GGP009

'IMPLEMENTING ZERO-TILLAGE PLANTING IN THE NSW SUGAR INDUSTRY'

Final Report

March 2007

Project conducted by the NSW farming systems group
with funding support from SRDC and NSW Sugar Milling Cooperative Limited

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TABLE OF CONTENTS

SUMMARY

The project 'Implementing Zero-Tillage Planting Systems in the NSW Sugar Industry' aimed to introduce a direct drill billet planter to plant extensive areas of trial and commercial cane in the three mill areas of NSW. A group of NSW cane farmers called the NSW farming systems group wanted to evaluate the commercial viability of direct drill billet planters and a Hodge dual row double disc billet planter was purchased.

Trial sites were established in the Condong, Broadwater and Harwood mill areas comparing zero-till planted cane with cane planted into conventionally tilled ground. These trials aimed to compare the economics of both systems and to demonstrate the robustness of a zero-tillage farming system.

Nine months after planting, biomass sampling took place at the tillage trial that was established on Woodford Island. Yield results indicated no significant differences between the two systems. An economic analysis indicates that a net return of $2627/ha for a zero-tillage farming system compared to $2506/ha for the conventional farming system. This equates to a $121/ha saving when adopting the reduced input system. These figures do not take into account labour savings and soil health benefits that are associated with the zero-tillage planting system.

Over the past two years 23 growers across the three NSW mill areas have used the Hodge to plant a total of 210 hectares of both trial and commercial areas of cane. It is estimated that up to 200 hectares will be planted with the Hodge in 2007 demonstrating that the system is gaining momentum every year.

Trial work to date has demonstrated that cane can be zero-tilled through soybean stubble across a number of soil types without any yield penalty. The NSW Farming Systems Group has made a number of modifications to improve the planter performance and their changes are documented in this report. Continued work by members of the NSW Farming Systems Group will help fine tune the zero-till planter, so it is an integral part of a robust new farming system. Growers from the NSW Farming Systems group are pleased with the progress of this project, as the main goals have been achieved, and the group is committed to future work on this and many other projects.

BACKGROUND

The project 'Implementing Zero-Tillage Planting Systems in the NSW Sugar Industry' aimed to introduce a direct drill billet planter to plant extensive areas of trial and commercial cane in the three mill areas of NSW. A group of NSW cane farmers called the NSW farming systems group wanted to evaluate the commercial viability of direct drill billet planters (members of the group are listed in appendix 1). The group consists of growers from the three mill areas of NSW and aims to demonstrate innovative methods of farming that will create a more viable and sustainable farming system.

The members of the group have already adopted soybean fallowing/controlled traffic farming and were keen to complete the system by introducing zero-tillage planting where possible. The group investigated direct drill billet planters and subsequently purchased a Hodge-Moller disc-opener planter as this was the only one of its type in the industry. Trial work began in 2005 with the group wanting to compare the economics and the robustness of the new system with the conventional farming system.

The Hodge double disc opener billet planter was delivered in early October 2005 and transferred to the Harwood mill area and following a few modifications trial work commenced. All members of the group plus other farmers in NSW had the opportunity to plant both trial and commercial areas with the zero-till billet planter.

The NSW Farming systems group were keen to compare the efficiencies of the Hodge with other dual row planters in the area due to the inefficiencies associated with current dual row billet planters. The planting rates of conventional dual row planters are around 14 tonnes/ha, depending on cane variety. The Hodge disc-opener has a more precise delivery system with an average planting rate of 9 tonnes/ha. The Hodge planters have a directed spray fungicide application system resulting in lower water usage and an estimated fungicide usage of 2.5 bottles/ha. At $9 for a 200ml bottle of fungicide there is a $45/ha saving per hectare compared to a typical dip system.

TRIALS ESTABLISHED IN 2005

Tillage Trials

In September/October/November 2005 trial sites were established in the Condong, Broadwater and Harwood mill areas comparing zero-till planted cane with cane planted into conventionally tilled ground. These trials aimed to compare the economics of both systems, assess productivity and demonstrate the robustness of a zero-tillage farming system. The Condong trial sites were established at Mark North's. In Broadwater trial sites were planted at Tom Walsh's and Jeff Pye's. The Harwood trials were established at Alan Munro's, Alister McFarlane's and Barry Davis's properties. Due to delays in the manufacturing of the group's zero-till planter, the trials in Condong and Broadwater were planted using Mark North's zero-tillage planter.

Photo 1: Shows the two tillage treatments, conventional till (left) and zero-till (right) at Munro's trial site (Woodford Island, Harwood mill area).

Photo 2: The Hodge double-disc-opener planter in action at Harwood.

This trial work was the first time cane had been zero-tilled using disc-opener type billet planters in NSW, and as expected there were a number of teething problems. Issues that were faced when planting in 2005 included, soil break-out in heavy soils when using discs, billet blockages in the chute of the planter, getting an even feed with trashy cane and steering the planter in a straight line. However, subsequent measurements (eg millable stalk counts) indicate good establishment at the trial sites. Some of these issues were addressed after Alan Munro and Mark North (two members of the farming systems group) travelled through Sarina, Mackay, Proserpine and the Burdekin over the three days prior to the Burdekin GIVE day in February 2006. This field trip is discussed later in the report.

