

# SRDC Research Project Final Report

Title of the Project: SREMS (Sugarcane Research Experiment Management System)

Project Reference Number: CSE017

Name(s) of the Research Organisation(s): CSIRO

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**Australian Government**  
Sugar Research and  
Development Corporation

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## Summary of project to date:

SRDC-funded physiological and agronomic experiments have been conducted by many researchers from various research institutes over the past decades. The resulting datasets are typically stored in idiosyncratic formats in a range of spreadsheet software packages. The data are, in most cases, unobtainable to other researchers and stakeholders resulting in potential repetition of experiments.

In response the CRC for Sustainable Sugar Production (Sugar CRC) developed the "Sugarbag" database. Sugarbag contained data from 138 experiments stored in Microsoft Excel and Access format. Utilisation of this database has resulted in value-adding to knowledge beyond the life and expense of the initial projects, particularly in the areas of sugarcane physiology and APSIM model development. In 2002 Sugarbag ceased to be maintained and is consequently out of date and under utilised. Since the cessation of Sugarbag, more recently generated datasets have generally remained in the hands of the project Principle Investigators and failed to be available for further value-adding. This project sought to address the issue by developing an updated database facility that was accessible via the web. The database was referred to as the Sugarcane Research Experiment Management System (SREMS).

The SREMS project methodology consisted of four distinct phases of activities. The first involved defining the nature of the database, potential user needs and the scope of the database functionality. The second phase consisted of a multitude of tasks focussed on producing the database. These included identifying a suitable software design, writing web and Visual Basic code to operationalise the database, sourcing, reformatting and inputting physiological and agronomic datasets into the SREMS database, testing the functionality of the database from the web platform and producing user-guideline documentation. This phase of the project required extensive communication with the owners of the datasets (referred to as custodians) and potential users of the database to ensure the product would meet the needs of those who were most likely to use it. The third phase of the project aimed to communicate the web-based database to potential users. This included a poster paper to be presented at the ASSCT 2008 conference, a live web demonstration of the database at the ASSCT 2008 conference, and introductory 'launch' information in the form of a flyer to be included in the ASSCT conference delegates' bag. The fourth stage of the project was aimed at maintaining the database up to April 2011 (a total of five years from the start of the SREMS project. This would have essentially entailed periodic software maintenance. On-going communication of the database was also planned to occur throughout the second, third and fourth years of the project in the form of bi-annual newsletters electronically sent to potential users and dataset custodians. Due to the termination of the project by SRDC on 25 March 2008, only phases one and two were wholly completed. The poster paper abstract submission to ASSCT was the only action completed as part of the launch activities planned for phase 3 of the project.

The most significant output delivered from this project was the fully-functioning web-based SREMS database software. The database contains in excess of 160 datasets from physiological and agronomic experiments conducted on sugarcane and associated rotational crops such as soybeans. It also contains metadata (descriptive text such as the location, start and end dates and treatment details) for a further 76 datasets. Additional outputs of the project included an ASSCT poster abstract and a contact list of potential SREMS users and dataset custodians.

## Background:

A number of outputs have resulted from the use of datasets contained in the sugarcane agronomic and physiological Sugarbag database. Subsequent use of this data has resulted in value-adding beyond the life and expense of the initial projects. The most notable outputs include:

- Development and testing of APSIM-Sugarcane model (Keating *et al.* 1999);
- Examination of physiological phenomena across the Australian sugar industry (Park *et al.* 2005);
- Examination of nitrogen concentrations in two year old crops from NSW (fed into project CSE011);
- Verification of APSIM model output on two year old crops from NSW (fed into project CSE011);
- Determination of the amount of fuel for electricity cogeneration with whole crop harvesting (Thorburn *et al.* in press);
- Development and utilisation of standardised protocols for field data collection which are widely applied throughout the research community (Mazzucchelli *et al.* 1997);
- Storage of large quantities of ancillary data (e.g. project CTA028 (Chapman *et al.* 2004)).

