

SRDC Grower Group Innovation Project

Final Report

SRDC project number: GGP040

Project title: Build a prototype planter suitable for planting peanuts into uncultivated Cane Trash Blanket.

Group name: SSPag Pty Ltd

Contact person: Don Halpin 0418748609

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Australian Government

**Sugar Research and
Development Corporation**

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Body of Report

Executive Summary:

The aim of this project was to build a prototype planter capable of seeding peanuts directly into uncultivated cane trash blanket. The group used their observations of difficulties we had in a previous project GGP028 to decide what needed to be incorporated into the design of the planter to make it effective. In GGP028 the group sought to use multi passes with readily available equipment to plant and grow peanuts in an uncultivated cane trash blanket. The strike and the inoculation of the peanuts in this trial were severely adversely affected by the enveloping of the peanut seeds in trash reducing the seed/ soil contact. GGP028 also included a replicated area that included a conventional treatment as well as zero till and tillage limited to a single ripping under the peanut row. The conventional was the best with the zero till being the worst. This led us to the decision that we needed to rip under the peanut row to break up compaction caused by the cane harvesting equipment. It was also very obvious that we needed to stop the trash from enveloping the peanut seeds. We proposed to do this using a large straight edge coulter as the front end of the planter. The ripper would follow the coulter very closely to avoid the ripper legs gathering trash and cane roots. These would be followed by spider trash rakes and then by a press wheel to slightly recompact the disturbed area to achieve an even seed bed. The vacuum air seeder assembly would finish the process. The group held a number of brain storming sessions with our manufacturer to decide on the final design and to discuss how modifications would be done after problems arose at the initial trials. An important part of the trial was to keep other growers and industry people updated on our progress. We arranged a field day on the day we seeded the first Two Hectare trial area on one of the group member's farm. The attendance was very good and the machine performed well. The trial area on both the properties consisted of a 2 ha block, half of which was cultivated conventionally and half of which was planted in the uncultivated trash blanket. The crop on the second farm had a number of problems affecting the yields of both treatments. The weather led to lateness of harvesting the cane and lack of time to allow the trash to settle before planting and lack of time to apply pre plant fertilisers. The group therefore feels that the trial on the first farm should be the basis of this report. A graph showing the results of a DPI conducted assessment consisting of five sites in each treatment on the second farm shortly before harvest is indicative of the problems at this site is Table 4. Concentrating on the first trial site, the gross return from the 1 ha trash section was \$4410 and the gross return from the 1 ha conventional section was \$5901. While there is still an obvious advantage from the conventional system the result is much closer than the GGP028 trial highlighting the improvement achieved by the construction of the planter. What is yet unknown are the effects on the soil of the minimisation of soil disturbance in the trash section. This is something that may conceivably take many years to quantify.

The other part of the trial was to assess three different ways of inoculating the peanuts. They were 1. Dusting the Seed, 2. Injecting the inoculant suspended in water, and 3. Applying a Granular Inoculant. Dusting proved the best with Liquid 10 % behind the dusted followed by the Granular 10 % behind the Liquid.

Background:

This project was necessary if we were going to be able to achieve the aims of our initial project GGP028. The aim of this project was to successfully demonstrate that a Peanut / Sugar Cane Rotation could be achieved without having to plough out the cane crop as is the conventional practice. This process commonly involves one or two passes with a rotary hoe or disc harrows as well as ripping and bed forming. The conduct of GGP028 showed up a specific impediment to achieving this goal. It was that, during the seeding operation (using conventional planting equipment) the seeds became enveloped in the trash. That is to say that the coulter that was designed to cut a path through the trash actually pushed the trash down into the soil creating a trash lined v into which the seed fell. This meant poor germination and poor inoculation as the soil seed contact was partial at best. The seed did not have enough moisture to germinate and the inoculant did not survive because it requires the soil contact to survive and multiply. We saw clearly that the ends of rows where there was no or minimal trash the peanuts germinated and grew well without the conventional cultivation. This led us to believe that the new system may be possible if we were able to design and build a planter specific to our requirements. We then successfully sought funding from SRDC for this project.

Aims:

- The problem that needs to be solved is how to plant peanuts into uncultivated cane trash blanket without the trash being pinned into the soil beside the seed negatively affecting germination and nodulation.
- The group intends to solve the problem by building a planter / yeoman ripper/ straight edged disc coulter combination machine that will allow exact tracking of the planter in the pathway cut by the coulter and de-compacted by the ripper.
- The skills of the group members will be enhanced by their involvement in design, sourcing suitable and affordable components, supervising manufacture and in trialling, modifying and ultimately demonstrating the machine.

