



Final Report

On Farm Series | Cotton Research & Development Corporation

Part 1 - Summary Details

CRDC Project Number: **CSP151**

Project Title: Support Development and Independent
Evaluation of Cotton Management Packages

Project Commencement Date: 01/07/2002 **Project Completion Date:** 30/06/2005

CRDC Program: On-Farm

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Part 3 – Final Report Guide

Background

Cotton growers are facing increasing pressure to manage resources more cost effectively and to be more accountable for the impact their decisions have on the surrounding environment. Decision support systems (DSS) have been developed to provide cotton growers with the best information available from research to assist with their management decision-making. A range of DSS are now available to assist industry in crop management, they are:

- CottonLOGIC – Pest management, nitrogen nutrition management, data recording and analysis (Over 1200 copies distributed annually).
- CottonLOGIC for Palm OS ® – In field electronic data recording and decision tools.
- OZCOT – user friendly version used by extension personnel and APSRU’s Commercial FARMSCAPE initiative. OZCOT is also extensively used in research.
- HydroLOGIC – Tactical and strategic water management tool – prototype released during 2002/2003 cotton season. Full release 2003/2004.
- WUEcalc – Field and whole farm WUE calculator used by extension personnel – ultimately to be incorporated into HydroLOGIC
- Cotton CRC’s website – aims to be central repository of research based information generated by the CRC and its participating organisations.
- Cotton CRC’s industry database – developed by the Cotton management support systems team and used to distribute extension material.

This project follows on from CRDC project CSP108C ‘Enhancing, Development, Support and Evaluation of Computerised Decision Support. The aim of this project was to provide additional programming and support capabilities for computerised decision support in the cotton industry and to provide independent evaluation of decision support to assist with planning and future development.

The project proposed here also has strong links to the CRDC project CSP125C ‘Continued development and field evaluation of micro-computer cotton management packages. This project supports the salary of Sandra Deutscher (CSIRO Experimental Scientist). Sandra is responsible for software testing, field validation of software once it is developed, software training, and contributing to software support. Project CSP125C also provides resources for the production costs of the CottonLOGIC package as well as some resources that contribute to overall software development.

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 software 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 extremely valuable information to help gauge the DSS software needs of the industry.

Objectives

The focus of the Cotton Management Support Systems Team is to take a leading role in ensuring that good science is passed effectively to the industry. Some outcomes of science can be delivered affectively via written documents, but increasingly there is a demand for

more interactive information delivery that enables growers to tailor the information to their needs and also in the rapidly changing world for up-to-date information. The aims of the project are:

- To maintain additional programming and support capabilities for computerised decision support in the cotton industry.
- To continue evaluating 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 and milestones are listed below:

Objectives and Milestones Year 1:

- (i) 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 for area wide management concerns.
- (ii) Provide support to industry and assist with distribution of decision support products
- (iii) Assist in the development of HydroLOGIC software for assisting growers' irrigation management.
- (iv) 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. This year the particular focus is on evaluating the Hand-held version of CottonLOGIC.
- (v) Submit a report and evaluation activities to key industry stakeholders.

Objectives and Milestones Year 2:

- (i) Provide support to industry and assist with distribution of DSS products
- (ii) Assist in the development of HydroLOGIC software for assisting growers' irrigation management.
- (iii) Develop a CottonLOGIC part of the Cotton CRC website dedicated to assisting with development and support of computerised decision support.
- (iv) Investigate new ideas for feasibility for implementation into CottonLOGIC.
- (v) With the assistance of a specialised independent consultant continue evaluation activities to assess the impact and nature of use of computerised decision support.
- (vi) Submit a report and evaluation activities to key industry stakeholders.

Objectives and Milestones Year 3:

- (i) Provide support to industry and assist with distribution of decision support products
- (ii) Assist in the development of CottonLOGIC and other computerised decision support tools
- (iii) Investigate new ideas for feasibility for implementation into CottonLOGIC.

- (iv) With the assistance of a specialised independent consultant continue evaluation activities to assess the impact and nature of use of computerised decision support.
- (v) Submit a final project report.