Photo 3: Establishment of zero-tillage cane through soybean residue

Shoot Counts

An assessment of the Hodge planter performance and tillage treatment effects on millable stalk density and gaps in trials planted in 2005 was undertaken in late March 2006. Two replicate10m lengths of row were marked out in each block or treatment. The number of millable stalks in 25cm sections along each 10m length of row were recorded on 30th March 2006 (3rd April, Condong sites). Stalk numbers in each of the two rows were recorded. Counting stalks in 25cm increments allowed an assessment of the extent of gaps along the row. If the 25cm counting increments with zero counts are expressed as a percentage of the row length it produces a very severe rating of gaps but can be used for comparative purposes.

The extent of gaps has been expressed three ways –

(a) total length of 25cm gaps was expressed as a percentage of 10m of individual row and averaged across replicates,

(b) the number of gaps ≥ 0.5m recorded per 10m of individual row length (averaged across replicates) and,

(c) the number of occurrences when gaps of ≥ 0.5m are found opposite each other in a pair of dual rows (number per 20m of duals).

All blocks and treatments assessed were dual rows on 1.8m centres. Additional sites were assessed to compare the project planter with other dual row planters in NSW. The tables below summarise the results and present averages.

Zero till - Conventional till comparisons

Table 1. Effect of tillage on BN81-1394 variety planted with the Hodge planter (SRDC funded)(block 600 at R. Munro & Sons).

PROPERTY	TREATMENT	
	Conventional till prior to planting	**Zero till (planted into soybean stubble)**
Millable stalks/10m of individual row	98	111
Millable stalks/m of dual row	20[A]	22[A]
Millable stalks/ha	108,889*	123,333*
Percentage of 25cm gaps	28%	22%
Gaps ≥ 0.5m/ 10m of individual row	3	2
Number of gaps ≥ 0.5m occurring opposite each other in 20m dual rows	1	0

[A] Rounded to nearest whole number

*Calculated from millable stalks per 10m of individual row.

1 Year Old Harvest Data

In May 2006, nine months after planting, biomass sampling took place at the tillage trial that was established on Woodford Island in October 2005. Sampling allowed an accurate weight of cane to be measured across both treatments and also gave the grower the option to stand over the block of cane rather than cutting it at year old. The variety in this trial is BN81-1394. All other trials that were planted in 2005 are being stood over, and will be harvested as two-year plant cane in 2007. This data will be presented in a supplementary report that will be submitted at the end of 2007.

Figure 1: Individual replicate biomass for both the conventional and zero-tillage treatments. (R Munro and Sons, Farm 1277, Block 600)

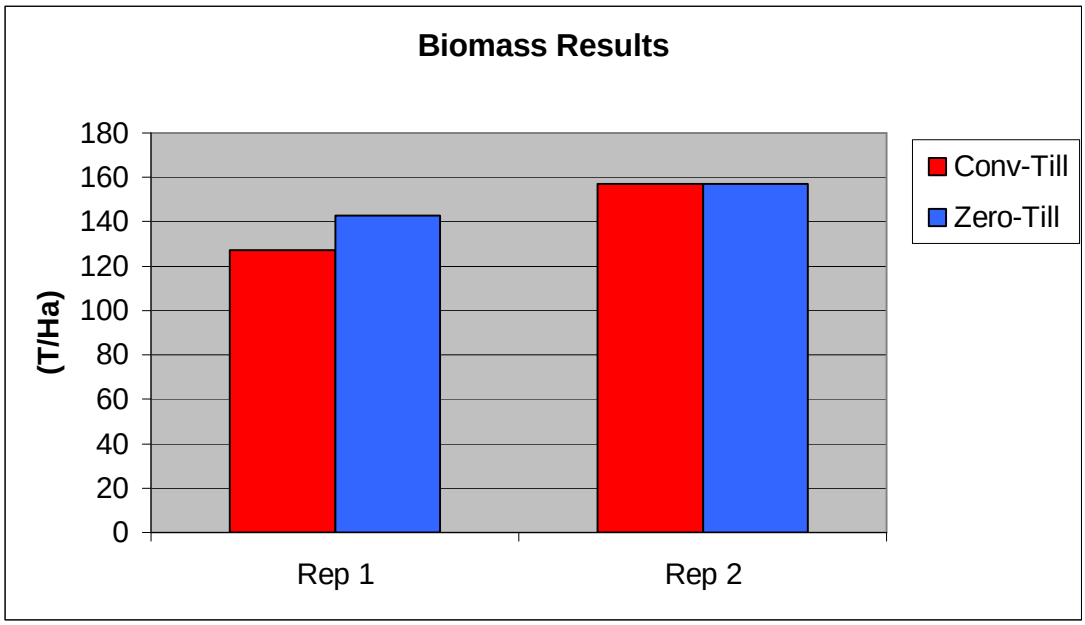
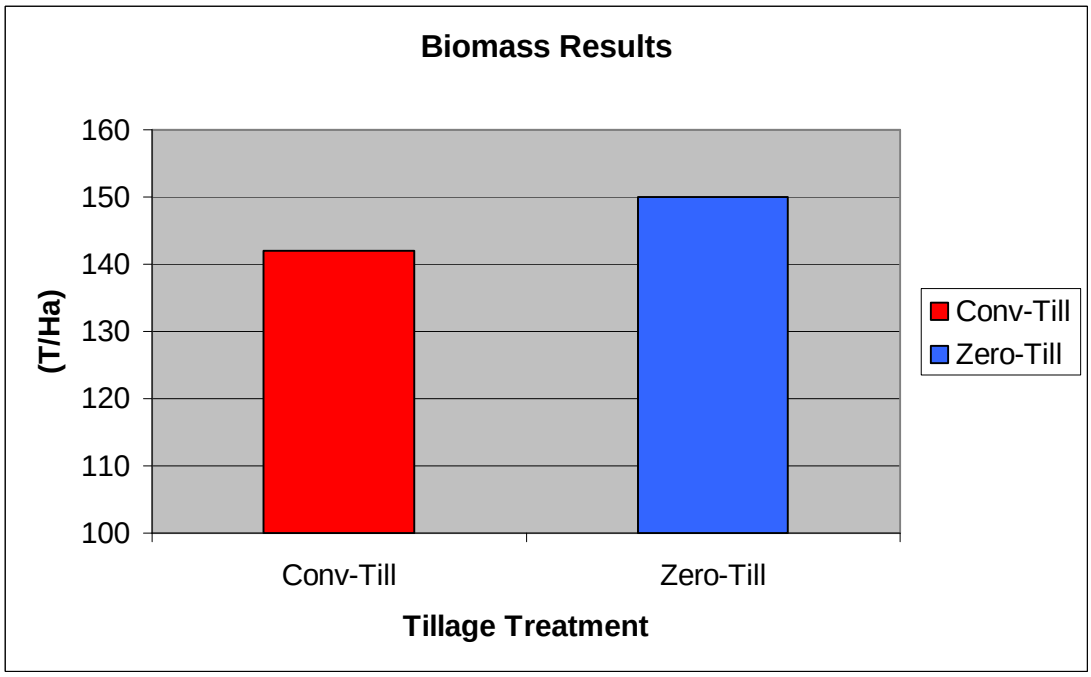


