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SRDC Grower Group Innovation Project final report SECMAPPER (Soil Electrical Conductivity Mapper): mapping soil electrical conductivity patterns below trash blankets and stubble

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SRDC Grower Group Innovation Project
Final Report

SRDC project number: GGP057

Project title: SECMAPPER (Soil Electrical Conductivity Mapper): a new machine for mapping soil electrical conductivity patterns below green cane trash blankets and crop stubble

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The EMMIT Grower Group is not a partner, joint venture, employee or agent of SRDC and has no authority to legally bind SRDC, in any publication of substantive details or results of this Project.
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1:0 Executive Summary:

The SRDC funded Grower Group SECMAPPER (Soil Electrical Conductivity Mapper) project has modified an existing VERIS 3100 soil mapping system to map bare soil blocks through to blocks with thick trash and stubble residue layers.

As a part of the project the Grower Group also investigated the following:
- Opportunities to map soil differences with a cane block;
- Compare the modified VERIS 3100 (SECMAPPER) electrical conductivity readings with the standard VERIS 3100 unit;
- Identifying potential saline and sodic soils within a cane block through the use of the VERIS 3100 unit;
- Compare two soil mapping systems being the VERIS 3100 and EM38 systems.

The EMMIT (Electro-Magnetic Mapping in Trash) Grower Group consisted of growers from the Herbert and Burdekin cane growing regions. The Grower Group gave the growers the opportunity to network and work together on the advancement of electrical conductivity (EC) mapping and precision agricultural activities in each district.

The grower group was supported by technical support personnel from the following agencies: Herbert Cane Productivity Services Limited (HCPSL), Ag Data Solutions, Farmacist, BSES Limited, Terrain NRM and Soil Horizons.

The Grower Group would also like to thank SRDC and Rabobank for providing financial assistance to the project.
The SRDC funded BPS001 project and this project have progressed the development and use of soil mapping systems like the VERIS 3100 system in the Australian cane industry. There are now significant areas in the Central, Burdekin and Herbert cane growing regions now being mapped utilising these systems; as a part of precision agricultural systems being adopted in the Australian industry.

2:0 Background:

There were severe limitations in the use of the currently available VERIS 3100 soil mapping systems in thick trash or stubble residue layers. The project objective was to modify an existing VERIS 3100 unit to map soils with thick crop residues present. As a part of the project field validation and testing occurred to ensure that the electrical conductivity readings were similar between non crop residue situations and high crop residues.

Detailed soil mapping over a wide range of soils, environments, and farming systems were assessed in the project. The output from the VERIS 3100 (SECMAPPER) was also compared to crop yield maps, alternative soil mapping systems and other geo spatial data.

The group has forged new, cross-regional linkages between innovative growers in the Herbert and Burdekin in the design, construction, and testing of the VERIS 3100 (SECMAPPER) machine, and has built grower capacity in fundamental precision agricultural techniques.

3:0 Aims:

(1) Design and build the VERIS 3100 (SECMAPPER), a soil electrical conductivity mapping machine, that will be a stand-alone, tractor-mounted or trailer unit for collecting soil conductivity data below thick trash or stubble residue layers;

(2) Test, evaluate, and modify the machine through operations on grower group and other farms in the Herbert and Burdekin where VERIS 3100 data are available from soil EC mapping activities associated with SRDC project BPS001 and commercial projects.

The project will demonstrate the efficacy of the new machine across a wide range of soils and farming practices in the two districts, including: flood and overhead irrigation, rain-fed systems, green cane trash blankets, burnt cane trash, leguminous fallow crops, and high residue non-cane stubbles.

4:0 Methodology:

Before the modification of the VERIS 3100 unit it was agreed by the Grower Group to assess and compare the differences between the VERIS 3100 and EM38 units to investigate which technology suits both the Herbert and Burdekin farming systems.

The Grower Group decided that the most cost-effective way of carrying out a proof-of-concept assessment is to adapt the trailer mounted VERIS 3100 soil electrical conductivity mapping machine owned by Mr. P. McDonnell, rather than building a new machine on a fertiliser box frame. The VERIS 3100 (SECMAPPER) machine will be a unit that can be trailed in the paddock behind a utility or tractor.
The machine had its existing coulters with insulated hubs replaced by larger, heavier duty, coulters whose hangers will also be adapted for ease of being raised and lowered to suit the different bed shapes and widths (single or dual rows, raised or flat, 1.6 – 2.0 m) to be encountered in the paddock. Detailed design issues related to efficiency of penetrating trash and the possible influence of trash/coulter contact on soil electrical conductivity signals will be resolved, and the machine modified appropriately, during field trials.

