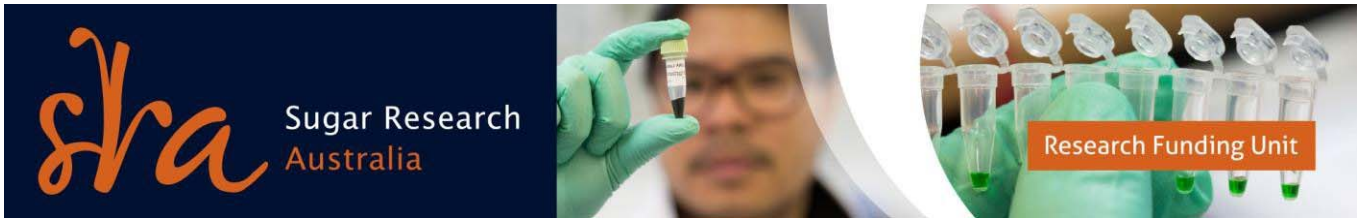
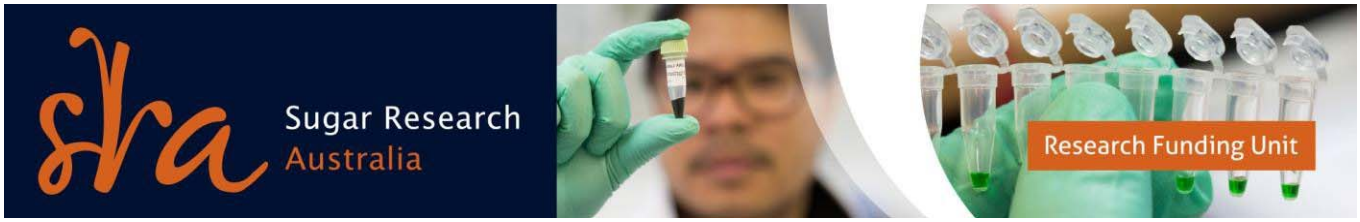


SRA Grower Group Innovation Project
Final Report

Improvement of internal soil drainage and yield on heavy clay soils in the Herbert - final report 2010/053

SRA Project Code	**Project #- GGP053**		
Project Title	Improvement of internal soil drainage and yield on heavy clay soils in the Herbert.		
Group Name	LUMPS Farming		
Chief Investigator(s)	Vince Russo		
Project Objectives	Project Objectives: Assess and evaluate practices which could potentially improve internal soil drainage and cane yield. The trials will provide growers with opportunity to access different practices and their cost effectiveness to improve crop establishment, cane yield, ratoonability and internal soil drainage.		
Milestone Number	Final report		
Milestone Due Date	1 March, 2015	**Date submitted**	28 February, 2015
Reason for delay (if relevant)	Lawrence Di Bella was unable to submit the final report on 1 December, 2014 because he was carrying for ill family members and then became ill himself.		
Milestone Title	Final Report		
Success in achieving the objectives	☒ Completely Achieved □ Partially Achieved □ Not Achieved		
SRA measures of success for key focus area			



Please cite as: Russo V. 2015. Improvement of internal soil drainage and yield on heavy clay soils in the Herbert : final report 2015. 2010/053. Sugar Research Australia Limited.

PART A

Section 1: Executive Summary

The Herbert consists of large areas of clay soils being approximately 60% of soils being sugarcane farmed within the region. These soils are usually nutritionally fertile; however yield potential is limited due to waterlogging. Surface drainage has been improved through laser levelling throughout the district, however yield potential is not fully realised due to limitations associated with internal soil drainage. The soils are prone to significant nitrogen losses associated with denitrification and anaerobic conditions which limit crop growth when waterlogging does occur.

The project investigated biological, mechanical and cultural practices which may increase the productivity of these soils. The project has clearly shown that yields can be increased on heavy clay soils in the Herbert through the use of mill ash as a soil amendment. The use of mill ash has also clearly shown that the product will enhance germination, crop establishment and increase stalk density leading to increases in cane yield on heavy clay soils in the Herbert.

Qureshi *et.al* (2000) highlighted that there was significant environmental benefits for transporting and applying mill by-products further from the mill site, to manage environmental hazards. This project has highlighted both the economic and environmental benefits of using mill by-products more effectively in a farming system. During the duration of the project SnE Plant Hire constructed a GPS zonal mill mud and ash applicator and has modified its fleet of trucks to allow for zonal application of mill by-products; this has been a very positive step in the handling and distribution of mill by-products in the Herbert.