Figure 2: Shows mean treatment biomass for the conventional and zero-tillage treatments.

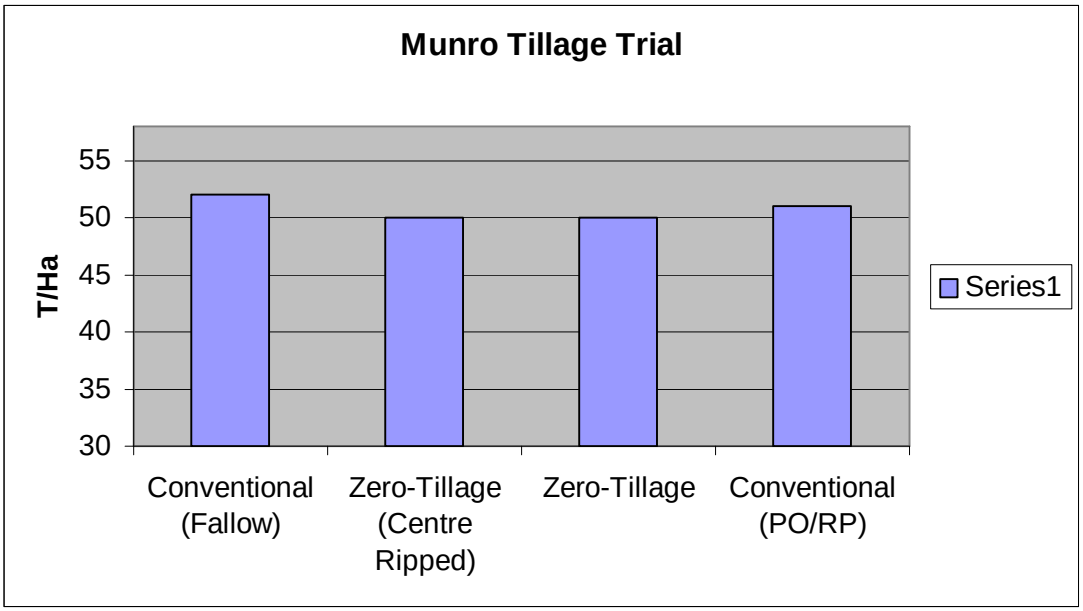


An analysis of variance was undertaken using Statistica version 5.0 to analyse the data from this trial. There was no significant difference observed ($p<0.05$) between the zero-tillage treatment and the conventional tillage treatment. In replicate 1 the zero-tillage treatment out-yielded the conventional till by 16 t/ha, with no difference in yield in replicate 2.

Another farming systems trial was planted in October 2005 and harvested as a plant 1 year crop in October 2006. All treatments were planted with the Hodge double disc opener to 1.8m dual rows with the variety Concord. The four treatments were:

- *Conventional fallow*, which was cultivated conventionally to gain a fine seedbed after a soybean fallow. This treatment yielded 52 t/acre
- *Zero-tillage/centre ripped.* The only work that this treatment had was a ripper tyne run straight up the middle of the row. This treatment yielded 50 t/acre.
- *Zero-tillage,* This section was totally zero-tillage and yielded 50 t/acre.
- *Conventional Replant,* This treatment was conventionally worked to prepare a fine seedbed following a cane crop. This was the only non-fallow treatment in the trial. This treatment yielded 51t/acre. This good result in the PO/RP section was possibly due to this paddock being relatively new to sugarcane production.

Figure 3: Effect of tillage on cane yield from the farming systems trial harvested on Woodford Island (R Munro and Sons, Farm 1277, Block 5320)



As there were no replications in this trial a statistical analysis was not carried out. With only 2 t/acre separating all four treatments we can be confident to say that there was no significant differences in yield between the four treatments. This result supports work conducted in the NSW farming systems project when similar yields were obtained from double-disc whole stalk planting in comparison to conventional tillage planting.

