Extension and Evaluation Resources

Australian Cotton Cooperative Research Centre

Planning and Conducting Focus Group Interviews

Ingrid Christiansen, August 2004

This document is designed for use by the cotton extension network as an aid in planning and conducting focus group interviews.

Throughout these notes, examples from the Australian cotton industry are indicated by the cotton boll symbol.

Introduction

When planning a new research or extension activity, a key objective is to match this activity to the current needs and perceptions of the client group. To do this, it is helpful to understand the range of attitudes that are held about the issue. Similarly, when evaluating the impact of research and extension investments we often look for a change in attitudes, opinions and practices. Whilst these changes are often considered difficult to measure, they are particularly important outcomes of extension programs.

Focus group interviewing is one technique that can be used to rapidly gather opinions and attitudes about an issue within an industry or sectors of an industry. The skills used in moderating focus group interviews are also useful skills for other extension activities.

What are focus groups and how are they used?

> Focus Groups: *"carefully planned discussion designed to obtain perceptions in a defined area of interest in a permissive, non-threatening environment."*[1]

Focus groups are a type of *semi-structured interview* conducted with a group of 6-8 people. They are particularly useful for exploring attitudes or feelings about a topic and to draw out specific issues. Participants are asked a series of open ended questions in a group setting and so are able to hear each others' responses and to make additional comments. This provides greater depth to the interview.

Some key points about focus groups[2]:

- It is an *interview*, not a discussion;
- It is not necessary for the group to reach any consensus;
- The object is to collect quality data where people consider their own views in context of the views of others.
- Focus groups gather qualitative data about attitudes.

Focus group interviews have been used since the 1930's by social scientists. They have been widely used for market research for the past 50 years to gather consumer perceptions and opinions.

Focus group interviews can be used for:

- Exploratory research;
- To assess the dimensions of an issue;
- To gather in-depth knowledge;
- To study how opinions form and change via a group discussion.

When would you use the focus group technique?

Focus groups can be used at any stage of an evaluation process. That is, they may be used for needs assessment, planning, review or improvement of a program. They are a useful technique but are not the only one! They have tended to be overused or misused in some areas. When thinking of using the focus group technique, consider the advantages and disadvantages. Consider also how widely focus groups have been used in the population group and the suitability to the topic in question.

" Focus groups are good to tease out what people really think. It is a better way to extract the real issues than a survey where people are often less forthright. Focus groups done well can extract the issues." *Bruce Pyke, CRDC*

Focus group interviews gather *qualitative data* to answer questions. They are useful in finding out why people feel the way they do – but are not able to determine how many people hold a particular point of view. Unlike Delphi or Nominal Group Techniques, focus groups do not aim to achieve consensus. Rather, they help to understand the depth and nature of the range of individual points of view.

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[1] *Kreuger R (1998) 'Focus Groups: A practical guide for applied research.' Sage: London*

[2] *Patton MQ (1980) Qualitative Evaluation and Research Methods. Sage: London*

Advantages and disadvantages of the focus group technique.
Collated from: [3]Iowa State University Extension; [4]Focus Group Interview – A reader; and [2]MQ Patton

Advantages	Disadvantages
Relatively easy to undertake	Requires highly skilled moderator
Fast - Results can be obtained in a short period of time from many people.	Groups are often difficult to assemble
Relatively cheap	Groups can vary considerably – many may be needed to balance.
Social interaction in the group gives freer and more complex responses	Individual responses are not independent of one another
Interview respondents stimulate each other	Need to use systematic processes to interpret data and skilled moderator – easily misused.
The researcher can probe for clarification and greater detail	Because the group is hand selected, the results may not be representative of the general population
Responses have high face validity due to the clarity of the context and detail of the discussion	Not intended to obtain numbers that represent a population – projection of results to a wider group requires caution.
Good for generating hypotheses when little is known	Limited number of questions is possible.
Flexibility	
Great ability to handle contingencies	
Findings emerge in a form that most users fully understand.	
Participants tend to provide some check and balances for extreme views.	

Focus group research in cotton RD&E

Focus group interviews have been used in the cotton industry for research and extension planning, information gathering and market research. Commercial companies associated with the industry also do focus groups. Some examples:

Attitudes towards Integrated Pest Management

In 1997 and 2001 focus group interviews about IPM were conducted across most cotton growing regions with growers, consultants, researchers and extension. These were conducted as a part of major training workshops where Jeff Coutts trained members of the cotton extension network and other extension agents in the focus group technique – and they then scattered out to conduct focus groups, returning to debrief and report. These studies have guided some IPM extension activities. As a result of the 1997 study, the IPM Short Course was initiated, IPM Guidelines developed and economic

[3] *"Focus Group Interview" EDGE Guidesheet, by Tom Archer, Ohio Cooperative Extension Service, The Ohio State University.*
[4] *Higgenbotham, JB and Cox KK (1979) "Focus Group Interviews – A Reader. American Marketing Association, Chicago.*

studies completed. The 2001 study looked at changes in attitudes as well as exploring attitudes to the newer area wide management groups.

Best Bet Weed Management
Focus group interviews with consultants in each region were conducted to gather a information about the management strategies for a range of weeds of cotton. This information was gathered to include as Best Bet Management Strategies in WEEDpak. These were undertaken by members of the cotton extension network in collaboration with the WEEDpak team.

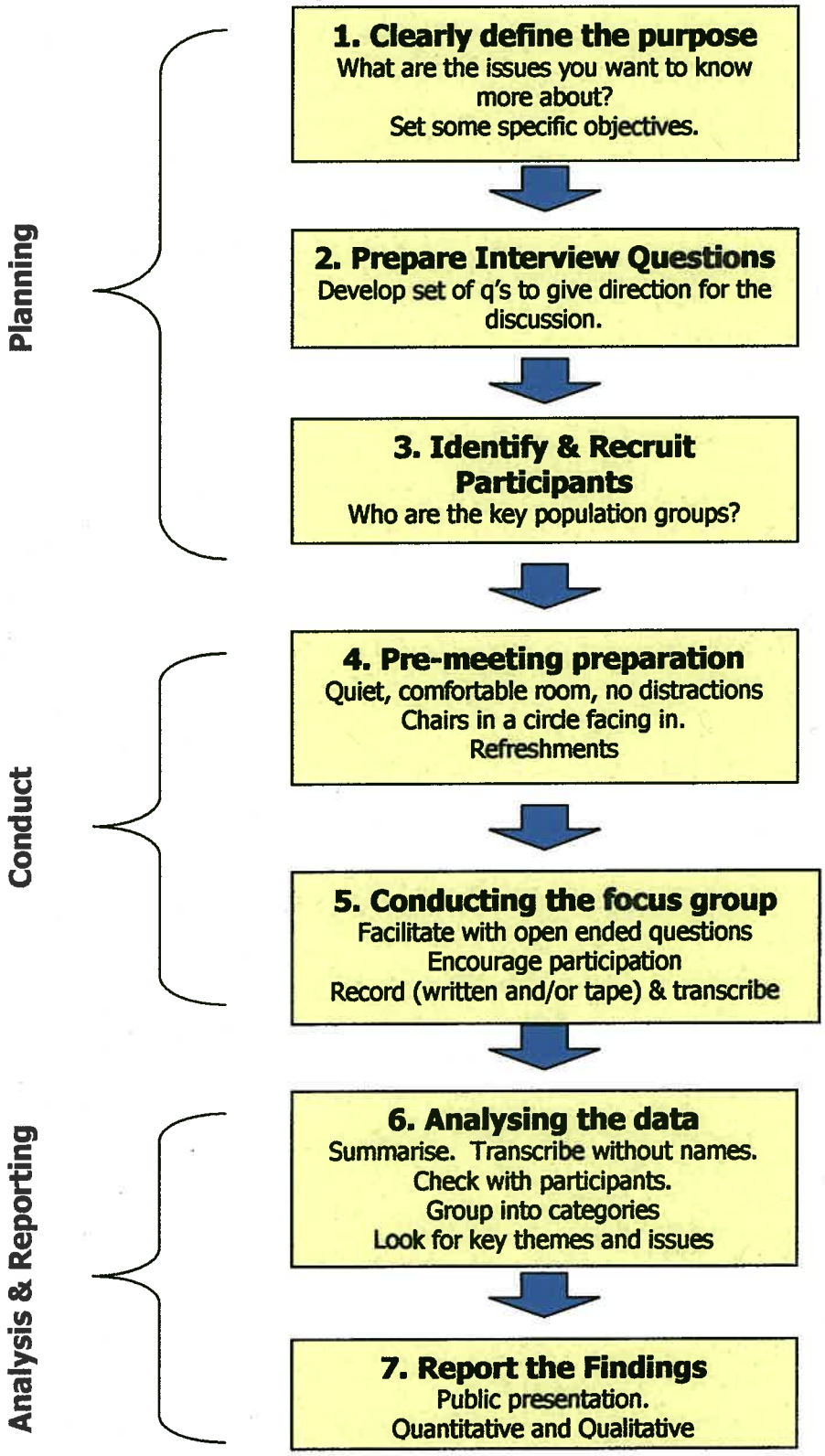
Approaches to Nutrient Management
Focus groups were conducted from Goondiwindi to Gunnedah in August 2004 with growers, consultants and researchers. These explored that the approaches towards nutrient management and sources of information about nutrition. It was again conducted together with a training workshop for extension staff.

Cotton Consultants Australia
The Institute for Rural Futures, UNE (Brendan Doyle et al) on behalf of the CCA have conducted focus groups for market research purposes. These groups have been conducted to gather information about questions from the companies that purchase the CCA survey data.

The UNE/CCA focus groups have involved growers and consultants (sometimes separately sometimes together) to gain a better understanding about the use context of various products. This includes views about the product fit in the agronomic context, product traits, usage and handle-ability.

The focus group process

This flow chart outlines the steps in the focus group process.[5] The notes that follow detail each of these steps.



[5] *Adapted from Iowa State University Extension "Extension to Communities"* www.extension.iastate.edu/communities/tool/assess/focus.html

Planning Focus Group Interviews

As with anything, good planning is vital. Once you have chosen to use the focus group interview technique, the flowchart can be used as a checklist and planning guide.

1. Clearly define the purpose

Firstly identify the issues that you would like to understand better.
This is the step where you funnel your fuzzy question or issues into a clear research area. It is important to be clear at this stage as otherwise the findings may not be as useful. At this stage consider who will use the information, what the purpose is, who you are studying (the groups/population sectors), resources and timeframe and the key issues in question.

For example, in the training workshop linked to the nutrition focus groups, the group, together with the input of a key nutrition researcher, worked from the broader question of nutrition management to the specific aspects that were important to explore as well as identifying the overarching purpose for wanting to gather the information.

2. Designing the Questions

The questions are to provide a guide for the discussion rather than to be a set of questions and answers. Aim for questions that are:

- Open ended to stimulate discussion;
- Simple;
- Unbiased;
- Flow from general to specific;
- Focused on the issue in question;
- Probes may be used to delve into some questions if needed.

How many questions?

One of the limitations of the focus group technique is that, because you have 6-12 respondents, you can only ask a few questions. About *5-6 main questions* are about all you can cover. Think it out - 10 people X 1 min per question is 50 mins – with some time for introductions and divergence - there's an hour gone.

The discussion will generally bring out new issues that the facilitator will want to follow up.

The Cotton IPM Focus Groups (2001) were based on 5 key questions with prompters for these.

3. Identify and Recruit Participants

This is the step that takes some time in planning and invitations before hand. Aim to have several groups that represent different possible views. Think, about the sectors of the population such as age, income, gender, race, place of work, place of residency, unemployed, students, industry sector. Each group should be fairly homogenous, representing one of these sectors of the population (eg cotton growers from the Macquarie Valley).

It is preferable to invite a group of people who don't usually come together as a group (often difficult when working within regional cotton areas!). Established groups may have established ways of relating to each other that may influence the discussion. Focus groups work best when all participants are on an equal basis.

In cotton extension, we have generally grouped people by region (largely for logistics) and sector (eg growers / consultants). We have also held interviews with groups of growers who are in Area Wide Management groups and those who are not.

Focus group interviews can be done with groups of 6 –12 people. (Thoughts on group size vary with some references suggesting 6-8, others 10-12 people.) You will often need to invite more to have these numbers on the day - some suggest inviting 25 participants in order to have 12 attend.

Invitations are generally most effective with an initial phone call followed up with a reminder fax or email.

In cotton extension the local Extension Officer/s generally invite participants so that the first contact is local. We often facilitate groups in regions other than our own.

For the CCA/UNE market research groups, the consultants bring along some of their grower clients – depending on the issue the growers and consultants may be grouped or may be in separate groups that run concurrently.

Facilitators

The discussion in the focus group can be influenced by the role, title or position of the facilitator or scribe. It is therefore not ideal for an extension agent or his/her supervisor to facilitate a group in their own regions. It would be preferable to have an extension agent from another region or an independent who has little connection wit the program. This is particularly relevant for groups that are looking at attitudes about issues related to extension programs. It has less influence where the group is about technical or practice based issues.

PLANNING CHECKLIST

Participants
- ✓ 6-12 people
- ✓ Homogenous groups for each population sector
- ✓ Invitation & reminder

Facilitators
- ✓ 1 moderator
- ✓ 1 scribe

Duration
- ✓ 1 – 1½ hrs

Location
- ✓ Easy to get to
- ✓ Quiet
- ✓ Chairs in a circle

Refreshments
- ✓ Drinks and/or nibbles

Recording
- ✓ Written and / or tape

Toilets
- ✓ Know where they are
- ✓ Ensure they are open

Conducting focus groups

4. Pre-Meeting Preparation

A quiet, comfortable room without distractions is best.
Set the chairs around in a circle facing inwards, preferably without a table in the centre. If needed, you may have the chairs around a table. Removing the table tends to break down some barriers, leading to more open discussion.

The facilitator will sit in the circle. The scribe is best seated at a table to the side – in this way the recording is less intrusive and it's far easier to scribe. Any telephones in the room should be unplugged or off the hook. If there is a reception at the venue, provide them with details of the meeting and advise that the room is in use and you would prefer not to be interrupted for any other purposes.

Tape recorders can be useful to record the meeting. I'd suggest that if you do use these, use them as a back up only – full notes are far easier to work through and tape recordings can be very difficult. They can be a very useful back-up to clarify points or find quotes. Set the tape recorder in the centre of the circle - a flat recording microphone can be helpful. Be sure to ask participants at the start of the meeting whether they are happy for the discussion to be recorded. State that the tape will be destroyed after the report is completed and that you will not record individual comments by name – so all comment will be confidential.

Refreshments (drinks / light food) can be set at the side of the room where they are easily accessible but don't distract from the discussion.

Duration - Focus groups generally run for 1-1 ½ hours with an absolute maximum of 2 hours.

One hr is generally enough – after that people tire of talking, and also people are more likely to come to the meeting if you ensure them that it will only take 1 hour. If you offer drinks, many will stay on afterwards – and you can continue to capture some thoughts during this time.

5. Conducting the Focus Group Interview

Facilitation

The facilitator is a key to guiding the discussion without being a part of it. A focus group is an interview and you are aiming to gather the views and attitudes of the participants - not to give them information. It is for the facilitator to create a relaxed, informal atmosphere where people are happy to express their opinions. The facilitator should never contribute opinions or make judgements about other's opinions. If asked a question about an issue, you can respond with promising to follow up about that afterwards. Explain this in the introduction so it is clearly understood. Questions can also be dealt with by asking other participants their opinions about that – this can be useful to flow discussion.

The introduction is important to help people to feel at ease and understand the purpose of the meeting. A generic introduction follows with the key points to mention –

thanking for attendance, explaining the purpose of the meeting, the process to be followed, to ensure participants of confidentiality so they can speak freely, etc.

Encourage all to participate It is helpful to start the discussion with a general question about each person's experience – and then go around the group one by one for a response to that question. This means everyone has spoken – and for some will mean they are then more likely to join the discussion. After this explain that for the rest of the questions it will be open discussion and invite all to contribute as they wish. Before the discussion starts, some facilitators ask participants to write their ideas down without consulting others. This is to bring out many viewpoints without bias.

For example, a first question may be "What are you experiences with IPM?" or "What is your general approach to nutrition management?". Such a question is specific to the individual so is a good starter for each to respond to around the circle. It is also helpful information as it provides you the full range of current views/practices.

Guiding Discussion The questions are to guide discussion, and so should be open ended and flow from general to more specific. Whilst it is necessary to keep the discussion broadly on track, ensure that the questions don't inhibit participants expressing their views, experiences and suggestions. Allow the discussion to flow in new directions so long as it is relevant to the issue in focus. There is no need to keep the discussion strictly along the order of the questions – if an issue from a later question is brought up earlier, you can follow that thread of discussion and later come back to the other questions. Making short notes/ticks on you question sheet will help you to check off which questions you have covered. Prompters for each question can help if the discussion is not flowing freely or to help bring it back on track. You may not need the prompters but it is helpful to have them prepared as they also remind you the key issues you want to explore within that main question.

Recording

A note keeper and/ or tape recorder to record the discussion. The note keeper should simply scribe the majority of discussion, not interpret it at this stage. Record some quotes word for word as these are valuable in the reporting (no names). The facilitator may also take some brief notes to aid in facilitation. For example, recording key issues or questions to come back to in the discussion.

Close

Keep note of time and the level of interest in discussion to choose when to close the meeting. The wrap up is the time to bring the discussion to an end, thank participants, reinforce that the information will be used, ask for feedback and cover housekeeping issues like follow up notes, etc. Ask participants if they have any other points to add or questions of each other. A generic wrap-up also follows. It is a good idea to have refreshments after the meeting for informal discussion and as an appreciation for their time.

Standard Introduction:[6]

Good evening and welcome to our session tonight.
Thank-you for taking the time to join our discussion of _____.
My name is _____ and I represent _____ [the cotton CRC extension network].
Assisting me tonight is _____.
We are attempting to gain information about _____.
We have invited people with similar experiences to share their perceptions and ideas on this topic. You were randomly selected because you have certain things in common that are of particular interest to us.
You are all _____ [eg cotton growers / members of an AWM group].
We are particularly interested in your views because you are representative of others in _____ (the county, committee , etc).
There are no right or wrong answer, but rather differing points of view.
Please feel free to share your point of view even if it differs from what others have said.
Before we being, let me remind you of some ground rules. (This is a research project and there are no sales involved. You will not be requested to volunteer or attend any future events or programs.)
Please speak up with only one person speaking at a time.
We are tape recording the session because we do not want to miss any of your comments. [Is this OK with everyone?] _____ will also be taking notes of all the discussion.
We will be on a first name basis tonight.
There will be no names recorded in the reports. You may be assured of complete confidentiality.

Keep in mind that we are just as interested in negative comments as positive ones, and at times the negative comments are most helpful.

Our session will last about an hour and a half. We will not be taking a formal break. The rest rooms are __just down the hall__ and refreshments are ___over near the wall___. Feel free to leave your seat for either of these or if you wish to take a stretch but please do so quietly.

Well let's begin. Let's find out more about each of us by going around the room one at a time. Tell your name and also your thoughts about _____(introductory question).

You may find it simplest to write a list of key points that you want to cover in the introduction and speak from that.

[6] *Source: Adapted from "Focus Group Interview" EDGE Guidesheet, by Tom Archer, Ohio Cooperative Extension Service, The Ohio State University.*

A generic wrap up:
Thanks very for your time and thoughts.
That has been a really useful discussion that will aid our extension and research planning for _____.
Just before we close, are there any other issues that we may have missed during this discussion?
To be sure that we've captured your thoughts correctly, we would like to send you a copy of our notes of this meeting. This way you can let us know if we have missed any points or have recorded something incorrectly.
Are you happy to do that? Can we send it out by fax or email? *(Collect details)*.
Thank-you very much – drinks are _____ if you'd like to join us.

Follow up

It is a courtesy and also accuracy check to send participants a copy of the notes to comment on. At the end of the meeting ask people if they would be happy to do this and collect their preferred contact details (email or fax is preferable to mail as it is quick). In the day or two following the meeting, send copies of the notes to participants. Ask for them to get back to you within the week if any changes are required. Most people tend not to respond so setting a closing date for final comments is helpful. After this it is not essential to follow up for comment from participants.

Trouble shooting

Whilst the process of focus group interviewing is simple, it does require skilled facilitation. Keeping people relaxed, talking and valuing all contributions is a key to focus group interviewing. Ideas for a few common challenges are noted here – you can add to these with your own experiences or from our discussions.

Key techniques:

- The 5 second pause – it might feel awkward but a pause is likely to be filled by comment. Pause at the end of a discussion to prompt other points of view or agreement with a previous comment.

- Probes – ask for additional information. General probes include:
  - "Would you explain further?"
  - "Would you give me an example of what you mean?"
  - "Would you say more?"
  - "Is there anything else to add?"
  - "Please describe what you mean."
  - "I don't quite understand."

What about participants who just don't contribute?

The initial question to all is a helpful start. If you have someone who you expect may be less talkative, try to ask the questions in the direction around the circle that will pick them up in the first half of the round. Eye contact is very helpful. You can direct questions to specific participants by eye contact and your body language.

If you know in advance – try to seat the quieter people opposite the facilitator where you will have most eye contact. Sometimes you can also ask quiet participants by

name about their experiences with a certain issue. Be careful with naming as this may put the person a little too much "on the spot" and be uncomfortable.

What about someone who dominates the discussion?
Use some of the same techniques above to focus on other participants.
Use phrases such as "Thank-you Fred for that – does anyone else have experiences about this issue?"
If you know beforehand that the person is likely to be a dominator try seating them beside you – in this position they have less eye-contact.

Discussion that goes off-track
This is a key role of the facilitator. Gentle or strong questioning by the facilitator can seamlessly guide the discussion back on to the key issue. If this doesn't work, acknowledge the issue and suggest that it be followed up at a later time. Say that in the interests of time we need to keep on the focus of the issue at hand. Be sure not to stifle discussion that is relevant to the issue, even if not in the questions.

For example, discussion about crop rotations is of relevance to crop nutrition but could easily end up being a discussion about details of growing those crops. Bring it back in focus by ask questions like *"And how does that impact your nutrient management in your cotton crop?"* Or *"So it sounds like we may need some more information or field days about incorporation of vetch stubble. How much do you vary your fertiliser regime after a vetch crop?"*

What if people don't want to be tape recorded?
You can first try to gain acceptance by promising that the tape recording is only for your own use, that it will be destroyed after you have made your notes and that no names have been recorded.

If they still prefer not to be recorded, respect this and simply take good written notes.

Analysing and reporting findings

6. Analyse the data

Focus group interviews gather a lot of information. The next step is to record and summarise the data so it can be analysed and key issues identified. Key points in analysing focus group interviews:

- Findings – what was said?
- Interpretations – what did the findings mean to the analyst?
- Judgements – Are the findings of value to the stakeholder?
- Recommendations – What should the stakeholder do?

Meeting reports

Soon after the focus group (preferably within 24 hours), facilitators transcribe the notes of the meeting, omitting names of the participants. When doing this, look for key themes or issues. There is no need to report the meeting under the categories of the initial questions. Rather, record fully the notes of discussion as they fit to the key themes that emerged from that meeting.

Write the report in a manner that illustrates the level of feeling about a particular point or issue. For example, phrases like:

The group agreed that …
There was general consensus…
There was a strong feeling from the group…
A few people felt….
Comment was made…
One participant felt strongly about…

Be sure that all comments are recorded somewhere. It is also helpful to include the feeling, body language and general level of enthusiasm about the topics. It helps if you include a few dot points of your key impressions of the key points of the meeting – generally in the conclusion.

Include quotes where possible to illustrate key points. Ensure that these are identified as quotes with "marking".

Acknowledge with thanks the participants but not by name. Do include how many people as this records how many people's views are represented. eg "thanks to the 8 growers who contributed".

Note the names of the facilitator and recorder, the date and location of the meeting and any other key points.

Refer to the full report of the IPM Focus Groups to see examples of how each focus group was reported. These reports were prepared by the facilitation pair and then all reports were analysed independently by Jeff Coutts.

The focus group study of "Approaches to Nutrition Management in the Cotton Industry" is a shorter, simpler reference. The focus groups and reports were done by members of the extension network and a small subgroup then analysed and reported the findings.

Debrief

If there are a number of facilitators conducting the focus group interviews, it can be helpful to facilitate a 'debrief discussion' to identify the key themes and ideas arising from the groups, discuss the differences across groups and identify initial feelings about future directions. This is best done within 1-2 days after the interviews so that it really captures the ideas that are fresh in the minds of facilitators. This can then provided a useful guide to cross-check when analysing the findings.

Analysis

The facilitators may do the analysis of the focus group interviews or a third party, who preferably has been involved in the process, may do it. When analysing the findings, look for key words and phrases that repeat regularly and then identify categories that will pick up all comments. Key words and phrases are coded for 1) central theme and 2) general sentiment (positive, negative, neutral, suggestion).

Take a step back and be sure to look equally at all reports and not to be biased by impressions from the groups you facilitated.

In analysing the findings look also for the general weight of each theme and how much certain views are repeated or diverse.

7. Reporting Findings

Generally some public reporting of the findings will be desirable. In reporting, consider the audience, focus on the important results and present in both written and oral form if possible.

There may be a preference to present it first to certain sectors to make a plan of action that can then be suggested or promoted when reporting more broadly. It is helpful to be able to say at the focus group meeting how the results will be reported and used. Focus groups identify a range of issues that may need to be specifically communicated to certain sector groups.

Findings from the IPM focus groups were reported at CCA forum and CRC Reviews, in Cotton Conference proceedings, media and as a publication on the Cotton CRC website.
Weed Management focus groups were recorded as a section on Best Bet Management in WEEDpak.

Other techniques and tools

Focus groups are just one technique for gathering opinions and attitudes about an issue. It is worthwhile comparing a range of methods used for collecting evaluation data to choose one that is best suited to the needs of the project. A useful quick reference table in comparing evaluation methods is available at http://www.mapnp.org/library/evaluatn/fnl_eval.htm.

Other techniques used in cotton extension activities include:

- Written surveys
- Phone interviews
- Convergent interviewing
- Narrative

Refer to the collation of cotton extension evaluations for more details.