These papers and outputs exemplify the usefulness of collating industry-wide data to enable broadscale analysis covering an extensive geographical and/or temporal scale. Failure to maintain Sugarbag with current datasets since the termination of the Sugar CRC has meant that any recent analysis of this nature

has been out of date and incomplete given current knowledge of sugarcane agronomy and physiology in Australia. There was therefore a clear need for a data repository to be re-established, however the resource demands associated with maintaining such a repository required that researchers and data-custodians accessing the database to upload new datasets, search stored datasets and, if necessary, delete and amend datasets, were able to do so independent of the database managers or funders. This project responded to this need by developing a user-friendly web-based database that would contain all datasets previously housed by Sugarbag, together with those subsequently produced. In order for the database to remain current, at the outset of the project, SRDC were considering including a statement in all future project contracts requiring agronomic and physiological data produced in relation to an SRDC-funded project be uploaded into the new database.

### **Objectives:**

The objective of this project was to add value to current and future sugar industry research by enabling wide and ongoing access to data from physiological and agronomic experiments. This was to be achieved through collation of experiment datasets into a new common database that would subsequently be maintained and readily available to researchers in the Australian sugar industry. More specifically, we aimed to:

- Adapt REMS software (presently used in the grains industry) to create a Sugarcane REMS (SREMS) database. **Achieved.**
- Identify and collate suitable published datasets from present custodians. **Achieved.**
- Standardise collated datasets into a common format and input into SREMS. **Achieved.**
- Develop a web-based facility to enable easy access to the database. **Achieved.**
- Communicate the SREMS facility to the research community through a workshop and newsletters. **Not achieved due to the termination of the project by SRDC on 25 March 2008.**
- Maintain the database facility for five years from the outset of the project. **Not achieved due to the termination of the project by SRDC on 25 March 2008.**

### **Methodology:**

Activities and project management aimed to deliver outputs and outcomes were designed to be undertaken on a year-by-year basis. The following is a summary of the activities undertaken and those that would have been achieved if the project had not been terminated by SRDC in March 2008:

#### **YEAR 1**

- In collaboration with the reference panel, develop a statement of intent that explicitly defined the extent of the functions to be included in the development of SREMS and the website facility.
- Determine the software and web facilities required to deliver the above.
- Evaluate the logistic requirements of each potential website host (SRDC, BSES, CSIRO) and determine the most appropriate location.
- Establish the SREMS database as determined above. Develop data input criteria, dataset formats and templates.
- Identify desirable datasets from within the Australian sugar industry research community for inclusion in the database.
- Engage dataset custodians in the process of data standardisation and input into SREMS.
- Formalise licensing agreement with APSRU and document user license application procedures.
- Develop web-based access to SREMS.
- Develop guidelines for use of SREMS database (data input, searching and retrieval).
- Establish a contact list of potential users, dataset custodians and other interested parties.
- Produce two milestone reports detailing activities to date.
- Consider the possibility of providing links from datasets contained within SREMS to project descriptions stored within the Australian Agricultural and Natural Resources Online database.
- Consult with Principle Investigators of Grower Group Innovation Projects and other grower-led projects to define additional work requirements and resources necessary to incorporate summary details of their datasets into SREMS. Propose a plan of future action accordingly.

**All activities and project management aimed to deliver outputs and outcomes were achieved.**

#### **YEAR 2**

The project was terminated during Year 2. Milestone report No. 4 (**Roll out and maintenance**) was due for submission on **1 June 2008**. **The following details the milestone criteria activities and project management undertaken in year 2 prior to termination, and those outstanding at the time of project termination.**

- Reassess a suitable host given SRDC's decision to not host SREMS on its server. Advise SRDC.

**Achieved.**

Following SRDC's decision to not host SREMS on its server, an assessment was completed by the project team on the suitability of three web application hosting companies and forwarded to SRDC on 30 January 2008 for consideration (see Appendix 1 for a summary of this assessment).

- Deliver functioning SREMS database to SRDC to arrange uploading on the chosen server.

**Achieved.**

A CD containing all the necessary files and their linkages necessary to produce a functioning SREMS database was posted to SRDC on 6 February 2008.

- Conduct minor refinements and maintenance of database to enable it to be operational.

**Not achieved.**

This achievement criterion was not met due to project termination, although the database was demonstrated to be fully operational on the CSIRO web interface.

- Conduct a demonstration of the SREMS database at the ASSCT 2008 conference in conjunction with a poster.