Just prior to harvesting this trial 150mm of rain was recorded. This gave a great opportunity to observe the differences in compaction/ stool damage between the zero-tillage and conventional tilled ground. Track machines were used to cut and haul in the trial block. Photos 4 and 5 illustrate the different compaction depth/stool damage between the two treatments.

Photo 4: Deep haulout ruts in convention-till

Photo 5: Minimal compaction in zero-till section

Harvest data will be collected from the following ratoon crop to see if any significant losses in yield occur from the extra stool damage associated with the conventional tillage treatment.

Shoot Counts

TABLE 2. Effect of tillage on Concord variety planted with the Hodge planter (SRDC funded) (block 5300 at R. Munro & Sons).

PROPERTY	TREATMENT	
	Conventional till prior to planting	**Zero till (planted into soybean stubble)**
Millable stalks/10m of individual row	97	96
Millable stalks/m of dual row	20[A]	20[A]
Millable stalks/ha	107,222*	106,111*
Percentage of 25cm gaps	25%	15%
Gaps ≥ 0.5m/ 10m of individual row	2	2
Number of gaps ≥ 0.5m occurring opposite each other in 20m dual rows	1	0

[A] Rounded to nearest whole number

*Calculated from millable stalks per 10m of individual row.

Results of stalk counts in both Munro's blocks 600 and 5300 indicate no adverse effects of zero till planting compared to conventional tillage. There was a trend (probably not statistically significant – no statistical analysis done to date) for zero till treatments to have fewer gaps than conventional tillage. In Block 600 there was a trend for the zero till to have higher stalk density, with no difference in millable stalk numbers between treatments in block 5300.

Hodge planter (SRDC funded) – modified Pioneer planter (Munro/McFarlane) comparison

Caution is required in interpreting the information shown in Table 3 below as the planter comparison is also across different blocks and there are soil type, soil moisture, planting date, etc. differences. There is anecdotal evidence that planting rates (t/acre) were similar for the two blocks/planters but no measurements were made of planting rate.

Table 3. Effect of planter and tillage on BN81-1394 variety (blocks 600 (Hodge) and 1700 (modified Pioneer) at R. Munro & Sons).

PROPERTY	**PLANTER**		
	Modified Pioneer (Munro/McFarlane)	**Hodge double disc (SRDC funded)**	
	TREATMENT		
	Conventional till prior to planting	**Conventional till prior to planting**	**Zero till (planted into soybean stubble)**
Millable stalks/10m of individual row	116	98	111
Millable stalks/m of dual row	24[A]	20[A]	22[A]
Millable stalks/ha	128,889*	108,889*	123,333*
Percentage of 25cm gaps	17%	28%	22%
Gaps ≥ 0.5m/ 10m of individual row	2	3	2
Number of gaps ≥ 0.5m occurring opposite each other in 20m dual rows	0	1	0

[A] Rounded to nearest whole number

*Calculated from millable stalks per 10m of individual row.

Hodge planted Q155

Table 4. Stalk densities and gap analysis for Q155 variety planted with the Hodge planter (SRDC funded) (block 3100 at Aljoy Plantations Pty Ltd).

PROPERTY	TREATMENT
	Zero till (planted into soybean stubble)
Millable stalks/10m of individual row	102
Millable stalks/m of dual row	20[A]
Millable stalks/ha	113,333*
Percentage of 25cm gaps	25%
Gaps ≥ 0.5m/ 10m of individual row	3
Number of gaps ≥ 0.5m occurring opposite each other in 20m dual rows	0

[A] Rounded to nearest whole number

*Calculated from millable stalks per 10m of individual row.

At this site (Table 4) the whole block was zero till. Three replicate 10m sections were counted in this block. There was a higher planting rate used when planting the last few rows on the southern side and one of the replicates was sited in these rows. However, stalk counts did not indicate any increase in stalk density in these rows (data not shown).

Modified Pioneer planter - North/Bartlett/Durrington Hodge planter comparison (Q210[A])

Table 5. Stalk densities and gap analysis for Q210 variety planted with the modified Pioneer (block 1700 at R. Munro & Sons) and with North/Bartlett/Durrington Hodge at Condong.

PROPERTY	TREATMENT	
	Pioneer - Conventional tillage	**Hodge – Condong (M. North) Zero till**
Millable stalks/10m of individual row	110	120
Millable stalks/m of dual row	22[A]	24
Millable stalks/ha	122,222*	133,333*
Percentage of 25cm gaps	15%	13%
Gaps ≥ 0.5m/ 10m of individual row	2	1
Number of gaps ≥ 0.5m occurring opposite each other in 20m dual rows	0	0

[A] Rounded to nearest whole number

*Calculated from millable stalks per 10m of individual row.

The comparison shown in Table 5 is affected by a range of factors other than different planters. However, it shows that there is no disadvantage in stalk density or gaps with zero till established cane.

2006 ESTABLISHED TRIALS

Planting Rate Trial

Following on from the tillage trials that were planted in 2005, a planting rate trial was set up to establish an optimum planting rate to gain maximum yield. Previous work carried out during the NSW Farming system project has shown that stalk planting dual rows at 2 t/acre has yielded similar to billet planted duals planted at 4.5 t/acre. Intensive shoot counts carried out in the NSW farming system project has shown that duals rows planted at 4.5 t/acre have produced up to 250,000 shoots per hectare at between 90-120 days after planting, only to carry around the 80,000 stalks/ha through to harvest. This trial aimed to reduce this 'crowding out' effect by planting at a lower rate but still having the optimum number of millable stalks at harvest.