- The project will build from the outcomes achieved from GGP028 “Facilitating enhanced peanut/sugarcane rotations by assessing and managing the issues related to growing peanuts” to further enhance a zero / min till production of peanuts as a legume rotational crop option.

Methodology:

The group held a number of discussions to come up with the basic design of the machine, the components we would source ready made and the components we would have built by the manufacturer we had retained for the project. We then had detailed discussions with our manufacturer and group members set about sourcing and ordering components. Our manufacturer was enlisted to source and order some components from local engineering firms that from experience he knew to be more competitive than big name brands. We delayed starting construction until we had all components in stock. We set them up on stands as they would be on the machine to decide what size frame was needed. Group members also had input as to what row configurations they were using now and what they may be doing in future so that we made the machine flexible enough to accommodate these scenarios. Our manufacturer then set about constructing the frame and some of the components including the trash rakes, the gear drive for the seeder and the re-compacting wheels. All the components were assembled and the machine trialled.

There were a number of problems that needed to be overcome at this stage.

The cane roots were building up around the ripper leg and creating a trench. The arms that supported the trash rakes were periodically building up a large ball of trash necessitating stopping to clear manually and the uneven cane bed caused by wandering harvesting equipment caused the coulter to track sideways. This then meant it was out of alignment with the ripper. The members held a brainstorming session in the field with the manufacturer to decide on modifications. The coulters would be welded rigid instead of having some sway. The rippers would be rebuilt to fit the curve of the coulter missing it by about ten mm. The trash rake arms would be mounted much higher allowing trash to flow freely under them. The modifications were made and the machine trialled again. There were still some problems particularly where there was ironstone in the soil as the stones would lodge between the coulter and the ripper stalling the coulter. We welded strips to the sides of the coulter to help it turn to dislodge the stones and sticks. The group decided the machine was performing sufficiently well enough to commence the planting operation so a field day was arranged so growers and other industry people could watch the trial being planted. The day was a success with a good crowd of interested growers and others in attendance. The machine performed well with only a few blockages. The trial was set up on a 2 ha site 1ha either side of a winch track. On one side the area was cultivated with one pass with a rotary hoe ripper combination and one rotary pass to incorporate the pre emergent herbicide. The lime and dolomite was applied before the first cultivation and the basal fertiliser was applied using a straight edged coulter on a slight angle to allow the fertiliser to fall into the soil. The trash retained side had the lime and dolomite simply applied to the trash surface but the fertiliser was applied in the same manner as the cultivated side. The conventionally cultivated side was set up to be irrigated with trickle irrigation to supplement the water supplied to the whole block with the travelling irrigator. Our previous trial showed us that particularly in the early stages the cultivated area needed more irrigation than the trash retained area. We did not want the cultivated area to be under watered nor did we want the trash side to be over watered both of which occurred in the previous trial GGP028. Both areas had the same post plant herbicide and fungicide regime but the trash section was weedier probably because of no pre emergent herbicide. Our consultant monitored both sections separately for maturity leading to seven days delay in harvesting the trash block. Given the maturity levels highlighted by the grades it would probably have been better to have delayed harvest even longer on the trash section but we needed to harvest when the machine was available..

Results and Outputs:

The results of this project are mixed.

On the one hand the main aim of this project to build a planter capable of planting peanuts into an uncultivated cane trash blanket was largely a success but the grower would need to choose blocks that don't have a very heavy trash blanket. It would also be advantageous to choose cane blocks with a single row on 1.8 metre centres. This configuration allows the coulters and rippers to work on a more even platform than presented by a dual cane row configuration. The dual row cane system means that you are planting the peanuts into the cane stool whereas the single cane row system means you are planting beside the cane stool which is always going to be easier. With the latest research showing no yield difference between single or dual cane rows at 1.8 metre centres this should not be an issue and most members of our group are heading to that planting configuration. The issue of the trash may also not be insurmountable as in our area there are viable outlets for partial trash removal. This would still mean not needing to cultivate and therefore preserving the soil structure and soil biota. It would however mean a less positive water saving regime.