Blakely Welding and Engineering (a specialised farm machinery engineering company) in Ayr undertook the designing and modifications to the VERIS 3100 unit for the project.

Once the unit was modified it was field tested to ensure that EC maps of fields mapped with nil or minimal crop stubbles present were similar to those fields with high stubbles present.

Due to the prolonged wet season experienced between September 2010- May 2011 and the stand over of cane in both regions the proposed trial program submitted in milestone report 3 was modified by the Grower Group to enable the project to continue. The modification of the trial program meant that alternative sites to assess the modified VERIS 3100 (SECMAPPER) unit had to occur; this had no negative impact on the projects outcomes.

Figure 1. Farming practices of the sugarcane growers involved in the VERIS 3100 (SECMAPPER) field trials in the Burdekin and Herbert Districts

<table>
<thead>
<tr>
<th>Grower</th>
<th>Crop residue</th>
<th>Irrigation</th>
<th>Paddock Status</th>
<th>Row spacing (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BURDEKIN DISTRICT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haigh (BPS001 site)</td>
<td>Burnt</td>
<td>Flood irrigation</td>
<td>Ratoons/dual row</td>
<td>1.83</td>
</tr>
<tr>
<td>Richardson</td>
<td>Grass/Trash</td>
<td>Flood irrigation</td>
<td>Fallow</td>
<td></td>
</tr>
<tr>
<td>D. Pozzebon</td>
<td>Burnt</td>
<td>Flood irrigation</td>
<td>Ratoons/single row</td>
<td>1.524</td>
</tr>
<tr>
<td><strong>HERBERT DISTRICT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pace (BPS001 site)</td>
<td>GCTB</td>
<td>rain-fed + supplementary overhead</td>
<td>dual row</td>
<td>1.83</td>
</tr>
<tr>
<td>Reinaudo</td>
<td>Bare</td>
<td>rain-fed</td>
<td>mound</td>
<td>1.83</td>
</tr>
<tr>
<td>Porta</td>
<td>Legume fallow</td>
<td>rain-fed</td>
<td>single row</td>
<td>1.62</td>
</tr>
<tr>
<td>Mammarella</td>
<td>Bare and GCTB</td>
<td>rain-fed</td>
<td>single row</td>
<td>1.62</td>
</tr>
<tr>
<td>Fighera</td>
<td>Bare and GCTB</td>
<td>rain-fed</td>
<td>dual row</td>
<td>1.83</td>
</tr>
</tbody>
</table>
Results and Outputs:

5:1 Comparing the Veris 3100 and EM38 units

Trials were established in the Herbert area to assess the VERIS 3100 and EM38 units before the modifications of the VERIS 3100 occurred. Trials were established at the following sites in the Herbert:

- Mammarella- Yuruga
- Reinaudo- Coolbie
- Pace- Crystal Creek
- Fighera (2 blocks)- Helens Hill

Both units were operated and mapped soils on the above farms on the same day to ensure that that there was similar soil moisture, ground cover and land preparation conditions (except for the Pace site). All blocks were mapped as fallow blocks because the un-modified VERIS 3100 did not operate effectively in high residue crop stubble situations.

The purpose of comparing the two soil mapping units was to assess if the soil mapping signatures for each system were similar before modifying the VERIS 3100 unit.

Rob Bramley (CSIRO) offered to analyse the data from each system (at no cost to the project). Rob Bramley’s analysis found that there was little significant difference between the two soils mapping systems.

Figure 2. Comparing soil mapping signatures between the EM38 and VERIS 3100 units.
5:2 Results and data interpretation from the soil mapping units

Dr. R. Bramley and Mr P. Mc Donnell processed the data from the Herbert sites and below are some of the trial results:

5:2:1 Mammarella site data:
At the Mammarella site a number of soil tests were undertaken at varying depths. At this site both soil mapping units identified areas of acid sulphate soil, high salinity and sodicity (refer to figure 3). Soil testings at depths of 0-300mm and 300-900mm were undertaken in accordance with the groupings generated from the VERIS 3100 data. Refer to figure 4- photography of equipment used on this site.