Section 2: Background

The Herbert consists of large areas of clay soils being sugarcane farmed within the region. These soils are usually nutritionally fertile; however yield potential is limited due to waterlogging. Surface drainage has been improved through laser levelling throughout the district, however yield potential is not fully realised due to limitations associated with internal soil drainage.

This project investigated 5 methods to potentially increase internal soil drainage and cane yields. Methods assessed were:

1. Conventional land preparation (including deep ripping)
2. Mill ash filled slot on a preformed mound on GPS
3. Mill ash broadcast
4. Mound pre wet season and zonal tillage on GPS
5. Bioactivate®, with conventional land preparation

In the initial project proposal mole draining was proposed as a method for assessment, however it was decided that this method was not feasibly possible. Mole draining of most clay soil blocks in the Herbert is not feasible because the landscape is extremely flat and there is nowhere to effectively drain the water to.

Section 3: Outputs and Achievement of Project Objectives

Activities undertaken at the trial.

The trial site was planted between the 4th and 5th of August with KQ228.

Prior to planting the following activities occurred to prepare the block for planting, refer to figure 1. Figure 2 highlights the practices undertaken in the first ratoon crop.

Figure 1. Practices undertaken on the trial between November, 2011-August, 2013.

Treatment	Practices undertaken (November, 2011- August, 2013)
Conventional land preparation	• 2 discing to plough out old crop • Spray with Roundup Power Max @ 4L/ha in April • Spray with Roundup Power max @ 3L/ha in June • Lime application @ 2.5t/ha • 2- tillage using coil tyned implement 1 week prior to planting • 2- ripping and hoeing 1 week prior to planting • Planting with a stick planter • GF351@ 348kg/ha of fertiliser • Sprayed with Sprayseed @ 1.6L/ha and Duirex @ 1kg/ha after 3 weeks after planting • 1 grubbing prior to hilling up • Side dress plant cane with CK50/50 @ 343kg fertiliser /ha • 1 hilling up • Sprayed with Stomp CR @3L/ha, Soccer @ 1.5kg/ha and Gramoxone @ 1.5L/ha
Mill ash filled slot on a preformed mound	• 2 discing to plough out old crop • Zonally apply mill ash @~100t/ha wet weight and mound • Spray with Roundup Power Max @ 4L/ha in April • Spray with Roundup Power max @ 3L/ha in June • Lime application @ 2.5t/ha • 2- zonal ripping and hoeing 1 week prior to planting • Planting with a stick planter • GF351@ 348kg/ha of fertiliser • Sprayed with Sprayseed @ 1.6L/ha and Duirex @ 1kg/ha after 3 weeks after planting • 1 grubbing prior to hilling up • Side dress plant cane with CK50/50 @ 343kg fertiliser /ha • 1 hilling up • Sprayed with Stomp CR @3L/ha, Soccer @ 1.5kg/ha and Gramoxone @ 1.5L/ha
Mound pre wet season and zonal tillage on GPS	• 2 discing to plough out old crop • Mound • Spray with Roundup Power Max @ 4L/ha in April • Spray with Roundup Power max @ 3L/ha in June

	• Lime application @ 2.5t/ha • 2- zonal ripping and hoeing 1 week prior to planting • Planting with a stick planter • GF351@ 348kg/ha of fertiliser • Spray with Sprayseed @ 1.6L/ha and Duirex @ 1kg/ha after 3 weeks after planting • 1 grubbing prior to hilling up • Side dress plant cane with CK50/50 @ 343kg fertiliser /ha • 1 hilling up • Sprayed with Stomp CR @3L/ha, Soccer @ 1.5kg/ha and Gramoxone @ 1.5L/ha
Mill ash broadcast	• 2 discing to plough out old crop • Broadcast application of mill ash @ 200t/ha wet weight • Spray with Roundup Power Max @ 4L/ha in April • Spray with Roundup Power max @ 3L/ha in June • Lime application @ 2.5t/ha • 2- tillage using coil tyned implement 1 week prior to planting • 2- ripping and hoeing 1 week prior to planting • Planting with a stick planter • GF351@ 348kg/ha of fertiliser • Sprayed with Sprayseed @ 1.6L/ha and Duirex @ 1kg/ha after 3 weeks after planting • 1 grubbing prior to hilling up • Side dress plant cane with CK50/50 @ 343kg fertiliser /ha • 1 hilling up • Sprayed with Stomp CR @3L/ha, Soccer @ 1.5kg/ha and Gramoxone @ 1.5L/ha
Bioactivate®, with conventional land preparation	• 2 discing to plough out old crop • Spray with Roundup Power Max @ 4L/ha in April • Spray with Roundup Power max @ 3L/ha in June • Lime application @ 2.5t/ha • 2- tillage using coil tyned implement 1 week prior to planting • 2- ripping and hoeing 1 week prior to planting • Planting with a stick planter • GF351@ 348kg/ha of fertiliser • Sprayed with Sprayseed @ 1.6L/ha and Duirex @ 1kg/ha after 3 weeks after planting • 1 grubbing prior to hilling up • Side dress plant cane with CK50/50 @ 258kg fertiliser /ha and Bioactivate® @125kg/ha • 1 hilling up • Spray BioBoost® 2L/ha • Sprayed with Stomp CR @3L/ha, Soccer @ 1.5kg/ha and Gramoxone @ 1.5L/ha

Figure 2. Practices undertaken on the trial between August, 2013- September, 2014.