A range of considerations in choosing an evaluation technique are described in further detail in another extension note: "Which Evaluation Method to Use?" by Ingrid Christiansen and also at www.cotton.crc.org.au.

Further reading

Title	Author & Source
Which Evaluation Method to Use?	Ingrid Christiansen www.cotton.crc.org.au
Changes in Attitudes towards Integrated Pest Management in the Cotton Industry 1997-2001	Jeff Coutts, Ingrid Christiansen and Cotton Extension Network www.cotton.crc.org.au
Approaches to Nutrition Management in the Australian Cotton Industry 2004	Ingrid Christiansen, Julie O'Halloran and Penny van Dongen www.cotton.crc.org.au
Designing and Conducting Semi-Structured Interviews for Research	Ted Zorn http://wms-soros.mngt.waikato.ac.nz/NR/rdonlyres/eeyjofyytzij7tll6qweatbllpdhlmu73qa4lilqsv6bahlkygsodnghivrmvierrufu27qon6pfaqb/Interviewguidelines.pdf
Probing Techniques for Semi-Structured Interviews	Ted Zorn http://wms-soros.mngt.waikato.ac.nz/NR/rdonlyres/epxdk57qczthkpyffiduvbtwvp44vt7mkqwemqefvan3qwtrk4tsoxepa5fhrzfpfjmr4uxattaiji/InterviewProbingTechniques.pdf
Focus Group Fundamentals	Iowa State University http://www.extension.iastate.edu/Publications/PM1969B.pdf
Customers in Focus – A guide to conducting and planning focus groups	Simply Better! http://www.workforce-excellence.net/pdf/focus.pdf
Overview of methods to collect information	Carter McNamara http://www.mapnp.org/library/evaluatn/fnl_eval.htm
Further references - useful links	http://www.slais.ubc.ca/resources/research_methods/group.htm

Appendix 1 Interview styles

There are a range of interview styles that may be used to gather data or to scope an issue. Consider also the potential effects that the interview process may have on the data that is gathered.

QUESTION TYPES

Closed questions: lead to short, directed responses – limited range.
Open questions: provide opportunity to give a range of longer, more descriptive responses.

RESPONSE EFFECTS

Recorded information is affected by:

- The orientation of the interviewer
- Class
- Ethnicity
- Gender
- Presence of third parties
- How the question is asked

Memory errors include:

- Forgetting
- Telescoping

STRUCTURED *vs* UNSTRUCTURED INTERVIEWS

Consider:

- Reliability and validity
- Usefulness or credibility of results
- Cost
- Anonymity
- Convenience
- Complexity of information required

STRUCTURED INTERVIEWS

Aim: Uniformity of wording and approach

Features:

- Ask questions as written
- Give respondent time to answer
- Prompt as directed
- Probe when necessary
- Record answers exactly as given
- Repeat your recorded answer to check accuracy
- May also include tasks to be done
- Comprises of key sections: demographic, core content, closure

Benefits:

- Equivalent to a written survey
- Limited influence of interviewer
- Clear time commitment
- Generally easier to analyse and report on.

UNSTRUCTURED INTERVIEWS

Uses: To develop a formal or semi-structured interview; for sensitive issues or conflict.

Features:
Let the informant lead
Get the informant onto a topic of interest and get out of the way
The informant provides information they think is important

Use probes: - Silence
Ask them to continue
Use long questions
Interrupt gracefully
Phased assertion or baiting, challenging
Must take notes or record the content
Also take notes about the process

SEMI-STRUCTURED INTERVIEWS

Features:
Uses an interview guide
Builds conversation around particular focus
More systematic and comprehensive
Can be used with groups

Benefits:
Uses limited time better
Allows individual experience and perspective to emerge

GROUP APPROACHES

Nominal Group Technique (NGT)

Use: To identify elements of a problem;
To identify elements of a solution;
To establish priorities where a group opinion is needed.

Features:
Based on one key question
Standardised meeting process

Increases rationality, creativity and participation
Take 60-90 minutes
Ask each person, in silence to write down answers to questions
Collate list/voting priorities

Benefits:
More directed than a focus group

OTHER APPROACHES

Consensus panels
Group assessment technique
Focus group
Delphic processes - use an initial questionnaire to help focus questions
– a series of 3-4 questionnaires
Rapid rural appraisal
Convergent interviewing
Participatory appraisals

EXTENSION PLANNING TOOLS

November 2004

Ingrid Christiansen, Cotton CRC Extension and Evaluation Specialist

Growing demand for accountability and impact of research and extension investments has seen extension programs shift their focus from outputs to outcomes and impacts. To achieve this, careful planning for the design of the extension program and the measures of success is needed. Planning at the start and throughout extension programs can also help to ensure efficient use of resources, shared understanding between participants and hopefully a more integrated and influential program. There are many different ways by which extension programs can be planned and no one way is the "best". This document provides a range of different tools that can be used in planning extension programs.

It is helpful to consider from the outset how you will evaluate the outcomes and impacts of the program and extension evaluation frameworks can be useful aids for planning both the extension strategy and the evaluation approach.

Understanding outcomes and impacts

Impact What will this mean for the environment, society and economics.

Outcome What the industry (or part of) will have achieved – consequence

Output What I will have achieved – product. ('I' as the extension agent)

Input The resources required – including time, people, funds, information.

Some of the simplest extension planning tools are the logic models and Bennett's Hierarchy (Figures 1 & 2). When using these linear models it is important not to assume that the inputs will certainly flow through to the desired impacts. Understanding and articulating the logic behind the plan and the assumptions and externailities are important elements of using logic models.

Other planning tools and conceptual frameworks come from more systems based perspectives, such as the sustainable livelihoods approaches.

It is worthwhile for extension agents to work with a number of different tools, or develop their own, to find a planning approach that best suits to their field of work, their work team and their own personal style. It is also helpful to understand whether your natural thinking leans towards outputs, outcomes or a combination of these – as this will help you to plan better.

The tools attached here are a few simple frameworks and checklists to aid in extension and evaluation planning. They aim to prompt thinking about outcomes and impacts and the steps required to achieve these.

More frameworks are described in "Strategic Approaches to Evaluation in Agricultural and NRM Research Programs" Ingrid Christiansen (2004) www.cotton.crc.org.au

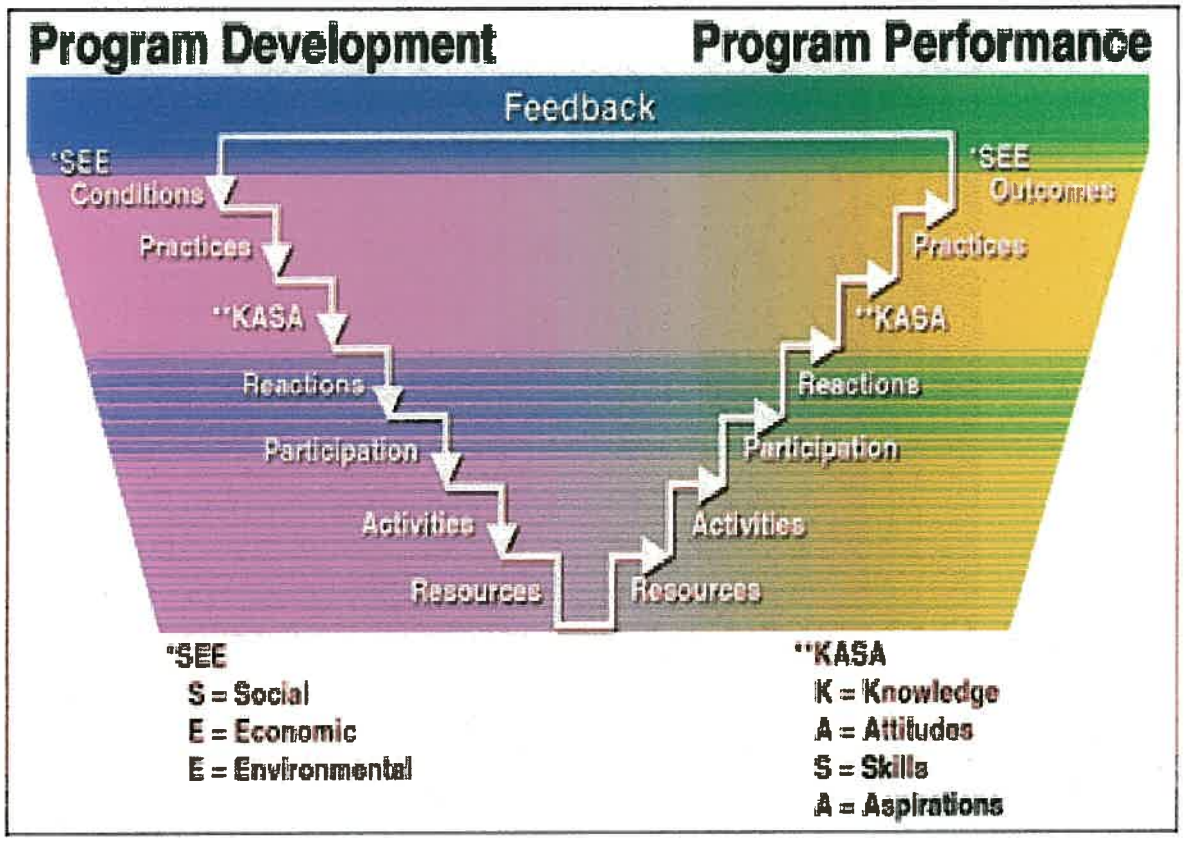


Figure 1 Targeting Outcomes of Project model

Source: Rockwell K and Bennett C (1995) Targeting Outcomes of Programs (TOP). In. (University of Nebraska - Lincoln; Cooperative State Research Education and Extension Service, USDA)

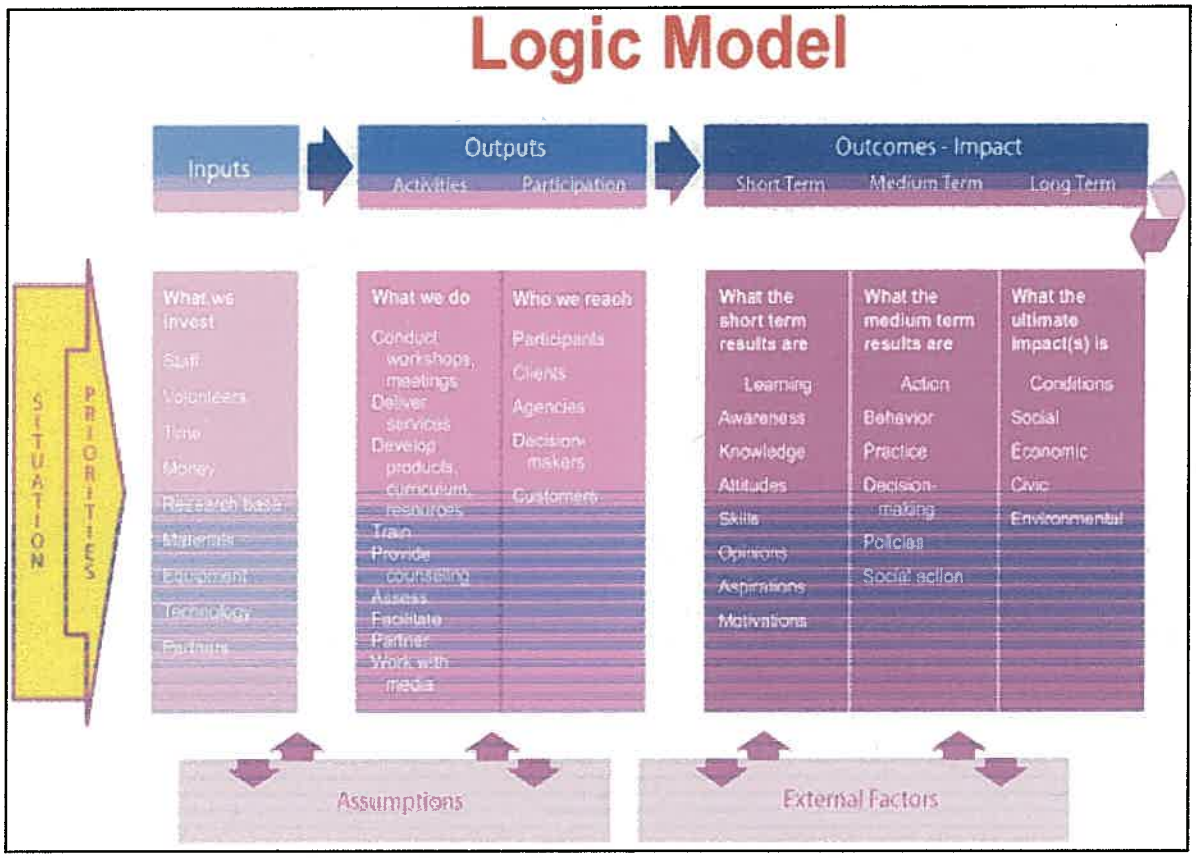


Figure 2 Logic Model for evaluation as used by The University of Wisconsin Cooperative Extension.

Source: Taylor-Powell E (2001) University of Wisconsin-Extension, Cooperative Extension program.

Extension Strategy

Key Issue:

Lead Focus Team:

Core outcomes desired:

Activities

	Trials and demo's	Information delivery	Groups	Education & training
Key Activities & person responsible				
Linkages with other activities				

Evaluation of outcomes

Extension Strategy Checklist

Who?

Why?

What?

When?

Where?

How?

Are the extension methods:

- ❑ likely to achieve your desired outcomes?
- ❑ suited to the objective?
- ❑ suited to the audience?
- ❑ suited to other participants (eg the researchers involved)?
- ❑ suited to group / individual approach selected?
- ❑ the best use of resources?
- ❑ economic?

Are you:

- ❑ confident in understanding and using the extension methods?
- ❑ using the extension methods well?
- ❑ able/willing to seek assistance from others if needed?
- ❑ engaging all key stakeholders?
- ❑ communicating these plans effectively/sufficiently?

Will:

- ❑ your key people be available?
- ❑ required resources be available?
- ❑ funding/sponsorship be required?
- ❑ you be able to measure the outcomes and impacts? How?

Extension Planning Matrix

KEY ISSUE:		
	To Achieve...	**Measure achievement by...**
Outcomes		
Outputs		
Inputs		

Planning SMART project goals

S

Specific

The W questions: Who, Why, What, Where, When
Just what are you actually wanting to achieve?

M

Measurable

How Many? How much?
How will you know when you've reached your goal?

A

Achievable

Reasonable goals that you are able to attain

R

Realistic

Can you make this dream come true?
You know you can get there and it's not impossible to reach!

T

Time-framed

When will you achieve it by?
Most of us achieve our goals better if we set a timeframe. This is often also important for communicating with others.
What's a realistic timeframe?

Planning Outcomes and Outputs

To use this planning tool, first define agreed outcomes for the project or issue. The outputs in column 1 can then be adapted to suit the topic area. Work through this form for each of the outcomes to determine the outputs and inputs needed to achieve the outcomes, and the external considerations and indicators of success. It is not always necessary to work on every output need be used for each outcome. The outputs can then be collated for all outcomes to develop a workplan. Variations of this have been used for planning the fibre quality extension strategy, water use efficiency project and NRM projects.

Outcome: _____

Define what each output will do to contribute towards this outcome, and the inputs to make it happen.

	Outputs		**Inputs**	
	WHAT	**WHEN**	**WHO will drive it** and who's involved	**WHAT will it require** *(time, cost, resources)*
COTTONpak				
BMP				
Training and Education				
Forums				
Local extension - **Groups** - **Field Days** - **CottonTales**				
Information Updates & Magazine articles				
Other - Conferences, etc				

Assumptions	**Externalities**

Understanding Impact, Outcomes and Outputs

Research and extension programs are increasingly focussed on delivering impacts and outcomes. This table provides some definitions of these terms.

	Macquarie Dictionary	*Extension concepts*	*Bruce Pyke's wisdom*	*Bennett's Hierarchy*	*Logic Model – University of Wisconsin-Extension*
Impact	4. influence or effect exerted by a new idea, concept, ideology, etc. 6. to have a noticeable effect on.	**What this will mean for environment, society and economics.**	**The problem has gone away or reduced.** *Could be at highest/broadest level. For an IDO it could be at a more local, less broad level.* *ie TBL locally or nationally.*	A level above the top level - TBL outcomes	***What the ultimate impacts is.*** (often the long term outcomes)
Outcome	That which results from something; the consequence or issue.	**What the industry (or part of) will have achieved – consequence**	**Something I'm hoping will change** (in industry, at local level, for an individual)	Associated with the upper levels – KASA, Practices, Outcomes	***What difference it makes*** Results or changes that occur from the educational effort. "So What?" What difference has it made in people's lives? Whose lives? Intended & unintended, positive & negative. May relate to knowledge, awareness, skills, attitudes, opinions, aspirations, motivation, behaviour, practice, decision making, policies, social action, condition, status.
Output	1. the act of turning out; production 2. the quantity or amount produced, as in a given time. 3. the product or yield, as in a given time	**What I will have achieved – product.** ('I' as the extension agent)	**Something I produce, Something I do**	Lower levels – Activities, Participation, Reaction	***What we do and Who we reach*** The activities, products and participation generated through the investment of resources.

Training Outcomes: A statement that clearly describes the skills and knowledge that a learner should be able to demonstrate as a result of training. It states what the learner is required to achieve in a training program. They must be observable, measurable and clear.

(ANTA, Learning Guide - Cert IV in Assessment and Workplace Training)

Other terminology

Vision, Mission, Goals, Aims, Objectives, Tasks Purpose, Actions Key Result Areas, Key Performance Indicators, Key deliverables, Milestones

Australian Cotton Cooperative Research Centre

Extension and Evaluation Resources

WHICH EVALUATION METHOD TO USE? August 2003

Ingrid Christiansen

These notes aim to provide some background to help in choosing an evaluation method. Maximum benefit is gained from the evaluation when the results are interpreted in the context of a larger evaluation framework such as Bennett's Hierarchy and the LOGIC model.

How do I choose which method is best?
When is a survey OK?
When do I use focus groups or interviews?
How else can I gather data?

A wide range of evaluation methods and instruments exist, requiring varying degrees of complexity, time and skill and suitable for different purposes. There are no real recipes of which evaluation methods to use when and where. The more familiar you are with a range of techniques, the easier it will be for you to choose which suits best for each situation.

In choosing the best evaluation technique, and to identify the key questions underlying your evaluation, consider[1]:

1. Who is the information for and who will use the findings?
2. What kinds of information are needed? (and will be used).
3. How is the information to be used? For what purposes is the evaluation being done?
4. When is the information needed?
5. What resources are available to conduct the evaluation?

Consider also the target group, the type of issue and your skills. Balance the quality of the evaluation against the resources/times available to collect and analyse data. Check what existing information is available.

Taking a little time to plan your evaluation (a flow chart is very helpful for this) will help you to identify which methods are most suitable for the topic, the target group, the resources, timeframes, etc. A plan helps to clarify the evaluation not only for yourself but also for anyone else involved – your team members, peers, funders and the group you are evaluating.

The following pages outline various evaluation methods. They are by no means comprehensive lists – these are the most common techniques. Be a little creative, develop your skills and think beyond the survey!

Some Evaluation Methods

Survey
Focus groups
Other group techniques – Delphi, nominal group technique, brainstorming, forums
Interviews – incl. rapid rural appraisal & convergent interviewing
Observation
Document review
Case Studies
Secondary data analysis
Pictorial records
Peer or expert review
Testimonial
Exam / Test
Log
Simulation
Most Significant Change
Problem story
Creative expression – stories, music, art
Action Cards
Simulation

[1] Patton, M.Q (1990) Qualitative evaluation and research methods. Sage Publications.

Some considerations in planning your evaluation:

partly from "Research Methodologies in Management and Extension" REC

Qualitative & Quantitative methods

Quantitative - numbers, standardized measures. Can gather responses from large numbers of people to a limited set of questions – can be statistically aggregated easily and simply presented.

Qualitative - meanings, concepts and characteristics. Provides much detailed information and a deeper understanding about a smaller group of people.

Quantitative methods can give numbers such as the number of growers adopting new practices. Qualitative methods can look further into attitudes, understanding and so forth.

Which to use? Used appropriately, both qualitative and quantitative methods, often a combination of the two, can be effectively used to provide valid, reliable evaluation data.
A basic principle of market research is to *always* do some qualitative work first to set the context and ensure you have the right questions for your quantitative study.

Following the questions on the previous page will help you choose which is most suitable in each situation.

Reliability

The dependability of the research results.

- Statistics can be used to estimate reliability. This is more difficult with qualitative studies.
- Be aware of your biases and state them when reporting.
- Standard phrases may be used in interviews.
- Survey response rate strategies.
- Keep a log of the study and how you reached the conclusions.
- Triangulation

Validity/Rigour

Will the methods chosen provide results that accurately reflect the issues and how people perceive them?
Will they achieve the objective of the evaluation study?
Can the results be extrapolated to other situations?

- Take into account all relevant factors, given the whole context.
- longer term study is more likely to give valid conclusions
- understand your own biases
- debrief with peers
- Keep a log
- Member checking - Check your conclusions with the group you are evaluating
- Triangulation

Triangulation

- *Gathering data by several methods* eg interviewing, participant-observer, survey, document analysis.
- Coming to the similar conclusions by a variety of methods increases the reliability, validity and rigour of the results.

Sampling

Many of our evaluations have some element of sampling bias.
The sampling technique used to depends on the method you are planning to use.
Take care to avoid bias in sampling – eg by interviewing only those growers you know well.
It can be worthwhile to run your plans past a biometrician for advice before you start a major evaluation.

Secondary Data

As you go through planning, ask whether existing data can be used to inform the evaluation. Secondary data (that collected for another purpose) can often be analysed

in another way – providing useful and often cost-effective input to your evaluation. This is particularly useful where you are looking at long term trends.

For example Bruce Pyke has analysed the CCA's market survey data over several years to find trends in pesticide usage. This can then be combined with other information (eg focus groups on Attitudes towards IPM) to pick out trends in IPM in the industry over several years.
Penny is analysing Incitec's database as an indicator of changes in soil condition.

Cost-Value

What resources (time/$) are needed to apply a given evaluation method?
Is this worthwhile for the quality of the data?
Can equally relevant data be gathered in other ways? Are they more efficient?
What scale of evaluation is justified based on the investment in/significance of the issue?

For example, we wanted to know about Industry Attitudes towards IPM.
Focus groups were used as the primary method. This was cheaper and quicker than individual interviews, and perhaps gave greater insight as participants bounced ideas off each other giving the range of views on the focal issue. However, it involved more travel and overall more time than a mail-out survey. Why choose focus groups? Data exists on trends in product usage, but this doesn't reflect if there is a change in attitudes and understanding (KASA change). Attitudes are very difficult to gather by a written survey, growers are complaining about being "over-surveyed" and focus groups themselves were a valuable learning for all involved. Overall, the higher investment in focus groups was justified in terms of the type of data to be collected and in relation to the investment in IPM research and extension.

Empowerment Evaluation

This form of evaluation, used particularly in education, health and community development, can also be a useful extension technique.

It involves a self-evaluation of a program conducted by the actual participants (stakeholders) in that program. The evaluation approach is used to foster improved practices and ownership. "It is designed to help people help themselves and improve their programs using a form of self evaluation and reflection."[2]

It can be embedded as a continual improvement process in a training or extension plan.

For example

- Regional reference groups that meet regularly, set plans, actively review these and then set new plans for the extension program in the coming year could benefit from this.
- Cotton extension officers have identified a need for a greater focus on water extension. Participation of the extension team in interviewing stakeholders and setting new irrigation extension directions is a form of empowerment evaluation where we as extension officers are the participants in the extension program and are looking at ways to improve our programs in this area.

[2] DM Fetterman, SJ Kaftarian and A Wandersman (Eds) (1996) 'Empowerment Evaluation: Knowledge and Tools for Self Assessment and Accountability'. pp. 411. Sage Publications: California, USA

Ethics

Ethics are important both for your relationships with your client group and to the validity and reliability of the study.

Some things to think about:

- Confidentiality
- Reveal your purpose
- Accessibility – establish trust and importance of the work with the target group
- Reciprocity – benefits for the people giving you feedback

Report findings in a suitable manner.

• • • • • • • • • • • • • • • • • •

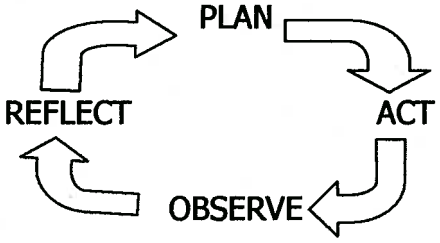
Tip

PLAN for evaluation before you even start the activity – then the evaluation may be able to be used as a part of the extension and reflection process and be simple to do.

Consider how you can build evaluation into your normal activities. If you plan the outcomes and impacts you can often simply collect and document the information as part of the activity (and discuss with participants) or through recording your reflections and observations.

Evaluation can often just be documenting and reviewing the outcomes of a good extension process.

Think about the little extras you could do to simply embed evaluation as an integral part of your activities.



Looking for more?

A few other good references and resources on evaluation techniques include (and there are plenty more):

"A Compilation of Information on Evaluation Methods" by Arnold Wissemann.

"Review of Evaluation in Agricultural Extension" by Jessica Dart, R John Petheram & Warren Straw, RIRDC Publication No. 98/136

Focus group technique training notes.

Cotton Extension Evaluations.

REC Evaluation Course notes

Journal of Extension (www.joe.org) and various evaluation journals.

Numerous texts on evaluation, qualitative research and survey design.

Some useful web resources:

Targeting Outcomes of Programs (Bennett et al.) http://citnews.unl.edu/TOP/

Penn State Uni Extension – Tipsheets http://www.extension.psu.edu/evaluation/

Uni of Wisconsin – LOGIC models – incl. an online training course, survey design http://www.uwex.edu/ces/pdande/

Australasian Evaluation Society http://www.aes.asn.au/

UK Evaluation society – with links http://www.evaluation.org.uk/ukes_new/Pub_library/Online_eval.htm

Action Research – Southern Cross Uni – incl. training course http://www.scu.edu.au/schools/gcm/ar/arhome.html

United Nation Development Program http://stone.undp.org/undpweb/eo/evalnet/docstore3/yellowbook/

RMIT – Collaborative Institute for Research, Consulting and Learning in Evaluation (CIRCLE) http://www.rmit.edu.au/ - Our organisation/Faculties/Applied Science/Centres &Groups/ C.I.R.C.L.E.