The variety Empire was used in this trial, which was planted with the Hodge dual row double disc-opener planter. Two different rates were used, a high rate (5.6 t/acre) and a medium rate (4 t/acre). Following on from planting, measured sections of row were dug up and billet weights, viable billet numbers and viable eye numbers were recorded. This benchmarked the different planting rates and showed a clear distinction between treatments.

Table 6: Planting densities (weight, viable billets, viable eyes) for both the heavy and medium rate treatments.

Heavy Rate (5.6 t/acre)

Dual rows 1.8m	Weight (kg)	Viable Billets	Viable Eyes
Total/m of bed (avg)	2.5	15	18
Planting Rate (T/Acre)	5.6		

Medium Rate (4 t/acre)

Dual rows 1.8m	Weight (kg)	Viable Billets	Viable Eyes
Total/m of bed (avg)	1.8	11	12
Planting Rate (T/Acre)	4		

Table 6 illustrates the variation in the two treatments with a most notable difference in the viable eye counts. In the high planting rate the viable eye count/m of bed was 18 with the medium rate count being 12. Work carried out by the SYDJV has shown that six viable eyes/m of individual row or 12 viable eyes/m of bed is adequate to gain maximum yield. Therefore the medium planting rate should have adequate planting material to maximise final yield.

Following on from this planting rate data, shoot count data was recorded at 90 days after planting.

The shoot count data illustrated in Table 7 shows that the cane planted at the higher rate (5.6 t/acre) has about 40,000 shoots/ha more than the cane planted at the medium rate (4.t/acre). Again there appears to be enough shoots/m of dual row (14) in the medium planting rate to maximise millable stalk count and in turn yield.

Table 7: Effect of planting density on shoot counts at 90 days after planting

PROPERTY	TREATMENT	
	High Rate Planting (5.6t/acre)	**Medium Rate Planting (4t/acre)**
Shoots/10m of individual row	106	68
Shoots/m of dual row	21[A]	14[A]
Shoots/ha	117,418	77,784

[A] Rounded to nearest whole number

ECONOMIC EVALUATION

One of the main aims of carrying out trial work was to carry out an economic evaluation between a zero-tillage system and a conventional system. Table 8,iIllustrates the operations that took place between soybean harvesting and cane planting in the zero-tillage vs conventional tillage trials. There are substantial differences in pre-plant operations between the zero-till and conventional tillage system. Yield has been based on results from Munro's biomass harvest which indicated no significant differences in yield between the two systems. Various assumptions have been made in the economic analyses, which are listed below.

- Fuel 91c/L (after rebate)
- Cane price = $25/t
- Harvesting costs $5/t
- No significant difference in yield between conventional tillage and zero-tillage
- Machinery costs calculated from BSES Machinery cultivation costs spreadsheet

Table 8. An economic analysis of a conventional vs zero-tillage farming system.

	Conventional Tillage	**Zero-Tillage**
Yield	150 t/ha	150 t/ha
Gross Return Less Harvest Costs	$3000/ha	$3000/ha
Less Input Costs		
Roundup Application pre- plant (3L/Ha)	$19/ha	$19/ha
Roundup application post-plant	-	$19/ha
Ripping	$36/ha	-
2 X Rotary hoeing	$104/ha	-
Herbicide application (Dual Gold @ 1.5l/ha and Gramoxone @ 1l/ha)	$54/ha	$54/ha
Multi-weed	$9/ha	$9/ha
Fertiliser (2 bags/acre urea)	$238/ha	$238/ha
Herbicide application	$34/ha	$34/ha
Total Costs	**$494/ha**	**$373/ha**
Net Return	**$ 2506/ha**	**$2627/ha**

The economic analysis indicates that a net return of $2627/ha for a zero-tillage farming system compared to $2506/ha for the conventional farming system. This equates to a $121/ha saving when adopting the reduced input system.

By adopting a reduced tillage system there are various other benefits that are not outlined in the economic analysis above. Excessive cultivation associated with conventional planting methods results in poorly structured soils. Cultivation reduces the number of beneficial soil micro-organisms and contributes to the loss of nutrients from the soil that are built up during the fallow period. The implementation of zero-till planting helps address these issues.

Growers in the three mill areas of NSW experienced wet spring planting conditions in 2006, resulting in many fields with more strikes and some with failed germination. This contrasts with good results achieved where growers were direct drilling with the hodge planter into raised beds.

A major advantage of converting to a zero-tillage system is the reduction in labour time. Labour was not included in the economic evaluation. A comparison in time spent in both systems (using operations outlined in table 2) has shown that in a conventional tillage system, 3.2 hrs/ha extra time is spent in preparing the seedbed for planting. On a property that is planting 20ha/year this equates to a 64hr saving in time or more than five, 12hr days. If a grower was paying an employee $20/hour this equates to a cost of $64/ha. By adopting zero-tillage a grower spends less time in the field allowing more time on other operations, or is able to take on extra land to increase production and increase the sustainability of the system.

EXTENSION

Since the project began in 2005 there has been a widespread extension program in place to communicate all results gained from the grower group. Extension staff from the NSWSMC and the BSES have been actively involved in the project and along with members from the NSW farming systems group have held numerous field days, canecheck meetings, farm walks and field demonstrations.

Photo 6. A Harwood CaneCheck group listens to Alister McFarlane (grower group member) describe the use of the project planter to plant cane into soybean stubble.