Methods

Supporting existing products, changing computer systems (eg. Windows 3.11 to Windows 95, 98, 2000 and now Windows XP), and continued demands for other computerised decision support tools to be developed and demands by industry to explore new opportunities, place significant pressure on the resources of the decision support team to meet all these needs. Presently, one full time programmer is assigned to developing CottonLOGIC decision support tools, however, much of his time can be dedicated in supporting and refining CottonLOGIC to meet users requirements. The provision of resources to fund an additional programmer has allowed and will continue to allow significant development to occur in the following areas:

- The completion of the handheld version of CottonLOGIC to be released to industry at the 2002 ACGRA conference.
- A prototype of water budgeting software which has been made available to IDO's and water use efficiency officers for field validation.
- A revamped version of HydroLOGIC in the process of being developed.
- Significant progress towards the reengineering of all software to meet the future needs of the industry and software development.
- Providing documentation of CottonLOGIC's database structure to enable third party software to access data contained in CottonLOGIC used for other purposes (e.g. GIS).
- Development of a new Australian Cotton CRC's website.
- Software tools to assist processing large amounts of data generated by the OZCOT crop simulation model.
- Jointly developing software with APSRU (Agricultural Production Systems Research Unit) tools to assist with storing model validation data, and to be able to compare this data with crop simulation model output.

Maintaining this 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. In the past the cotton management support systems team has attempted to quantify the usage of products such as EntomoLOGIC, but the accuracy of internal evaluations is often questioned. 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 decision support technologies to influence management practice and attitudes within the industry. The basic approach to all such evaluations is to combine several of the following methods:

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

2. 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.
3. With the assistance of the consultant conduct another survey to put quantifiable data behind the key findings of the interim report.
4. 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 for decision support development
5. The consultant to prepare a report and presentation on findings for key-stakeholders.

This activity has been ongoing over the past three years. The independent consultant Mr Peter Van Beek has conducted numerous (50+) interviews with a range of different stakeholders 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 provides 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 effected 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 will lead to a more complete qualitative and quantitative assessment of decision support while adding understanding to the depth of learning and appreciation of the environment in which computerised decision support has to work, and of the effects it has.

Results

This project supports part of the overall effort of the CSIRO Plant Industry Cotton Management Support Systems team based in Narrabri. Financial support is also provided by CSIRO Plant Industry and the Australian Cotton Cooperative Research Centre. A brief outline of the major results and outcomes from this project are given below under the general headings of: Decision support development and distribution; Field validation of decision support; Decision support training and support; and Decision support industry feedback.

Decision support development and distribution

The Cotton Management Support Systems through the additional support provided by this project assisted in the completion of the following tasks:

- NutriLOGIC Online
- HydroLOGIC
- Cotton CRC's Website
- Implementation of the CSIRO Common Modelling Protocol
- Online Pest and Beneficial Guide and IPM Guidelines
- The Early Season Diagnosis web tool
- Online Myall Vale Weather Data

Details of these activities are documented in more detail in the CRDC final report for project CSP163 'Delivering Science to Agribusiness - Novel Decision support tools'.

Other specific tasks that this project assisted with are documented below.

CottonLOGIC Redevelopment

Significant planning into the future infrastructure of software development to maintain and improve functionality of DSS had also commenced during the course of this project. Constant input and feedback has been sort from all CottonLOGIC stakeholders (researchers, growers and industry) during the planning and design of the new CottonLOGIC software. This process has included a review of existing CottonLOGIC software, the creation of functional specification documents, technical specification documents and a software prototype. Further details of specifications for the new CottonLOGIC are contained in the appendix of this report. The result of this input has seen the inclusion of new ideas and also the refinement of existing concepts into a non-functioning prototype which is being used to assist in gathering feedback from users (see Figure below).

Redevelopment of EntomoLOGIC software has begun. It is anticipated that a desktop and handheld version will be made available to industry in the 2006/2007 cotton season.