Australian Cotton Cooperative Research Centre

Extension and Evaluation Resources

COTTON EXTENSION SEASON PLANNER August 2004

Cotton Extension Network

This season planner has been interatively developed by the extension team as a tool for the cotton extension team to use when planning extension activities at a local and national level.

A range of helpful resources are identified for each topic. In addition, useful resource for all topics include:

- Past CottonTales (see CRC web);
- All COTTONpaks (esp. searchable CD);
- Past trial books;
- Cotton Conference papers;
- Cotton production course notes;
- Researchers;
- Local growers and consultants;
- Extension agents and agronomists working in other commodities

Using this planner: *"Whilst it is good to have sharing of information for newsletters, we need to stress the need for plenty of local parallels or data. There are an infinite number of other things that could be put in each stage- but these may only crop up once every 10-100 years. ... The best thing we can possibly do is have a finger on the pulse with our local industry – identifying issues as soon as they arise and knowing the industry group well enough to formulate an extension strategy that will suit that group and the issue."*

Dave Kelly 2003

Issues	Key points	Resources
CONTINUAL TOPICS		
Crop development	Day degrees Crop progress	*SILO/CRC day degrees calculator*
Pheromone trap data	Collate and disseminate local trap results	*Local traps*
Farm Hygiene	'Come clean, Go clean'	
AWM Groups	Pre-season and post-season meetings may need particular attention	
Water management	WUE – in-field and whole farm Measure to manage Systems comparisons Water efficient practices – getting the best out of your system Impact of waterlogging/water stress	*WATERpak* *Water team* *Local trial data* *CRDC /NCEA book on systems*
Resistance management	Resistance monitoring data Principles of resistance management Egg collections	
Visiting researchers		
Financial Benchmarking	Improving the bottom line Encouraging input of data and summarising local results	*Boyce Comparative Analysis*
Environmental management	Riparian zones Habitat Leaching; overland flow Water quality Greenhouse gases	*Riparian guidelines* *Nick Reid et al* *Regional NRM groups* *BMP*
Deep Drainage	Water loss & nitrate leaching	*Nilantha, Des McGarry, Upper Namoi extension trial*
Fibre Quality	Fundamental of fibre quality What customers want Seasonal issues	*CRC Mill Survey* *Textiles research group* *Training for growers under development?*
Extension planning	Following through on focus group plans Evaluation of extension activities	

POST HARVEST TO PRE-PLANTING

Issues	Key points	Resources
Weed management	Overwinter control Farm hygiene - overwintering weeds and stubble regrowth (pest/disease build up)	*WEEDpak; ENTOpak* *IPM guidelines - weed/ insect interaction* *Weeds researchers*
Nutrition *N & other fert. applications*	Fertiliser regime –nutrient export; soil testing and interpretation.	*NUTRIpak* *Rocky*
Rotation options	Collaboration with other non-cotton extension staff	*Rotations guide* *CRC Information Update*
- Planting into wheat stubble		
Planting choices	▪ Variety selection ▪ Seed treatments ▪ Field selection ▪ Fusarium ▪ Climate / Water outlook	*Variety Guides; Breeders & Seed companies* *F-rank / Fuscom* ***Climate outlook tools** – Dave McRae's newsletter; Peter Hayman – NSW DPI; DPI&F website; Streamflow & Rainman* *Trial results & researchers*
Trap/refuge crops	Different for each region Agronomics of trap crops eg pigeon peas	*ENTOpak; Researchers* *Draft Pigeon Pea note – Linda Heuke*
Soil condition	Compaction, Organic matter, rotations/treatments Sodic, saline and hard-setting soils	*SOILpak; Soils updates drafted by IDOs*
Feeding cotton seed	Fusarium and contamination implications	*Cotton Australia*
Extension Planning	▪ ***Post /pre-season industry reference group meetings***	*Reference group members*
	▪ Trial books ▪ Extension workshop ▪ Extension training ▪ Focus team activities ▪ Evaluation interpretation	*Growers, consultants, Researchers* *Extension Network* *Ingrid* *Focus teams*

CROP PREPARATION/PRE-PLANTING

Issues	Key points	Resources
Pre-season AWM/IPM meetings	First meetings now or just after planting – set plans for season / motivate groups	*Groups; group leaders; IDOs*
Weed Management	- Preplant Herbicides - RR Choices	*WEEDpak* *New Pest Management Guide* *Weeds researchers*
Soil insects	Soil health Infurrow treatments	*Soil critters notes* *DPI note on wireworms and earwigs* *Lewis Wilson/ extension team data shows value by region*
Planting configurations	- UNR - With reduced irrigations - Skip/double row	*Ozcot being updated for this* *Recent trials – Dirk, Penny, Julie* *Drought book, UNR forum notes* *Old cotton research review*
Planting dates	- pest management - with limited water - seedling diseases - soil temperatures for best planting – encourage people to monitor soil temps in paddock – graph/tabulate local results for CottonTales	*ENTOpak* *HydroLOGIC / Ozcot & Dirk* *IDM Guidelines* *Local data*
Spray management plan	PAMP and BMP	*Cotton Australia lead this*
Spray set-up	Importance of good spray application for efficacy and to minimise drift	*SPRAYpak* *Workshops – private providers*
Irrigation **- Water budgeting** **- Efficient application**	*How much to plant? When to water? Season strategy* *Application type & management;* *Pre-irrigate or water-up?* Measure to manage	*HydroLOGIC / Ozcot* *Past experiences in valley* *WATERpak* *Water focus team; researchers - Dirk/Graham*
Extension	*– co-arranging AWM meetings* *- trials – set-up, find collaborators, develop protocols* - update egg coll'n guidelines, etc - update contracts lists for season	*National trial protocols developed by focus teams & researchers; Consultants and collaborators* *Liase with Lars - TRC list*

PLANTING TO FLOWERING

AWM Groups	*May prefer to have first meeting just after planting*	
Insects	- IPM generally	*New IPM guidelines*
	- Heliothis emergence rates (modelled)	*HEAPS, Martin Dillon, Dave Murray*
	- Cutworm/Armyworm	*CRC update*
	- Aphid management	*Louise Rossiter + collection guidelines*
	- Egg collections / resistance results from last season	*Bollgard guidelines / other agronomists*
	- Planting & managing refuge crops	
	- Early season sprays – Endo guidelines / maintaining beneficials	*Pest pocket book; BDI tables*
	- Beneficial sampling methods	*Farm walks*
	- Tolerating early damage (pre-squaring) - promote with:	*Cottongrower article about sampling*
	– Early season thresholds – thrips, tipworms, mites, mirids, heli's	*Data from Lewis & extension trials*
	- Bollgard®II efficacy and management	*Pest Management guide*
	- Value of native vegetation and beneficial refuges	*CottonLOGIC*
Disease	- Seedling diseases	*IDM Guidelines; CRC Updates*
	- Hygiene: Come Clean Go Clean	
	- Detecting Fusarium – promote testing	
Plant stands	- whether to replant?	*CSD publication; Ozcot*
Nutrition	- Petiole testing	*NUTRIpak*
	- Foliar fert's	*Rocky*
	- Premature senescence	*Soil & tissue tests*
Crop progress	- Day degrees; physiology of cotton plant growth	*Day degrees calculator – SILO/CRC web*
Irrigation	- water stress/ timing of first water for root development	*Old CRC research review;*
	- Scheduling	*WATERpak*
		Water team; Dirk; James N
Weeds	- Roundup® Ready sprays	*WEEDpak*
	- IWM	*Pest Management guide*
Cultivation		*SOILpak*

FLOWERING TO OPEN BOLLS

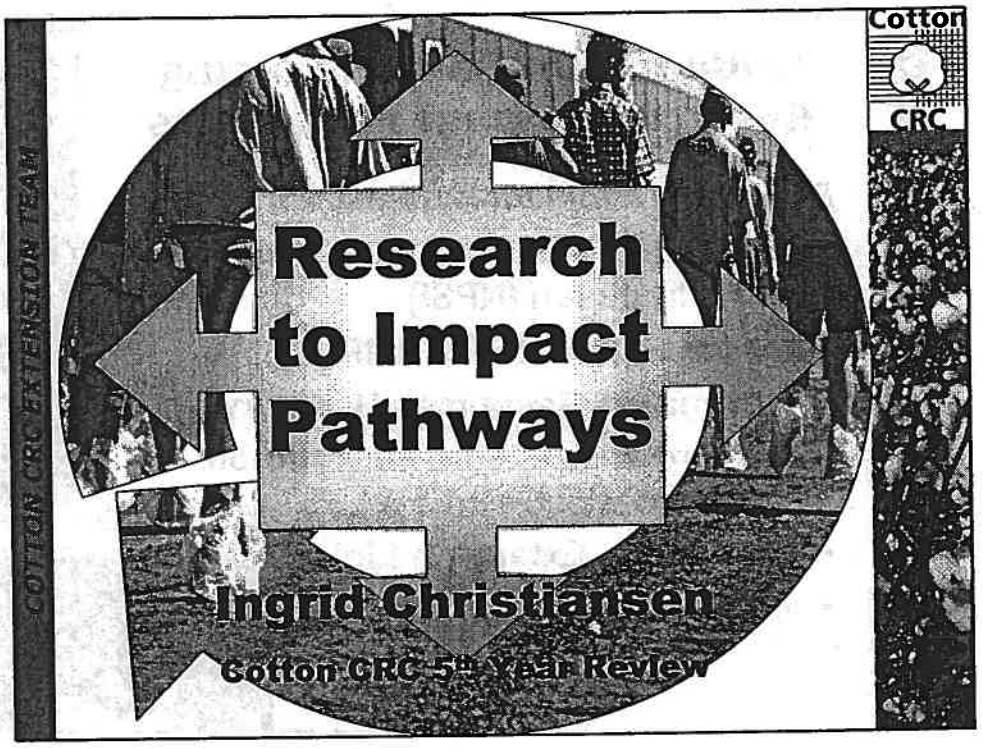
Insects	- IPM	
	- 'Last generation' trap crop options	
	- Thresholds – heli's and secondary pests	
	- Mite sampling	
	- Damage monitoring	
	- Managing pests in non-cotton crops	
	- Bollgard®II Efficacy	
	- Whitefly monitoring and management	
Crop Growth & Damage	- Fruit retention & Fruiting factor	*Extension trial – Mark & Dallas*
Monitoring	- Plant mapping	*ENTOpak*
Growth regulation	Plant growth	*Trial results*
	Water availability	*Crop physiology basics*
	Nutrition	
	Growth regulators (Pix, etc)	
Weeds	Layby options (generically)	*Pest management guide*
	IWM	*WEEDpak*
Fibre development	Fibre quality management	*Cotton Course Notes*
	Boll development	*Drought book*
Spray application	Minimise drift, improve application	*SPRAYpak*
	Application – volumes; nozzles; pressure; etc	*Product labels*
Disease	Detecting Fusarium – promote identification testing	
Extension	AWM / grower groups	
	Field days; farm walks	

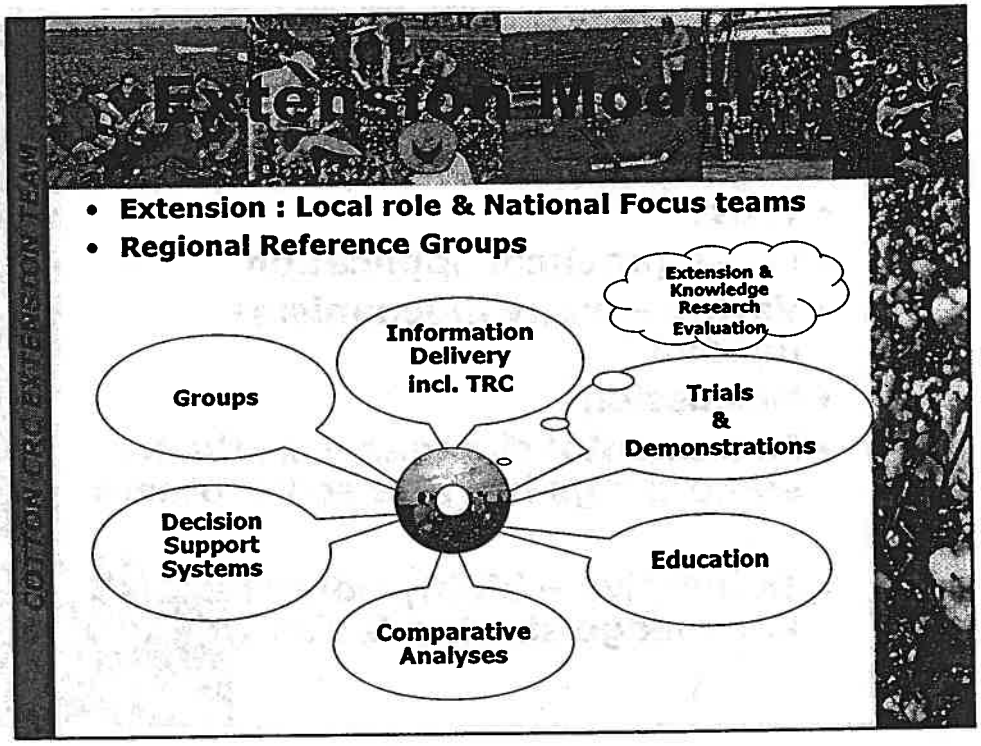
1 OPEN BOLL PER METRE TO HARVEST

Cut out	Avoiding early cut out Timing cut-out with limited water	*Lots in the Cotton Course notes*
Last spray implications	Timing for harvest Aphid resistance management	*Label details* *CRC Updates; Lewis/Grant Herron*
Timing of last irrigation	Need to make it relevant to region	
Insects	Aphids & honeydew Whitefly monitoring and management Pupae busting non cotton crops	*CQ newsletters; CRC update*
Boll and Fibre development under water stress	Fibre quality	*Plenty on this in Cotton Course Notes* *Drought book*
Defoliation & boll openers	▪ Timing ▪ Under hot conditions / cold conditions / water stress ▪ Ground rig and aerial ▪ Potential impact of boll openers on fibre quality	*Past notes* *Label details / product manuals* *Grant Roberts*
Late season trap crops	Timing plough down	*ENTOpak*
Extension planning	- Trial book starting - Late season AWM groups	

HARVEST

Picking	Good picking protocols Reducing contamination	*Field to Bale protocols* *Local gin guidelines*
Farm Hygiene	Limiting disease movement	
Harvest Safety		*CRDC Video*
Pupae busting		*ENTOpak; dryland pupae busting guide* *Bollgard® II requirements*
Compaction	Implications of a wet pick Management options	*SOILpak* *Nilantha*
Season review	Yield, quality, water use	*Local data*
Extension planning	- Gathering results for trial book - End of season industry reference groups meetings – gathering priorities for next season - Planning end of season research review	


COTTON CRC EXTENSION TEAM
Cotton
CRC
Research to Impact Pathways
Ingrid Christiansen
Cotton CRC 5th Year Review


COTTON CRC EXTENSION TEAM
Extension Model
• Extension : Local role & National Focus teams
• Regional Reference Groups
Extension & Knowledge Research Evaluation
Information Delivery incl. TRC
Groups
Trials & Demonstrations
Decision Support Systems
Education
Comparative Analyses

Understanding & Enhancing Research – Impact Pathways

Extension & Evaluation Research:

- Knowledge Management in Cotton and Grain Irrigation (NPSI)
- Changes in attitudes to IPM
- Information Resources Use Survey
- Numerous extension & education evaluations
- Research – Extension Linkages
- Evaluation approaches.

Knowledge & Learning

- Experiential
- Trust
- Local, practical application
- Varied – many mechanisms needed
- Discussion
- Incremental changes – works for some things but less so for others
- Innovative – highly educated, knowledge sharing & risk willing

Extension - Research Links

What works well?

- Regular, individual contact ⇒innovation and communication.
- Extension staff embedded in research programs.
- Collaborative trials
- Interactive forums with research, extension and industry – eg Farming Systems Forum

Extension - Research Links

What works well? ...Cont'd

- Two- way information flow – issues for research and information from research
- Many researchers interact direct with industry frequently.

Partnering Public and Private Sector Knowledge Services

Awareness
Understanding
Value – incl. $
Confidence
Experience
Testing
1:1 Advice
Practical Application

Private Consulting

Public Extension

DEMAND

SUPPLY

Evaluating Impact of Research & Extension

For Accountability .... return on investment

To identify research needs

To improve programs

To identify research ↔ practice pathways

"Keep up the good work - [illegible] granted until we urg[illegible]

Evaluation in Cotton CRC

Extension

- frameworks - Bennett's

  Hierarchy & Logic Model – evaluation & planning tools

- skills & practice

Strategic approaches for RD&E

- Review & Interviews
- Build Capability & processes

COTTON CRC EXTENSION TEAM

Cotton CRC

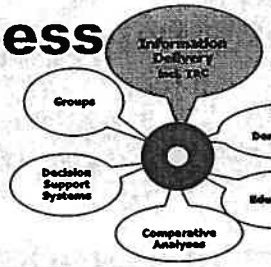
Bennett's Hierarchy of IPM programs

Bennett's level	Evaluations conducted				
Outcomes	- Analysis of total pesticide usage data - Water quality data - Record of social complaints				
Practices	- Benchmark Survey - GCA Surveys	Attitudes to IPM - Focus groups 1997 & 2001			Regional Tipping Out Trial Impact Survey
KASA	- IPM Short Course pilot + follow up interviews		AWM groups phone survey	Insecticide Usage Comparative Analysis Evaluation	
Reactions	- Cotton Tales Surveys - Information Resources Survey - Field day evaluations				
Participation	- IPM Short Course Numbers - Numbers of AWM groups - Cotton CRC website hits				
Activities	- Project reports				
Inputs & Resources	- Annual reports - Project Budgets				

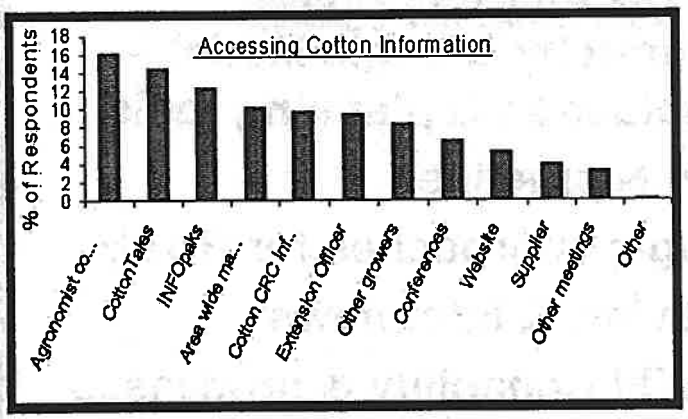
COTTON CRC EXTENSION TEAM

Cotton CRC

Information Access



Most preferred means to gather information is from agronomist, CottonTales, COTTONpaks

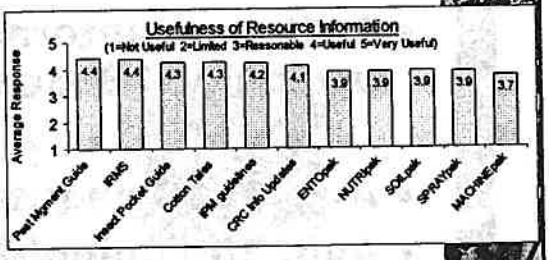


Information Access

- Technology Resource Centre
- COTTONpaks
- Information Updates
- Regional Trial Books
- CottonTales (fax-out newsletters)
- DSS
- Web
- COTTONpaks CD
- Field days
- Seminars
- Groups

Use of Information

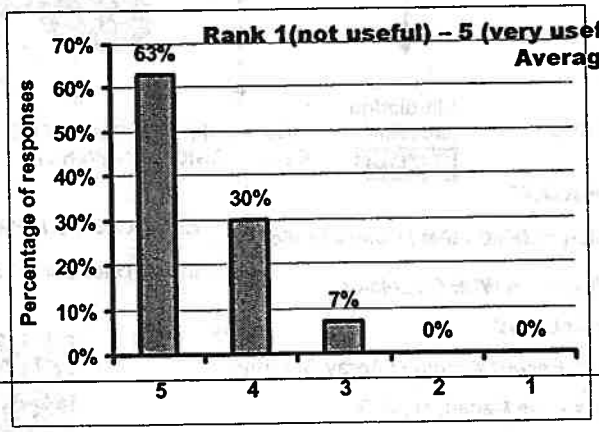
- 90% of industry have & use CRC information resources
- 97% considered to be worthwhile
- 5% of growers use SOILpak to diagnose soil management problems... BUT...



"The cotton industry is very well served with information. The quality of the publications is first class."

Newsletters

CQ "How useful is Cotton tales to you?"



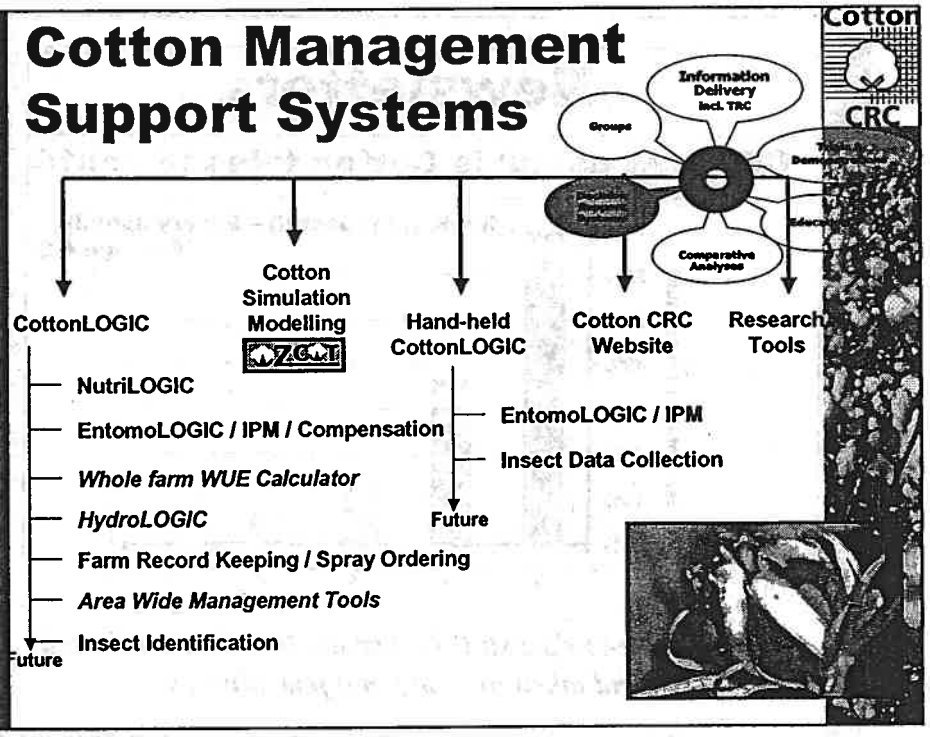
"Useful, up-to-date stuff in a small dose that can be read and taken in easily in a few minutes"

Australian Cotton
Cooperative Research Centre

Internet and Website

- 91% have internet access – 61% use daily, 33% weekly.
- Avg. 2500 pages served / day
- Avg. 500 unique visits /day
- 59% of regd. CottonLOGIC users request email updates
- Now also on COTTONpaks CD

Cotton Management Support Systems



Comments from Independent evaluation

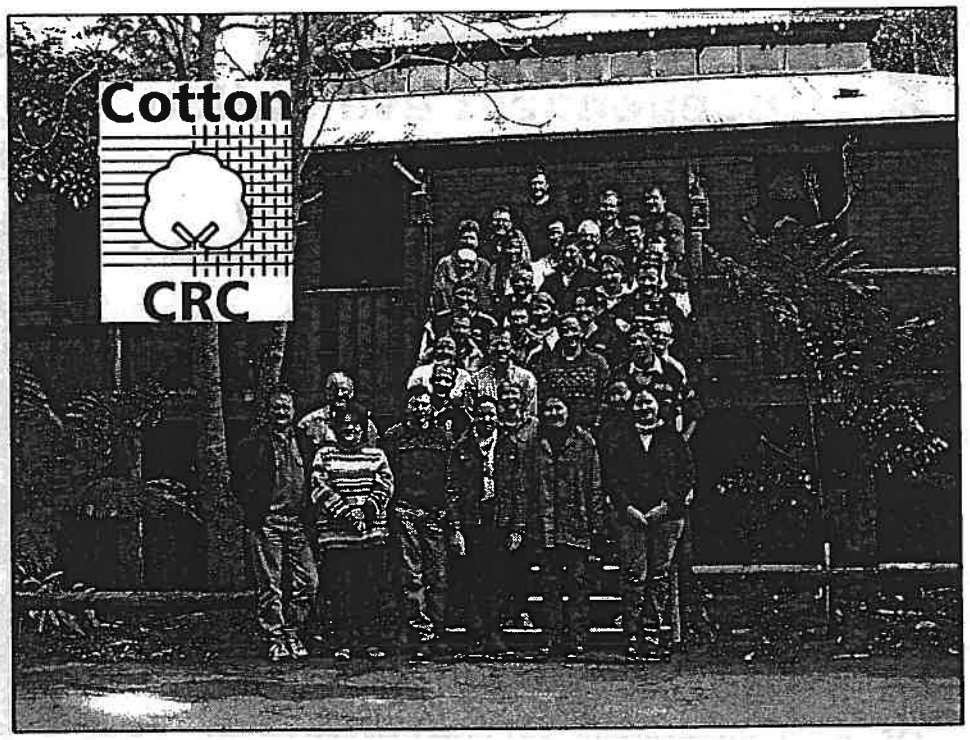
- *"CottonLOGIC is a good back-up and verification tool, I would be very upset if it was not regularly upgraded"*
- *"CottonLOGIC is Better and easier to use than other programs"*
- *"Since CottonLOGIC growers attitudes have changed.."*
- *"CottonLOGIC needs a computer, which is back in the office and most days we get there too late to work out recommendations then. The Palm top system may overcome that."*

Future

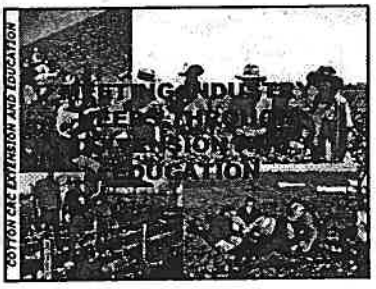
Keep adapting to meet needs

The world of science is changing – build our skills and capabilities

Cotton Industry → **COTTON CATCHMENT COMMUNITIES**


Cotton
CRC

CRC Review



Extension and Education

Overview - *Ingrid Christiansen*

Information Delivery

Grower Groups - *Dave Kelly*

On-farm Trials

Comparative Analysis - *Sarah Hood*

Computer based Decision Support - *Sandra Deutscher & Stewart Whiteside*

Education and Training - *John Stanley*

COTTON CRC EXTENSION AND EDUCATION

Cotton Extension Network

- Industry Development Officers
- District Agronomists
- Water Use Efficiency and Irrigation Officers
- Specialists – Spray Application, IPM Training
- National Coordinator
- Trainee IDOs

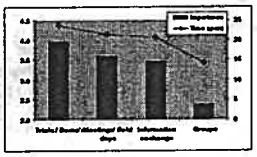
COTTON CRC EXTENSION AND EDUCATION

Key Focus

Area Wide Management groups
Benchmarking
Trials
Data Collection and Coordination
Field Days
Workshops
One on one
Information exchange - CottonTales, Media, Pak's, Trial Books, Courses, etc
National Extension Focus Teams
Meetings
Visitors
Professional development / training
Technical updates

COTTON CRC EXTENSION AND EDUCATION

Extension Activities



COTTON CRC EXTENSION AND EDUCATION

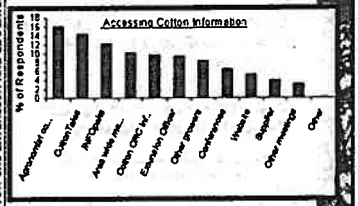
Industry Reference Groups

- Growers, consultants, industry representatives
- Provide local direction
- Ensure activities meet key needs
- Local ownership
- Support and advice

COTTON CRC EXTENSION AND EDUCATION

Information Delivery

COTTON CRC EXTENSION AND EDUCATION



COTTON CRC EXTENSION AND EDUCATION

Hitting The Mark

- Know the Grower Group
- Collaboration
- Know the Issue

COTTON CRC EXTENSION AND EDUCATION

Information paks

- ENTO pak
- MACHINE pak
- NUTRI pak
- SOIL pak
- SPRAY pak
- WEED pak

" Most of the publications are of a high standard that needs to be maintained".