When the Hodge planter was in use, local growers were contacted to give them a chance of seeing the planter in operation. In 2005 demonstrations of zero-till were conducted at 8 sites across the three mill areas. The majority of growers were impressed with its capability and saw how this concept could be introduced into their own farming system. A lot of growers realised that modifications were needed to be made on the planter to fine tune its capability across various conditions.

The planter was taken to the 2006 NSW Farming System Field Day held in April, where over 150 growers were in attendance. At this field day there was a lot of grower interest in the zero-tillage system, and a number of enquiries were made about the availability of the planter in the 2006 planting season.

Work carried out by the NSW Farming Systems Group on zero-tillage planting was presented at the 2005 GIVE Day held at the Burdekin Agricultural College. Group members Alan Munro and Nathan Ensbey presented information on how the planter performed across NSW and issues that need to be addressed by the group to make this type of system a commercial reality. The group members received positive feedback from their work to date and were asked a number of questions from interested growers after the presentation.

In March 2006 a grower group from Bundaberg/Maryborough travelled through the NSW cane industry. This group took the opportunity to inspect the Hodge planter and also inspected one of the trial sites at Harwood. The group was keen to adopt such a system in their own region, and enquired about possibly hiring the planter off the NSW Farming Systems Group to carry out research.

In October 2005 a grower group from the Plane Creek milling district visited NSW. The group had the opportunity to view the zero-till planter planting through soybean stubble in Harwood. The majority of growers in the group had experience using disc-openers and were able to give us some ideas on how we could improve the planters operation. On some of the harder/dryer soils the planter front was having trouble penetrating the ground. A couple of growers indicated that on their own planters they have 1 tonne fertiliser boxes on the front frame which keeps the discs in the soil, across all soil types.

After the 2005 planting season two members from the grower group Mark North and Allan Munro visited a number of growers who zero-till plant using the Hodge double-disc planter in Queensland. As a result of this interaction the NSW Grower Group aimed addressed a number of issues that can be seen in the planter modification section of the report.

Demonstrations that were carried out in the 2005 planting season created a lot of interest and resulted in a number of growers trialing the system in the 2006 season. Over the past two years 23 growers across the three NSW mill areas have used the Hodge to plant a total of 210 hectares of both trial and commercial areas of cane. It is estimated that up to 200 hectares will be planted with the Hodge in 2007 demonstrating that the system is gaining momentum every year.

Since the project has begun there has been a number of growers keen to modify their existing planters to have zero-tillage capability. One Harwood planting contractor has purchased a new locally built (Sanderson) planter which incorporates Hodge style double disc openers, (see photo 7). Another Harwood grower purchased Hodge engineering discs and had a local engineering shop modify his Austoft billet planter to suit. (see photo 8). Various other growers have also shown a keen interest in modifying their own planters and more modifications are expected for the 2007 plantings.

Photo 7: Modified Sanderson planter

Photo 8: Modified Austoft planter

Photo 9: Demonstration of the zero-till planter at Alister McFarlane's trial site at Harwood.

A number of articles have been published in newsletters that are sent out to all cane growers in NSW. By doing this, growers who are unable to attend canecheck meetings etc are still able to read about trial work and results. Some of the articles that have been circulated are included in Appendix 2.

PLANTER MODIFICATIONS

Soil break-out was a universal issue when planting on heavy soils and could only be overcome by slowing planting speed down to around 3.5 km\hr. Various options were looked at, including a scraper arrangement developed by Merv Russell at Rocky Point. Alan and Mark whilst in Mackay visited Hodge Industries and Wayne Willis showed them the new disk scraper arrangement that should reduce dirt throw away from the planting slot. Hodge have supplied another set of discs with a reduced opening angle, which should reduce break-out, as long as the internal width is still wide enough to allow billets to move freely without blockage. The side press wheel modification was created to stop soil break-out from the side of the disc and allow an even cover of dirt on the set. The wheel requires some modification to stop dirt build up inside the hub as this caused the wheel to block up and stop spinning. These modifications will be carried out in 2007 (see photo 10)

Photo 10: Side press wheel modification to overcome break-out.

Billet blockages were a problem in the 2005 planting season. This was overcome initially by shortening of the Teflon chutes that feed the billet down into the discs. However some blockages were still occurring when planting ceased in 2005. Billet lengths for 2005 NSW trials were usually in the range 275 - 300mm and Qld growers with more experience of the Hodge/Moller style of planter mechanism suggested we need to consider reducing billet lengths to 225 - 250mm range for this planter. This was done on a number of farms in 2006 and resulted in less blockages and a more even feed.

Several Qld growers have placed a 200-250mm spacer in the planter between the elevator pick-up and bin in order to reduce “bridging” of billets that occurs and stops the elevator feeding uniformly. This spacer increases the volume of the pick-up area and thus reduces the pressure on the planter operator to be continually bringing billets forward from the rear trailer into the pick-up area (see photo 11).

Photo 11: Shows the spacer modification.

Mounting a simple needle pointer that is visible to the planter operator indicates when the steerable trailer wheels are properly centred and thus are tracking correctly.

At a few sites planted with the Hodge in 2006, pineapple disease was detected. Due to the cool wet planting season experienced in NSW the conditions were conducive for this disease. As a result two more fungicide outlets will be attached to the planter before the 2007 planting season to allow for a more reliable cover of Shirtan. The group also intends to trial some zonal tillage in 2007 to increase soil temperatures in the planting zone to aid germination early in planting season.

