January, August & Final Reports

REPORTS

Part 1 - Summary Details

Please use your TAB key to complete part 1 & 2.

CRDC Project Number: CSP106C

January Report:	☐	Due 29-Jan-01
August Report:	☐	Due 03-Aug-01
Final Report:	☒	Due within 3 months of project completion

Project Title: Enhancing Development, Support and Evaluation of Computerised Decision Support

Project Commencement Date: 01/07/1998 **Project Completion Date:** 30/06/2002

Research Program: Farming Systems Agronomy

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Part 3 – Final Report Format

1. Outline the background to the project.

Managing sustainable cotton production is becoming more difficult with the ever-increasing demands for limited resources. To assist with management of cotton crops the technology resource centre (TRC) of the Australian Cotton CRC aims to develop and distribute a range of decision support systems. Some of these systems are computerised eg. entomoLOGIC, nutriLOGIC, and hydroLOGIC, which all come under the banner of CottonLOGIC. The package is accepted as an industry standard for integrated pest management and is widely distributed and used across the industry (registered copies 785 Dec. 1998; currently 1177 Sep. 2002). However, supporting existing products, changing computer systems (eg. Windows 3.11 to Windows 95 and now Windows 98), increasing demands for other computerised decision support tools to be developed and demands by industry to investigate new opportunities (eg. GIS capabilities), have placed significant pressure on the resources of the TRC to meet these needs. Presently, one full time programmer is assigned to developing CottonLOGIC decision support tools, however, much of his time is dedicated in supporting and refining CottonLOGIC to meet users requirements. In doing so, much needed development and enhancement of new and existing software have been neglected, examples include:

- Development of hydroLOGIC and water balance/budgeting components in CottonLOGIC.
- Development of a user-friendly cotton model.
- Development of CottonLOGIC to enable merging of user data from different paddocks/farms for overall analysis of pest management and farm operations.
- Implement suitable on-line help capabilities within CottonLOGIC.
- Tools required for research support including data collection and experimental picker software.
- Storing CottonLOGIC code for future use.
- Automate the Cotton CRC's publication posting and request section of the web.
- Completion of the Cotton CRC's Industry database.
- Maintain and create new software installers.
- Upgrading CottonLOGIC to Visual Foxpro.

Access to further programming support will allow some of the tasks that are necessary for continued progress of decision support to be completed and thus allow the benefits of these tools to be passed on to industry much quicker whilst maintaining support.

Evaluation of the impact of computerised decision support to assist in decision-making processes is important for planning and future development of such products. Recent attempts to quantify the level and type of use of products such as EntomoLOGIC have not been successful. A survey conducted in May 1997 had approximately 10% of users reply. Novel approaches have been used in other decision support projects in Australia to evaluate acceptance and use of such products. This part of the project aims to utilise the skills of an independent consultant specialised in evaluation of decision support to assess the impact and use of CottonLOGIC and other technologies (eg. Publications, extension services) to influence management practice and attitudes within the industry. The basic approach to all such evaluations is to combine several of the following methods:

- The consultant to meet with people closely involved in the development of the package to evaluation strategies.

- The consultant to conduct a series of semi-structured interviews with three to four people in each key stakeholder group, e.g. CSIRO, Govt. Depts., consultants, growers (a mixture of companies and family businesses separately), and representatives of grower organisations. The data collected will be condensed into an interim report.
- With the assistance of the consultant conduct another mail survey to put quantifiable data behind the key findings of the interim report.
- Again with the assistance of the independent consultant co-ordinate a number of focus-group discussions to identify precise meanings, cause and effects, alternative solutions and opportunities or whatever is needed for decision support development.
- The consultant to prepare a report and presentation on findings for key-stakeholders.

It is envisaged that this activity be conducted over the duration of the project so that the ongoing assessment of other groups in the industry can be included in the evaluation. In addition to this it will lead to a more complete qualitative and quantitative assessment of decision support while adding understanding to the depth of learning and understanding of the environment in which computerised decision support has to work, and of the effects it has.