Information PAKs

- 5% of growers use Soil PAK to diagnose soil management problems...BUT
- 25% of growers use Spray PAK when changing their spray set-up

"Information resources that we receive have been excellent"

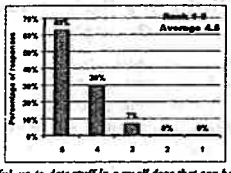
Newsletters

- Cotton Tales
- Heliothis Hotline
- Water Works
- Weather or not
- e News

"Cotton Tales are a very valuable source of agronomic & valley specific information. Please keep them coming".

Newsletters

"How useful is Cotton tales to you?"



"Useful, up-to-date stuff in a small dose that can be read and taken in easily in a few minutes"

Media

- Press Releases
- Radio
- TV

Field Days

- Issue Specific
- Location Specific
- Cotton Tradeshow/ Conference

Groups

- Self Directed
- Co Learning Environment
- All Different

"Having an IDO in the region makes leading AWM as a grower just so easy."

Groups (AWM)

- 1997 – lack of understanding of and confidence in IPM systems.
- 2001 IPM widely accepted throughout the industry.

"Keep up the good work - we growers take it for granted until we urgently need it".

Working With Farmers in on farm trials and Demonstrations

COTTON CRC EXTENSION AND EDUCATION

Research Influences Thoughts, Practices, Values, Livelihood

Much is at risk!

On farm trials/demos reduce the stakes by:

- Producing local/transferable/accessible results
- Being part of the farming system and not isolated components - "real"
- Developing confidence and relationships between all stakeholders
- Resulting in collective, on-going and action orientated learning

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COTTON CRC EXTENSION AND EDUCATION

3 Types of On Farm Trials & Demonstrations

1. Benchmarking
2. Demonstrational
3. Developmental

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COTTON CRC EXTENSION AND EDUCATION

Benchmarking

- Growers are placed on a continuum amongst peers
- Physical Trials or Desktop Studies/Survey
- More successful growers in the area of interest articulate how they achieve the levels they do

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COTTON CRC EXTENSION AND EDUCATION

Benchmarking

- RWUEI
  - Extension Program involving across industry benchmarking trials and participatory action research by all stakeholders
  - 29 physical trials involving detailed measurement of water use

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COTTON CRC EXTENSION AND EDUCATION

Benchmarking

- Comparative Analysis
  - Cotton Growers Group
  - Australian Cotton Comparative Analysis
  - CotBench (Formerly Fisher & Wicks)

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Demonstrational

- Early Season Compensation Trials
  - Greatest IPM opportunities are early season
  - a lot of damage suffered early season
  - Lewis Wilson showed that the plant could compensate for this damage

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COTTON CRC EXTENSION AND EDUCATION

Demonstrational

- Extremely Hard Concept to act upon - ie not spray
- IDO's in each valley set up regional trials - simulated early season damage
- Some treatments quite severe
- "Looks terrible!" at start
- "Can't tell the difference" at harvest
- Regional results - confidence and support in implementation

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Developmental

RWUEI Dam Cover Trial

- Evaporation biggest loss
- Limited options
- Trial a dam cover
- Major developmental trial looking at the practicalities of installing and using dam covers on a major scale

COTTON CRC EXTENSION AND EDUCATION

Trial Books

- Produced in each region
- All on farm trials
- Any other research results relative to the area

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COTTON CRC EXTENSION AND EDUCATION

Grower Feedback

- Preferred process for improved knowledge is farm walks/field days and Grower Groups
- On farm trials and demonstrations are key farm walk/field day sites and can be catalysts for or implemented as a grower group directive
- 4th preferred option is local trial books

COTTON CRC EXTENSION AND EDUCATION

Extension Officer

- See it in action
- Can't dispute it
- Confidence Building
- Builds Relationships and opens channels for constructive feedback and reflection
- Involved in data collection and have immediate access to results

COTTON CRC EXTENSION AND EDUCATION

Researcher Feedback

- Value in the range of the regions and scenarios
- Test the robustness of models and decision support tools
- Promotional and provides feedback
- Respect and repour between researcher and grower and extension officer and for the research.

COTTON CRC EXTENSION AND EDUCATION

Computerised Decision Support

Presented on behalf of the Cotton Management Support Systems team by

Sandra Deutscher and Stewart Whiteside

COTTON CRC EXTENSION AND EDUCATION

Our Aim

Develop and support effective decision support systems founded by quality science

COTTON CRC EXTENSION AND EDUCATION

General Philosophy

- Assist dissemination of research findings
- Provides information for informed crop decisions
- Not a substitute for skilled crop managers

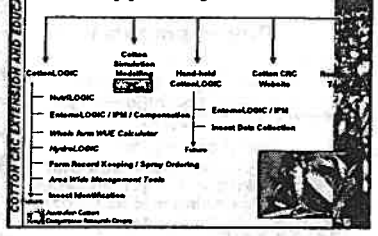
COTTON CRC EXTENSION AND EDUCATION

Team Functions

- Software Engineering and Researc
- Software Development
- Education and Training
- Support
- Industry Feedback
- Promotion, Packaging and Distribu
- Field Validation and Evaluation

COTTON CRC EXTENSION AND EDUCATION

Cotton Management Support Systems



COTTON CRC EXTENSION AND EDUCATION

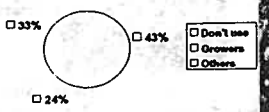
Cotton LOGIC

- EntomoLOGIC
  - Insect management
- NutriLOGIC
  - N Fertiliser management
- Other crop monitoring tools
  - Tracking crop development
  - Plant Mapping
- Record Keeping
  - Spray Ordering
  - Farm Operations / Gross Margin analysis

COTTON CRC EXTENSION AND EDUCATION

Cotton LOGIC

Over 1240 registered copies



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COTTON CRC EXTENSION AND EDUCATION

Comments from Independent evaluation

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COTTON CRC EXTENSION AND EDUCATION

the PalmOS®

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COTTON CRC EXTENSION AND EDUCATION

CottonLOGIC for the PalmOS®

- Insect data entry
- Insect density reports
  - Helicoverpa model
  - Mite model
- Insect data from the last 16 days
- The ability to edit crop information

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COTTON CRC EXTENSION AND EDUCATION

CottonLOGIC for the PalmOS®

- The capacity to enter temperature forecasts
- The ability to download crop profiles
- The ability to use multiple handhelds
- The opportunity to use your time more efficiently

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COTTON CRC EXTENSION AND EDUCATION

Comments from Independent evaluation

- "If the palm top and CottonLOGIC were no longer available I would go and shoot a few people who made the decision to stop funding it as they are vital to the industry"
- "It makes the job easier as it saves hours of hand entry at home, which makes life much easier."

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COTTON CRC EXTENSION AND EDUCATION

Water Use Efficiency Calculator

- Used to show / confirm the efficiency of water usage at field and farm level
- Based on history of Irrigations, rainfall, weather, soil types and LAI
- In use by Water Use Extension Officers in QLD, to assist in Decision Support
- Uptake of technology and concepts is going strong

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COTTON CRC EXTENSION AND EDUCATION

HydroLOGIC

- Used to assist in Irrigation / water use decisions
- Based on history of Irrigations, rainfall, weather, soil types, OZCOT growth model and possible future weather models / analysis
- Almost ready for use in Alpha Field Testing phase
- Uptake of technology and concepts should be strong due to current issues concerning water usage

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COTTON CRC EXTENSION AND EDUCATION

- Scientific Research and Analysis tool for Cotton Crop Growth Simulation
- User Friendly Version (Beta) shown / released to Extension in Feb 2001
- Will become the basis of most cotton modeling over the next couple of years via the PI CSIRO Common Modeling Protocol
- Limited version with reasonability checks will form basis of HydroLOGIC

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Internet and Website

- Avg. 2500 pages served / day
- Avg. 500 unique visits /day
- 59% of regd. CottonLOGIC users request email updates
- Primary source of PDF document distribution
- More interactive support site due for CottonLOGIC 2002 release @ Cotton Conference

The Future

- Common Modeling Protocol
- New Infrastructure, with focus on opening the models, data and information to 3rd parties
- Extra science made practical
- Consider Cotton Industry needs on regulatory and operational requirements

Cottoning On

with John Stanley
and Bill Dalton

Education Summary

- **Top Marks in Course Assessment** (know where you stand)
- **Commitment to Relevance** (shared ambitions and clear goals)
- **Commitment to Active Learning** (and to practice it relentlessly)

Two Ways to Cotton On

- **IPM Short Course**

  Busy but need to 'cotton on' to IPM
  On the road to Quality Assurance
  2 + ½ + ½ + ¾ days

- **UNE/CRC Certificate Courses**

  Need to 'Cotton on' to the whole story
  On the road to consultant accreditation
  4 Units, ½ year each & 4 day Res-school

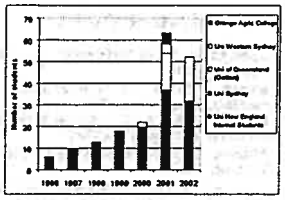
Cottoning on for how long

- Courses were devised following consultation with industry
- IPM Short course has just emerged from the pilot stage
- Cotton Certificate has been running for 9 years

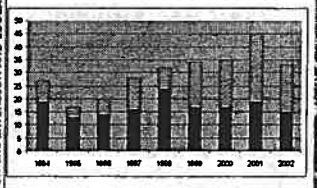
Cottoning on Where

- At field days and centers which suit the short course
- Across Australia with Externally enrolled students and at Residential Schools at the ACRI
- In Universities with Internally enrolled students:
  University of New England
  University of Sydney
  Queensland University (Gatton College)

Internal Enrolments



External Enrolments



COTTON CRC EXTENSION AND EDUCATION

Who is Cottoning On

Occupation	%
Agronomists	45
Farmers	20
Consultants	11
Government	8
Seed Companies	6
Chemical Companies	5
Ginning Companies	2
Finance	1
Other	1

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COTTON CRC EXTENSION AND EDUCATION

Are We Cottoning On

- 100% notes useful, well organised
- 93% used notes since finishing
- 100% res-schools useful
- 98% agreed should be compulsory
- 88% well organised and run
- 78% helped with their work
- 93% valuable training role for the industry

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COTTON CRC EXTENSION AND EDUCATION

IPM Short Course

- Emerged from Pilot Stage
- Grower Emphasis
- 25 participated so far

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COTTON CRC EXTENSION AND EDUCATION

Education Summary

- **Top Marks in Course Assessment** (know where you stand)
- **Commitment to Relevance** (shared ambitions and clear goals)
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COTTON CRC EXTENSION AND EDUCATION

Evaluation

Are our extension and education services being effective?

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COTTON CRC EXTENSION AND EDUCATION

COTTON CRC EXTENSION AND EDUCATION

Evaluating change

Focus group assessment of Industry Attitudes towards IPM - Cotton Extension Network, May 1997 & October 2001

CCA IPM Survey for CRDC (2001 & 2002)

Cotton Industry Benchmark Survey

Cotton Comparative Analysis (BOYCE)

Benchmarking of grower groups.

Water Use Efficiency evaluation

Individual activity evaluations

Extension Review 1995 and 7

And constant feedback through close links with industry

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COTTON CRC EXTENSION AND EDUCATION

Extension Role is strongly supported

Growers are enthusiastic about AWM groups

"Having an IDO in the region makes leading AWM as a grower just so easy."

"...I have learnt more in the past 3 years than in the previous twenty."

Australian Cotton Cooperative Research Centre

Cotton CRC

Research – Extension Linkages in the Cotton Research Community

Ingrid Christiansen

June 2004

The linkages between research and extension sectors of the Cotton CRC were explored through a series of interviews of 24 cotton industry researchers and a group workshop with the cotton extension network. This report summarises the findings as reported to researchers and extension agents at ACRI, June 2004.

Why look at research-extension linkages?

- To enhance the benefit of research to industry
- Efficiency and timeliness of pathways for research to reach industry
- The CRC Model is about linking research to industry
- Continuous improvement & innovation?
- Some researchers have identified a need to improve research – extension linkages.
- Evaluating research impacts, needs and understanding of links and roles.

Method

- 24 in depth semi-structured interviews of researchers
  - *Narrabri, Toowoomba, Armidale, Sydney*
- A workshop session with extension
- Researchers were also asked about evaluation approaches and this is reported separately.

Key Findings

There was a quite some variation in views from different researchers but many common themes emerged. These can be best summarised around the areas of: Core Values, Perspectives and Opportunities

Core values - Research

- *Quality science*
- *Honesty*
- *Integrity*
- *Rigour*
- *Measurable*
- *Passion*
- *Usability*
- *Change*
- *Sustainability*
- *Belief*
- *Visibility*
- *Learning*

Core values - Extension

- *Communication*
- *Link*
- *Reliability*
- *Accessible*
- *Cooperate*
- *Synergy*
- *Unbiased*
- *Conduit*
- *Triple bottom line*
- *Worth*
- *Knowledgeable*

Researcher Perceptions

Research – Extension Linkages

- Most researchers considered extension to be core players in delivering research to industry
- Didn't always feel that this was happening
- Recognition of workload and effort of extension staff
- "It must work as farmers are now using softer chemicals"

R-E links

- Extension help to get work out into the industry
- I try to call IDOs about the trials I have in their region – two way – develop trials together
- Linkages are strong with some
- It's up to extension to get research out
- "I assume that extension get the information out"

Overall perception of links

- Most commonly considered to be poor, non-existent or "could be better"
    - Turnover rate in extension
    - Many considered problem was on side of researchers
    - Time required to involve extension properly – effectiveness?
    - Restricted to links with a few
    - Don't see many extension staff visiting researchers
- A few had excellent linkages with IDOs – mainly in the regions where they had trials.
- Toowoomba researchers considered links were good
    - Good in cotton because industry is well structured, has many meetings
    - Direct link of an extension person in research teams
    - "Works best with those links we engineer ourselves"

Specific activities that link research and extension

- IPM Short Course
- COTTONpaks focus research effort
- Field Days
- CCA forums
- Seminars, etc

A Question of Scale

- Many researchers work closely with a few growers and consultants that they collaborate with.
- Some consider this is enough and don't need extension to be involved
- Scale? What about getting the message out to all the other growers and consultants? Many rely on Cottongrower articles, etc for this.

Production Focus

- NRM researchers perceived that the extension team is mainly focused on production issues
- Extension 'pull' is driven by industry queries and demands – production issues
- Environmental issues are more passive – need a way to get them out there

Select few?

- Some researchers were concerned that extension staff focus on a few researchers that they have relationships with and don't seek new ideas from other researchers
- Some researchers feel "left out"
- "Extension work on their interests and only take the information that they want"

Two way flow

- Extension is not linear
- Many were keen for a two –way flow of information
- For extension to feedback priorities for research, issues, grower thinking and needs
- Most felt this wasn't really happening

Understanding of extension model

- "I expect that 30-40% of extension work is ad hoc"
- Some understanding of focus team structure
- Little understanding of new extension coordination model
- New researchers in particular needed an overview of who/how in cotton extension
- Unsure how extension plan priorities

Understanding of extension processes

- Strong emphasis on Cottongrower articles for some
- Many researchers comment on the time they spend "doing extension" - talking at meetings; field days; direct queries.
- Collaborative trials have worked well – but researcher needs to be aware of how much time is involved.
- 1 researcher keen for training in extension processes

Extension Perspectives about linkages

- 2 way communication – varies
- Some researchers make contact when visiting the region.
- Cooperative approaches
- Participation with growers can give researchers direction eg regional forums
- Formal & informal
- Regular & ad hoc

Extension Perspectives about linkages

- Good & Healthy
- Poor
- Variable
- One sided – extension need to chase information from researchers.
- Need to cultivate linkages.
- Building – 2 way value

- Develop relationships with a few researchers.
- Some researchers have an 'open door' policy – happy to talk but expect us to go to them to seek the new research.
- Some researchers have prepared a list of key trials to address an issue – really helpful for grower discussion/involvement
- Lack of researchers in some issues.
- Sourcing researchers to visit southern areas is difficult.

Drivers for linkages (who/what?)

- Demand driven
- Outcomes/results
- Specific question or problem – individual or focus team
- Personality of researcher – some are difficult to get information out from
- Personality of extension
- Selfish needs – eg regional work vs need to publish
- Relationship with researchers

Other issues from extension

- Meshing together R&E
- Who's responsibility is it to get science out?
- Some extension staff link with researchers outside of cotton
- Reactive / proactive extension – cyclical?

Some observations

- Research perceive that extension are delivering science to industry
- Gap in understanding of who "extends" science
- Need for research to understand their role in communicating their science – and how extension operates
- Need for clarity about extension role in 'delivery' of science
  ⇒ Role clarity needed

Opportunities identified by researchers

- Research identified they have a role in extension
- Difficult with already full workloads of both R&E
- eg IPM Short Course has increased load on researchers as the number of IPM researchers in the industry has declined
- Researchers need to be proactive to identify extension opportunities

Linking with all

- Talk with the quiet achievers
- Extension to contact all researchers not just the select few
- "It makes me feel great when extension call to ask me about my research – that someone wants it an is interested"
- Researchers need at least one contact person for their work and v.v. for focus teams
- Focus team leaders link with some researchers – who need to know hey are

representing others
- "Some scientists are introverts, need to be more aware of this and extension be more proactive about contacting extension "

Building Communication
- Most researchers want direct calls from extension to seek research to extend and feedback key issues
- Scrap email – talk more
- Put CottonTales on ACRI tea room table
- IDOs tour ACRI trials again
- Forums / extension workshop - Be involved in planning
- Contacts list searchable by expertise, including past years. eg upgrade CRC web contacts
- Focus teams link with research but research time is limited
- Workshops for R&E to bid communication lines – assume this happens anyway at centres like ACRI; produce extension materials from such workshops

Proactive from research
- Research let people know they have a message
- More extension publication of research outcomes
- Could deliver training for extension / consultants
- Extension strategy developed at completion of final report

Drawing on extension knowledge
- Researchers were keen to have feedback from people closer to industry (eg extension) of what angle / "hook" to use & what audiences
- Extension better understand how growers access NRM issues
- Need to figure out a strategy of how to communicate with stakeholder groups.

Planning
- Currently ad hoc planning – R&E need similar objectives
- Research to be more aware of extension planning process
- Haven't been involved with extension workshops for some years – how?
- Perhaps pick key research topics at a time when they're ready to go out – perhaps focus on that hot issue for ~ a year
- Best to have extension involved early when planning a research project – but difficult due to high turnover in extension.

Two-Way Flow
- Provide feedback of priorities and issues facing growers
- Questions IDOs get from industry about science could be discussed more
- Link grower interest and research needs for trial sites – list of grower trials at start of season
- More ways to communicate, more integration – eg last year's CRC Review started to help with that. More internal communication about what's not known. Struggling to have regular information.
- Extension – involved in forums, good summaries, etc.
- Extension put together the key issues about a topic (and Qs) to communicate to researchers...discuss at CRC Review, etc
- Set up a Listserver – medium for extension to ask all types of Qs & seek information – even if "dumb" Qs. Scientists happy to have these and answer them.
- Database of who has knowledge (expertise) about issues – searchable by expertise.

Other ideas

- Regional reports that IDOs do for the Cottongrower could also include research trials being done.
- Researchers develop delivery tools – extension raise awareness about these.
- Let researchers know of field day schedule

Opportunities identified by Extension

- Contacts list for researchers – with expertise
- Email reminder for research to contact local extension when doing trials in the regions
- Booklet of what research is being done for the year ahead
- Document / website of options for researchers to communicate with extension
    - Focus teams, local roles
    - Role of extension team
    - Links / opportunities
- Include extension linkages in project proposals – link person; liaise at development stage; funders to distribute.
- Soils workshop model for building teams/learning and linkages.

Comments

Researchers were very open in their comments and most were very keen to discuss the issues of linkages with the extension network. It was generally an important issue to many of them. It should be noted that, as might be expected, the group session with the extension team was not able to draw out the same level of in-depth, individual thoughts that the one-one-one interviews with researchers did.

The extension team considered the linkages to be far stronger than those observed in these interviews with researchers.

An area that requires more discussion is whether extension should actively seek and promote research. There are subtle but significant difference in views:

- extension actively access research in response to priorities identified by the industry, on both an on-going and ad hoc basis and also proactively in response to priorities identified through regional reference groups and similar target setting processes.
- There could be considered a wider role for the extension team to identify and promote research that may not align with priorities identified by their local industry.
- This latter point could be particularly relevant for NRM issues which may be important to address even if they are not readily identified by industry participants as an immediate high priority.
- Exploring the issues that are NOT identified as priorities by industry could be equally important in identifying areas for extension need.

Whilst extension team members are very actively attuned to local issues and the interactions within the extension team are strong, there appears to be some lack of clarity in relation to the greater purpose, direction and higher level goals for the overall extension program at the current time.

Recommendations

1) Purposively ensure two way interaction between researchers and extension

Whilst several researchers have excellent relations with several extension team members, the direct interaction and two way flow of information between all researchers and the extension network could be enhanced. It is recommended that focus teams and related researchers work together to develop strategies for how best to interrelate and communicate.

It is suggested that a 'buddy system" be initiated where each researcher is paired to an extension officer. The extension officer would actively contact their buddy researchers at least twice per year to ask about progress with their research, new ideas, emerging issues, industry priorities and issues and opportunities for interaction with industry and extension. Researchers would also be encouraged to contact their 'extension buddy' as a first point of contact in the extension network. These 'buddy discussions' aim to be broader rather than seeking a solution to a specific problem. They would in no way intend to limit the regular, needs based interaction between all members of the extension team and relevant researchers but aim to ensure that new research ideas or opportunities are picked up and that all researchers have direct, personal contact with at least one member of extension team. They also aim to share the workloads evenly through the members of the extension focus teams.

2) Clarify roles and expectations of RD&E sectors in delivering research to industry.

There is a need to clarify the roles and expectations of different sectors in relation to extension (which is a role of all sectors). This will vary for different issues but some overall frameworks could be helpful. This would target new research and extension people entering the industry as well as the existing networks. The collaborative development of an extension strategy for each discipline area is suggested and will be trialled for the fibre quality arena.

3) Communicate to researchers the key extension techniques used and extension model/contacts.

Clear, simple communication about the extension model used by the cotton industry appears to be needed. A simple quick reference could be developed, drawing on the material presented at several CRC Reviews.

It would also be valuable to communicate to researchers some simple messages about various extension techniques that are employed. This would aim to both build the skills of researchers for their own extension activities as well as developing a shared understanding of the approaches used by the extension network and the challenges and opportunities faced.

4) Ensure that researchers participated in CRDC's planned review of extension.

Researchers are key stakeholders for the extension program and any review of the cotton extension model would ideally actively seek input from research and explore opportunities, barriers and institutional arrangements towards enhancing the effective linkages between research and extension and also in setting the future direction and purpose of the extension program.

5) **Consider linking research and extension programs, possibly through joint project funding.**

Researchers who were directly linked with one or more extension agents through their projects, programs or other initiatives had the most positive views of the linkages. It would worthwhile considering whether this partnership/joint project model would be more beneficial than the current model of independent projects.

Acknowledgements

Research guidance and insights for this study from Professor Beth Woods, Dallas Gibb, Bruce Pyke and Guy Roth were greatly appreciated.

Thanks to the Cotton Research and Development Corporation and the Australian Cotton Cooperative Research Centre who funded this research through the "National Cotton Extension Coordinator" project.

Thanks to the research and extension staff who contributed their thoughts through interviews and group discussions.

Copyright

This document is intended as an internal working document to assist in enhancing the effectiveness of the extension program through continuous improvement cycles.