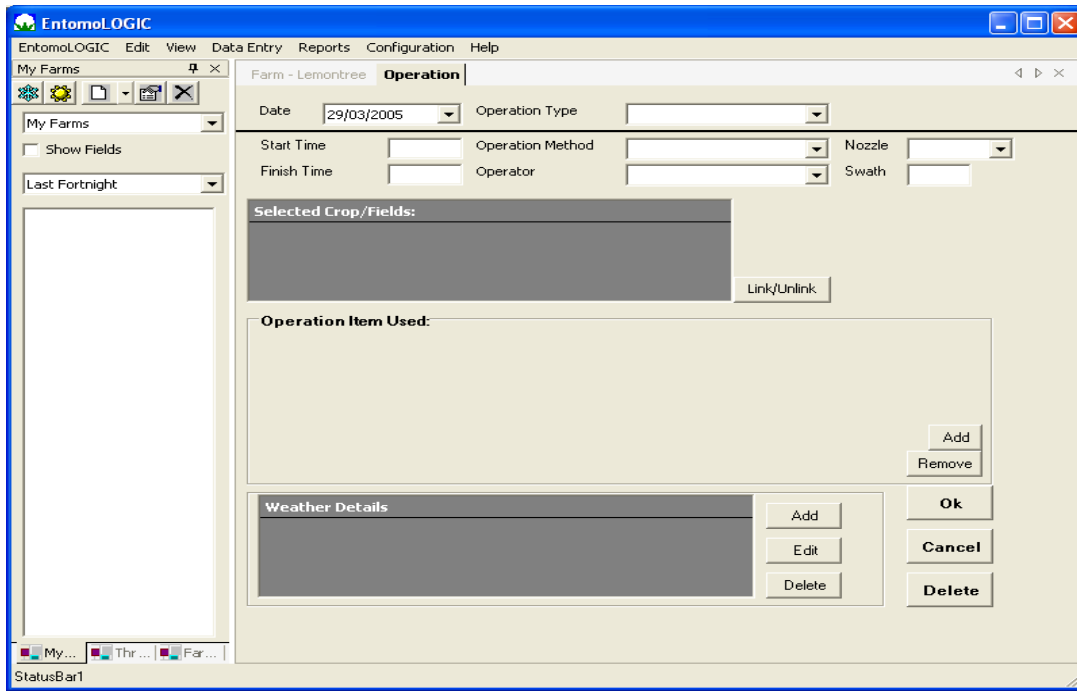


Figure: Screen shot of the CottonLOGIC prototype which is being used to assist in gathering feedback from users.

Scenario Generator

Software to run multiple simulations of the OZCOT crop simulation model was developed. This enables the researcher to generate quickly large amounts of information from the OZCOT simulation model and compile it into a database for interrogation (see Figure below). We have also modified an existing database interface that can be used to display and present this information. It is intended that these tools will be used to construct databases of information generated by OZCOT for a range of irrigation management options for different cotton growing regions. Information can be displayed graphically and account for variation in yield, water use from historical perspective for different management options (see Figure below). This decision tool has been tentatively named 'Cotbase'.