**Partially achieved.**

A poster abstract was submitted and accepted by ASSCT 2008 conference (Appendix 2). The Principal Investigator of the project had been in correspondence with ASSCT conference organisers regarding an on-line demonstration of SREMS during the conference poster session. Given the termination of the SREMS project, the on-line demonstration has been cancelled and notification given to the conference organisers that the poster will not be displayed at the conference (however due to the Conference Abstracts already having been sent to the printers, the SREMS poster abstract will appear in this publication).

- Maintain a contact list of potential users and dataset custodians.

**Achieved.**

A contact list of potential users and dataset custodians has been maintained throughout the life of the project (Appendix 4).

- Produce the first of a bi-annual electronic newsletter to be included in the ASSCT conference bag. Newsletter to target dataset custodians and provide information on how to use the database and available datasets.

**Not achieved.**

This achievement criterion was not met due to the project being terminated.

- Liaise with SRDC about mandatory input of research summary text by PI's of SRDC-funded physiological/agronomic research into SREMS directory in the early stages of their project.

**Achieved.**

SRDC and the project team discussed the mandatory input of research summary text produced by the Principle Investigators' of SRDC-funded physiological/agronomic research being submitted into SREMS. It was agreed that SRDC would initiate a link between their current project database and SREMS at a later date once the database was installed and operational.

**YEARS 3 and 4**

- Conduct refinement and maintenance of database (within the scope of the statement of intent) as deemed necessary from user feedback.
- Maintain a contact list of potential users, dataset custodians and other interested parties wishing to receive updated information on SREMS.
- Produce bi-annual electronic newsletters to be sent to target dataset custodians and other interested parties providing information on documented changes and newly available datasets. The newsletter will also be used to elicit feedback from users.
- Produce annual milestone report detailing maintenance activities and documented changes, nature of use, outputs and outcomes resulting from the use of SREMS, and user feedback.

**YEAR 5**

- Evaluate the efficacy/useability of the SREMS database through surveys/interviews.
- Conduct refinement and maintenance of database (within the scope of the statement of intent) as deemed necessary from user feedback.
- Maintain a contact list of potential users, dataset custodians and other interested parties wishing to receive updated information on SREMS.
- Produce bi-annual electronic newsletters to be sent to target dataset custodians and other interested parties providing information on documented changes and newly available datasets. The newsletter will also be used to elicit feedback from users.
- Produce annual milestone report detailing maintenance activities and documented changes, nature of use, outputs and outcomes resulting from the use of SREMS, and user feedback. Also include an assessment of the project and make recommendations for future provision of the SREMS database.

## Outputs:

Outputs produced by the project up to the time of project termination included:

- Web-based SREMS database application containing 160 datasets and a further 76 Meta-datasets from physiological and agronomic experiments conducted on sugarcane and associated rotational crops such as soybeans. It includes descriptive information (metadata) about each experiment, such as the location, start and end dates and treatment details.
- ASSCT poster abstract (Appendix 2) and example screenshots from SREMS test web-site developed at CSIRO (Appendix 3).
- Updated contact list of potential SREMS and dataset custodians.

## Intellectual Property and Confidentiality:

The datasets contained in SREMS remain the property of the original dataset custodians. All contributors of data have been notified about the termination of the project and informed that the SREMS database remains the property of CSIRO and if in the future the database is further developed or implemented the data custodians would be informed. They were also advised that they would be informed and consent sought if any of the data contributed was intended to be used in a new context. (Appendix 4).

## Environmental and Social Impacts:

There were no environmental or social impacts resulting from the project up to the date of termination.

## Expected Outcomes:

Had this project continued for a further 3 years as proposed, the following economic, environmental and social outcomes would have been expected:

- Reduced time (and monetary resources) expended between project start-up and adoption of R&D outputs through (a) an increased clarity in the identification of knowledge gaps, (b) reduced repetition of experiments, and (c) centralised data storage. (Economic outcome);
- More efficient R&D projects, leading to more rapid delivery of R&D outputs and industry benefits. (Economic and environmental outcomes);
- Improved accountability of researchers to ensure agronomy and physiology research results are available to the wider community (research and industry) in a user-friendly format. (Social outcome);
- Enhanced collaboration between researchers and industry to enable an increase in research outputs and technologies. (Economic, environmental and social outcomes);
- Improved environmental benefits, especially at the larger scale, due to the facilitation of data analyses across a number of experimental sites and geographic regions. (Environmental and economic outcomes).