Disclaimer

Evaluation Skills and Approaches

A survey of the National Cotton Extension Network

August 2003

Collated by Ingrid Christiansen

Background

The CRDC has identified a vision for: *A more sustainable, competitive and profitable cotton industry providing increased economic, environmental and social benefits to regional communities and the nation.*

The Cotton Extension Network aims to contribute to this vision: By maintaining close links with industry and with research providers, access, generate and promote locally relevant information and practical knowledge, coordinate activities and facilitate communication between stakeholders to enhance cotton growing practices in each region. (Cotton Extension Mission, 2001)

Measuring the impact of extension activities is increasingly being required as CRDC move towards reporting on Triple Bottom Line Outcomes.

Within the Cotton Extension Network, evaluation is being approached as a tool for planning, review and continual improvement. In this way, evaluation can help to tailor extension programs to industry needs, prioritise effective extension approaches and plan programs to achieve outcomes. These learning and improvement benefits are more of a focus of our evaluation efforts than is monitoring and assessment.

Moving towards evaluated outcomes will require extension staff to have good skills in evaluation frameworks, evaluation techniques and outcomes planning. This survey was conducted prior to the 2003 Cotton Extension workshop. It was used to help develop an evaluation training session at the workshop and also to benchmark the team's current levels of skills and approaches.

In total, 25 responses were received which included all 9 Industry Development Officers (IDOs), 2 of the 5 District Agronomists who are linked with the Cotton CRC, 8 Water Use Efficiency or Irrigation Officers and 6 people in specialist roles such as education and the Technology Resource Centre.

Evaluation skills and approaches

****Note that each of these groups is relatively small so the use of percentages in presenting results is indicative only.*

Overall skills in evaluation

As to be expected, there are varied levels of skills in extension evaluation. Overall about half of the team consider that they have average to good skills in evaluation.

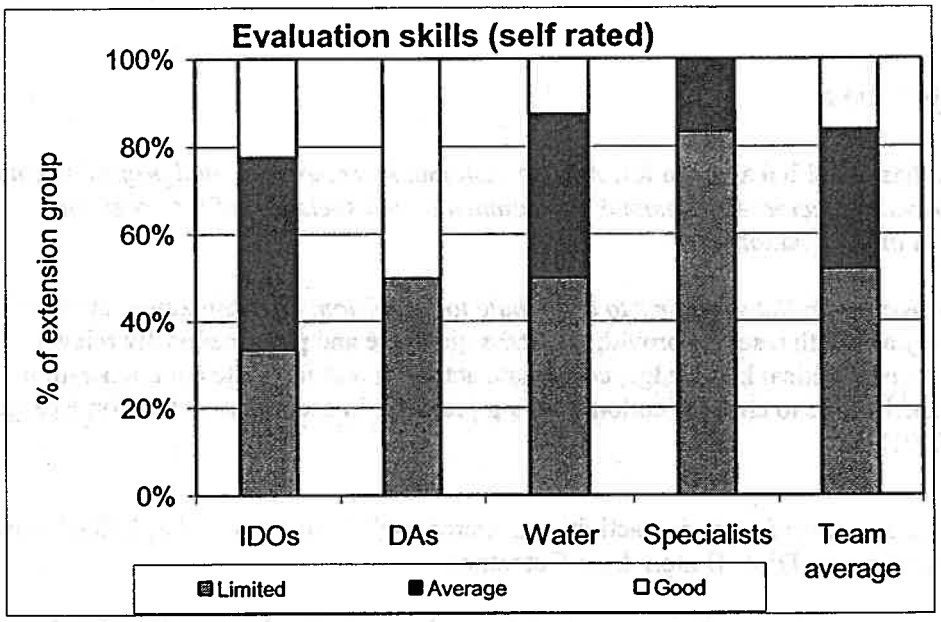

Figure 1: Response to: "How would you rate your skills in extension evaluation."

Frameworks for Evaluation

Careful planning is a key element of useful evaluation. A number of frameworks have been developed to assist with planning and interpreting evaluations. These frameworks can also be useful for drawing together an evaluation of a wide range of activities and impacts across all cotton research and extension.

As of August 2003, half of the members of the Cotton Extension Network did not use frameworks for planning evaluation of their activities (Figure 2). Bennett's Hierarchy (Bennett 1977) was used by 5 members of the team and one person used Logical frameworks. These trends were similar across all of the extension roles and were not linked to years of experience.

Other frameworks used by the team included the guidelines from the Certificate IV in Assessment and Workplace Training, varied frameworks depending on the task and the Better Practices Process.

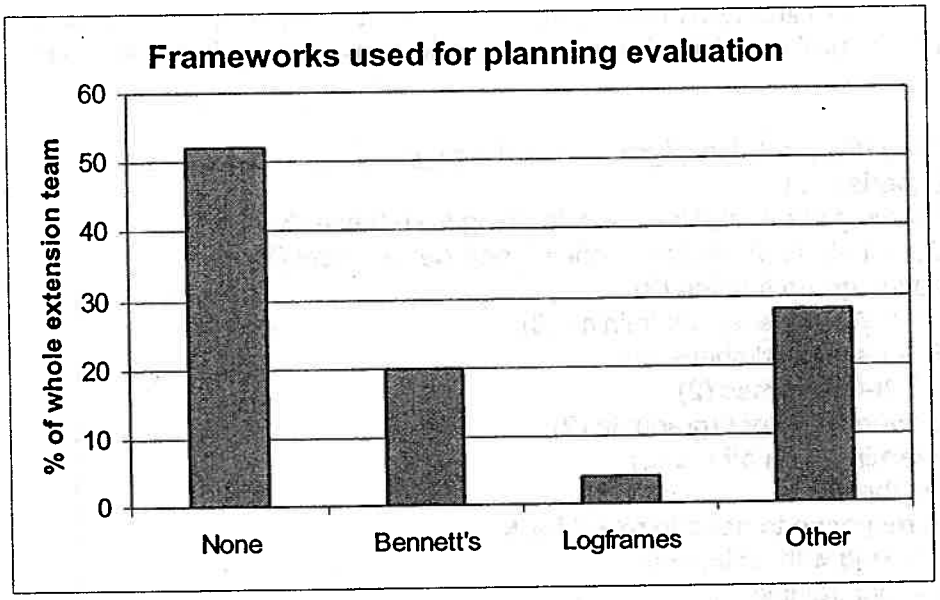

Figure 2: Frameworks used for planning evaluation of activities.

We have since developed a framework for Cotton Extension evaluations that combines the Logic model and Bennett's Hierarchy. The extension network worked through this at the 2003 annual workshop.

Evaluation Methods Used

All extension staff used a variety of methods for gathering evaluation data (Figure 3). By far the most widespread was observation. Interviews, written surveys, records/minutes and reference groups were also widely used. Case studies were used only by IDOs. Focus group training and practice had been offered in 1997 and in 2001, yet only 9 of the 25 respondents indicated that they used this technique (note that several team members had joined since 2001). Similar numbers used narratives or other participatory methods. Other methods used included anecdotal, show of hands, numbers participating in a program, numbers implementing changes on farm and evaluation sheets at the end of a course.

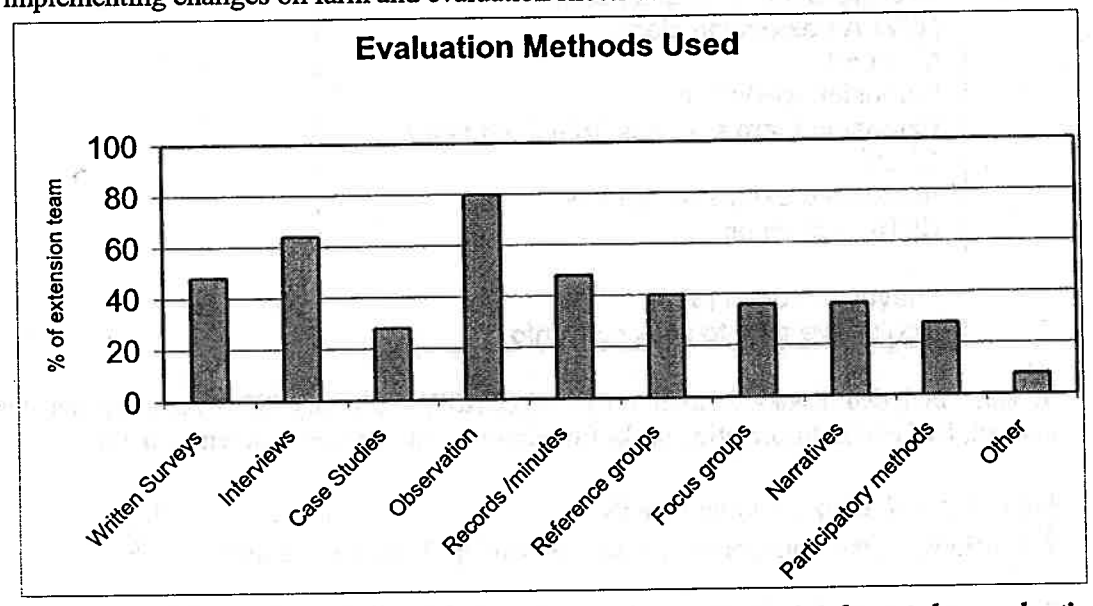

Figure 3: Methods used by members of the cotton extension network to gather evaluation data.

Developing Evaluation Skills

Cotton extension staff are clearly active learners – they primarily develop their evaluation skills through practical experience in carrying out evaluations – both their own and their colleagues.

Table 1: Evaluation skills have been developed through:

Experience (6)*
Carrying our evaluations and learning from these (3)
Certificate IV Workplace Training and Assessment (3)
Focus group training (3)
NSW Ag professional training (3)
Extension workshops (2)
CRRI-Q^ courses (2)
University – undergraduate (2)
Learning from others (2)
On the run
In response to need to report back
Working with colleagues
Formal training
Practice
Project activities
Reading about evaluation techniques and alternate approaches
Reading past evaluations

**Numbers indicate number of responses of this type.*
^CRRI-Q – Centre for Rural and Regional Innovation, Queensland – formerly the Rural Extension Centre

Table 2: Further information about evaluation techniques is sought from:

Reading* (10)
Peers (10)
Past evaluations (2)
NCEC / Ingrid (2)
Sharing ideas with researchers
NSW Ag extension alerts
My head
Extension workshop
Extension team activities from 2 years ago
CRDC
Accredited extension trainers
CRRI-Q courses
I haven't / I don't (3)
Don't have time to seek such info

*Reading included: Books, Journal of Extension, NSW Ag library, NSW Ag extension alerts, Internet, Evaluation Information packs from Ingrid, course notes, University notes.

Further developing evaluation skills

The majority of the team are keen to further develop skills in evaluation.

Six people identified that they were keen for any training that may be useful. *"Any and all that are on offer."* Some of these felt it important to develop their skills but didn't know enough about the area to identify which specific areas would be most useful.

One IDO preferred training to be done as an activity for the whole extension group for a given / planned task, such as had been done with the IPM Focus groups. There were also several who did not feel a need for further evaluation training. Any training opportunities will need to cater to this range of training needs and preferences.

Table 3: Areas preferred for evaluation training.

All areas (6)
Survey techniques - incl written surveys (4)
Matching evaluation methodology to aim of project/evaluation
Frameworks
Questions to ask
REC courses
REC course was good - now get in and do it a few times
Group evaluation
Measuring change and impact of a project
Measuring triple bottom line in relation to projects - indicators
Planning (2)
How to get the right information out of an evaluation
Assessment
What other people do
I need the time in my day to carry out evaluation. Just don't have the time.
None / no response (5)

Evaluating programs

Understanding the impact of research and extension on triple bottom line change requires us to look beyond activity level evaluation to an evaluation of whole programs. These programs generally involve both research and extension together, each contributing in different ways to the end result.

There is a possibility for the extension team to assist with evaluating whole programs. The extension team were asked whether they felt they had the skills to assist with evaluating research and extension programs.

Responses were fairly equally split with most commenting that they felt that they could assist with evaluations if provided with some frameworks and/or assistance (Table 4).

Time rather than skills was identified as the limiting factor by one respondent.

Table 4: Extension team skills to assist with evaluating research and extension programs.

	Yes, I have the skills to assist	No, I don't have the skills
Number of responses	14	11
Comments	With frameworks As part of a bigger team Enjoy doing this With assistance in planning I have access to people who do and can learn If given directions and guidelines Limited knowledge To assist perhaps Assist Not time	Assisting others could help my skills and abilities Could with some methodology provided Have some skills however more would be helpful

Review and on-going improvement

Several processes are used by extension staff for feedback and improvement of extension activities (final column, Table 5). The most common mechanisms used are discussion with growers/clients and peers. Only a few (and mostly IDOs) identified reference groups as important in gathering feedback and in improving their programs.

Concepts of Outputs and Outcomes

The concepts of outcomes, outputs and how to measure these was quite varied across the extension team (Table 5).
The questions deliberately did not define what outputs and outcomes were as we were aiming to get an idea of what people's current concepts were.

Since this survey, sessions at the extension workshop focused on evaluation and planning for outcomes – and understanding how outputs and inputs contribute. Evaluation frameworks were introduced and worked with by some focus teams.

Table 5: Outcomes and outputs of cotton extension, measuring the linkages and processes used to gain feedback on extension activities.

	Outcomes	**Outputs**	**Measures**	**Processes for feedback and improvement**
IDO	Industry adoption of industry research findings & protocols Coordinated demonstration of research eg farmwalks, AWM groups activities	Production of resource materials on focus team issues for extension team and industry use. Timely coordinated distribution of research findings to extension team and industry.	Industry need or problem Local industry request/feedback Need to meet DPI strategic plans / outcomes DPI Directors directive	Narratives Grower group feedback FUSCOM committee meeting Consult with local grower & CCA members for feedback to gauge 'local' industry attitudes & needs.
IDO	In our case playing an important role in meeting the objectives of CRDC, CRC, DPI Qld by whatever means it takes.	It varies for each activity. For a field trial it may be that x number of growers are aware that a particular practice is applicable to a certain area, and then we can move onto the next step of further progressing adoption. For a newsletter it may be that x number of people are aware of a certain issue	Keep the triple bottom line objectives of CRDC, CRC, DPI Qld objectives in the back of my mind at all times. Some activities will not directly have a triple bottom line impact but may be the conduit or catalyst for something that does.	Speak to as many clients as possible about the most effective way to do these things. eg after a field day etc, ask people if they were happy with the way it went and the implications of what was at the field day to what they will do on their property.
IDO	Attitude change Practice Change Productivity gains / WUE	Field days Trials	See productivity gains / WUE Practice change Attitude change	None
IDO	Change towards a more efficient, sustainable production / return.	-	-	-
IDO	Practice change to improve WUE, reduce pesticide use, improve soil structure/health, increase sustainability	Participation Numbers Take home messages Interest Shown / enquiries	Evaluate to determine practice change / adoption. Follow up meeting / field day attendees.	Direct questioning of clients. Committee input R&E subcommittee Evaluation in / post meetings
IDO	A more educated and informed cotton growing community who produce a heap of cotton of high quality with minimal external threat to the environment	Outputs? Don't really understand the Q – a change in practice?	I usually don't but he surveys recently completed are one way I guess.	Word of mouth – comments following information sessions and cotton tales, you can get a feel following a session and surveys.

	Outcomes	Outputs	Measures	Processes for feedback and improvement
IDO	Increased grower and industry knowledge and awareness of latest research technologies. Achieving change to best management practices for sustainable cotton production.	Continuously updating growers on the latest research and information using Cottontales, group discussions, farm walks, field days, on-farm trials. Ensuring that outputs meet the needs of the growers within the valley by addressing local and national issues.	Evaluation of activities. Observation. Individual discussion with growers.	Grower reference group, evaluations of some activities, individual grower feedback.
IDO	People gaining knowledge and experience. Improve people practice in both long and short term and improve productivity or improve profitability. As extension is not a one way tool to learn I take the opportunity of extension to learn from others and make sure that the activity creates discussion and every opportunity for people to learn from each other.	The output is that there is an actual change of practice by a grower or that they learn something and are keen to learn more. That I learn something from the activity.	If a grower changes their practice or learn something then there is a output which in term means the outcomes are achieved.	Main tool has been getting feedback from peers that attend the activities and using the cotton consultant group as focus group to gain feedback about activity that are run.
IDO	Making a difference in the information exchange for an area. ie to be a provider of good information for growers so that they can make informed decisions on farm. Facilitation the exchange of information amongst growers.	Putting out good information and backing this up with demonstration (eg trials) if possible. Organising a forum (eg farm walk, grower meeting) that allows good information exchange.	Observation. Getting grower feedback. Individual interviews and reference group meetings.	Focus group members, meeting and individual follow up phone calls for individual feedback. CGA meetings.

	Outcomes	Outputs	Measures	Processes for feedback and improvement
DA	Relevance, timeliness, in summary promoting beneficial change both economically and environmentally.	Promoting relevant and beneficial change to the target group as outlined above.	By general feelings of myself, peers and the target group. Also by the level of acceptance of the extension outcome.	Mainly communicating with target group regarding their feelings and attitude towards the extension.
DA	Increasing the average gross margin of cotton production in each valley. Increasing production of lint per meg of water used.	? Not sure how to answer this.	Haven't had to do this bit yet – will probably need some guidance.	Phone surveys of people receiving / attending the activities.
Water -NSW	Recognised awareness of poor WUE industry wide and a move towards rectification.	Satisfied clients with promptly answered enquiries.	Don't often as most activities are directed from above and requests for evaluation is not forthcoming.	Self assessment Internal reporting
Water -NSW	-	-	-	-
Water -NSW	Modified practices on the ground. Queries brought about by growers thinking about their methods More productive cotton enterprises with sustainable futures.	Relevant, apply-able, current best practice knowledge and methods.	Grower feed back through the avenues listed above.	See previous.
Water - NSW	Change in grower knowledge. Change in grower management. Commercial uptake of techniques	Published hard copy material. Powerpoint CD presentations. Above onto WWW. Training manual.	Oral feedback.	Observation of responses. Subsequent modification of techniques.
Water - NSW	Change in practice at ground level Increased long term viability Practical solutions	Increased WUE Increased understanding Develop and work towards whole farm solutions when problems occur	Observation Discussion with growers Benchmarking exercises	Discussion Whiteboard – key issues / points resulting from discussion
Water - QLD	Profitable farming systems and associated communities	Information Packages Training Workshops	Evaluation of outcomes (which involves ascertaining links between outputs and outcomes via client groups).	Records of enquiries Interaction with client groups Surveys

	Outcomes	Outputs	Measures	Processes for feedback and improvement
Water - QLD	If researchers are better trained in extension their trials might become more relevant to growers and they might be able to get their information out easier.	Increased grower awareness and knowledge	I think that if growers become more involved in research they will take ownership and they are more likely to take up new ideas and concepts.	Talking to growers and other extension people. Get other extension officers to look over my work before I present it and get them to give ideas on how it can be improved and try to incorporate those ideas. Talk to growers after meetings to find out what they thought of the session.
Water – Qld	Practice change as required	Change in decision making	So far they haven't	Anecdotal
Specialist	Developing and promoting the adoption of improved technologies and practices to ensure that the cotton industry is economically and environmentally sustainable. Establishing strong collaborative linkages with other research providers. Through extension activities and interactions we need to strengthen linkages within industry and between local communities therein increasing community capability and capacity. Improve skills, communication and intellectual knowledge base of growers/consultants through adoption of the latest research findings.	To try and get the message across to the relevant body using the most appropriate extension method.	Don't know.	Working in an industry where there is rapid technological change and increasing complexity in decision making it is essential to maintain program of continued learning and skills development. Feedback from peers, collaborators, industry is important to me as a guide to the direction of my research and to my strengths and weaknesses. Therefore I take opportunities to present my work at a range of forums in order to get such feedback eg presenting talks at field/bus tours, seminars, AWM meetings, attending courses, conferences etc. Constructive feedback from the above experiences has contributed to my plan for personal development.
Specialist	Changes in Knowledge Attitudes Skills and Aspirations	Self directed learning Industry using Decision Support Tools	Industry evaluation via independent consultant	

	Outcomes	Outputs	Measures	Processes for feedback and improvement
Specialist	In the insect management area: Increased capacity of growers and consultants to understand and confidently adapt IPM research to their own businesses. Aims and results of relevant research projects easily accessible and understandable to potential end-users of that research information	Information resources (newsletters, fact sheets etc) Group meetings that are relevant to issues at hand Local information updates/field days etc. and learning opportunities for local growers and consultants	At the moment these links have not been explored explicitly to any great extent – however as an observer I am able to make some connections. However, there is a real challenge to move towards evaluating the impact of a whole program or extension effort rather than just the impact of a single newsletter or extension activity. We need appropriate methodologies (and some training in these/perhaps even co-ordination) to get to this stage. In my work we are currently developing a communication and evaluation plan as a milestone in our current project and as a basis for future project proposals. It is important that evaluation be built into research/extension projects up-front than done as either an ad-hoc or post-hoc exercise. Lastly, surveys are useful but I think they are overrated and will not give us everything we need/want.	Self-evaluation and reflection on activities, esp. how well the process matches with known adult-learning principles. Identifying strong/weak points and formulating general 'rules of thumb' help me to plan more effectively for the next time – this is an ongoing process. I frequently involve key colleagues (usually DPI) for gaining the necessary feedback, but have on occasion contacted growers/consultants to seek their input on how useful they found the content/process.
Specialist	Education Knowledge	Able to achieve or know about the learnt module / area		Verbal feedback Written
Specialist	Growers using most sustainably profitable system for growing crop – little off farm impact	Provision of all relevant information required	Informal interviews during contacts	Watching distribution of packages /web – what is moving

	Outcomes	Outputs	Measures	Processes for feedback and improvement
Specialist	A change in attitude and practices towards more sustainable and economically viable cotton production, by using IPM practices	Number of growers through the IPM course. Number of courses conducted Number obtaining accreditation	That is the problem, how to draw the links and establish the correct process behind activities and outcomes. No doubt the outcome (s) could be improved on to help reflect output Attitudes and intangible evidence needs to be captured so it is meaningful to report to funding bodies	Written evaluation form, Verbal feedback in general from students. Suggestions from presenters. Information obtained from courses

Recommendations

1. Develop simple, clear evaluation frameworks for cotton extension and utilise these both in planning and evaluation prior to commencing an extension program.

The LOGIC model and Bennett's Hierarchy were used in the evaluation session at the 2003 extension workshop. Working through these, people commented that they were planning an extension program whilst planning an evaluation – highlighting the value of simple frameworks for both outcomes planning and evaluation.

2. Identify the relative importance of evaluation and also the benefits it can have in focussing on effective extension activities and follow this through to workplans.

The importance of evaluation to clearly demonstrate the outcomes from the extension investment has been regularly reinforced by CRDC. It's importance is well recognised by the team, having been regularly raised at the extension workshop prior to the evaluation session. Perhaps this needs to flow through more clearly to individual's works plans as some comments were made about not having enough time to evaluate. Evaluation tied with outcome planning can also be an effective time management tool.

3. Clarify the interpretations of "outputs", "outcomes and "impacts" and measures of these for the purposes of cotton extension.

There are widely different interpretations of the meanings of these words in relation to extension. This is further complicated as different funding agencies and different groups use different interpretations. Some clear definition of how they will be used in cotton extension purposes may save some confusion – this is likely to evolve further over time.

4. Establish some consistent measures for use across the extension network.

Whilst many activities are locally driven, there are many overarching impacts that the extension program is aiming to achieve. Currently the measures used to review these are variable across the extension program. Since the workshop, the focus teams have been undertaking evaluation of various issues using consistent measures across the industry. The focus teams together with research programs could then evolve this into some consistent, long term measures.

5. Develop skills in specific evaluation METHODS

Following the extension workshop, the groups had a good understanding about extension & evaluation frameworks. What they are really after now is some more skills in techniques for undertaking evaluations – eg survey design, interview techniques, etc. This could be done through a training workshop or through guided evaluation projects. Since this time, most of the team have participated in a whole group activity using interviews to review irrigators' knowledge management.

References

Bennett CF (1977) 'Analysing impacts of extension programs.' (Washington DC Extension Service, US Dept of Agriculture.)

WUE & Irrigation																													
Garry Giddings																													
Phil Goyne																					✓								
WUE																													
Graham Harris														underway							✓								
Sarah Hood																					✓								
John Okello-Okanya																					✓								
Peter Smith																													
Andres Spragge								✓				✓									✓								
Barry Swann																													
Olivia Whiteoak																					✓								
David Wigginton																					✓								
David Williams								✓												*									
Coordination																													
Ingrid Christiansen							✓	✓	✓					✓											✓				
Dallas Gibb								✓																					
David Larsen								✓	✓																				
Geoff McIntyre									✓																				
Bruce Pyke								✓																					
Nicky Schick																													
Guy Roth																													

NSW Ag project management course good

Writing - Di Morley

As at Nov 2002

✓ Have done
* Would like to do
Part - some units complete

	Group Extension						Evaluation						Training			Communication skills					Technical									Tertiary
	Adult Learning	Time Management	Facilitation skills	Group Dynamics	Benchmarking		Evaluation principles & planning	Focus Group Technique	Surveys	Semi- structured Interview	Narrative	Photo essay		Cert IV Workplace Assessment & Training		Scientific Writing	General writing	Presentation skills	Negotiation	Media Skills	Cotton Production Course	Ozcot	Bollgard Accreditation	RR accreditation	Chemcert / Smart train	Spray Application technology	Legal			
IDOs																														
Evan Brown								✓													part	✓				✓				
Steve Ginns																						✓				✓				
Mark Hickman								✓	✓					part			✓				✓	✓				✓				
David Kelly								✓	✓												✓	✓				✓				
Julie O'Halloran								✓	✓												part	✓				✓				
Kirrily Rourke								✓	✓													✓				?				
Greg Salmond								✓			✓										✓	✓				✓				
Rebecca Smith																														
Annie Spora			✓					✓		✓				✓						✓	part	✓			✓	✓				
Anne Sullivan			*	*				✓									*	*			part	✓				✓				
Penny van Dongen								✓			✓						✓				part	✓				✓				
Jenelle Hare			*	*			*							underway				*				?								
District Agronomists																														
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Leigh Jenkins		*					*							*				*												
Griffith DA																														
Klara Schulze			*	*				?						part		✓	✓			✓		?			✓		✓			
Sarah Sykes																														
Education & Training																														
John Stanley																														
IPM Training Coordinator																														
Mascha Raymond																					✓									
Specialised Support																														
Sandra Deutscher								✓														✓								
Bill Gordon							✓																			✓				
Rachel Holloway								✓																						
Peter Hughes																	*			*						✓				
Austin McLennan	✓							?										*								✓				
Paul Kleinmeulman																										✓				
Julie Ferguson																														

ROLE OF EXTENSION TEAM

Ingrid Christiansen
September, 2001

Several members of the team had asked prior to the workshop for clarification of what the role of the extension team is – what is expected of us from our funding bodies and management?