The other part of the project being the growing of a 2 ha block of peanuts half planted in conventionally cultivated soil and half planted in the uncultivated trash blanket was a success and a failure depending on how the comparisons are

made. The production from the trash retained section was 5194 kg / ha at a price per tonne of \$847. While this compares well with the crop we grew in the trash last year at 3500 kg / ha and to the district average for Irrigated Peanuts it does not compare well with the other half of the 2 ha block. The conventionally cultivated section produced a payable yield of 6857 kg /ha at a price of \$861/tonne. A gross return / ha on the trash was \$4399.31 whereas the conventionally cultivated sections gross return / ha was \$5903.87. This is a shortfall of \$1504.56. The growing cost savings of the trash system were approximately only \$177 for the hectare and the freight, harvesting and drying charge difference due to the lesser quantity was \$228. This is a total of \$405 for the hectare. This still leaves a shortfall of \$1099 for the hectare. This result is clearly unacceptable even if you take into consideration that there may be long term benefits to the soil using the new system. It would be hard to imagine that any improvement to the soil would result in a \$1099 net return over the next three year cane cycle in comparison to a three year cane cycle following a conventionally grown crop of peanuts. It may well become a viable proposition in a regime where government legislation restricts the cultivation of farm land to reduce erosion and run off to protect the reef. There was another plus to consider and we noticed the same result last year in that the trash section recorded lower cadmium content in the peanuts. This could have a big impact in the viability of the system if it meant the difference between say 0.19mg/kg and 0.21mg/kg. There would be a \$80 premium per tonne for the peanuts from the trash section. The cadmium penalty for peanuts between 0.149 and 0.2 is \$20/ tonne whereas the penalty over 0.2 is \$100/ tonne.

Table 1 below summarises the data discussed above. The water costs are set at \$70 / megalitre with the trash block using 2 megalitres and the conventional block using 2.5 megalitres In the early stages of the crop before canopy cover, it was necessary to trickle irrigate the conventional block on four occasions when the trash block didn't require irrigation so that the conventional block did not suffer moisture stress. The cultivation costs are based on Diesel @ \$1.60 / litre after rebate and wages of \$22 / hour. The price of Glyphosate assumes \$15 / litre and applied at 4 l/ha, Fusilade @ \$42/litre applied at 1.65l/ha and Treflan at \$7.25 / litre applied at 2.1 l/ha. Herbicide spraying cost assumes \$10/ ha per application.

Table 2 shows the result of the innoculant trial that was incorporated into the trash retained area of the trial. A ten metre section of each treatment was collected after digging and stored until the DPI's portable thrasher was available. The threshed peanuts were then sent to PCA for weighing and grading. The results are self explanatory with the dusted treatment being the best.

Table 1.

	Cultivation, Water & Herbicide Costs	Gross Returns	Harvesting, Freight & Drying Costs	Cadmium Content
Trash Block	\$440.00	\$4399.31	\$785.84	0.1mg/kg
Conventional Block	\$611.77	\$5903.87	\$1013.95	0.13mg/kg

Table 2

Variety	Cleaned Weight grms	Ker Moisture % after Shelling	Sieves Used	J's	1's	2's	mfg	splits	ts oil	hp oil	Shell	
Liquid Inoculant	8920	7.4%	Runner	506	79	36	3	61	31	73	211	1000
Granular Inoculant	8670	7.4%	Runner	458	101	31	2	67	28	93	220	1000
Dusted Inoculant	10980	7.3%	Runner	543	70	33	2	59	22	67	204	1000