2. List the project objectives and the extent to which these have been achieved.

The aims of this project were:

- To provide additional programming and support capabilities for computerised decision support in the cotton industry.
- To evaluate the impact and nature of use of computerised decision support in the Australian cotton industry to assist in planning and future development of these capabilities.

Specific objectives that were to be achieved in each year of the grant were:

Year 1

- Employ a computer programmer with Foxpro, Visual FoxPro or Dbase language capabilities.
- Assist in the development of CottonLOGIC to enable merging of user data from different paddocks/farms for overall analysis of pest management and farm operations.
- Provide support to industry and assist with distribution of decision support products
- Assist in the development of CottonLOGiC and other computerised decision support tools
- Investigate feasibility of new approaches for implementation into CottonLOGIC (eg. GIS capabilities).
- With the assistance of a specialised independent consultant conduct industry consultations (outlined in background of this proposal) to evaluate the current impact and nature of use of computerised decision support.
- Submit a report and evaluation activities to key industry stakeholders.

Year 2

- Provide support to industry and assist with distribution of products

- Assist in the development of CottonLOGIC and other computerised decision support tools
- Investigate and implement suitable on-line help capabilities within CottonLOGIC
- Investigate new ideas for feasibility for implementation into CottonLOGIC.
- With the assistance of a specialised independent consultant continue evaluation activities (outlined in background of this proposal) to asses the impact and nature of use of computerised decision support.
- Submit a report and evaluation activities to key industry stakeholders.

Year 3

- Provide support to industry and assist with distribution of decision support products
- Assist in the development of CottonLOGIC and other computerised decision support tools
- Investigate new ideas for feasibility for implementation into CottonLOGIC (eg. GIS capabilities).
- Investigate the feasibility of migrating CottonLOGIC software from FoxPro 2.6 to Visual FoxPro, and begin implementing if required.
- With the assistance of a specialised independent consultant continue evaluation activities (outlined in background of this proposal) to asses the impact and nature of use of computerised decision support.
- Submit a final project report.

Achievements

This project has run from the 1st July 1999. A new programmer Darren Linsley was employed in late December 1999.

Present development in both areas DSS and OZCOT has been outstanding compared with the past. ***This has primarily occurred because of enhanced resources provided by CSIRO, and the CRDC (resulting from this project) for the employment of additional programmers over the last three years.***

In the case of computerised decision support systems in the past three years we have been able to complete:

- A handheld version of CottonLOGIC that will run on the Palm OS ® operating system for in field electronic data collection and decision-making. Released at the Australian Cotton Conference in August 2002. We consider this a world first for this technology.
- A prototype whole farm and field water accounting package and water use efficiency calculator. The water use efficiency officers in Queensland and New South Wales are presently testing this. To be included in CottonLOGIC.
- Redevelopment of a functional and visually improved Cotton CRC website. Deployed early Dec 2001 and again in August 2002.
- Dedicated resources to the redevelopment of cotton crop simulation model OZCOT. The model is pivotal in the research effort into farming systems, HydroLOGIC, compensation and fibre quality.
- Publication of specifications to allow other programmers to develop software that can communicate and access CottonLOGIC information.

- Development of a Beta version of HydroLOGIC (Irrigation scheduling and management) for preliminary testing this summer. To be included in CottonLOGIC.
- Resources to work with SILO to improve Cotton Industry's access to weather data through the Internet and CottonLOGIC software.
- Development of a user-friendly version of OZCOT. All industry development officers have this tool and have been trained to use it.
- We have also managed to maintain general support for CottonLOGIC. Fixing bugs and some improvements in reporting capabilities.
- Enhanced training in the use of CottonLOGIC. We are working with more Universities and colleges (Warren TAFE, UQ, UNE, Emerald Ag) to enable CottonLOGIC to be included in their courses.
- Compiling and publishing the results of validation experiments conducted over the past 10 years for promoting CottonLOGIC, IPM and nitrogen management.
- Various other software tools developed for research purposes. Some include software to present weather data on the Internet, software to assist in operation of experimental pickers, Fusarium assessment using the Palm handheld in the field, tools to compile validation data for simulation model testing. *Important to note this has enabled other research to proceed much more efficiently.*
- Significant planning into the future infrastructure of software development to maintain and improve functionality of DSS.