Figure 3. : Shallow (0-300mm) soils map on left and deep (0-900mm) soils map produced for the Mammarella site- VERIS 3100 unit measurements.

To reduce the impact associated with the sodic/ saline soil a spoon drain was installed and the area was treated with additional lime as per soil test recommendation. Additional lime was applied also to the area which was affected by acid sulphate soil exposure and leachate managed appropriately.

Figure 4: Soil mapping with the VERIS 3100 at the Mammarella site.
5:2:2 Fighera site data.

The site consists of 2 blocks in close proximity to each other. The area has a history of sodic soils since the block was cleared for cane production. The soil mapping devices did map variation in soil type and sodicity within the field successfully. Refer to figures 5 and 6.

The grower applied mill ash in an attempt to improve soil structure and to address soil sodicity. The application of the mill ash did not prove to pose any issues when mapping soils.

It was noted that large electrical transmission towers and steel boundary posts caused significant issues in relation to the EM38 unit. In close proximity to metal and electrical structures the EM38 signal is disrupted and the data is useless.

Figure 5. Fighera site 1 and 2 combined EM38 processed data.
Figure 6. Fighera site 1 maps for shallow and deep readings from the VERIS 3100 unit. Shallow (0-300mm) map-

Deep (0-900mm) map-

Figure 7: Lawrence Di Bella (Terrain NRM), Peter Mc Donnell (ADS) and Serge Fighera inspecting the VERIS 3100 unit.
5.2.3 Reinaudo site data- Both soil mapping units identified the saline and sodic areas within the cane block. The highly saline area in the block (refer to figure 8) was reclaimed land where-by top soil from higher productivity areas within the block was imported and placed over the saline affected soils. The activity of reclaiming saline affected land in this case has proven to be useless and has had no impact on improving the soils ability to grow cane and reduce the impact of salinity; this was confirmed by the EM38 and VERIS 3100 mapping. Refer to figure 8 and 9.

Figure 8. Reinaudo EM38 processed data-

![Reinaudo EM38 processed data](image)

Figure 9. Reinaudo VERIS 3100 processed data and site location map-

![Reinaudo VERIS 3100 processed data and site location map](image)

Above left: Photograph of the field adjacent to mapped area affected by salinity
Above right: Shallow (0-300mm) VERIS 3100 map
Below: Deep (0-900mm) VERIS 3100 map

At the Reinaudo site the soil mapping occurred after mound planting had occurred. Both units operated successfully on the newly planted mounds without modifying the mounds shape or displacing planted setts. Figure 10 & 11 are photographs of both units operating on the mound planted field.

Figure 10 above: The EM38 sled mapping soils at the Reinaudo site
5.3 Modification to the VERIS 3100 (SECMAPPER) unit.
The Grower Group decided that the most cost-effective way of carrying out a proof-of-concept assessment was to adapt the trailer mounted VERIS 3100 soil electrical conductivity mapping machine owned by Mr. P. McDonnell, rather than building a new machine on a fertiliser box frame. The VERIS 3100 (SECMAPPER) machine is a unit that can be used in the paddock behind a utility or tractor.

The machine’s existing coulters and hubs were replaced by larger, heavier duty, coulters. The coulter assembly was modified for ease of being raised and lowered to suit the different bed shapes and widths (single or dual rows, raised or flat, 1.6 – 2.0 m) encountered in the paddock. Detailed design issues related to efficiency of penetrating trash and the possible influence of trash/coulter contact on soil electrical conductivity signals was resolved, and the machine modified appropriately, during field trials. Refer to figure 13 and 14.

Blakely Welding and Engineering, a specialised farm machinery engineering company in Ayr was where the work was undertaken. Parts and specialised componentry (like the dGPS systems) were installed and are now operational in the utility. Refer to figure 12.

Figure 11 above: The VERIS 3100 unit mapping soils at the Reinaudo site

Figure 12. Modification of the VERIS 3100 (SECMAPPER) unit at Blakely Welding and Engineering, 2010.
Figure 13. A photograph of the modified coulter and housing on the VERIS 3100 (SECMAPPER) unit.