All treatments received the same practices during this period. The treatments are as follows:

- Fertiliser application in mid-November 2013 (the potassium and sulphur rates were not varied where mill ash was applied).
- Sprayed with 2,4-D @ 0.8L/ha, Starane @ 0.8 L/ha and Tordon @ 0.75 L/ha in January 2014.

Soil tilth, land preparation and tiller counts

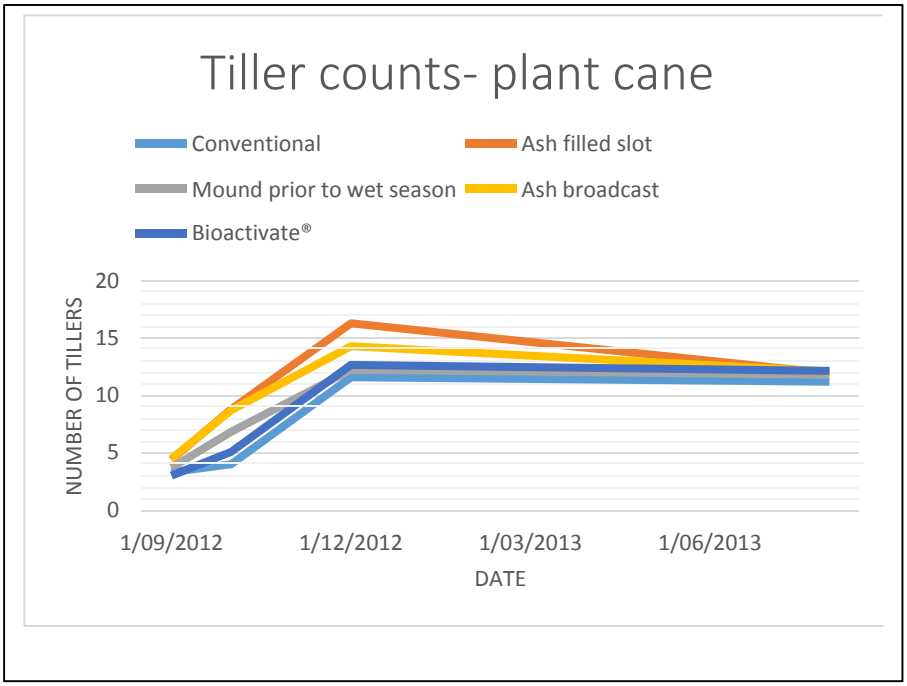
Figures 3, 4, 5 and 6 are photographs of activities undertaken prior to planting.

Figure 3. Zonal ripping and rotary Hoeing before planting on the pre-formed bed treatments- late July, 2012.

Figure 4. Treatment on the right is zonal applied mill ash and treatment on the left is conventional tillage before planting- late July, 2012.

Figure 5. Preformed mounds prior to the wet season; note the large clods present- December, 2011.

Figure 6. The conventional land preparation treatments prior to the wet season- December, 2011.



The soil condition at planting was noticeably different between treatments. The conventional prepared treatments had considerably larger clods present at planting, while both mill ash treatments and the mound pre wet season and zonal tillage on GPS treatments had less larger clods and more finer particles at planting. Figure 7 are the tiller counts for the trial in plant cane.

Figure 7. Tiller counts throughout the plant crop till harvest. Germination (tiller counts) and establishment was noticeably better on the mill ash treatments compared to the conventional land preparation treatments (refer to figure 7). Refer to figures 8 and 9 for photographs of different germinations between treatments. Figure 9 highlights the differences in soil colour between the mill ash application and conventional land preparation treatments after planting.

Figure 7. Improved germination in zonal mill ash treated treatments compared to the conventional treatment.

Figure 8. Enhanced cane germination in the broadcast mill ash treatment (on left) compared to conventional land preparation (on right).

Figure 7 indicates that the crop did not sustain the higher tiller numbers in the ash treatments by harvest time and there was no significant difference (lsd 5%) between any treatments for the number of tiller.