reverse the polarity is reversed so that the wheels will steer to keep the trailer directly ahead of the tractor.

Reverse filling is possible when GPS is fitted to the tractor.

Results and Outputs:**Deguarra Harvesting Group**

The Deguarra Harvesting group at North Eton fitted a rear steerable axle on their 14 tonne McLean elevator tipper haulout. The aim of fitting steerable axles to the haulout unit was to reduce compaction over the grow zone during row entry and exit period. Another advantage of this unit is the potential to reverse fill under guidance, which will reduce harvest time and increase field efficiency. It is also hoped that this unit will lead to a reduction in maintenance on bin axles less stress and tension on axles from the current screwing action of the haulout unit. The reverse ability of this system was unable to be tested as the tractor was not fitted with GPS guidance.

To test the difference in compaction between the rear steerable unit and the conventional unit a trial was set up to compare the area of compaction in the grow zone, and in the inter-row.

Using a fallow block, a 3 metre headland was marked out. Witches hats were also used to mark out the 2 metre row spacings with 800mm dual rows.

The conventional haulout drove into the paddock over the marked out row, simulating a normal paddock entry. The tractor and bin tyre marks were then marked with spray paint.

The haulout unit then entered the paddock in a second marked row, with the rear steerable unit operating. The tyre marks were again sprayed with coloured paint.

The traffic area was then measured to determine the effect on the grow zone and the difference compared to the conventional haulout entry to the steerable axle haulout entry.

Results

- With the conventional axle it took 31.4 metres for the tractor and haulout tyres to become aligned as 1 mark
- With the rear steerable axle it took 8.2 metres for the tractor and haulout tyres to become aligned as 1 mark
- Within the 800mm dual row (grow zone) area
 - Conventional axle – 25% compaction
 - Rear steerable axle – 0% compaction
- Within the remaining area
 - Conventional axle - 75% compaction
 - Rear steerable axle - 20% compaction

Photo's of the trial being conducted and the demonstration day will be provided on CD.

Promotional activities report

Demonstration was conducted on the 28 of November 2007 in which 27 growers and harvesting contractors came together to view row entry of the haulout. As the results indicate the row entry was dramatically reduced when compared to the standard unit. This demonstration was the first of its type in the Australian sugar industry and show cased how and why a steerable axle allows the haulout unit be more effective in the row entry and exit period.

The unit will be on display at the Mackay BSES Limited field day which will be held on the 22 & 23 of May 2008. The field day is patronised by 1500 growers and the project information and results will be highlighted at this event.

Deguara Harvesting has collaborated well with the Blackburn harvesting group to extend information, at the demonstration that was held on the 28 November Lee Blackburn also highlighted trial information to the growers and harvester operators that were present.

Intellectual Property and Confidentiality:

This project was implemented for the good of the sugar industry incorporating both the farming and harvesting sectors.

No patents have or will be applied for.

EHS Manufacturing and Hyteco Hydraulics have expressed interest in the project.

The steering is available as an optional extra on new units.

Capacity Building:

The modification of the haulout unit has heightened the awareness that the present system is far from perfect. The feeling of the group is that this is an important tool in the move to a zero till farming system.

Outcomes:

All outcomes as stated in the application have been achieved.

The two main outcomes are:

1. The compaction at the ends of the fields with the steering working has been reduced to the point where zero till is achievable.

2. The reverse filling potential has been a bonus and will make the modification commercially viable in that harvesting could be 10% to 15% more productive because of the elimination of the turning around time for the haulout units.

For the system to reach its full potential GPS must be fitted and a minimum of two units modified.

Environmental Impact:

The environmental impact of the modification is extremely positive in that we, as a group, feel that without it long term zero till is not going to be achievable. The potential to increase field efficiency though the ability of a tractor trailer combination to reverse fill reduces fuel, time of operation and effort, this will impact positively on the environment.

Communication and Adoption of Outputs:

Many forums have been used to display the modified haulouts with SRDC being acknowledged on all occasions.

- Demonstration on 28 November 2007 to growers at the trial site on our farm
- Demonstration to Tropical City Group with a mix of farmers, contractors and manufacturers from throughout Queensland
- A presentation at the GIVE Conference held in Mackay
- Hosting of bus trip to look at the unit at the conclusion of GIVE Conference
- Displaying unit at Mackay BSES Field Day to approximately 1500 growers and contractors

Recommendations:

The Deguara Harvesting Group concludes that, as a group, we have made a huge step in the move towards a successful controlled traffic farming system. The sugar industry has been led to believe that matching wheel centres to row centres only is all that is necessary to be classified as controlled traffic. After measuring the area compacted on the ends it is obvious that this is not sufficient. As the harvesting groups grow larger the payload of the haulouts will increase as will the length of the units making the steering essential.

Publications:

Project milestone reports have been lodge with SRDC to highlight the activities that have been conducted within this project. The SRDC web site will make this and other reports available to the wider grower and harvester community.