## Future Research Needs:

No requests are being made for further research needs.

## Recommendations:

It is recommended that SRDC periodically assess the need for an industry-wide repository for field data of a physiological and agronomic nature to provide efficiencies in data sharing and collaboration between research and industry researchers.

## List of Publications:

Park, S.E., Prestwidge, D.B., Horan, H.L., Verrall, S. and Laredo, L.A. (2008). SREMS: A web-based database for sugarcane physiological and agronomic experimental data. *Proceedings of the Australian Society of Sugar Cane Technologists*, 30: 580.

## References:

Chapman, S.C., Rattey, A. and Jackson, P.A. (2004). Evaluation and re-structuring of regional selection programs to maximise efficiency and speed of cultivar release. Final Report SRDC Project CTA028. <http://www.srdc.gov.au/ProjectReports/ViewReports.aspx?ProjectNo=CTA028>

Keating, B.A., Robertson, M.J., Muchow, R.C. and Huth, N.I. (1999). Modelling sugarcane production systems I. Development and performance of the sugarcane module. *Field Crops Research*, 61:253-271.

Mazzucchelli D.K., Spillman, M.F. and Muchow, R.C. (1997). Minimum dataset manual for the collection of crop, soil and climate data in sugarcane field experimentation. CRC for Sustainable Sugar production. 65pp.

Park, S.E., Robertson, M.J, and Inman-Bamber, N.G. (2005). Decline in the growth of a sugarcane crop with age under high input conditions. *Field Crops Research*, 95: 305-320.

## Appendix 1

### **Summary of assessment of three web application hosting companies – review by Shaun Verrall**

After searching for web application hosting companies that met our hosting requirements for SREMS (see below for these requirements). Three companies were selected. These three companies represented the best of each of the three selection criteria used to base our final decision upon. The first criteria were lowest cost, second was best quality, and the third was ease of integration and maintenance with existing websites.

#### **Quotes**

The lowest cost was **WebHostForASP.Net** - > \$15 per Month  
([http://www.webhostforasp.net.au/hosting\\_compare\\_aspnet.aspx](http://www.webhostforasp.net.au/hosting_compare_aspnet.aspx) [see "SQL Plan"]) (also see attached email)

Best Quality was, **Studio Coast** -> \$20 per Month  
(<http://www.studiocoast.com.au/hosting.asp> [see "Standard" plan])

Ease of Integration and maintenance - **Big Bridge** -> from between \$42 per Month and \$82 per Month

#### **Recommendations**

The **WebHostForASP.Net** gives you the most bang for your buck, you get 5 GB storage space and 30 GB bandwidth. However such low prices normally come at the cost of reliability (how often their server goes down), speed (how long it takes for the page to complete downloading when you visit the site) and Help Desk Service (how long it takes for them to fix any problems you have). They usually provide a better price than their competitors by signing up more users for the same amount of IT asset. Hence they tend to overload and crash more, and slow down more and take longer to respond to Help Desk requests.

**Studio Coast**, offers the best in terms of quality, they offer a 99.9% Uptime guarantee (<http://www.studiocoast.com.au/sla.asp>) where they offer you a full refund if the Uptime of your website drops below 99%. They do this by having redundant connections to WestNet, Optus, AAPT and PIPE Networks. They also are a local Brisbane company which means the offices are located nearby to SRDC. They even offer co-location of your servers with them (<http://www.studiocoast.com.au/colocationbrisbane.asp>), so web servers can be moved out of the SRDC building and co-located. This would enable hosting SREMS on "your own" web servers and in this case you do not need the web hosting companies. Whilst *on paper* the 200MB Disk Space and 4GB Data Transfer per month, does not seem to compete with the WebHostForASP.Net 5GB and 30GB per month, *in practice* it is important to consider not just these figures but also the reliability and day to day maintenance of the website.

Finally, **Big Bridge** offers the best in terms of ease of integration and maintenance. (N.B. integration refers to the linking of the SREMS database with the SRDC projects database. This may be something that SRDC considers doing as an additional feature of SREMS at some time in the future).