A disc penetration issue occurred when planting a block in the Harwood mill area under dry soil conditions. Weights were attached to the planting frame in 2006 following similar trouble with soil penetration in 2005. In the majority of cases this worked well, but in a late planted block even with the weights on the planter, the discs were having trouble penetrating the ground. In Queensland the majority of growers zero tilling through soybean stubble are slashing their beans off prematurely to preserve moisture and then planting through the stubble in autumn.

In NSW, growers harvest their bean crops in May/June, and don’t plant until September/October. In some instances, (especially late plant) this extra time between harvesting soybeans and planting cane allows the soil to becoming increasingly difficult to penetrate due to it drying out. Spring is typically the driest time of year in northern NSW and the later paddocks are zero-tilled, the harder the ground is becoming, causing the penetration and covering issue. As a result the NSW farming system group will be trialing a set of narrower discs in 2007 to try and overcome this issue. The group also investigating the use of a zonal (strip/vertical) tillage machine called the Soil Warrior to address the issue. (see photo 12).

Photo 12: Soil Warrior

The group is keen to look closer at the metering system on the Hodge billet planter due to there still being some gaps in the established crops. Slow motion photography is one option the group is looking at in 2007 to focus on the pick up area in the elevator boot.

Other modifications the group is keen to carry out include, delivering the billets into the ground at the back of the discs where the slot is at its widest. This will reduce the level of billet stacking an increase set to soil contact.

The group is also keen to attach flexible spring rollers to the planter to crush large clods that form in the furrow after the press wheels run over the set and thus get more even set coverage. Photo 13 shows the flexible spring in action in broadacre cropping.

Photo 13: Auspoint Press harrow

As a result of the successful trial and extension work carried out in 2005 and 2006, there is an increasing number of growers who are keen to trial zero-tillage planting on their own farms. This, coupled with the NSW grower group wanting to further refine the planter, it will be modified and made available for trial work and commercial plantings in the 2007 season.

COMMENTS ON THE HODGE PLANTER

- Capable of planting in direct drill and conventionally cultivated fields
- Leaves raised beds relatively in tact during planting compared to conventional runner opener which destroys the beds
- Soil disturbance and planter penetration may be improved by using narrower double discs, but this may cause poorer set to soil contact due to billet “stacking” during planting (test this pre 2007 Spring planting)
- Soil break-out is an issue when planting heavy soils and restricts planter speed to 3–4 km/hr
- Fitting Kinze side wheels fixes this and planter speeds 7-8 km/hr possible on heavy soils (further improvements proposed for Spring 2007)
- Billet lengths of 225-250 mm seem to produce the most even metering, producing less blockages
- Good metering is only possible if supplying clean material to the planter

- Achieved good plant stands at planting rates of 8.75 t/ha with varieties like Q203 and Q205
- Still occasionally get 1-3 m gap in one of the dual rows due to chain not picking up billets. Reason is unknown and hope to use some slow motion photography to try and improve the metering
- Good fungicide coverage from sprays at much lower rates than the conventional dip billet planters
- This lower fungicide rate coupled with more targeted spray poses less of an OH&S issue for the planter operator
- Relatively small pick-up area for the billet metering means the planter operator has to keep focused on bringing billets forward
- Self-centreing wheels on planter trailer simplifies the planter operator's task, but it is currently an expensive modification

CONCLUSION

Until recently, the availability of a zero-till billet planter has been limited, with all farming systems trial work being done with a disc-opener whole-stick planter. Although the establishment of this zero-till cane has been promising, growers do question the commercial credibility of the whole-stick planter. Over the past two years the NSW Farming Systems group has been dedicated to creating a farming system that included zero-tillage billet planting of sugarcane through soybean stubble. After gaining funding to purchase a zero-till dual row planter the group has been actively involved in gaining knowledge through networking with growers throughout the Australian sugar industry and through carrying out trial work and in turn modifying the Hodge planter to suit local conditions.

Trials that were planted in 2005 illustrated that there was no yield decline by zero-tilling cane into soybean stubble when compared to planting into conventionally worked ground. A subsequent economic evaluation demonstrated that savings of up to $121/Ha could be made by adopting such a system. This saving doesn't take into account timesavings made by reductions in cultivation and improvements in soil health in moving into such systems, or the better timeliness of operations possible with direct drilling.

One of the major limitations of the zero-tillage system is maintaining the controlled traffic system from the soybean crop through to cane planting. Most of the soybean crops in NSW are harvested by contractors with headers set up on 2.8m axle widths. For a true controlled traffic system to be implemented headers need to be modified to either 1.8m/1.9m (straddle one bed) or 3.6m (straddle two beds). Several growers in NSW have successfully carried out these modifications to headers and they are achieving good results with direct drilling their crops.

Over the past two years 23 growers across the three NSW mill areas have used the Hodge to plant a total of 210 hectares of both trial and commercial areas of cane. This has given disc-opening technology broad exposure across both the NSW Industry and wider sugar cane farming areas. The NSW Farming systems group in conjunction with the BSES and the NSW Sugar Milling Cooperative have held numerous field days, farm walks and cane/check meetings to extend results. From this there have been a number of growers either purchase or modify planters to have similar capability to the Hodge planter.

The NSW Farming systems group is committed to making the concept of zero-tillage cane planting a commercial reality. In most cases this has already been realised, but some work still needs to be carried out to make this a more robust system. The group plans to carry out further modifications to the planter and give the industry further exposure to this system in the future to increase the adoption of the new farming system.