In an attempt to clarify this, a strategic planning session was included in the extension workshop. Before this could be done, it is important to be clear about the activities undertaken by individuals in the extension team in different regions and with different roles.

What are the Key Activities of Cotton Extension Team?

In many ways the activities of the cotton extension staff have changed considerably since the first industry development officers started. Initially the roles were very much trial based - conducting local trials to ground test the research from ACRI and elsewhere to overcome the "my valley's different" barrier and to gather localised information. Refer to Cotton Extension Review 1995 CRDC/CRC – distributed by Bruce post workshop.

Some members of the team asked - Has the focus of the role of IDO changed in this time? Is the industry / CRDC /CRC expecting different things from IDOs and the extension team as a whole?

Feedback from key stakeholders prior to the workshop indicated NO - the focus is still the same but the technique that is best used may be different. With a greater move towards IPM we are now dealing with more complex systems, in these cases group based activities (such as AWM groups) may prove to be more effective than trial work alone.

Some key points from discussion with R&D leaders:

- **Choose the technique that will best achieve the outcome for each issue** (ie trials, information delivery or groups). This also means taking into account which techniques you personally are most effective at delivering.

- **Local ownership of your extension activities is crucial.** Ensure that local cotton growers have input into what activities you are doing each year.

- **Close the loop** – ensure your are providing feedback to researchers about what research needs are being identified in your valley, emerging issues, etc.

The specialised roles generally have more specific objectives. Since the National Extension Team commenced the water team has been included. These programs have their own specific objectives but the same principles apply. Local industry involvement, appropriate selection of techniques and feedback to researchers will help ensure the roles are effective.

<u>*Cotton Extension Roles*</u>
Industry Development Officers
District Agronomists
Water Extension team
Specialised support – CottonLOGIC, Technology Resource Centre, IPM Training and support, Spray Technology, BMP, Coordination

Key Activities of extension staff identified at extension workshop

Area Wide Management groups
Benchmarking
Trials
Data Collection and Coordination eg Pheremone traps
Field Days
Workshops
One on one
Information exchange
- Cotton Tales
- Media
- Pak's
- Trial Books
- Courses
- etc

National Extension Focus Teams
Meetings
Visitors
Professional development / training
Technical updates

These key activities can be broadly grouped into:

- Trials and Demonstrations
- Meetings and Field Days
- Information Exchange
- Groups (incl. AWM)
- Your own skills development

How is time allocated between tasks/issues?

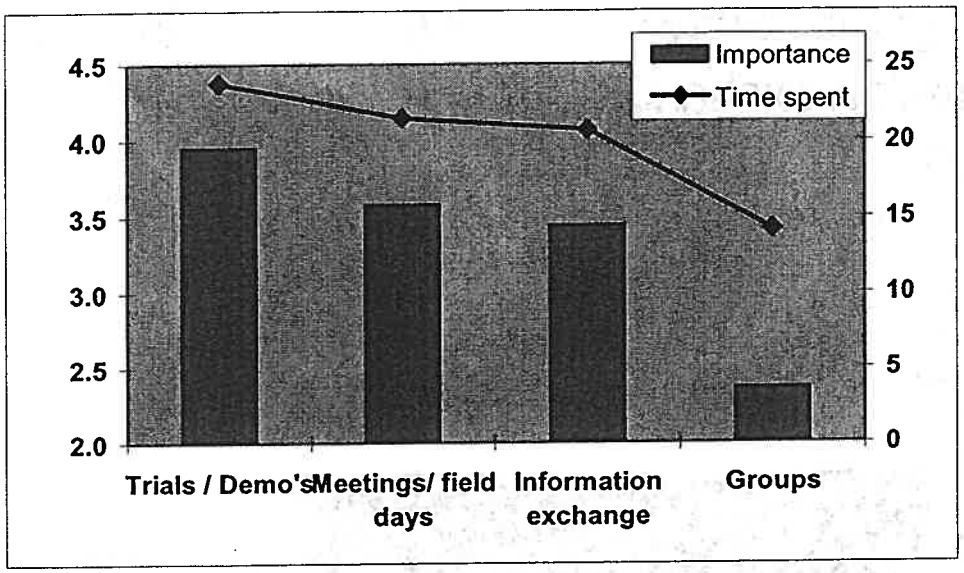
Dallas asked everyone to individually complete a form indicating the proportion of time spent on each activity and how important (relatively) they consider the industry in their valley perceive that issue. Everyone was also asked to rank how relevant they consider different extension methods to be in promoting information about each key issue. Results included on the following page.

The form also gathered feedback about how the extension team as a whole can help individuals with these activities. As summarised overleaf.

Extension Focus and Activities

Compiled by Dallas Gibb from feedback from Cotton Extension Team members

Extension Activity



National Focus Activities

	Importance	Time spent
Insect Management	4.6	44
Farming Systems	4.0	20
Disease Management	4.4	19
Weed Management	3.5	9
Environmental Managem't	3.7	6
Water Management	4.1	3

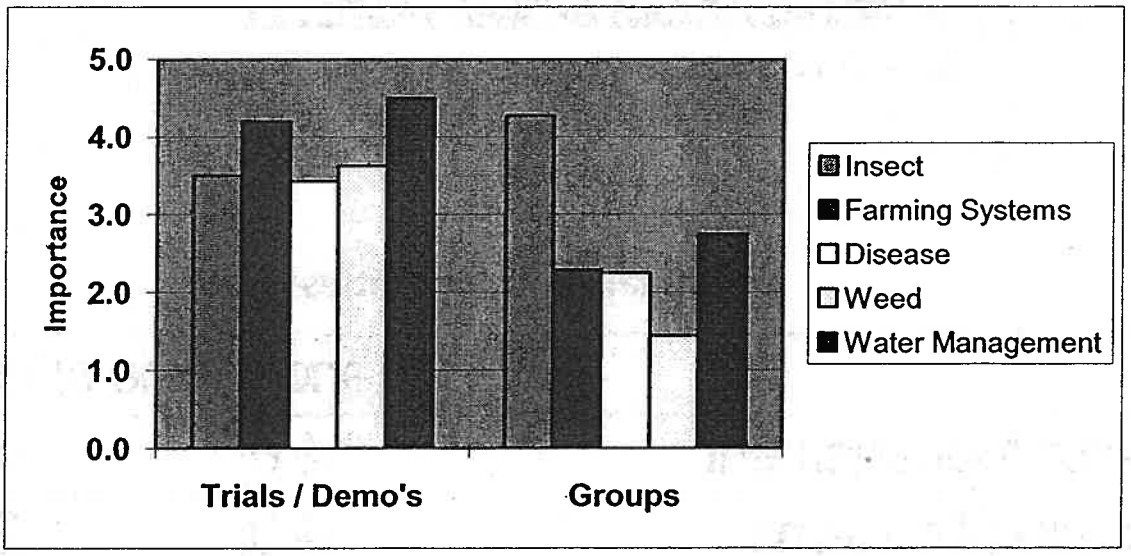
Note: These figures do not include members of the water extension team as many of this group had not been present at this time/filled out the forms. Therefore the actual time spent on water issues by team as a whole would be far greater.

"Importance" is a ranking 1-5
Time spent is a % of time spent on the issue.

Extension Activities

	Importance	Time spent (%)
Trials / Demo's	4.0	24
Meetings/ field days	3.6	22
Information exchange	3.4	21
Groups	2.4	14

Activities by National Objective



Ranking of each style of extension method with respect to its relevance in promoting the key issues.

Key Issues, Extension approaches and help with activities

How can we as a team increase our performance?

Insect Management

Regional Insect Management
Resistance Management
Resistance testing
IPM techniques
Number of growers adopting IPM
Beneficials
Hard/soft alternatives
Adoption of AWM
Research on application techniques for ground application – refer envir. section for detail
Reduction of pesticide dependence
IPM – individual farms and area wide scale
Dynamic control thresholds
Exploring suite of management options in IPM
Growers with improved appreciation of IPM
Adoption of AWM / IPM tools in insect management
Range of tools available for IPM – importance of these and reasons behind decisions made
Increased use of trap crops
Area wide management – non-cotton growers cooperating with cotton growers
Pesticide efficacy, Targeting / timing / techniques, Condition monitoring, Application selection (details in envir section)

Extension Approach	Help from group for your activities	By Who?
TRIALS/DEMONSTRATIONS	Trial protocols Beneficial sampling and ID Sampling of wheat stubble trial Not seen as the vector unless growers want assistance Large scale IPM system trial Pupae busting comparisons Info Resources Access to researchers Need various ideas acceptable to local group	Researchers Julie F - - Insect team
MEETINGS AND FIELD DAYS	Materials to show at field days & meetings Guest speakers from successful groups to get the ball rolling Evaluate pupae busting Info resources Guest speakers Coordination of when each valley is holding meetings/field days	Insect Team Insect team eg Lewis W, Julie F

Insect Management Cont'd

INFORMATION EXCHANGE	Pro-formas for Cotton Tales As new R&D evolves direct info link to IDO, etc Info for Cotton Tales Trial book Info resources Approval of Cotton Tales Available info Provide results from other districts and research Happen at AWM group meetings Need newsletter	Insect team - Insect team Insect team
GROUPS (AWM)	Support for comparative analysis work Guest speakers – successful valley grower Info on IPM adopted by other AWM groups Info resources Guest speakers Funding for benchmarking? Network with other AWM groups On farm group demo's Need support staff for the extra AWM groups that are forming 1 group established in Hillston – need IDO to coordinate in all areas – Hay, Condobolin, Hillston with DAs & Scott Hardwick Attend meetings as guest speakers on spray application	Upper level management Insect team
YOUR OWN SKILLS	Increase knowledge of beneficials – ID and role of each ID what other AWM groups do and what my role is Confidence, process of running a group Comparative analysis – how to? Learning all the time Cotton Course, CCA meetings, etc	
OTHER	Tap into existing BMP groups for AWM Growers want more input to IRMS - Some growers need to realise importance of IRMS Protocols, Labour, Guest speakers Employ another economist to help Ziaul	 CRDC/Cotton CRC

Farming Systems

Pupae control techniques

Cotton into wheat stubble

Soil structural decline

Trap crop agronomy

Rotations (link with disease management)

Wheat stubble trials

Nitrogen rates

Improved production system for cool season areas – UNR/Wheat/Twin

Salinity management

Fertility management

Local Farming Systems Explored and developed to suit local conditions and needs

Adoption of sustainable rotations in the dryland cotton system

Soil structure

Soil fertility – roles of P, K and N

Benefits of rotations

Sustainable farming practices that don't promote increase in diseases, weed problems and insect pressure

UNR, Twin row

Sowing into stubble

Farming Systems Cont'd

Issue / Extension Approach	Help/coordination required	By Who?
TRIALS/DEMONSTRATIONS	Assist with finding cooperators Protocols and handy hints to get around problems. Rotation crops – focus farm/grower case study Labour for running trials & data collection – NOT causal $ eg shared Tech. Assistant Info resources Researcher cooperation Many years needed for rotations trials – bus trips to other areas may be best Many trials running in area – need to be documented – a trial book may be priority for new IDO – consult with growers	Farming Systems team Farming Systems team Farming Systems team
MEETINGS AND FIELD DAYS	Guest speakers, experts to explain how Field day on trial site – guest speakers Info resources Ideas from the focus group for field days A lot more info to share Trials are not currently being utilised for extension (Hillston)	Researchers Farming Systems team
INFORMATION EXCHANGE	Help in distribution of information Communicate with other DAs ~rotations Fact sheets / Media Industry wide info sheet eg DK's wheat stubble Guest speakers Info resources At meetings	TRC Farming systems team
GROUPS (AWM)	Groups need kick starting if to do this Guest speakers	
YOUR OWN SKILLS	What are the implications of rotation crops – previous research More interaction with farming systems researchers in both Qld and NSW Constant development Cotton Course	
OTHER	Some presentations for IDOs to access to share with growers	

Disease Management

Observing what's happening in the field – in crop monitoring by growers and agronomists for early recognition.

Fusarium hygiene

Fusarium and Black Root Rot management

Adoption of disease management strategies to minimise spread of Fusarium wilt and BRR

Create awareness of disease precaution

Create awareness of disease management

Farm hygiene

Disease prevention

BBT management

Protocols to minimise spread of Fusarium wilt & adoption/use of these

Black Root Rot control/management

Other disease prevention

Number of farms with disease – prevention protocol

Disease Management

Issue / Extension Approach	Help/coordination required	By Who?
TRIALS/DEMONSTRATIONS	Be told what's going on before season starts – sharing of info relating to trials Demo of available equipment Continue collaboration with Natalie Moore in regards to monitoring spread/incidence of Fusarium & trials which look at products & rotations to reduce Fusarium levels Group informed about research trials – better communication between researchers/extension	
MEETINGS AND FIELD DAYS	Most effective in raising interest in disease mgmt Collaborate with Cotton Australia (BMP) & CGAs Baseline info Guest speakers Disease management options from latest research Promote info on washdown bays, products, designs – sponsorship to run Need experts/pathologists to talk Run a disease wrap up every year – winter Researchers/gurus visiting area for field day	Disease Team
INFORMATION EXCHANGE	Good info available More one sentence messages to promote DISEASEpak Best Practice Updates – Fusarium management, BBT Promote info on washdown bays, products, designs Need precise info on disease to extend – still a bit fuzzy "Cotton Sheet" (newsletter) resurrected by IDO	Disease team Disease team + research Pathologists
GROUPS (AWM)	Disease has been discussed but focus is on insects, farming systems & water Work with CGA Baseline info Possible vector if group wants Videos?	Disease team
YOUR OWN SKILLS	Teach us to ID diseases to provide diagnostic service Aim to improve all the time Disease identification skills and other disorders What is available – eg equipment, literature	
OTHER	One-on-one available to identify problem areas/sources Link into BMP working groups Most problem fields rotated out of cotton until answer is found	Researchers

Weed Management

Application techniques

Overuse of residual herbicides

Host weeds for Fusarium control – ID and control

Adoption of sustainable crop rotations to control / limit the development of problem / resistant weeds in the cotton production system

National issues

WEEDpak development

Local increased awareness of IWP

Identification of key species

Herbicide and farming options to reduce RR cotton volunteers

Integrated approach to weed control

Weed ID and management guide

Control of volunteer cotton (including RR)

Best management of weed species

Trap crop weed management

New growers brought up to speed in weed control

Pesticide efficacy, Targeting / timing / techniques, Condition monitoring, Application selection

Control of weeds coming up on new cotton soil that in the past has only been used for grazing

Bathurst Burr

Weed Management

Issue / Extension Approach	Help/coordination required	By Who?
TRIALS/DEMONSTRATIONS	Researcher cooperation No real help – more grower involvement for this Herbicide trials, in crop and fallow + other management options – biocontrol Demo plots Need to document what new growers are already doing for benefit of new growers	
MEETINGS AND FIELD DAYS	Roundup trial used in field day - guest speakers Speakers – researchers Visits by researchers Relay to researchers and Monsanto the need to have this info to be extended Field day at trial sites– tap into ACRI weed team Nutgrass control	
INFORMATION EXCHANGE	Not getting much info Grant R good help with writing up a trial WEEDpak Brochure for ID of hosts weeds & methods of control Weed ID & management guides Links with researchers 1-2 page CRC news note on options ie if rotating with sorghum use Starane, etc Cotton Tales Media Options for growers	Weeds team
GROUPS (AWM)	Focus farm	
YOUR OWN SKILLS	Don't have anything which will help growers Always aiming to improve Ensure those IDO/DAs not accredited become accredited – notes are good Options available for control Need help on herbicides & rates & weed ID	
OTHER	-	

Environmental Management

Research on application techniques for ground application – refer envir. section for detail

Pesticide application – drift issues *vs* coverage needs

River health – importance of flows

Riparian zone

Salinity

Water quality

Generate and nurture applied knowledge of growers and pesticide applicators in ground application technology

Salinity management

High risk systems/areas

Herbicide and insecticide drift reduction

A lot of the other issues are Cotton Australia & BMP related

Water quality

Spray drift/odour problems

Water availability

Environmental quality under sustained irrigated cotton and grains production

River quality – no residues

Spray drift management – no breaches, fish kills, etc

Pesticide efficacy, Targeting / timing / techniques, Condition monitoring, Application selection

Environmental Management

Issue / Extension Approach	Help/coordination required	By Who?
TRIALS/DEMONSTRATIONS	Funding for ground application trials Cooperation of researchers Protocols for trials Simulated herbicide drift trial Funding for extensive application trials – create interest & support info.	
MEETINGS AND FIELD DAYS	More extension personnel to extend ground application research findings Cooperation of researchers Baseline info (SPRAYpak) Spray application workshops Coordination of when each valley is holding meetings/field days	Environment Team Peter Hughes
INFORMATION EXCHANGE	More extension personnel to extend ground application research findings Baseline info (SPRAYpak) Cotton Tales on Spray drift Newspaper articles Ranking of insecticides by odour Confidence in non-smelly chemicals Big issue for product selection More updated technical application info from trial work	Environment team Environment Team
GROUPS (AWM)	Identify growers currently implementing relevant management practices and share this info – they may be able to act as guest speakers Attend meetings as guest speakers on spray application	
YOUR OWN SKILLS	OK – always try to get better Consult with envir groups eg EPA, spray group Improved presentation skills	
OTHER	Need new, useful info generated that is relevant to applicators and growers and fills current gaps in our own knowledge and skills Have run some small spray app'n workshops on my own Due to not being involved with spray rigs on a regular basis do not have a good knowledge of system. Tie in with survey work being done ie Janelle Montgomery Investigate efficacy with the use of LDP in each area – if achievable control, holds beneficial attributes in relation to drift, etc	

Water Management

You can improve your WUE!

Stored soil water can be an important part of this

Liase/collaborate with WUE officer

Best local irrigation management practices

Evaluate efficiency of current systems

Trialing limited water options for the Breeza plain

Irrigation scheduling practices adopted in grains & cotton

Measurement of all aspects of water on-farm as a basis of objective assessment & improvement

Declining water resources (mainly groundwater)

River/groundwater salinity & potential impacts

Irrigation strategies to improve WUE

Recycling

WUE

Issue / Extension Approach	Help/coordination required	By Who?
TRIALS/DEMONSTRATIONS	Practical solutions or monitoring equipment in the field is an essential component As per WUE officer No good without extending through workshops/field days/meetings Liaise with water team – IDOs facilitate Casual staff Timely equipment availability Working equipment Local demo sites Interested farmer groups Training in monitoring equipment for water on/off field If it is to be industry specific – need industry funding support Limited water experiment to assess alternative irrigation strategies – BMPs Mark Hickman already assisting with trial/demo work that enables a holistic approach to cotton Irrigation officer	Andres, NCEA
MEETINGS AND FIELD DAYS	In conjunction with trials Irrigation course for cotton Paul Dalton or Peter Smith to assist Light pro with OHT / Multimedia projection unit Forward planning Promotional facilities Cooperation of Cotton IDO in organisation of events	Stuart Bray/Peter Smith

Water Management Cont'd

INFORMATION EXCHANGE	Water works not promoted enough? NSW grower in Border Rivers region not aware of project (due to Border issues QLD RWUE was not able to work in NSW part of valley) IDO may need to do this if water is an issue that valley is unsure if acceptable? Pro-forma for use Decision support 1 to 1 or group approach Information access (research & trials) Support from ACRI on HydroLOGIC, water budgeting tools Funding of technical interchange sessions with extension/research people Production regrading water use Mark H helps with communication via Cotton Tales, Cotton Trial Book, etc and communicating with growers	
GROUPS (AWM)	Format for Comparative Analysis Information to be presented at meeting Involve in group activities of water team Potential link for extension meetings (use of existing structure)	Raelene/water team Water Team
YOUR OWN SKILLS	Water issue of WUE more focussed around WUE officer – will help facilitate. Training in information technology Training in group facilitation Decision support Professional training in extension & communication & irrigation Formal training in irrigation management through Charles Sturt University Cotton agronomy skills – UNE &/or cotton IDOs Assistance required to produce manual & pass on skills To educate & increase awareness of riverine salinity and impacts on cotton production – need info on salt impacts on cotton	Casual assistant
OTHER	Put main research results in water section of BMP manual? Growers asking about pre-watering *vs* watering up on seedling vigour and yield Integrated approach – to come with time Regular phone interview Regular Cotton Tales from other areas Regular monthly reports from other areas Evaluation Clerical assistance required to convert knowledge "in head" to digital format	Casual Assistant

Australian Cotton
Cooperative Research Centre

COTTON EXTENSION TEAM
KEY ACTIVITIES 2001

INDUSTRY DEVELOPMENT OFFICERS

DISTRICT AGRONOMISTS

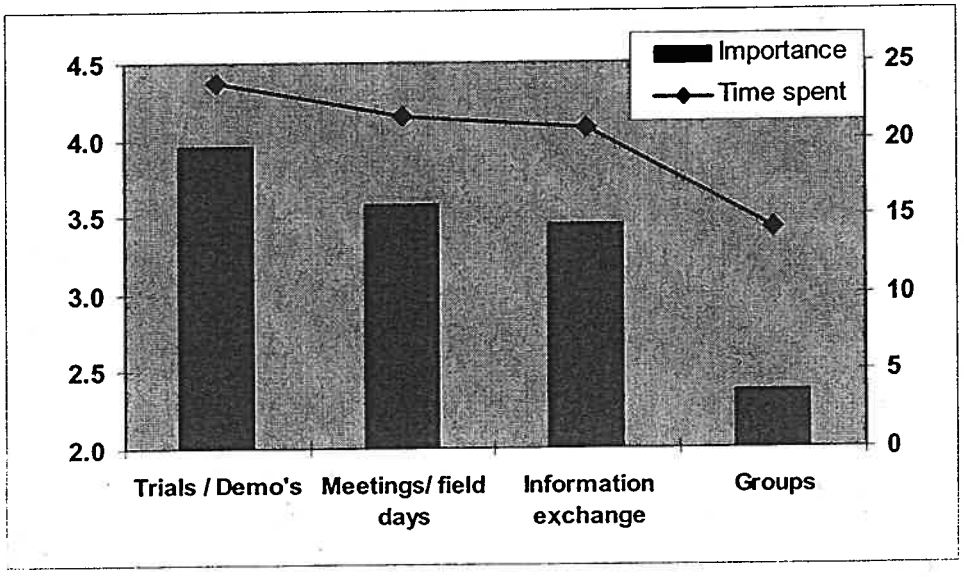
WATER EXTENSION TEAM

SPECIALISED SUPPORT – Cottonlogic, Technology Resource Centre, IPM training and support, Spray Technology, BMP, Coordination

Key Activities:

Area Wide Management groups
Benchmarking
Trials
Data Collection and Coordination eg Pheremone traps
Field Days
Workshops
One on one
Information exchange
- Cotton Tales
- Media
- Pak's
- Trial Books
- Courses
- etc

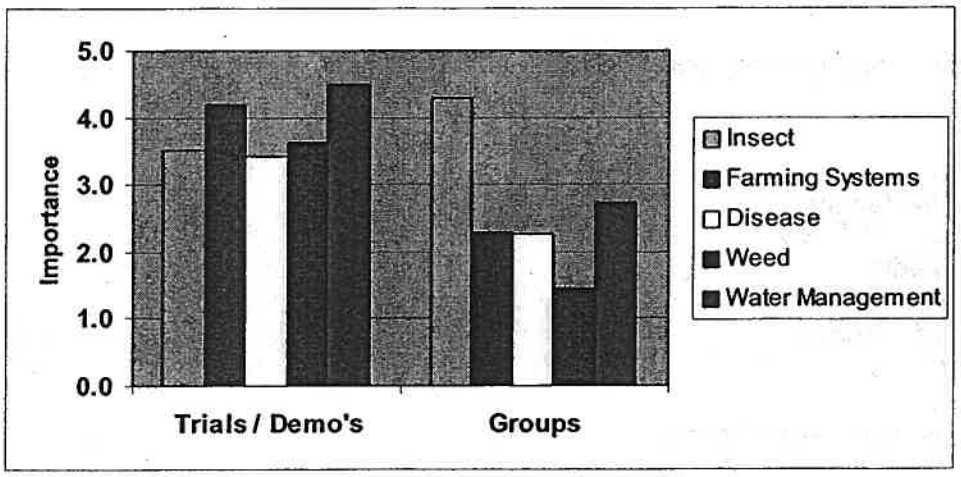
National Extension Focus Teams
Meetings
Visitors
Professional development / training
Technical updates



TIME SPENT ON DIFFERENT ISSUES – IDO'S AND DA'S

	Importance	Time spent
Insect Management	4.6	44
Farming Systems	4.0	20
Disease Management	4.4	19
Weed Management	3.5	9
Environmental Management	3.7	6
Water Management	4.1	3

NB – this is for IDO's and DA's only – we didn't' have forms back from many of the water team. As the water extension officers spend all of there time on irrigation/water management the total time spent on water issues by the extension team as a whole is a far greater percentage.



Cotton Extension Models

The Australian Cotton CRC's National Extension Network includes Industry Development Officers (IDO), District Agronomists and specialist staff in the areas of Water Use Efficiency, Irrigation, Integrated Pest Management (IPM), Spray Application Technology, Education, Evaluation and extension approaches. They are located in every major cotton growing regions and provide a close link between industry and research. In addition Cotton Australia's grower services managers drive the implementation of Best Management Practices (BMP).

Extension approaches

The cotton extension model used by the Industry Development Officers includes a range of approaches such as Information Transfer; Trials and Demonstrations; Groups; Benchmarking; and Education. Through each of these is threaded evaluation to ensure that activities are reaching the mark and achieving positive outcomes for industry.