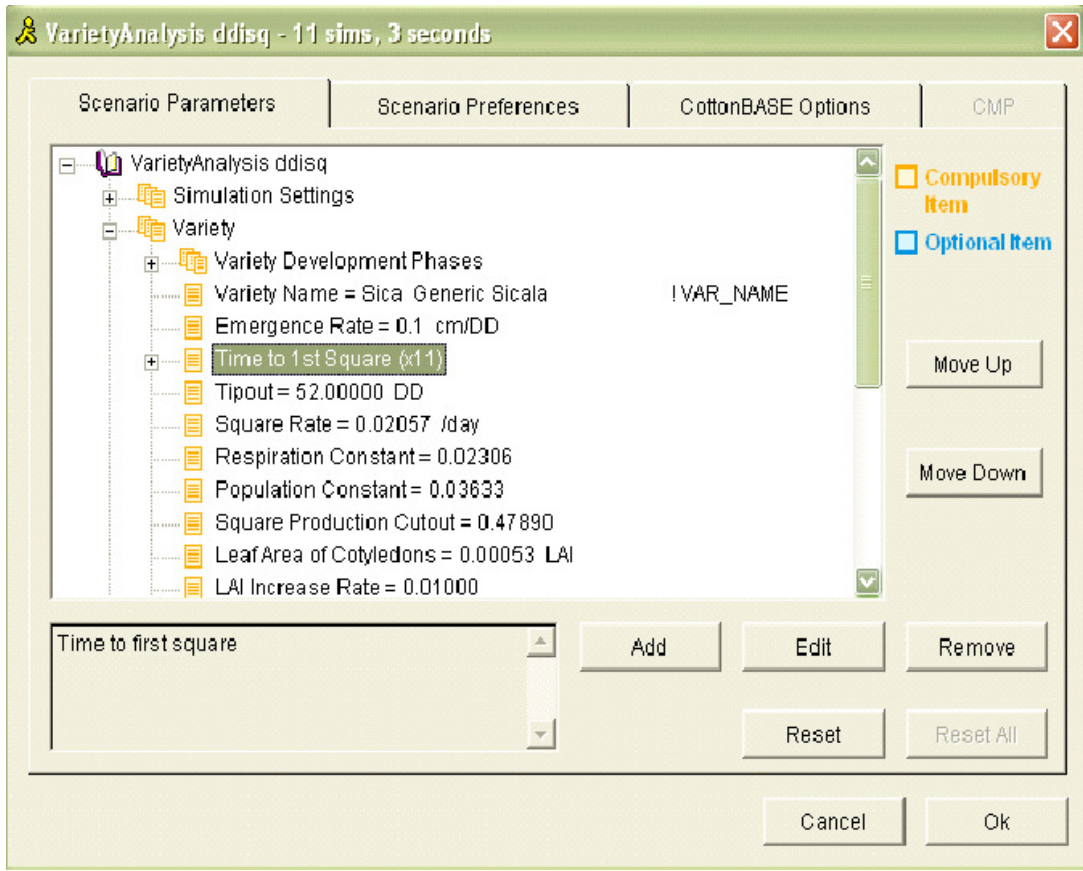


Figure: Screenshot of the OZCOT scenario generator used to generate multiple runs of the OZCOT cotton crop simulation model.

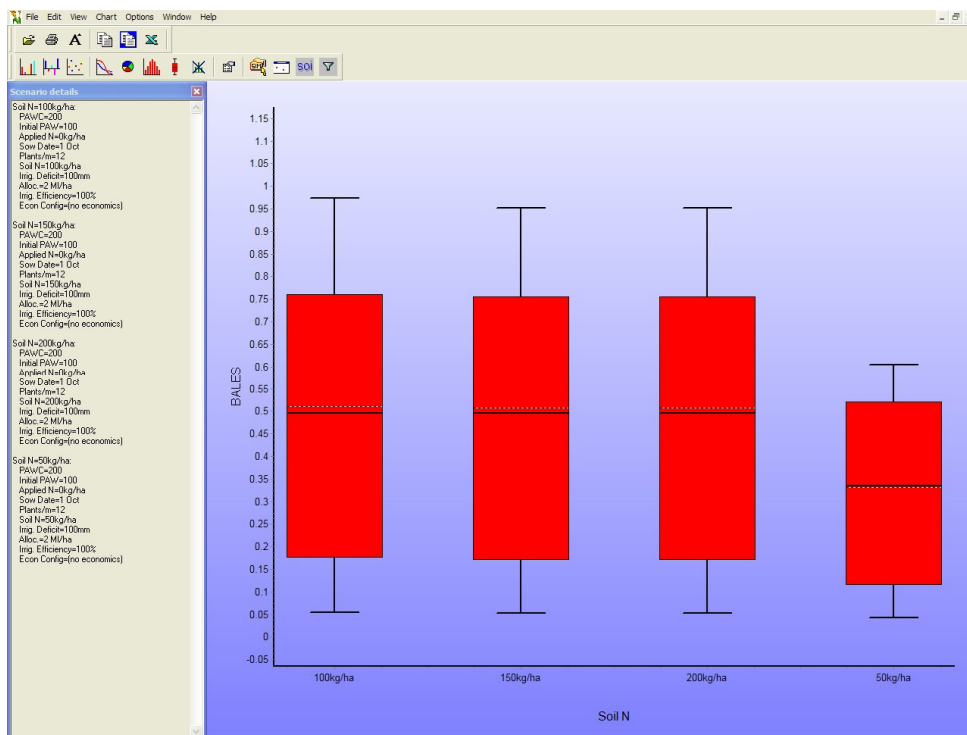


Figure: Screenshot of the Cotbase decision tool used to present and analyse information generated from multiple simulations of the OZCOT cotton crop simulation model.
CottonLOGIC Handheld

Two additional tools were developed as part of CottonLOGIC handheld system: GPS capability and whitefly data entry (see Figure below). In addition to these tools the CottonLOGIC handheld version was upgraded to run on new Palm® operating systems.



Figure: Screenshot of CottonLOGIC for Palm OS® whitefly data entry screen.

Decision Support Evaluation

Due to reductions in project funding associated with the drought activities designated to evaluate the impact of cotton decision support were only completed in the first year of the project.

The evaluation commissioned was the fifth independent assessment done on the impact of decision support systems for the cotton industry for the Cotton Management Support Systems team. The assessments have provided progressive feedback aimed at helping to develop these decision support tools. The two earlier reports focussed on CottonLOGIC, while the other two focussed on the hand-held system. The reports of all four assessments are available on request from Dr M Bange, Australian Cotton Research Institute (ACRI) Narrabri.