During this period there have also been three major releases of CottonLOGIC and four minor releases. The major features were spray ordering and gross margin analysis.
Independent evaluation of decision support activities commenced with this project. Mr Peter Van Beek was contracted to undertake this activity. He has conducted numerous interviews **(50+) with a range of different stakeholders and CottonLOGIC users in the industry.** Comprehensive reports of the major findings have been provided to the CRDC and industry. The reports have been extremely positive, highlighting the importance of CottonLOGIC and decision support to the industry both directly and indirectly. The assessment also played a significant role in identifying the problems and deficiencies in decision support development and provide a basis on which to improve. Where possible much of the recommendations in the reports have been acted upon by the decision support development team. Some quotes taken from the report are below:

'The science behind CottonLOGIC was seen as one of its valuable aspects'.
'The use of CottonLOGIC had affected relationships with consultants and other stakeholders'.
'One saw CottonLOGIC as a back-up and verification, and would be upset if it was not regularly updated'.
'Consultants would survive without CottonLOGIC, but not having it would be a disaster for the industry, as it is important in disseminating information'
'The new versions come out too late to try changes, familiarise, and train staff in the applications'.

Continuation of this evaluation has lead to a more complete qualitative and quantitative assessment of decision support while adding understanding to the depth of learning and understanding of the environment in which computerised decision support has to work, and of the effects it has.

3. How has your research addressed the Corporations three outputs: Sustainability, profitability and international competitiveness, and/or people and community?

This project has strong links with the fundamental operation of the Technology Resource Centre of the Cotton CRC and delivery of research outcomes from both CRDC and Cotton CRC funded projects.

Providing cotton managers with the latest research via computerised decision support, enables decisions to be made that are sensible, profitable, and have the lowest impact on the surrounding environment. CottonLOGIC has become an industry standard in record keeping and pest management, and thus its use is recommended in the Best Management Practice guidelines.

4. Detail the methodology and justify the methodology used.

This project has allowed more resources for the team to develop decision support more effectively. Another important aspect when considering the process of development of computerised decision support is that does not only include the programming of the software. Successful development and delivery of decision support for adoption by industry encompasses many different processes from the conception of an idea through to delivery and support. Some of the important defined functions and activities of the decision support team presently undertaken are outlined in Table 1. Each role requires resources and is critical to the overall success of the products delivered by the team.

Table 1: **Team functions and examples of activities of the decision support team.**

Team Function	Example of activities
Software development	- Software coding, and testing
Software engineering	- Investment in maintaining software development platform
Education and training	- CottonLOGIC workshops, field days
Support	- Phone support at the Cotton CRC's Technology Resource Centre (TRC), direct support
Industry Feedback	- Workshops, TRC, Industry Steering Committee
Packaging and Distribution	- CottonLOGIC packages, and mail outs through the TRC
Promotion	- Attendance at trade shows, local shows with the TRC
Scientific Review	- Attendance at Scientific Conferences, Publications, Peer Review, Scientific Journals
Field Validation	- Regional specific field trials using CottonLOGIC, working closely with the Industry Development Officers
Project Evaluation	- Surveys, Independent feedback from specialist DSS Consultant
Administration	Personnel and project management, sourcing funding, strategic planning

In an endeavour to achieve a focus on developing and delivering decision support, it is important to define a consistent and equitable strategy based on simple philosophical and moral principles to meet the needs of all stakeholders relevant to the cotton industry, and to

the development of decision support. Points which try to encompass the philosophy by which the decision support team attempts to function are as follows:

- Aim to develop effective, useful and user-friendly computerised decision support systems backed by good science.
- Promote responsible crop management based on the best and most appropriate science that is accepted by industry (e.g. Best Management Practice).
- Responsibility for the science used in the software is inherently shared by all researchers involved, and not entirely by developers of decision support.
- Selection of priority areas for effort is based on appropriate constructive feedback and industry input.
- No group or region within the industry will be favoured nor ignored.
- Approach each task pragmatically, and only after careful planning and responsible considerations commit to software development.
- Make activities and decisions transparent to superiors, industry and funding bodies.
- Produce quality outcomes, thoroughly tried and tested.
- Decision support systems are just that, they do not make the decisions, but provide information to assist in the decision-making processes. Promote the decision support systems as tools. (E.g. Promote IPM, and CottonLOGIC helps achieve this)

Provision of extra resources provided by this project allowed these processes to be implemented.

5. Detail results including the statistical analysis of results.

Not Applicable

6. Discuss the results, and include an analysis of research outcomes compared with objectives.

Not Applicable

7. Provide an assessment of the likely impact of the results and conclusions of the research project for the cotton industry. Where possible include a statement of the costs and potential benefits to the Australian cotton industry and future research needs.

CottonLOGIC is continually being upgraded to account for industry and research requirements. Minor releases are constantly been made available through the Cotton CRC's website

Future trial results and the promotion of CottonLOGIC will be communicated through workshops, Cotton Grower Articles, CottonTales, Media releases, Trade shows and field days. Past field work on insect management and NutriLOGIC will be compiled as a journal articles.

Results of any programming conducted in this study and others supported by the CRDC are disseminated through CottonLOGIC or the Cotton CRC's website. Results of evaluation

activities will continue to be distributed to study participants as well as relevant industry parties including the CRDC. The CRDC has commissioned research for 2002-2003 to review the economic benefits of decision support and outline a plan for the future.

8. Describe the project technology (eg. commercially significant developments, patents applied for or granted licenses etc).

Software is provided free of charge to the Australian cotton industry.

9. Provide a technical summary of any other information developed as part of the research project. Include discoveries in methodology, equipment design, etc.

Refer to section 2 for information and software developed in the course of this project.

10. Detail a plan for the activities or other steps that may be taken;

(a) to further develop or to exploit the project technology.

(b) for the future presentation and dissemination of the project outcomes.

This project ceased 30/06/2002. Funding was provided by the CRDC to fund a new proposal titled 'Supporting development and evaluation of cotton computerised decision support systems' again with the specific aim to maintain programming support and decision support evaluation.

It is important to note that this support has been crucial to not only maintaining development of CottonLOGIC, but has provided the resources for other development activities that have been long demanded by the industry. It also gives the decision support group some scope to explore new opportunities. The evaluation component of this project has provided an extremely valuable and independent process in which to gauge the DSS software needs of the industry.

11. List the publications arising from the research project.

Bange, M., Deutscher, S., and Plummer, C. (1999). CottonLOGIC: Survey shows the way forward. 20(4). The Australian Cottongrower. pp.40-42.

Constable, G., Deutscher, S., Dorahy, C., Larsen, D., Rea, M., Rochester, I., Wright, P. and Thongbai, P. (2001). NUTRIpak, a practical guide to cotton nutrition. Australian Cotton CRC. CSIRO Publishing.

Deutscher, S.D., Bange, M.P. and Rochester, I. (2001). Testing NutriLOGIC, a decision aid for nitrogen fertiliser management in cotton. Proceedings of the 10th Australian Agronomy Conference, Hobart, TAS. 2001. www.regional.org.au/au/asa/2001/

Deustcher, S.D., Bange, M.P., Johnston, S., Larsen, D., Linsley, D., and Whiteside, S. (2002). Introducing CottonLOGIC for the Palm OS® handhelds. In Proc. 11th Aust. Cotton Conf. August, Brisbane Aust. The Aust. Cotton Growers Research Organisation.

Deutscher, S.A. (2001). NutriLOGIC Trial Results 1999/2001 (Boggabri) Upper Namoi Valley Cotton Trials Booklet.

Deutscher, S.A. (2002). NutriLOGIC – optimising your N fertiliser rates. Proceedings of Lower Namoi Field Day.