Figure 14. A photograph of the modified housing on the VERIS 3100 (SECMAPPER) unit.
To assess if there was any differences in EC reading after the new coulters were installed, the same field was re-mapped to access if there was any differences; at Haig, Lamari, Mammarella and Pace sites. The Haig block was mapped in 2008 using the un-modified VERIS 3100 unit (refer to figure 15 map A below) and the block was re-mapped in 2010 with the modified VERIS3100 (SECMAPPER) unit fitted with the larger coulters (refer to figure 15 map B below). There was a strong correlation in EC readings between the 2 mapping periods indicating that the modification has had no significant impact on EC readings.

![Figure 15. Comparison between the modified VERIS (SECMAPPER) unit and un-modified VERIS 3100 unit - Haigh site.](image)

Map A. Un-modified VERIS 3100 map, mapped in 2008.

Map B. Modified VERIS 3100 SECmapper map, mapped map in 2010.
5.4.1 Porta site (Herbert):

At the Porta site the modified VERIS 3100 (SECMAPPER) unit was used where a desiccated legume crop existed (figures 16 and 17). The unit had no difficulty obtaining soil to coulter contact in this situation. Figure 18 is the shallow and deep EC map produced for the site.

![Figure 16](image1.png)

Figure 16 above: VERIS 3100 (SECMAPPER) unit operating in legume stubble at the Porta farm.

![Figure 17](image2.png)

Figure 17 below: The cut line produced by the coulter cutting through the legume stubble.

![Figure 18](image3.png)

Figure 18 .
Above left is the VERIS 3100 (SECMAPPER) shallow reading map for the Porta site, 2011. Above right is the VERIS 3100 (SECMAPPER) deep reading map for the Porta site, 2011.
5:4:2 Lamari site (Herbert):
The Lamari site was a sprayout fallow with a significant amount of dead cane material, desiccated weeds and green weeds present. This situation would be the most difficult situation in which to map a field. The largest issue experienced at this site was vehicle clearance, not the VERIS 3100 (SECMAPPER) operation. Refer to figures 19 and 20.

At this site EC maps were produced under the high biomass situation and when the organic matter was incorporated and the field was ready for planting. The EC maps will be presented later in this report.

Figure 19.
Above: The VERIS 3100 (SECMAPPER) mapping in a field of ratoon spray out, at the Lamari site, 2011.

Figure 20.
Below: The pathway the VERIS 3100 (SECMAPPER) made through the Lamari site, 2011.
5:4:3 Richardson site (Burdekin):
At the Richardson site the VERIS 3100 (SECMAPPER) unit was used in a thick green cane trash blanket. No difficulties experienced at this site. Refer to figures 21 and 22.

Figure 21. Photograph of the modified VERIS 3100 (SECMAPPER) unit in operation in a trash blanket in the Burdekin area (Flamingo farm).

Figure 22. Photograph of a cut in the trash blanket caused by the VERIS 3100 (SECMAPPER) unit.
5:4:4 Haigh site (Burdekin):
At the Haigh site the VERIS 3100 (SECMAPPER) unit was used in a thick green grassy fallow. No difficulties were experienced at this site. Refer to figure 23.

![Figure 23. Photograph of the modified VERIS 3100 (SECMAPPER) unit in operation in a grassy fallow in the Haigh site (Burdekin area).](image)

5:4:5 Mammarella site:
At this site some issue arose due to the narrow row spacing, the mound height and compacted soil on the edge of the mound caused due to harvest traffic. Due to the difficult conditions, one of the coulters was damaged and broken in the process. Coulter breakage and soil to coulter contact will be a limitation to mapping in ratoon cane blocks.

The other issue experienced was soil to coulter contact under this situation. Figure 24 highlights the unit’s inability to make soil to coulter contact in the inter-space. Without soil to coulter contact will cause a loss in data points throughout the field.

![Figure 24. Photograph of the modified VERIS 3100 (SECMAPPER) unit in operation in a trash blanket at the Mammarella site in the Herbert area.](image)
5:5 Repeatability of mapping over time.
5:5:1 Pace site (Herbert):

The Pace site was originally mapped as a part of the BPS001 SRDC in 2009 as a cultivated block ready for planting, with the un-modified VERIS 3100 (SECMAPPER). Refer to figure 25.