This report has a wider focus. At the time of commissioning this assessment, CottonLOGIC required a major rewrite on to a different platform in order to remain current. This would incur substantial cost. In addition, some parts of CottonLOGIC were highly specific to cotton and/or pest management while other parts were of a more general record-keeping nature. During the past few years, the rural software industry had consolidated around a smaller number of commercial suppliers of software for general farm records. The Support Systems team thus questioned how appropriate it would be to spend industry money on transcribing and updating the general record-keeping parts in CottonLOGIC. They also wanted to assess if the cotton/insect specific sections of CottonLOGIC were still wanted by the industry and if these would be worth transcribing onto another platform.

The author of the evaluation report was asked to conduct interviews with a wide range of users to obtain insights about where and how computer-based decision support tools fitted into interviewees' management. The aim was to assist the team in directing its (limited) resources to best serve the cotton industry with computer-based decision support tools. Section 3 of the report contains a summary of the findings. Detailed synopses of the interviews are given in Section 6. Transcripts of the full interviews have been made available to Dr Bange. The report was discussed with the CottonLOGIC team prior to finalising it.

The author conducted 24 interviews between 26 May and 2 June 2003 – 14 were face-to-face, 10 by phone. A team member selected the interviewees: growers (6 interviewees), company agronomists (3), company managers (3) consultants (9), and others (3). Interviewees lived in Central and Southern Queensland and in Northern NSW down to Narrabri. Some were known to be keen users of computer-based programs; others preferred paper-based systems.

The data strongly indicated that:

- There will be few if any objections if CottonLOGIC was made compatible with, and linked to, other programs – such a decision will be strongly supported.
- There will be little objection if CottonLOGIC would leave the recording of general farm operations to the commercial programs.
- There is likely to be very strong protest if the insect part of was no longer available.
- Work on other science-based programs such as HydroLOGIC is supported and expected.
- Work related to quality is expected to become important.

More inferred than indicated is the need to continue with the Palmtop. Given the amount of data to be entered, it will be essential for efficiency and avoiding mistakes in transcribing. Linkage of the Palmtop with either GPS and / or a mobile telephone is most desirable.

A full copy of the report is provided in the Appendix of final report.

Outcomes

Economic

Improved technologies to assist with optimising strategies for pest and irrigation management have the benefit to increase fibre quality and yield. Optimising inputs such as fertiliser, water and pesticides will also reduce costs and increase profitability.

Environmental

Sensible and logical decisions based on sound science and utilising information technology demonstrates a willingness to optimise use of inputs such pesticides fertiliser and water. Less pesticides and fertiliser will benefit the riverine environment. Appropriate timing of irrigation practices lessens the chance of deep drainage.

Community

Demonstration to community of the Australian cotton industry readily adopting innovative information technologies to improve regional economic and environment sustainability. The decision support software produced by the Cotton Management Support Systems Team can also be used for education and training.

Intellectual Property

Project Participant supplying Background IP.	Description of IP.
	All Software Tools
CSIRO Plant Industry	CottonLOGIC Software; IP Situation – Copyright; Conditions of Use – Research Agreement; Freedom to Operate - Yes
CSIRO Plant Industry	HydroLOGIC Software; IP Situation – Copyright; Conditions of Use – Research Agreement; Freedom to Operate - Yes
CSIRO Plant Industry	EntomoLOGIC software; IP Situation – Copyright; Conditions of Use – Research Agreement; Freedom to Operate - Yes
CSIRO Plant Industry	OZCOT crop simulation model Software; IP Situation – Copyright; Conditions of Use – Research Agreement; Freedom to Operate - Yes
CSIRO Plant Industry	Early season diagnosis/day degree calculator; IP Situation – Copyright; Conditions of Use – Research Agreement; Freedom to Operate - Yes
CSIRO Plant Industry/Cotton CRC	CottonLOGIC for the Palm® handheld software; IP Situation – Copyright; Conditions of Use – Research Agreement; Freedom to Operate - Yes
CSIRO Entomology	HEAPS- Helicoverpa; IP Situation – Copyright; Conditions of Use – Research Agreement; Freedom to Operate - Yes
CSIRO Plant Industry	NutriLOGIC; IP Situation – Copyright; Conditions of Use – Research Agreement; Freedom to Operate - Yes
CSIRO Plant Industry	Cotton Scenario Generator; IP Situation – Copyright; Conditions of Use – Research Agreement; Freedom to Operate - Yes
CSIRO Plant Industry	WUEcalc; IP Situation – Copyright; Conditions of Use – Research Agreement; Freedom to Operate - Yes

Conclusion

A take home message is that this project was able to deliver a large range of world class cotton decision support tools. There is strong evidence to suggest that these tools are considered valuable to the industry. A range of DSS activities that this project provided additional support to were:

- NutriLOGIC Online;
- HydroLOGIC version 1;

- Commencement of CottonLOGIC redevelopment;
- Maintenance of the Cotton CRC’s website;
- Implementation of the CSIRO’s common modelling protocol;
- Completion of the online pest and beneficial guide.
- Assistance in completion of the revised IPM guidelines;
- Release of the online Early Season Diagnosis Tool;
- Delivery of Myall Vale (ACRI) weather data online;
- Completion of a new version of the CottonLOGIC crop check cards;
- Field validation of the Early Season Diagnosis Tool and sucking pest sampling methodologies; and
- Conduct of CottonLOGIC/HydroLOGIC training workshops and provision of a decision support helpdesk.
- Completion of upgrades to CottonLOGIC for Palm® OS handhelds
- Development of a OZCOT scenario generator and graphical display tool

Extension Opportunities

Development of DSS is specifically aimed at research dissemination. CottonLOGIC and other decision support software are continually being released or upgraded via the Cotton CRC’s website or distributed through the TRC. A key outcome of this project will be the provision of new tools in a number of formats (written, CD ,WWW) to meet the needs of industry. This will ensure industry-wide to the industry. Minor releases or improvements to software are constantly been made available through the Cotton CRC’s website. Other initiatives include:

- The formal release of HydroLOGIC will occur during the life of this project.
- A redeveloped HEAPS will be made available to researchers.
- Improvements to the user-friendly OZCOT will be made available to extension personnel.
- The CRC’s website will be maintained.

Online Resources

Online decision support tools developed by the Cotton Management Support Systems team delivered via the web include:

Name	Purpose	Address
CottonLOGIC Support	Provision of support, upgrades and feedback	www.cotton.crc.org.au/CottonLOGIC
SILO day degree calculator	Calculates day degrees and provides historical analysis	http://www.cotton.crc.org.au/Tools/Agronomy/SILODayDegCalc.htm
Early season diagnosis tool	Crop monitoring tool based on SILO day degree	www.cotton.crc.org.au/esd

	calculator	
Pest and Beneficial Guides	Online resource for cotton insects	http://www.cotton.crc.org.au/insects.htm

Part 4 – Final Report Executive Summary

Managing sustainable cotton production is becoming more difficult with the ever-increasing demand on limited resources. In addition cotton growers are facing increased pressures to manage resources more cost effectively and to be more accountable for the impact that their decisions make on the surrounding environment. Computer based decision support systems (DSS) and simulation models are being developed and used to provide cotton growers with the best information and tools available from research to assist with their management decisions. A primary aim of the decision support and modelling teams in the cotton industry is to utilise sound and up to date technology, and integrate this technology across different electronic platforms and mechanisms, and finally delivering it to the industry for adoption ‘Science into Practice’.

While the flagship of cotton decision support is CottonLOGIC (registered copies 1175 Dec. 2001), there are many other tools that are being developed by the group such as the handheld version of CottonLOGIC, HydroLOGIC and the Cotton CRC’s website. Supporting existing products, changing computer systems (eg. Windows 3.11 to Windows 95, 98, 2000 and now Windows XP), and continued demands for other computerised decision support tools to be developed and demands by industry to explore new opportunities, place significant pressure on the resources of the decision support team to meet all these needs. Presently, one full time programmer is assigned to developing CottonLOGIC decision support tools, however, much of his time can be dedicated in supporting and refining CottonLOGIC to meet users requirements.

Importantly the support provided by this project 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 to occur. It also gives the decision support group some scope to explore new opportunities.

A range of DSS activities that this project provided additional support to were:

- NutriLOGIC Online;
- HydroLOGIC version 1;
- Commencement of CottonLOGIC redevelopment;
- Maintenance of the Cotton CRC’s website;
- Implementation of the CSIRO’s common modelling protocol;
- Completion of the online pest and beneficial guide.
- Assistance in completion of the revised IPM guidelines;
- Release of the online Early Season Diagnosis Tool;
- Delivery of Myall Vale (ACRI) weather data online;
- Completion of a new version of the CottonLOGIC insect check cards;

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- Conduct of CottonLOGIC/HydroLOGIC training workshops and provision of a decision support helpdesk.
- Completion of upgrades to CottonLOGIC for Palm® OS handhelds
- Development of a OZCOT scenario generator and graphical display tool

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. This information has directly assisted future developments of software, promotion, training, support and distribution.