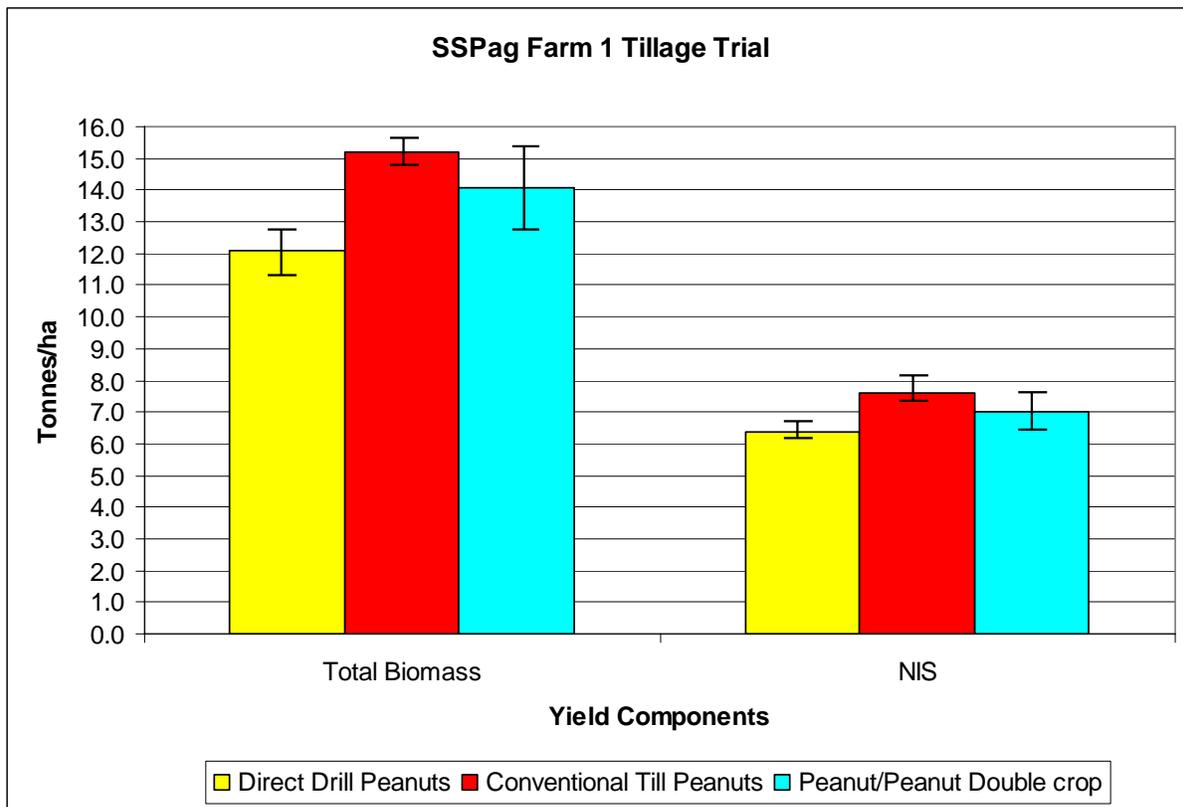


Table 3

Table 3 shows the result of samples taken and analysed from the trial area as well as another adjoining crop where peanuts had also been grown the previous year. This was done by the DPI approximately two weeks before harvest and we are grateful for their assistance. This data represents what would be delivery weight and not payment weight which our financials are worked on. The tonnes per hectare in these figures correspond almost exactly with the delivered weight in the conventional section but these figures are about 3.3% higher in the trash section (direct drilled Peanuts) than was actually achieved at harvest. These results could indicate slightly more loss at harvest in the trash section. It should be noted that NIS stands for Nut in Shell.