The site was re-mapped in a green cane trash blanket ratoon block in 2011 with the modified VERIS 3100 (SECMAPPER). Refer to figure 26.

The variations between the two maps are caused by the differing soil moistures present and the coulter to soil contact difficulties found when mapping zero tilled green cane trash blanket ratoon blocks under dry soil conditions.

Even though the pattern variations in the EC map, the identification of sodic soils within the block remained the same between the two time periods; giving us confidence that the system can effectively map sodic potential soil areas.
EC or EM maps should not be used in isolation. Soil testing data, soils, topography, yield and satellite / aerial maps should be used to develop management plans for a property.

5:6:1 Mammarella site (Herbert): Figures 27 and 28 indicate there was no significant differences between years at this site. Elevation data (figure 29) also indicates that topography has an impact on drainage and should be considered when considering field management strategies.

Figure 27 on left.
The EC reading taken at the Mammarella site (in the Herbert area) in 2010, prior to the VERIS 3100 modification. Mapping was undertaken on a cultivated field prior to planting.

Figure 28 on right.
The EC reading taken at the Mammarella site (in the Herbert area) in 2011, with the modified VERIS 3100 (SECMAPPER). Mapping was undertaken on a green cane trash blanketed ratoon crop.
Above left is an elevation map created by the VERIS 3100 at the Mammarella site (in the Herbert area), 2011.

Above right is an aerial photo of the Mammarella site taken on the 9/7/2011. Note the area affected by salinity at the bottom of the block.

Below right is a combined EC map for the Mammarella site, 2011.

Below left is the VERIS 3100 unit in operation at the Mammarella site, 2010.

Figure 29

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5.2 Lamari site (Herbert): Figure 30-33 highlight the different geo-spatial layers of the Lamari farm. In the Lamari case a management strategy has been put in place to address productivity issues on the farm. The management strategy has been developed using the available data for the farm. Figure 34 is the VERIS (SECMAPPER) unit in operation in sub-block of interest.

**Figure 30.** EC map at the Lamari site under a high residue situation, May 2011.

**Figure 31.** EC map at the Lamari site under a low residue situation, August 2011.

**Figure 32.** 2009 yield (t/ha) map at the Lamari site.

**Figure 33.** Satellite image of the Lamari site.

**Figure 34.** EC mapping at the Lamari site under a high residue situation, May 2011.
5:7 Grower group meetings conducted.

- The project has built on the outcomes of a series of meetings in Ingham, Ayr, and Townsville prior to and since the submission of the GGIP proposal. The inaugural Grower Group meeting was held in Townsville in September, 2009 to bring together the members of the Grower Group from both the Herbert and Burdekin areas prior to the commencement of the project. Refer to figure 35.

![Image](image.jpg)

Figure 35. The inaugural EMMIT Grower Group project meeting held in Townsville, with Herbert and Burdekin representatives present.

- Meetings of subsets of the EMMIT Grower Group were held in Ingham (23/2/10) and Ayr (9/3/10) to consolidate group membership and to confirm the GGIP project objectives as set out in the proposal.
- A project planning meeting was held at Ingham on 12th of March, 2010 (attendees: A. Pace, S. Fighera, L. Di Bella, P. McDonnell, R. Coventry) to determine the nature of the VERIS 3100 (SECMAPPER) machine to be built and the sites at which activities would occur during the project.
- 29th of April, 2010 in Ingham. This meeting was attended by 4 grower group members (3 Herbert growers and 1 Burdekin grower) and 3 technical support staff. The purpose of this meeting was to discuss project work plans and activities to occur in 2010.
- 27th and 28th of May, 2010 in Ingham. This meeting coincided with the soil mapping activities in the Herbert using the VERIS 3100 and EM38 units. The meeting was attended by 4 growers and 3 technical staff. The meeting reviewed soil mapping techniques and designs for the modification of the VERIS 3100 (SECMAPPER) unit.
- 15th of November, 2010 in the Burdekin. This meeting was very well attended with all growers from the Burdekin and Herbert EMMIT Grower Group attending the meeting with representatives from Burdekin Productivity Services (BPS)- 1 person, Herbert Cane Productivity Services Limited (HCPSL)- 2 people, BSES- 1 person, Terrain NRM- 1 person, Tully Cane Productivity Services- 2 people and Rabobank- 2 people (total of 21 people) attending . Refer to figures 14 and 15. Rabobank sponsored the day by providing lunch and covering the cost of travel for participants. Refer to figures 36 and 37.
The meeting reviewed trial results to date, undertook a SWOT analysis of both the VERIS 3100 and EM38 units, developed a work schedule for the next 12 months and viewed the modified VERIS 3100 (SECMAPPER) in operation. The meeting recommended that the VERIS 3100 unit accepted by the industry in the Herbert, Tully and Burdekin areas as the preferred soil mapping tool because of the following reasons:

- VERIS 3100 units already exist in the Burdekin and Mackay areas. These units are currently not being used to their full capacity.
- The availability of new sensors being made available on the market to sense for phosphorus and organic matter. It was noted that the Mackay unit would be fitted with an organic matter sensor in 2011. The availability of these additional sensors would allow for variable rate nitrogen and phosphorus to be considered in the future, if deemed successful.
- Less time required to undertake calibrations with the VERIS 3100 unit compared to the EM38 unit.

The meeting agreed that further testing of the VERIS 3100 SECMAPPER modification in high crop residue situations was still required before consider using the unit to map large areas (the project will undertake further testing in 2011). It was agreed that the VERIS 3100 unit could now be used to map fallow cultivated soils with no or very minimal crop residue at present.

Figure 36. Growers and technical staff inspecting the modified VERIS 3100 (SECMAPPER) unit in the Burdekin.
15th of December, 2010 in Ingham. This meeting was a follow up from the Nov. 15th meeting, with the Herbert sugarcane industry technical groups- BSES, Sucrogen, DEEDI and HCPSL staff. The purpose of the meeting was to investigate opportunities to map large areas with the VERIS 3100 (SECMAPPER) equipment in the Herbert into the future. The group is seeking possible funding sources to allow for the mapping to occur, if this project was successful.

Herbert Sustainable Farming Systems meeting (coordinated by HCPSL and BSES staff) - 21st of March, 2011. Sixteen growers and industry technical staff were present. The meeting discussed the project comes and direction of the project during 2011.

Herbert Cane Productivity Services Limited (HCPSL) sub-program review. The project outcomes were presented to the HCPSL Board for consideration. Date conducted 14th of September, 2011. The Board is considering options on how the technology can be utilised by the Herbert industry into the future.

3rd of November, 2011. Project completion meeting with the Grower Group and technical support staff.

5:9 Key research findings
The key research findings from the project are:

- The modified VERIS 3100 (SECMAPPER) can be used in high crop residues and stubbles without compromising EC readings.
- The VERIS 3100 unit, modified or un-modified can effectively identify high electrical conductive saline or sodic soils. The unit can also be used effectively to identify soil variations. Field validation and soil testing will be required to ensure that the correct management decisions are made.
- EC maps should be used in conjunction with soil tests and other spatial information when developing management strategies or plans.
- The VERIS 3100 (SECMAPPER) unit has limitations in the following situations:
  - Narrow and uneven row spacing in blocks that have been compacted due to harvesting. In this situation where the bed becomes higher/lower and wider and narrower, the fixed coulters are unable to maintain soil contact. Coulter damage ay also occur under this situation.
  - Under extreme dry and compacted soils, because soil to coulter contact cannot be achieved.
6:0 Environmental Impact:

No specific issues.

7:0 Communication and Adoption of Outputs:

7:1 Shed meetings and field days

The following shed meetings and field days were conducted to report back to industry and the wider community:

- Herbert Sugarcane Productivity Forums in Ingham on 22\textsuperscript{nd} and 23\textsuperscript{rd} of February, 2011. 156 growers attended the forums.
- Herbert cane industry productivity forums- 14\textsuperscript{th} and 15\textsuperscript{th} of February, 2011. Approximately 150 growers attended the forums. Refer to figure 38.
- Hinchinbrook Shire NRM forum- 22\textsuperscript{nd} of March, 2011. Community interest groups present. 24 attended.
- Year 11 Gilroy Santa Maria College Biology field trip- 17\textsuperscript{th} of August, 2011. 26 students and teachers attended. Refer to figure 41.
- Herbert Resource Information Centre (HRIC)- Spatial Community in Action Conference (Ingham)- 18\textsuperscript{th} and 19\textsuperscript{th} of August, 2011. Approximately 150 attended from across Australia.
- Herbert cane industry productivity forums- 19\textsuperscript{th} and 20\textsuperscript{th} of February, 2011. Approximately 85 growers attended the forums. Figures 39 & 40.
- Sustainable Agricultural Initiative (SAI) Platform visit to the Burdekin and Herbert cane industries- 19\textsuperscript{th} and 20\textsuperscript{th} of October, 2011. The delegation consisted of representatives from food manufacturing and industry groups within Australia. 16 attended the event.