Close industry engagement is a core mode of operation. Industry reference groups in each valley and for specific programs provide growers and consultants with the opportunity to set priorities for the extension program.

Information Transfer

Relevant, timely information is communicated to industry through a range of sources, including:
INFORMATIONpaks: ENTOpak, SPRAYpak, MACHINEpak, SOILpak, NUTRIpak, WEEDpak and IDM guidelines are a compendium of relevant information on their specific issue for the cotton industry.
Newsletters: Regional fax-out or email newsletters such as Cotton Tales and WaterWorks provide timely, concise, locally relevant information.
Field Days and Farm Walks are a widely used forum for observing the results of trials, hearing from researchers and promoting discussion between industry participants.
Workshops on specific issues such as spray application technology allow the issue to be discussed and demonstrated in greater detail.
Collation, distribution and interpretation of regional data such as pheromone trap results for timely use through the season.
Web: The Cotton CRC website hosts a wide range of information resources and tools. Forums and chat rooms will soon be operational. www.cotton.crc.org.au
Computerised Decision Support: Decision Support Tools, in particular CottonLOGIC have been developed to aid the accessibility of research information and to make it more readily usable. Further tools such as the OZCOT crop simulation model, a water use efficiency calculator and HydroLOGIC, a decision support for irrigation management are under trial.
Technology Resource Centre: Cotton CRC's Technology Resource Centre acts as a central point for the development and distribution of information resources, maintains industry distribution lists and develops the CRC website.
Link with Research: The extension team provide a channel to enhance two-way communication between research and industry and between different regions of the industry.

Trials and Demonstrations

One of the key drivers for establishing the IDO positions was the need for on-farm, regional trials. Trials are utilised for groundtruthing and gathering local data, building confidence in recommendations or techniques, benchmarking and for developing technologies.

Groups

Grower driven groups such as area wide management groups have rapidly gained momentum across the cotton industry as growers look to each other for support in implementing complex systems. Grower driven groups are most effective with the extension team providing support and coordination.

Benchmarking

Benchmarking through physical trials or desktop data interrogation allow growers to view themselves on a continuum amongst their peers. Benchmarking also allow the extension network to focus efforts on elements that show the greatest variability between farms.

Education

The *Cotton Production Course* offered by the Australian Cotton CRC / UNE provides scientific and practical skills that promote sustainable and profitable cotton production. Its main purpose is to build technical capacity in the industry service sectors and it also attracts some growers.

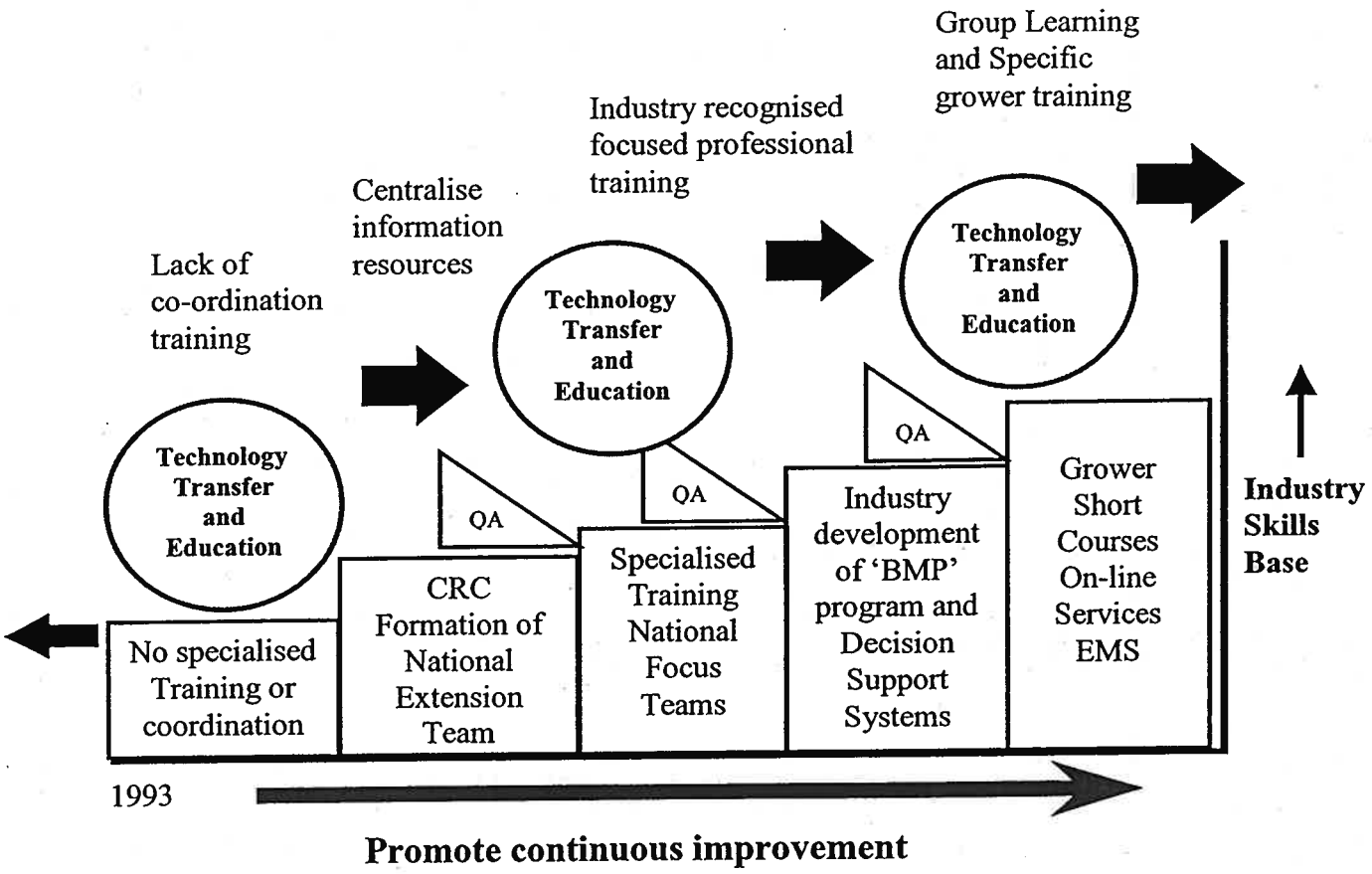
An *IPM Short Course* has been specifically designed for cotton growers. It comprises practical and theory session to give hands-on experience and knowledge about Integrated Pest Management. It is available for small, interactive groups in all regions on demand.

A *Waterwise* course offered by NSW Agriculture focuses on the basics of irrigation management.

Extension Focus Teams

In addition to their local role, each member of the extension network contributes to a national extension effort through one of the Insects, Farming Systems, Environment, Diseases & Weeds or Water focus teams. These teams work closely with researchers and their ACGRA members to ensure that consistent messages are extended across the industry with minimal duplication of effort. They aim to take a strategic approach to developing and integrating information and extension methods for industry wide issues and to partner closely with the related research programs.

Figure 1. Progression of extension methodology.



Australian Cotton
Cooperative Research Centre

National Cotton Extension Network
Strategic Directions

Developed June 2001, Cotton Extension Workshop by the cotton extension network

The industry's **vision** (CRDC Strategic Plan 1998-2003) is for:

A more sustainable, competitive and profitable cotton industry providing increased economic, environmental and social benefits to regional communities and the nation.

Mission Statement

The National Cotton Extension Team aims to help achieve this outcome…

By maintaining close links with industry and with research providers,
access, generate and promote locally relevant information and practical knowledge,
coordinate activities
and
facilitate communication between stakeholders to enhance cotton growing practices in each region.

JUNE 2001

Strategic Planning

Bruce Pyke introduced CRDC's new Strategic Plan and Annual Operating Plan:

- CRDC is under increasing pressure to report on "outcomes" (ie change) as opposed to "outputs" (eg field days, etc);
- In recent years investment in extension has grown substantially;
- The framework for the extension program is based on the 1995 Review of Extension (copies of which Bruce has subsequently mailed to everyone);
- Role of IDOs is regionally driven – coordination, validation and education;
- The review identified a need to improve coordination and synergy at a national level – reason for creation of the NCEC role;
- Links between researchers and extension officers expected to be strong – a two way loop with the questioning of research by IDOs as now occurs.
- TRC to be a strong resource provider.

References: CRDC Strategic Plan
CRDC Annual Operating Plan
Cotton CRC Strategic Plan
Cotton Extension Review Aug/Sept 1995

Cotton Extension Team Vision

(ie what future would we like to see for the cotton industry?)

A brainstorming session to gather a united view for where the extension team would like to see the industry in the future came up with the following ideas:

A competitive, profitable and environmentally sustainable cotton industry
...receptive to change
...valued part of the Australian economy and community
...satisfying market demands

A economically, environmentally and socially sustainable cotton industry...
A sustainable, profitable and environmentally conscious Cotton Industry...
A cotton industry that has...
... responsible and efficient management of resources
...contributing to the Australian economy
...valued by an accepting community
...meeting a market need.

After discussion about the wordsmithing (and frustration over how involved this can be!), it was decided that the following words capture the above vision of the extension team:

A more sustainable, competitive and profitable cotton industry providing increased economic, environmental and social benefits to regional communities and the nation.

(CRDC Vision statement - CRDC Strategic Plan 1998-2003)

So the logical step was taken and the extension team chose to adopt the CRDC Vision Statement. This is ideal as it means that the members of the extension team share the same vision as the industry has determined with CRDC.

Mission of the National Cotton Extension Network

(ie what is our role in achieving the vision?)

The extension team broke into smaller groups based on their roles (IDOs; DAs, Spray Application & IPM and Water) to develop a clear picture of the role of the extension team. With a member of each group taking on the role of a key stakeholder (grower, consultant, environmental/community rep, Regulator, Buyer/ginner) the aim was to develop a rounded, agreed view of our role.

Feedback from this session:

Ensure we access and generate all the information and support stakeholders/the cotton industry to ensure the sustainable rate of adoption for management techniques to gain desired change.

- Communicate
- Change – responsive to stakeholders – initiate and facilitate change
- Participatory
- Content
- Pivotal (central link)
- Proactive
- Seek and evaluate

Access, generate and promote information and tools necessary to support the active participation of all stakeholders in the ongoing adoption of improved management practices.

Mission Impossible!!
Assist the cotton industry to continually improve profitability and sustainability through:

- coordination of extension and research
- education
- implementation

To facilitate a more sustainable, competitive, profitable cotton industry providing increased economic, environmental and social benefits to regional communities and the nation.

A team of resource providers and facilitators who are independent conduits for change for the Australian cotton industry and the broader community.

Role of extension team in industry?

- Resource provider, adapt/dovetail research into production systems.
- Provide and environment condusive to change.
- Conduit, facilitator, link, vehicle, deliverers.
- Independence, non-biased, uncorrupted, immune to bribery.
- Concern for community issues.
- Keep out of regulatory processes
- Production of high quality cotton.
- Educators of growers, industry and community.
- Trial facilitator.
- Promote industry in local community.
- Support industry network.
- Encourage communication between growers.

View of Grower Perspective:

- Timely and relevant support and information
- Sensitivity
- Not waste my time

- Coordination of resources, information and activities
- Facilitation of leaning and progress
- Two way process
- Up to date
- Not biased
- Help me to grow cotton more profitably
- Secure info for future (resources, market access)
- What's "New"
- Listen to my problems/needs
- Link to researchers
- Be GOD!!
- Do trials for us
- Funding submissions
- A wealth of knowledge
- Grower's employees
- Local contact – 1st point of call for independent info
- Cheap consultant
- Too national outcome focussed

View of Environmentalist/Community Perspective:

- Stop cotton producers polluting
- Stop sucking rivers dry!
- No cotton farms near towns
- But want your money for the community
- Natural (organic) cotton
- What do they think of us/who are we?
    - Part of the problem / biased
    - Shield to industry
    - Tool to changing attitude/practices
    - Non tree hugging land rapists
    - Public servants
    - Biased industry reps
- What do they want from us:
    - Relay concerns about environmental issues
    - Recognition of environmental concerns
    - Transparency of auditing process and industry
    - Be part of regulatory process
    - Be part of education process
    - What are you doing about the rogues?

View of Regulator/Government Perspective:

- Conforming to CAPS, WAMPS, LWMPs
- "Improved efficiency"
- Mandatory legislation
- We want to licence
- Whole of government – everyone
- Want us to implement promises the industry made RE self regulation – BMP, PAMPs, IPM
- Industry is abiding by current legislation

Extension Perspective:

- Targeted group, well defined
- Method of presentation – suitable target group
- Aids used need to be suitable to target audience
- Message is regional results – gather data
- Suggested changes that fit in with the vision
- Continuity of staff
- Keep of jobs (trust)

View of Buyer/Ginner Perspective:

- Grower to be shareholders
- Secure premiums $
- Sponsorship/funding
- Quality product

Cotton Extension Network Mission Statement

Needs further comment from extension team and R&D leaders but something along the lines of:

By maintaining close links with industry and with research providers, access, generate and promote locally relevant information and practical knowledge, coordinate activities and facilitate communication between stakeholders to enhance cotton growing practices in each region.

This could do with improvement – any comments/ideas??????????
Or do any of the ones above do the job better??

NATIONAL COTTON EXTENSION NETWORK

Ingrid Christiansen, National Cotton Extension Coordinator
Australian Cotton Cooperative Research Centre, 2001

Access to information, the uptake of research and development and communication between growers and regions is highly important to the productivity, profitability and long term sustainability of the cotton industry. Helping this to occur and enhancing the benefit gained from the research investment are a team of extension officers located in all cotton growing regions. Extension and industry development officers in the Australian Cotton CRC's National Cotton Extension Network are employed and managed by NSW Agriculture, Qld Department of Primary Industries (QDPI), CSIRO, Cotton Research and Development Corporation (CRDC), University of New England (UNE) and the Centre for Pesticide Application and Safety at the University of Queensland (UQ). This team comprises of a range of extension and development roles.

Cotton Industry Development Officers

IDOs are dedicated development extension officers for the cotton industry. Funded by the CRDC (7 positions), Cotton CRC (2) and Qld DPI (1), they undertake regional trials, facilitate area wide management groups, organise field days and workshops and coordinate local data collection (eg pheremone trap results and annual trial books). IDOs also provide access to information through Cotton Tales, media, Information Paks and various activities. They also provide feedback from growers and consultants to researchers about research needs in each valley. The activities undertaken each season by IDOs are based on the interests and needs expressed by the local industry in each region. As they are responsive to local needs, extension programs vary between regions. Your IDOs are David Kelly (C Qld), Greg Salmond (Darling Downs), Mascha Raymond (Macintyre), Annie Spora (Macintyre whilst Mascha is on maternity leave from October 2001), Sarah Kerlin (St George and Dirranbandi), Gwydir (to be filled), Mark Hickman (Upper Namoi), Kirrily Rourke (Macquarie) and Evan Brown (Lachlan and Murrumbidgee). Jenelle Hare provides technical support for extension activities and trials on the Darling Downs. In Bourke, Craig Dunn acts as a district coordinator for information and trials.

District Agronomists

NSW Agriculture District Agronomists (DAs), funded by the department, do similar roles with the cotton industry as the IDOs. However, only a part of their time (20-60% depending on the valley) is dedicated to cotton. They also work with broadacre and grazing industries, strengthening the farming systems experience of the team. DAs would work with many growers who have mixed farming operations. District Agronomists working with cotton are: Chris Watson (Lower Namoi), Cameron Tonkin (Walgett), Leigh Jenkins (Warren), John Francis (Condobolin) and Myles Parker (Griffith).

Specialist Support

IPM Training and Support

The Cotton CRC is currently developing a short course in IPM for cotton growers. Bill Dalton (Goondiwindi) coordinates the development and delivery of this course. Courses will be offered in all cotton growing regions this year.

Julie Ferguson (DPI, Pittsworth) facilitates area wide management in both the cotton and grains industry on the Darling Downs whilst also providing IPM support Queensland wide for the grains industry. Julie has been involved in developing resource materials and provided support for AWM in many parts of the industry.

Spray Technology
Choosing the right nozzles, droplet size, pressure, volume and spray conditions is to achieve an effective pesticide application is essential both for product effectiveness and to minimise drift. Spray trials and spray workshops are conducted in all valleys by Peter Hughes, QDPI Toowoomba and by some IDOs. UV dyes are used for evening workshops so that droplet size and distribution can be clearly seen.

Bill Gordon also undertakes research and extension activities in spray technology. Until recently, Bill was based at QDPI Toowoomba but has moved to a new position with the Centre for Pesticide Application and Safety (CPAS) at UQ focussed on extending results of the research work at CPAS. Contact your local IDO if you are interested in more information or in holding a workshop in your region.

BMP
Implementation and support for the industry's Best Management Practices program is undertaken by Cotton Australia Grower Services Managers – Gavin Inglis (BMP Coordinator and Upper Namoi), Christine Richards (Lower Namoi, Menindee and Lower Darling), VJ Wigney (Gwydir and Walgett), Dan Galligan (Macquarie, Bourke, Lachlan), Liz Alexander (Central Qld), Andrew Luhrs (Darling Downs), Elizabeth Cowlishaw (Darling Downs, St George and Dirranbandi) and Mike Beeston (Macintyre, Mungindi and Goondiwindi). The Cotton CRC extension network provide technical support for BMP. Rachel Holloway (CRDC) coordinates aspects of the BMP program and the BMP Audits.

Water Extension Team
Irrigation and water use efficiency extension programs are underway in both states. Demonstration trials, benchmarking, field days, grower discussion groups, information materials and training courses focussed on water management are arranged and undertaken by this team. In Queensland, the Rural Water Use Efficiency Initiative (RWUE) operates in partnership with the cotton and grains industries through the Cotton CRC. NSW Agriculture has Waterwise on Farm, Water Use Efficiency and Irrigation Advisory programs which work across all rural industries. Your water extension team are: John Okello-Okanya, Darren Springer, Andres Spragge, Graham Harris, Olivia Whiteoak, Sarah Hood, Raelene Greenslade, Peter Smith, Garry Giddings, Barry Swann and David Williams. Phil Goyne coordinates the Cotton and Grains RWUE program in Queensland.

Technology Resource Centre

The Cotton CRC Technology Resource Centre (TRC) develops information materials that are provided to the industry and associated groups via the world-wide web, email and in hard copy. Products distributed by the TRC include Information Sheets and Information paks (ENTOpak, NUTRIpak,etc) which are available free of charge to all industry participants. Mailing details of industry members are maintained by the TRC for CRDC, ACGRA and CRC mailouts. The TRC also assists with the development of, support and distribution of CottonLOGIC. The TRC is coordinated by David Larsen. Sandra Deutscher provides additional support and training for CottonLOGIC users and its ongoing development.

Cotton Production Course

The Cotton CRC has developed a postgraduate course in cotton production, offered through the University of New England. Residential courses are generally held at ACRI, Narrabri. Undergraduate modules in cotton production are also provided at UNE, University of Sydney and University of Qld, Gatton.

Coordination and Leadership

A national extension coordinator, Ingrid Christiansen links together activities of the extension network across the regions and with research and industry groups. Extension staff are managed by CRC joint program leaders Geoff McIntyre (QDPI) and Dallas Gibb (NSW Agriculture). An extension coordinating committee including Ingrid, Geoff, Dallas, Bruce Pyke (CRDC), Nicky Schick (Cotton CRC), Bruce Finney (ACGRA) and Adam Kay (CRDC Board) provide overall coordination, leadership and support for the team and ensure industry input to national extension activities.

National Extension Focus Teams

In addition to their local or specialised roles, each member of the extension network also has a national role as a member of a National Extension Focus Team. These teams provide a national focus and prepare resource materials for specific issues related to Disease, Weeds, Insects, Environment, Farming Systems and Water. The aim is to minimise duplication of effort and provide timely, coordinated access to information resources across all regions. These teams work closely with researchers to produce information materials such as the Cotton CRC Information Updates which are distributed by the TRC, field day displays, development of new techniques and ideas and act as a contact for the relevant issue. They also include membership from the relevant ACGRA committee to ensure that the extension effort is meeting the industry's needs.

Contact Us

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District Agronomists

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Feedback from Participants/Interviewers in the Knowledge Management Research Workshop

Moree & regions 28-30 October

WHAT DID YOU LEARN OR SKILLS DID YOU DEVELOP FROM BEING INVOLVED IN THIS WORKSHOP THAT YOU DON'T THINK YOU WOULD HAVE GAINED FROM READING THE REPORT?

IDOs, DAs, DEOs

1. more knowledge of the Goondi region, issues and priorities for growers there; what Bec is dealing with.

2. range of issues affecting the extension team and the different attitudes of team members to some issues; the common things we all face (building our sense of being a team)

3. the real benefits of conducting formalised interviews and of following a set of questions that is being widely used (replicated) - transferability of this technique to local area

4. the joys of flying Plummet Airlines - great to fly and just concentrate on the workshop without extra hours in the car

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1. confidence is approaching interviews in a way that will develop outcomes

2. a good appreciation of how growers develop ideas and make decisions, and a realisation that there are some many growers on different levels that you are not going to keep everyone happy - no matter what you do.

3. a short cut from Dalby to Pampas!!

****

1. Opportunity to become more conversant with irrigation issues through hearing issues of importance to those interviewed (esp. important as I don't explicitly deal with water issues at all)

2. specific instruction, training and experience in conducting interviews

3. 1st hand opportunity to experience a convergent interviewing process, see what worked well, identify possible areas for improvement. Also enjoyed and gained confidence in using the card technique for determining how people make changes - could be applied to a range of topics

1. I felt the emotion and the frustration that is tied up in the whole water reform process for the Upper Namoi. You don't read the emotion in a report.

2. I learn although it seems to use that growers are making very little process with improve WUE, the intent is there. They want to improve their water management. But they either don't know how to progress past the point they are at already or they cannot afford to spend the money having little knowledge of the future of water reform.

3. I learn where Spring Ridge and a few other villages are.

I can't say that I have learn anything new about interview techniques. I realise that there were time constraints but I felt that we had very little to do with the process apart from doing the interviews. Everything else was pre organised and pre decided.
****

1. It was certainly interesting to hear growers' perspective on the issues and just how they made there decisions and where they do access there info.

2. I certainly like the ideas in an interview to actual use the cards rather then just use questions as it gave the person time to think about it from a different angle.

3. Having people from other industry was a good as it gave a different perspective to the discussion

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1. Ownership of results

2. Motivation to read the report

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1. It is of benefit to be able to go to a grower and be able to communicate with him on a one to one basis and be impartial and to let them express themselves fully without being led by the interviewer

2. Confidence that the responses are genuine and have not in any way been mis-interpreted by the interviewer

3. A good way to be able to delve deeply into how irrigators in the my area think about what are their important water issues and act to improve their knowledge about water issues and from where they source their information.

Irrigation Extension

1. An insight to thoughts and perceptions

2. That what I think I know may not always be right

3. The higher than expected level of awareness by consultants of impending and ongoing water related impacts and their understanding and acceptance to them.

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1. Interview skills and confidence

2. Interview methods

3. An appreciation for the Thai food in Moree! (Just kidding -- An appreciation for conditions in other areas)

****

1. I don't think that I would have understood the differences in priority between different consultants.
2. I thought that it was a good opportunity for me to see how information is gathered for those sort of reports.
3. I think that it was a good experience for me to interview people outside my area and to find out their opinion.

Special extras

1. the whole process ... how a relatively quick (many interviewers, few respondents each) process can retrieve a heap of valuable data quite quickly

2. in other circumstances (different topic, less exploratory questions), the convergence would have dramatically altered the Q's for round 2

3. my interview technique improved quite a bit over just 3 interviews, now to learn about "developing the questions"

OTHER - not sure that the "breadth of methodology employed" for the card sort activity can be easily analysed with any real "confidence" ... we had trouble just in the small group discussion trying to match our methodology.

Ever improving: Evaluation and outcomes in the National Cotton Extension Network

Ingrid Christiansen[1,2], Bruce Pyke[1,3], Dallas Gibb[1,4] and Geoff McIntyre[1,5]

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Abstract
From its inception, the National Cotton Extension Network has had close links with industry stakeholders, providing mechanisms for continual feedback and priority setting for extension and education programs. A culture of evaluation, planning and continual improvement is being further developed within the extension network to ensure extension and education programs are "hitting the mark" for stakeholders and to provide accountability to funding agencies.

Frameworks combining the logic model and Bennett's Hierarchy are being used to assist extension team members to move from activity level evaluations to contributing to outcome evaluations. Extension focus teams are using these frameworks in planning extension programs, assessing performance and evaluating outcomes of these programs.

Media summary
Evaluating the impact of extension programs is increasingly important for accountability. Evaluation can also provide opportunity for learning and continual improvement. Extension staff have used a variety of evaluation tools to identifying their contribution towards key industry and community goals for sustainable cotton production. Evaluation frameworks are being introduced to better understand the complementary contributions of a range of programs towards achieving change.

Keywords
Evaluation, Outcomes, Participation, Cotton, Extension Skills, IPM

Introduction

A saying widely used by irrigation extension officers through to business managers tells us "You can't manage what you don't measure". Considering this, as extension professionals, how well do we measure our achievements, the impacts and outcomes of our work and identify areas for improvement? Are we gathering the information we need in order to develop our own extension careers and our extension programs effectively? This paper outlines some of the approaches and activities used by the National Cotton Extension Network in moving towards an outcomes focussed, evaluated approach.

Background

The management of a cotton crop requires a high level of knowledge and timely decision making. The cotton industry has developed a strong demand for information and learning avenues to develop its knowledge and skills base. Since the modern cotton industry began to grow in Australia in the 1960s there have been strong linkages between industry and research. The Australian Cotton Growers Research Association (ACGRA), formed in 1972, provides grower input into planning, priority setting and critical review of research. ACGRA advise Cotton Research and Development Corporation (CRDC) project investments and host the biennial Australian Cotton Conference. Since 1993 the Australian Cotton Cooperative Research Centre and its predecessor have enhanced research prioritisation and linkages across agencies and with industry.