NSW FARMING SYSTEM GROUP – LIFE AFTER GGP009?

- Core people in the initial group came from the members of the NSW Farming System Project (NSC005) Steering Committee
- Initially a single issue group focused on developing direct drill billet planting capability into soybean residue
- Success on the RD&E side with this project has seen the focus widen to address other issues emerging with the adoption of our “new” farming system
- Development by the growers and funding by SRDC of Travel and Learning Opportunity NFS001 “Increasing the knowledge of raised bed farming by the NSW Farming Systems Group” will address another integral part of our new farming system, hopefully as successfully as GGP009

- SRDC's recent approval of the group's R&D project, FPP034 "An integrated approach to nutgrass control", marks the groups first exposure to running their own project. The group strongly supports this project because nutgrass has proliferated in our plough-out/replant and zero till cropping systems. A move to a soybean/fallow phase introduces real opportunities to target the nutgrass explosion.

There are challenges in operating a grower group over three Mill areas and 220 kms, but this is offset by very strong support from group members, NSWSMC Agricultural staff and BSES Officers.

The group aims to collect data from there trials throughout the whole life cycle of the crop to see if any variation in yield occurs in later ratoon crops. These results will be communicated to the wider sugar industry by growers from the NSW farming systems group, staff from the NSWSMCo and BSES.

Trial work to date has demonstrated that cane can be zero-tilled through soybean stubble across a number of soil types without yield decline. Continued work from members of the NSW Farming Systems Group will help fine tune the zero-till planter, so that it is an intergral part of a robust new farming system. Growers from the NSW Farming Systems group can be pleased with the progress of this project, as the main goals have been achieved, and the group is committed to future work on this and many other projects.

APPENDIX 1: GROWER GROUP MEMBERS

Harwood

Alan Munro

Alister McFarlane

Nathan Ensbey

Peter Rose

Lewis Hughes

Jonathon Hirst

Condong

Mark North

Anthony Durrington

Dave Bartlett

Stuart Haw

Kevin Twohill

Broadwater

John Clarke

Geoff Pye

Wayne Rodgers

Jim Sneesby

Bert Plenkovich

John Elliott

Tom Walsh

APPENDIX 2: ARTICLES THAT HAVE BEEN PUBLISHED IN NEWSLETTERS TO PROMOTE THE PROJECT

Guidance Used to Establish Soybeans

Geoff Pye in a block of soybeans that were established using GPS technology

By adopting GPS technology and controlled traffic farming in the soybean phase of the farming system, East Coraki farmer Geoff Pye aims to reduce costs of growing the subsequent cane crop. " By planting our beans on controlled traffic lanes using GPS and then harvesting the beans on the same traffic lanes there won't be any compaction in the growing zone. This means less work when preparing a seedbed." Geoff plans to only work ground where the cane is to be planted leaving the wheel tracks firm.

The fallow blocks were scribed using GPS on a 1.8m row spacing and planted by a contractor whose planter was set up to plant three, four row beds at a time. Geoff's beans are going to be harvested by John Clarke who will have his soybean header wheels set on 3.6m spacings which will allow it to straddle two beds at a time and maintain the controlled traffic laneways. Following the success of trial work conducted with the zero-till dual row planter, and minimum tillage planting that Geoff carried out on a commercial scale last year he is certain this is the way to go.

Zero-Till Planting Shows Potential

During the 2005 planting season a number of trials were set up comparing zero-till planted cane through soybean stubble with cane planted through conventionally worked ground. One site was at Tom Walsh's property at Woodburn where Q203 was the variety planted. There has been an excellent establishment of cane in both the treatments, illustrating that the direct drill system can reduce cultivation costs while maintaining yield. " This low cost system has huge potential.

Tom Walsh in a block of dual row Q203 that directly drilled through soybean stubble

There is no difference at all between the cane that was directly drilled through the soybean stubble and cane that was planted into conventionally worked ground." This was the first time a billet planter with disc openers was used to establish zero-till cane. " The planter is not perfect yet and requires some modifications to the covering system, but as you can see (see photo) the potential for this system is there."

Dual-row/zero-till cane planting trials

Following the successful establishment of zero-till cane planted into soybean stubble in 2005, additional trials were established in 2006 using the Hodge planter with double disc openers. Once again the double disc system worked well at sites where cane was zero-till planted into beds that had previously grown soybean (see photos). At two sites where the beds were not cropped to soybean but had been established mid year and received 5 to 6 inches of rain in late August, the beds had to be lightly hoed prior to planting due to hard setting.

As more growers adopt dual row planting we have been measuring planting rates for various dual row planters. This involves digging up measured lengths of row and recording viable billets, viable eyes and weight of cane planted and has helped growers refine the planting rate for dual rows. The results indicate that the important factor is the number of viable eyes rather the tonnes of cane per acre in the ground. Trial work has indicated that around 6 eyes per meter of individual row (12 eyes/m of dual row bed) is adequate. In most cases Harwood growers were getting between 12 and 24 eyes/m of dual row. A satisfactory planting rate of 6 or more eyes per meter of row might be achieved with 3.5 tonnes BN81-1394 per acre whereas for Empire around 5 to 5.5 tonnes per acre might be the planting rate.

At Harwood 15% of the mill area is currently planted to dual rows. If these growers had 100% of the farm planted to this configuration it would amount to 25% of the mill area.

Zero till

Q203 planted directly into soybean stubble