Figure 38 . Lawrence Di Bella (HCPSL) presenting to a grower meeting in the Herbert, 2011.
Figure 39. Peter McDonnell explaining the operation of the VERIS 3100 (SECMAPPER) at the HRIC conference in Ingham, 2011.

Figure 40. Explanation of the VERIS 3100 (SECMAPPER) and EM38 systems at the HRIC conference in Ingham, 2011.
At all these events SRDC and the project co-operators were acknowledged for their involvement.

7:2 Adoption of outputs
There has been an increase in the use of EC mapping activities in the Herbert and Burdekin since the commencement of the project.

A number of growers who have EC mapped blocks in each district have sought further technical assistance to develop management strategies for individual cane blocks or whole of farms. The EC map in conjunction with soil tests and other spatial data is allowing the grower and technical support officer to discuss and develop strategies to manage cane blocks (like sodic or saline soils).

8:0 Intellectual Property and Confidentiality:
There are no issues in this area.

9:0 Capacity Building:
The project has brought together growers from the 2 regions to share experiences and knowledge, especially in the area of precision agriculture and sodic soil management.

The project has also allowed the growers gain the following from the project:
- A better understanding on how to conduct farm research based trials.
- A better understanding of the soils they are managing.
- A better understanding the limiting factors that influence and drive yield variation in a crop.
- A better understanding concerning the management of sodic, saline and acid sulphate soils; this was especially noticed with the Herbert growers and technical support staff.
10:0 Outcomes:

The outcomes of this project are as follows:

- The project has achieved its main objective which was to design and build a modified VERIS 3100 (SECMAPPER) soil electrical conductivity mapping machine, that will be a stand-alone, tractor-mounted or trailer unit for collecting soil conductivity data below thick trash or stubble residue layers. The research indicates that the modification to the unit did not impact on the EC readings taken by the unit.

The project outcomes has allowed the Farmacist group to now commission and construct a tractor-mounted modified VERIS 3100 (SECMAPPER) unit, which is currently based in the Mackay region.

Some modifications to the design are required to improve the machines ability to move over ratoon cane paddocks without causing damage to the machine. Although the machine can now map in drier tougher conditions, it is even more crucial that through field validations occur to ensure a good understanding of what is being mapped. The following quote must be remembered during mapping operations “Just because we can, doesn’t mean we should”, Peter McDonnell.

- Confidence in the VERIS 3100 systems to effectively map areas of sodic and saline soils in cane growing regions of Australia. Soil testing should be used to validate areas of sodic and saline soils.

- The knowledge and capacity of the Grower Group was significantly increased due to the project especially in the area of precision agriculture and soil variation.

- An increased awareness by the cane industry and other groups concerning the availability and use of equipment like the VERIS 3100 and EM38 to map soil variation within a block.

11:0 Recommendations:

The Grower Group makes the following recommendations:

- The Herbert cane industry investigates opportunities to map the cane area south and west of Ingham where there are potential sodic soils present.

- The Burdekin cane area continues to utilise EC mapping equipment to assist in the management of sodic and saline soils.

- Further research and farming systems development be undertaken in dryland farming areas like the Herbert and Central cane growing areas were sodic soils are limiting cane yield potential. The management of sodic soils in irrigated farming areas like the Burdekin are well developed, however this is not the case in dryland farmed areas.

- Investigate further opportunities to adopt precision agricultural techniques (like variable rate technology) to fully utilise the data generated by EC mapping processes.

- Establish EC mapping protocols similar to those being developed for yield mapping processes.
12:0 Publications:

- Project updates were posted on the Terrain NRM website.
- Proposed report on the final outcomes in the 2011 Herbert Region Productivity Report.

13:0 Special thanks to the following for their support and involvement in the project:

**EMMIT Grower Group**

[Logos of various organizations]