Deutscher, S.A. (2001). Supporting science through CottonLOGIC. Australian Cotton Grower magazine. Nov/ Dec issue 2001.

Deutscher, S.A. (2000) Useful Internet Sites. 10th Aust. Cotton Conference, 16-18 August, Brisbane Aust. Women in Agriculture session.

Deutscher, S.A. (2000). Validation and Calibration of NutriLOGIC. In Proc. 10th Aust. Cotton Conf. 16-18 August, Brisbane Aust. The Aust. Cotton Growers Research Organisation, pp. 315- 319.

Deutscher, S. (1999). CottonLOGIC Moving towards 2000. The Australian Cotton Grower.

Hearn, A.B. and Bange, M.P. (2002). SIRATAC and CottonLOGIC: persevering with DSSs in the Australian Cotton Industry. Agricultural Systems. 74 (1) pp. 27-56.

Van Beek, P. (1999) CottonLOGIC - impact assessment first report. Consultancy report provided to CSIRO Cotton Research Unit

Van Beek, P. (2000) CottonLOGIC - impact assessment second report. Consultancy report provided to CSIRO Cotton Research Unit

Van Beek, P. (2002) CottonLOGIC - impact assessment of CottonLOGIC for Palm OS® handhelds. Consultancy report provided to CSIRO Cotton Research Unit

12. Are changes to the Intellectual Property register required?

The following named remain the intellectual property of CSIRO Plant Industry:

CottonLOGIC – cotton management software (presently includes Entomologic and NutriLOGIC)

OZCOT – cotton crop simulation model

HydroLOGIC – software to assist cotton growers with strategic and tactical irrigation management.

The following named remain the intellectual property of both CSIRO Plant Industry and the Australian Cotton CRC:

CottonLOGIC for PALM OS® handhelds and associated conduit software – a version of CottonLOGIC that uses the PALM computing system.

Part 4 – Final Report Plain English Summary

Project Title: Enhancing Development, Support and Evaluation of Computerised Decision Support

Principal Researchers: Dr M.P. Bange, Mr C. Plummer and, Mr Darren Linsley, Mr. D. Larsen

Project Aims:

- To provide additional programming and support capabilities for computerised decision support in the cotton industry
- To evaluate the impact and nature of use of computerised decision support in the Australian cotton industry to assist in planning and future development of these capabilities.

Summary:
To assist with management of cotton crops the technology resource centre (TRC) of the Australian Cotton CRC aim to develop and distribute all types of decision support systems. Some of these systems are such as CottonLOGIC is accepted as an industry standard for integrated pest management and is widely distributed and used across the industry (registered copies 785 Dec. 1998). However, supporting existing products, changing computer systems, increasing demands for other computerised decision support tools to be developed, and demands by industry to investigate new opportunities have placed significant pressure on the resources of the TRC to meet these needs. Access to further programming support will allow some of the tasks that are necessary for continued progress of decision support to be completed and thus allow the benefits of these tools to be passed on to industry much quicker whilst maintaining support.

Evaluation of the impact of computerised decision support to assist in decision-making processes is important for planning and future development of such products. Recent attempts to quantify the level and type of use of software products have not been successful. This part of the project utilised the skills of an independent consultant specialised in evaluation of decision support to assess the impact and use of CottonLOGIC and other technologies (eg. Publications, extension services) to influence management practice and attitudes within the industry. Accessing this information will assist in future developments of software, promotion, training and distribution.

Present development in both areas DSS and OZCOT has been outstanding compared with the past. ***This has primarily occurred because of enhanced resources provided by CSIRO, and the CRDC (resulting from this project) for the employment of additional programmers over the last three years.***

Comprehensive reports of the major findings have been provided to the CRDC and industry. The reports have been extremely positive, highlighting the importance of CottonLOGIC and decision support to the industry both directly and indirectly. The assessment also played a significant role in identifying the problems and deficiencies in decision support development and provide a basis on which to improve. Where possible much of the recommendations in the reports have been acted upon by the decision support development team.