Big Bridge will be responsible for the look and feel of the SREMS pages as well as the integration with the SRDC website.

At the moment users browsing on the SRDC website can view information about past SRDC projects and download the final report etc. To allow users to also download the experiment from this same page SREMS was designed in such a way that all Big Bridge/SRDC would need to do is to store the SREMS ID for the SRDC project in the same database that currently stores the information about the projects (with a minor tweak to the page as well).

No matter who finally hosts SREMS, Big Bridge will be able to do this, it will be easier for them to keep the SRDC website up to date on a day to day basis when changes are made, and more experiments are added to SREMS and more SRDC projects are added to the SRDC website, if they are hosting SREMS as well as managing the SRDC content. Perhaps SRDC or Big Bridge will be able to formalise this integration process

so when new SRDC projects are added to the SRDC website their experimental data is also added to SREMS and the SREMS ID is stored on the SRDC database at the same time.

Big Bridge offers web hosting although it is not really part of its core business which focuses mainly on digital content. Their price varies from \$42 to \$82 per month depending upon the plan. Even though this is expensive, when I was speaking with them about the quote I had to make it clear to them to give me a quote for just SREMS. They kept wanting to give me a quote for both the SRDC website and SREMS. I got the distinct feeling that if you negotiated these two together you would have got it as a much cheaper price. Even getting them to give me a quote for just web hosting was difficult because as I said it is not part of their core business and they do not do it very often. They normally either handle just the content or they handle everything (hosting and the content). For that reason I think it was a bit on the expensive side.

My recommendation would be since the overall annual price for Big Bridges cheapest plan of \$500 is not expensive, and considering how easy it will make the integration of SREMS with the SRDC website. I think you should go with Big Bridge and keep things simple.

### **Requirements for SREMS**

- ASP.NET 1.1
- IIS 5.1 or greater
- Uses a Microsoft Access Database via ADO.NET (read and write permissions)
- Web application uploads Excel spreadsheets to a folder, does this via a "File Field" Control (see <http://msdn2.microsoft.com/en-us/library/aa478971.aspx> ) so it needs write permissions for ASPNET account to a folder that stores the spreadsheets. This folder will grow as people upload more files to it. To start out it will need around 200MB of disk space. Similarly the application downloads Excel spreadsheets to users as a normal file download.
- Need to be allowed to use SMTP to automatically send emails.
- Need to be able to get statistics usage of the website.
- Need to assign own domain name, not sub domain.

## Appendix 2

*ASSCT 2008 conference SREMS poster abstract*

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### **SREMS: A WEB-BASED DATABASE FOR SUGARCANE PHYSIOLOGICAL AND AGRONOMIC EXPERIMENTAL DATA**

By

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Sugarcane physiological and agronomic experiments have been conducted by many research institutes over the past decades. The resulting datasets are typically stored in idiosyncratic formats in a range of spreadsheet software packages. The data are, in most cases, unobtainable by other researchers and stakeholders, resulting in the potential repetition of experiments.

In response, the CRC for Sustainable Sugar Production developed the Sugarbag database. Sugarbag contained 138 sets of data sourced from 12 research institutes, with experiments dating back to 1933. Utilisation of Sugarbag has resulted in value-adding to knowledge beyond the life and expense of the initial projects, particularly in the areas of physiology and model development. In 2002, Sugarbag ceased to be maintained and is now out of date and consequently under-utilised. More recently generated datasets have generally remained in the hands of project leaders, failing to be available for further value-adding.

In order to collate recently produced data and maintain access to Sugarbag, a new web-based database called Sugarcane Research Experiment Management System (SREMS) has been developed. In addition to experimental data, SREMS also contains information on irrigation, fertiliser, fumigation, cultivar, ratooning, planting and harvest date, lodging, experimental design, site location, researchers and meteorological data. Data is presented in a standardised format allowing users to search the database and instructions guide users in downloading and upload datasets. This presentation provides a hands-on demonstration of the SREMS database.

SREMS presently contains over 300 datasets and is planned to expand as additional data become available. It is hoped that SREMS will add value to current and future sugarcane industry research by enabling wide and ongoing access to data and encouraging greater standardisation of field data collection protocols. SREMS can be found on the SRDC website ([www.srdc.gov.au](http://www.srdc.gov.au)).