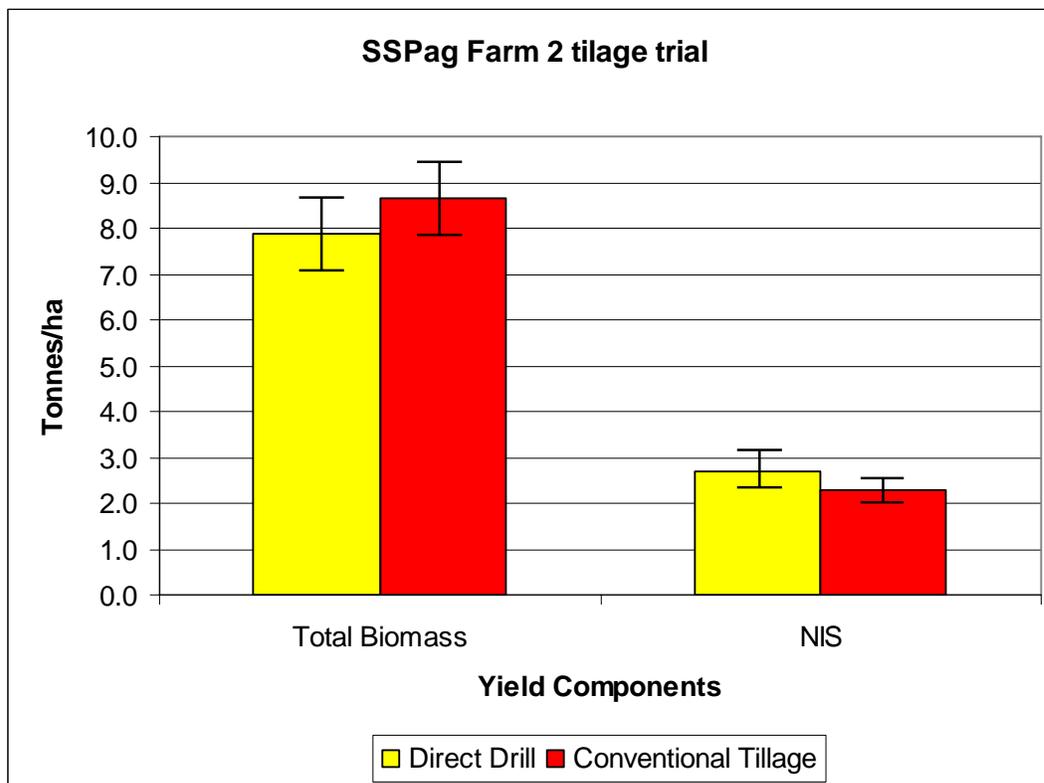


Table 4

Table 4 shows the results of a DPI conducted assessment of the trial area on the second farm that was severely affected by weather particularly before planting which adversely impacted at planting and at other critical times causing the very poor results in both treatments. Note that NIS stands for Nut in Shell.

Intellectual Property and Confidentiality:

There are no issues to do with intellectual property or confidentiality in regard to this project. The group is happy to share any information they have gathered as part of this project.

Capacity Building:

The group members all took ownership of this project. They all attended planning sessions and were prepared to do their share of the work in regard to sourcing equipment and brainstorming with our manufacturer. Two group members agreed to conduct part of the trial work but the weather interfered with the conduct of one of the trial sites leading to it not being a worthwhile site to assess the new system. Even though the results are not as good as we had hoped some group members are keen to make some changes to hopefully enhance the viability of the new system. One important factor will be when the single row cane on 1.8 meters comes up for the peanut rotation. We are also keen to use the planter to plant Soy Beans directly into the trash blanket so this will mean a continued collaboration on this project.

Outcomes:

The benefits of this project are difficult to quantify clearly. While we have built a planter that will plant peanuts successfully into a cane trash blanket the resulting crop did not compare well with the conventionally grown crop at the same site. It was however at a level most growers in this region would find acceptable. At 5.194 t/ha the trash block exceeded the district average of 5.07 t/ha. There would have been many conventionally grown crops that produced less tonnes per hectare and the quality of the nuts was good at 54.6% Jumbo, 10.1% Grade 1 and 5.3% Grade 2. We are hopeful of seeing better results planting into single cane row configurations as these blocks come on line and are also keen to explore the planter’s usefulness in planting Soy Beans into a trash blanket. The lower cadmium levels in the peanuts grown in the trash section could prove important even if it is only useful in trying to understand the factors affecting cadmium uptake. We were aiming for production of at least 5 tonne per hectare and we achieved this but the trash crop did not come close enough to the conventional crop in the same block. That is the bottom line.

Environmental Impact:

The beneficial environmental aspects are many including virtually excluding wind and water soil erosion and our water monitoring equipment showed consistently better percolation of water to the 50 cm depth in the trash retained section. We also observed less run off during overhead irrigation on the trash section. This was very important in this block as it has a slope conducive to water running off during overhead irrigation. Also the amount of fossil fuel used on the trash section was around 50 litres less than on the conventional section.

Communication and Adoption of Outputs:

At this point in time our communication with industry has been limited to a field day held to demonstrate the planter in action, a bus trip held on the 21st Feb about 4 weeks before harvest and presenting at GIVE 08. The bus trip was sponsored by the Peanut Company of Australia. The participants included growers, consultants, DPI and PCA staff. They were shown the trial area as well as the cane growing on the GGP028 trial area. A key feature of this trial is the rows containing the rep area had no fertiliser applied and nobody was able to pick out these rows from the remainder of the block that was fertilised to recommendations. The rep area was not fertilised so we can better ascertain the effects that the different cultivation regimes in the peanuts has had on the subsequent cane crop. Our fear was that the addition of all the fertiliser recommended would even out the results . We believe that the ever increasing price of fertiliser will make some participants in the bus trip consider not fertilising the cane crop following their peanut crops.

Recommendations:

Our recommendation at this point in time would be that anybody wanting to try the system do so on a small area preferably on well drained sandy loam soil. It would be particularly suited to blocks prone to water erosion after cultivation. We would also suggest not following dual row cane and definitely steer well clear of poorly drained areas as the trash cover exacerbates any water logging problems.

Publications:

A member of our group Don Halpin gave a presentation detailing this project at Give 08. This contains reference to and pictures of our other activities and a CD of the Power Point Presentation is included with this report.