There are a wide range of mechanisms by which growers and consultants contribute to setting priorities for research and extension. Regional reference groups in each valley and for specific programs help to set

priorities for local and national extension programs. Grower learning groups such as area wide management groups also identify priorities, needs and interests for extension and research. Cotton Consultants Australia host technical forums and are involved with many research and industry committees.

Many researchers, growers, agronomics consultants, agribusiness and other industry participants take an active role in the knowledge system. Agronomic consultants are a key part of the cotton industry, particularly in the area of insect management and their focus is now expanding to whole farm agronomic management.

Key Objectives for Cotton Extension and Research

The Cotton Research and Development Corporation and the Australian Cotton Cooperative Research Centre provide the primary leadership for research and extension in the Australian cotton industry. CRDC's core outcome is for "a more sustainable, profitable and competitive cotton industry providing increased environmental, economic and social benefits to regional communities and the nation". CRDCs five year strategic plan highlights for Program 1, People and Knowledge, an aim towards "Improving the capacity of industry and the community to use the knowledge and innovations gained through research and development. A continuing culture of innovation in the cotton industry, which creates viable rural communities" (CRDC 2003). Similar themes of uptake of research and knowledge apply across all programs.

Similarly, the Australian Cotton CRC aims to "enhance the development and growth of the Australian cotton industry through the application of collaborative research, education and the adoption of sustainable farming systems". Through a coordinated national network providing extension, support and educational support to the cotton industry, it strives for benefits of widespread adoption of sustainable management practices, increasing the industry skill base and an industry perceived to be a responsible corporate and community citizen. Each of the partner agencies also work towards similar objectives of sustainable production.

In both organisations these objectives are underpinned by specific targets. Measuring the contribution of extension programs towards achieving these objectives is becoming increasingly important.

The National Cotton Extension Network

Under the leadership of the Australian Cotton CRC, the National Cotton Extension Network provides a close link between research, industry initiatives and the consultants and growers. The uptake of research is a high priority for the industry with CRDC investing approximately 10% of its R&D expenditure in extension programs (CRDC 2003) to supplement the state department extension services. In particular, this includes Cotton Industry Development Officers (regional extension positions focussed on cotton production), national extension coordination, a technology resource centre, decision support and education. These positions partner with NSW Agriculture District Agronomists, Cotton Seed Distributors' Extension Agronomists and specialists in the areas of Water Use Efficiency, Irrigation and Integrated Pest Management (IPM) to form the National Cotton Extension Network. Each member of the network is active through their local role and as part of one of the national extension focus teams – Insects, Disease & Weeds, Environment, Farming Systems and Water. Senior members of the extension team provide leadership of these focus teams. This leadership role provides a career development opportunity for team members as well as encouraging the sharing of knowledge and experience.

Four new environmental extension specialist roles will soon expand the capabilities of this network in the natural resource management area. Cotton Australia, the peak industry body, leads the implementation of the industry's Best Management Practices program (BMP).

Key extension methods
Knowledge is developed and shared through a range of extension approaches which can be broadly grouped as:

- Trials and Demonstrations;
- Groups;
- Comparative Analyses;
- Education;
- Information Transfer; and
- Computer-based Decision Support Packages

Information resources are made available to the industry free of charge through the Cotton CRC Technology Resource Centre and local extension staff. These include the COTTONpaks (compendiums of information about a technical issue), CottonTales newsletters (1 page weekly-fortnightly regional news and research by fax or email), Research updates, identification guides, pocket guides and the Cotton CRC Website.

Computerised decision support packages are available for insect and nutrient management (CottonLOGIC) and water management (newly released HydroLOGIC) and a searchable CD of all printed resources. Information is also available via field days and seminars.

Area wide management groups, educational courses and comparative analyses are some of the avenues for communication and development of ideas.

The changing face of extension
This forum challenges us to "extend extension: beyond the traditional boundaries, methods and ways of thinking". With so many changes in the extension context, traditional approaches need to be queried, adapted, abandoned or progressed.

Recent years have seen significant changes in the profession of extension. The tradition of an extension officer who would spend 20-30 years in a single region, developing their local knowledge and delivering that to the growers in their community is rapidly disappearing. In its place we see a young, mobile workforce, with temporary contracts and many extension professionals moving on to new projects after 3-5 years. Extension workers are coming in from and moving out to a wide diversity of roles. The extension role is also now shared across many players including researchers and consultants.

How do we know if we are hitting the mark?
With such a high commitment by industry to the extension network, it is important to ask whether this is returning an enhanced uptake of research. Evaluating the impact of extension programs is important for a range of reasons, particularly for accountability; on-going improvement and for achieving change. Increasingly research funders are focusing on the "triple-bottom line" (CRDC 2003; Roth 2003) and the related contributions of research and extension programs.

Evaluation Frameworks
There are multiple levels at which extension programs are targeted and similarly can be evaluated. At the higher levels, measures of actual impacts are the ones that can most clearly demonstrate return on investment but they can lose their value if too many assumptions are needed to attribute change to research and extension inputs. Lower level evaluations often provide valuable feedback for enhancing extension activities but don't measure the actual impact of these programs. In practice, evaluations at different levels are useful for different purposes. Evaluation frameworks have been introduced as a means to both plan extension and evaluation activities and to bring together the results of evaluations at a range of levels. This recognises that short, simple evaluations are often the best means for learning and to gather feedback on a certain issue or tool. Use of a carefully designed evaluation framework can provide a means for activity evaluations to contribute to a broader impact evaluation. As an example, Table 1 depicts some of the evaluations conducted by the Cotton CRC in relation to Integrated Pest Management (IPM) against Bennett's hierarchy (Bennett 1977). Several of these cross multiple levels.

Bennett's level	Evaluations conducted				
Outcomes	- Analysis of total pesticide usage data - Water quality data - Record of social complaints				
Practices	- Benchmark Survey	Attitudes to IPM - Focus groups 1997 & 2001	AWM groups phone survey	Insecticide Usage Comparative Analysis Evaluation	Regional Tipping Out Trial Impact Survey
KASA*	- IPM Short Course pilot + follow up interviews				
Reactions	- Cotton Tales Surveys - Information Resources Survey - Field day evaluations				
Participation	- IPM Short Course Numbers - Numbers of AWM groups - Cotton CRC website hits				
Activities	- Project reports				
Inputs & Resources	- Annual reports - Project Budgets				

* KASA = Knowledge, Attitudes, Skills and Aspirations

Table 1. Evaluation activities at multiple levels related to IPM in the Cotton Industry.

A wide range of tools and frameworks have been used for extension evaluation in Australia. (Dart, Petheram et al. 1998). Some of these are quite prescriptive and an instant "turn-off" for many extension staff. Some of the key considerations in selecting a framework to use for the cotton extension program were:

- Useful for extension evaluation AND planning.
- Flexibility for a wide range of issues and evaluation methods.
- Simple to use and to communicate.
- Aligned to the key outcomes of our funding bodies.
- Help extension staff to review, learn and improve.
- Encourage staff to be mindful of outcomes and impacts when planning extension activities.
- A framework open enough to stimulate creative approaches to evaluation.

The framework we have introduced (Figure 1) is a combination of the LOGIC model (Taylor-Powell 2001), using Bennett's Heirarchy to help define the logic (Bennett 1977). Its simplicity allows great flexibility in choosing evaluation methods to suit the issues and the evaluator. It also fits very well with how our primary funder, CRDC report on how we have contributed towards R, D&E targets and impacts. Bennett's is a useful tool to help break it down further and understand the value of the different levels of extension impact in leading towards the triple bottom line impacts.

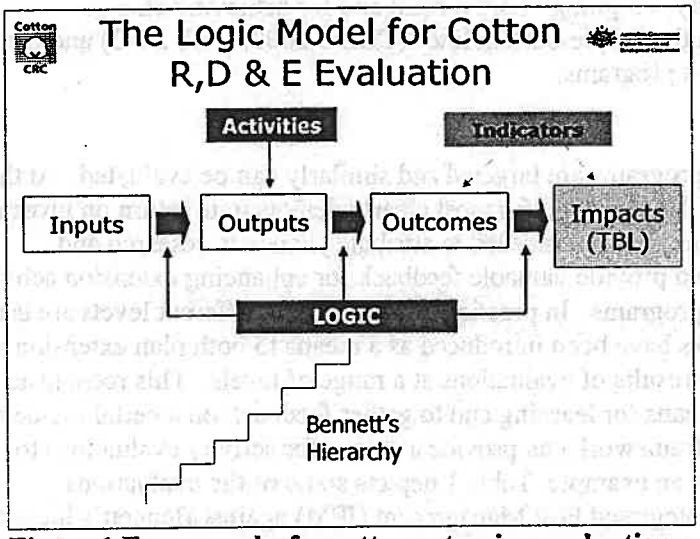

Figure 1 Frameworks for cotton extension evaluation

The frameworks were introduced to the extension network at the annual planning workshop in August this year. As the team worked through them for various issues, they recognised that evaluation tools are also

extremely useful for planning extension programs. This is consistent with the Targeting Outcomes of Projects (TOP) framework (Rockwell and Bennett 1995) that suggests that you work down Bennett's hierarchy for planning and up the hierarchy for evaluation.

Developing an evaluated outcomes culture

Evaluation in extension could be considered like going to the dentist - one of those jobs everyone knows is important but avoids doing. Building an evaluation culture is not only about the skills to evaluate, it's also a shift in focus from outputs to outcomes and impacts and a continuous learning and improvement cycle.

Where were we?

Prior to 2001, a few major evaluation exercises had been undertaken and a small handful of extension evaluations had been reported on. Evaluation was rarely included in extension planning workshops. Several extension officers commented that they regularly gathered feedback for their own, informal evaluation. This is a great habit for personal learning and reflection. However, as much of this tacit knowledge was rarely recorded, or even communicated with peers, much opportunity has been lost to be able to measure impact of extension programs over time. As staff leave, they take this tacit knowledge with them and the capacity of the new extension team members to learn from the experiences, or draw on the history of success or failure of different extension approaches in given regions is limited.

What have we done?

Building evaluation capability is best approached through multiple angles, from top–down and bottom-up (McDonald, Rogers et al. 2003). Similarly, the skills and motivation for extension evaluation have been introduced to the Cotton Extension Network through complementary approaches including training, encouragement and practical experience. The appointment of a new National Cotton Extension Coordinator in 2001 coincided with an increased focus from the CRDC board on evaluated impacts of extension. Building the focus and capability for evaluation has been central to the Extension Coordinator role.

Our overall philosophy regards evaluation as a learning and planning exercise that also provides accountability reporting. Integral to this approach is team participation rather than purely external evaluation. Some partnerships with external evaluators to study industry wide changes have developed skills and brought in "fresh eyes" as detailed further below. As with many CRDC research programs, external reviews are conducted with the extension program as a whole reviewed in 1995 and another external review is planned.

Some of the activities include:

- Training – as a group or individually through CRRI-Q courses.
- Participation in evaluation research eg IPM Focus groups, Knowledge Management.
- Evaluation "tasks" eg each team member presented an evaluation activity at the annual extension workshop.
- Reporting frameworks modified to base on evaluation framework.
- Focus team planning and reporting.
- Annual planning workshops.
- Reinforcement from board members.

Evaluation of selected extension activities conducted by individuals and shared with their colleagues has built confidence in evaluation skills, enhanced communication of planned outcomes and approaches to extension and provided valuable data on the effectiveness of different extension approaches. Maintaining the commitment of individuals to evaluate without the time pressure of presenting this to their peers is difficult.

Over the past three annual extension and planning workshops, the concepts of evaluation and outcomes have been gradually built upon as depicted in Table 2.

Year	Evaluation trends
2001	Individuals presented activity evaluations Team vision and mission revisited and redeveloped
2002	Skills session on planning for outcomes and outputs Planning frameworks introduced
2003	Evaluation frameworks introduced Skills session – planning and evaluating TBL outcomes Focus teams applied evaluation frameworks to plans Logic based reporting format developed Focus teams identified key indicators and evaluation needs

Table 2. Evaluation and outcomes development at annual extension planning workshops

Where are we now?

The last few years have seen a change in the general approach. Evaluation is now closely linked with planning and is largely considered as a core operating activity. The concepts of working towards outcomes and evaluating these are well ingrained in the extension team.

The evaluation frameworks introduced this year aim to draw together the multiple levels of evaluation. The focus teams are taking the lead in monitoring and understanding the effectiveness of their activities at all levels. It is also hoped that this will provide some direction and achievement for the focus teams which had been struggling to deliver outcomes.

Team participation in industry wide studies

Whole of industry studies have been undertaken of changes in industry attitudes towards IPM (1997 & 2001) and knowledge management (2003). In keeping with the participative evaluation and learning approach, these were undertaken by the extension team under the guidance of independent consultants. This model provided team members with the chance to build skills through first hand experience whilst, with the guidance of an experienced social researcher, gathering valuable information. Team members were also able to gain a closer understanding of the issues than could have been achieved through simply reading the report. Several have made changes directly as a result of the direct feedback and the team as a whole have greater ownership of the results.

There are also limitations of this approach including the cost and time of having so many involved, potential bias, potential difficulties in collating data across so many interviewers and the risk of missing some key points due to previous perceptions. In general, the approach fits well with our objectives of achieving a mix of accountability reporting, learning and on-going improvement through evaluating.

Industry Attitudes Towards IPM

Integrated pest management approaches to reduce the reliance on pesticides have been one of the primary focuses of cotton research and extension. Focus groups were undertaken in 1997 and 2001 to better understand the issues impacting on the adoption of IPM in the industry with a view to identifying priority areas for extension and measuring the impacts. They explored the social, economic and technological aspects of IPM. In response to the initial focus groups study in 1997, IPM guidelines were developed, an IPM short course was developed and is now being delivered, economic comparisons of IPM were conducted and the Area Wide Management concept was extended.

Key findings from the 2001 study were (Coutts, Christiansen et al. 2001):

- The principle of IPM is widely accepted throughout the cotton industry as an integral part of farm management.
- IPM was viewed in a holistic fashion with an acceptance that it was the appropriate use of a range of available approaches and tools to reduce insecticide use and improve insect control, farm productivity and sustainability. There was some variation between regions in the emphasis placed on the various tools for IPM and resistance management.
- Growers in many regions are taking increasing responsibility for insect control decisions, with decision making moving toward a partnership between grower and consultant.

- Growers seem to be more educated and interested in insect management and are using their knowledge to set the type of pest management approaches they want.
- There was strong support for the extension role and the need for on-going information dissemination and education programs about IPM in the industry.
- Research was widely supported by industry stakeholders.
- There was strong support for Area Wide Management (AWM) Groups across the industry, a desire for increased involvement of non-cotton growers, and a preference for smaller, more informal groups.
- The introduction of 'Bollgard®II' was viewed by all groups as the next major advance in IPM with a comprehensive management strategy needed.
- The future for IPM was seen to be with a fully integrated farming systems approach involving cooperation with other crop management systems.
- Regions vary in the degree to which they have practically implemented IPM. Those more interested in IPM in 1997 were generally more advanced with IPM in 2001.

These focus groups were conducted during a three-day intensive workshop for the cotton extension team together with some extension staff from other industries. In the first day, Jeff Coutts, then with the Rural Extension Centre, trained participants in the design and conduct of the focus group technique and assisted with the overall design. The second day saw participants form pairs to travel widely to various regions to conduct focus groups of growers, consultants and researchers. These groups had been pre-arranged by the local extension officer. The next day participants wrote up their reports around emerging themes and regrouped to debrief and share learnings. Jeff Coutts then worked through the individual reports to identify key themes and differences across the industry sectors and regions.

Extension officers who participated in this study have commented that as well as learning the focus group technique and building their skills in it by actually applying it, being involved in the process gave them a greater depth of understanding of the issues and influenced their own extension practices more than had they simply received a report.

Knowledge Management

Water management has greatly increased in focus in the industry over the past few years. Water use efficiency is being identified as a key management, research and extension priority by industry, governments and regional natural resource management bodies. In planning extension and research programs in this area, it is valuable to understand how industry sectors access information and develop their knowledge to make decisions. This is the subject of a project being undertaken by the Cotton CRC with the National Program for Sustainable Irrigation. The project aims to develop extension and capacity building frameworks that match the preferred learning styles of cotton and grain irrigators and their consultants. This study has been very strongly supported by industry participants who are keen to see a focussed irrigation extension and research effort.

Applying a similar model of extension participation and learning as was used with the IPM focus groups, the extension team were trained in interview techniques before conducting interviews across cotton growing regions, converging by phone to compare findings and refine the questions, doing more interviews, debriefing key findings and then returning home to conduct a few more interviews. A modified convergent interviewing approach was used with techniques such as card maps and force field analysis used in the interviews. Professor Victor Callan from the University of Queensland Business School is leading the training and data analysis for this project, providing a unique perspective for interpretation. A few interviews were conducted prior to the workshop to test-run the process and develop the questions.

It was particularly valuable during the workshop to have extension practitioners and a supply chain manager from other industries involved. They were able to provide different perspectives to the discussion to help reduce internal bias and share ideas from their industries. They also provided the team with valuable feedback about our own collaboration style.

Extension participants commented that participation in the workshop and conducting interviews provided them with a greater understanding and ownership of the issues as well as experience with interview

technique. Responses to a reflective question "what did you get out of being involved that you wouldn't have gained from reading the report?" varied but had many common themes as grouped in Table 3.

It is particularly interesting to note the wide range of different skills and understanding that was developed through this three-day workshop. That is, in addition to the funders' primary objective of understanding growers' learning styles, participants also developed their understanding of the issues affecting water management, developed their skills and developed their sense of team with their colleagues.

Understanding of issues	• More knowledge of the issues and priorities in different regions; • Felt the emotion and frustration of water reform; • Opportunity to become conversant with irrigation issues; • Differences in priority between different people.
Understanding of industry learning styles and decisions	• Good appreciation of how growers develop ideas and make decisions; • Realisation that growers are at so many different levels – no one package keeps everyone happy; • Impact of uncertainty of water reform as a barrier to investments to improve WUE; • Growers' perspectives, how they make decisions and access information; • Growers have intent to improve WUE – they either don't know how to or can't afford to progress; • Level of awareness, understanding and acceptance by consultant agronomists of water impacts.
Skills	• Appreciated benefits of formalised interviews and following replicated questions for transferability to local area; • Confidence, skills and technique in approaching interviewing to develop outcomes; • Specific instruction, training and experience in conducting interviews; • First hand experience in [modified] convergent interview technique – see what worked and identify areas for improvement; • Convergence would have had more impact in different circumstance; • Use of the card technique helped to think from a different angle; • Interview methods; • Understand how information is gathered for this type of study; • How a relatively quick process can quickly retrieve a lot of valuable data; • Lack of involvement in planning and design limited learning; • Valued the different perspectives of participants from other industries; • Good to get out of my comfort zone; • What I think I know may not always be right.
Team development	• Understanding of the different attitudes of team members to some issues; • Build confidence in process by doing it together; • Understand the common things all face - building sense of team; • Understand the issues faced by colleagues in other regions; • Ownership of results & motivation to read the report.

Table 3. Benefits that extension team members indicated they gained from being involved with the Knowledge Management Research project that they didn't feel they would have gained from simply reading the report.

Future

The extension network has developed to be a strong team that collaborates closely over its 16 locations and state boundaries. A potential risk of this is that as the extension group have developed to be as strong team, this may have been at the cost of linkages with research in some cases. Evaluation has been increasing in the extension program. Research will also be faced with a need to move towards evaluated outcomes.

Evaluation of full research and extension programs is the next stage. Bringing together research and extension to identify shared outcomes could be a good starting point to build R, D & E evaluation and enhance linkages. There may be an opportunity to embed some learning elements in a Benefit – Cost Analysis of the Cotton CRC soon to be undertaken by an external consultant. This may be an opportunity to

assist research and extension disciplines to reflect on their achievements and identify key priorities for a new CRC.

A part of this approach will be to refocus the National Extension Coordinator position as an extension and evaluation specialist to be a resource in developing the extension, participation and evaluation skills of both the extension network and the research community.

Conclusion

Evaluating the outcomes of extension and research programs is becoming increasingly important for funding agencies. It is also an opportunity for extension programs to learn, to change and continually improve. Moving towards evaluated outcomes signifies a change in organisational culture that takes time, skills and motivation. This change is perhaps somewhat easier to appreciate and relate to for extension practitioners than for researchers.

Evaluation on it's own is not a priority task of most extension professionals. Building skills, capacity and motivation for review and innovation helps in embedding evaluation and outcome reporting in the overall extension approach. Regular encouragement by funders and managers of the value of the extension role, reinforced by the importance of demonstrating outcomes can be partnered with training and development opportunities.

By using evaluation frameworks we hope to enhance the thinking about evaluated outcomes when extension activities are planned. We are also hoping that these will enable us to measure a higher level understanding of program impact by drawing on the manageable sized evaluations that extension individuals conduct for their own learning and improvement.

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Knowledge and Learning in the Australian Cotton Industry

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Abstract
Managing a cotton crop is knowledge intensive and so effective knowledge management strategies are required for the crop to perform well. Recent research shows that cotton growers and consultants are experiential learners who actively seek information and experiences to develop their knowledge. Strategies are needed to aid experiential learning for assisting substantial changes in issues that cannot be easily "learnt by doing". Knowledge services are moving towards partnerships between growers, consultants, research and extension. This paper describes the situation, challenges and opportunities that exist for improved knowledge systems in the cotton industry.

Media summary
The role of crop science is to generate new knowledge for use by farmers. However due to many challenges, including information overload, this knowledge is not always useful or used. Research highlights opportunities and partnerships to improve the uptake and use of research and industry learnings.

Key Words
Knowledge; Learning; Extension; Cotton; Decision support; Irrigation

Introduction
This conference defines the role of crop science to generate new knowledge for use by farmers. In this context, *how* is knowledge generated, shared and used? Management of a cotton crop requires high levels of knowledge and timely decisions. The Australian cotton industry is typified by a high level of innovation with active seeking and sharing of knowledge within the close industry network and is now one of Australia's most innovative rural industries (Plowman 2004). However, he cautions us by stating that, as an industry matures, knowledge sharing and risk taking decreases, leading to lower levels of innovation. With this in mind, the nature of knowledge and learning in the cotton industry should be investigated so that strategies can be made to innovate and prepare for the second generation of farmers.

Research has traditionally focussed on contributing to new information for managers. Information has been described as data whilst knowledge or 'Know-How' is related to the processes of learning, understanding and applying information (Soo, Devinney *et al.* 2002). Research indicates that cotton growers and consultants actively seek to develop what Soo and her colleagues describe as 'know-how' rather than 'know-what' (Callan, Christiansen *et al.* 2004). To remain effective, research and extension needs to expand beyond delivering information to augment knowledge systems. This paper describes current knowledge systems being used in the Australian Cotton industry and research being undertaken to improve them.

Knowledge Pathways In the Australian Cotton Industry
Knowledge is the core business of research and extension agencies, consultants and suppliers who service the industry. Knowledge pathways follow a tangled web of many approaches and a multitude of people who access and disseminate information, provide advice, generate ideas and test new concepts (example Table 1). The context of knowledge generation and sharing occurring through social interaction (Brown and Duguid 2000) is strongly evident in all sectors of the Australian cotton industry.

Extension has shifted from being solely a public sector role to a mix of public and private services. There is opportunity for these sectors to effectively partner rather than compete in the knowledge value chain. Most public sector research and extension in the cotton industry is integrated through the Australian Cotton Cooperative Research Centre (Cotton CRC) including:

- Research - fundamental and applied;
- Extension - a mixture of technology transfer and participative learning approaches; regional and

- Computerised decision support systems including CottonLOGIC (pest, nutrient and irrigation management) and internet based technologies;
- Technology Resource Centre – editing, publishing and distribution of information resources.
- Education - A Post-Graduate Cotton Production Course targeted for consultants and a grower-based Short Course in Integrated Pest Management.

The private consultancy sector is also a critical part of the cotton industry knowledge system. On almost every farm crops are checked 2-3 times per week by a crop consultant, most of whom are tertiary trained. Consultants provide advice on pest management, nutrition, disease, rotations and irrigation. Suppliers and manufacturers also provide support for agronomic decision making. Merchants, gins and marketing consultants provide marketing advice. Services and training are also available for business management, risk management and for other issues. Clearly it is a highly serviced knowledge system.

Table 1 Key sources of information for water management in the Australian Cotton Industry – as perceived by growers, consultants had similar perceptions.

Resource	Most Important	Somewhat Important		Less Important
People	Own experience Researchers Consultants – irrigation, crop, other Other growers	Farm staff Bankers Water suppliers Other farmers	Family Grower groups Extension staff	Resellers Chemical representatives Spray contractors
Resources	Trial data Field days Cotton Tales Grower experience Case Studies	Benchmarking Legislation Magazines COTTONpaks	Soil characteristics Soil monitoring Weather bureau Decision support systems	Media World Wide Web Formal courses Cotton conference Knowledge research directory BMP manual

The Nature of Knowledge and Learning in the Australian Cotton Industry

Recent research has highlighted that, at least in relation to water management most growers are: 'change ready'; are active seekers of information; actively share knowledge; and willing to experiment and continuously learn (Callan, Christiansen *et al.* 2004). This research also identified that cotton farmers, and other sectors of the industry, are highly experiential learners who have many different mechanisms by which they prefer to learn and seek information. Their own experience was clearly the dominant influence on decision making with particular focus on economic and practical implications of the information. *"I build up my self-confidence about the value of changes to how I manage water by talking to my consultants and other farmers. I won't change unless I see it working elsewhere...I need good advice and consultants, using research and other farmers and their experience guides me a lot."*

This research also found that experience is developed through application on farm, observations and discussion with peers, field days, participation in research trials, benchmarking and personal networks. Grower learning groups also play a role in the knowledge systems for many growers and consultants. These groups, which resemble communities of practice (Plaskoff 2001), are voluntary, driven by the participants (often with the coordination help of the extension officer or a consultant) and are founded on communication to share experiences and in some cases develop plans for a regional approach. Area Wide Management groups that formed to address pest management concerns are one example of this in the industry, however, other communities of practice exist, often very informally, such as: the clients of a common consultant, social groups, neighbours, past participants in training courses, regional grower groups and the events and activities of the small regional communities. The research identified that knowledge flows between regions through personal networks, forums and research and extension communication.

Trust in information, and the source of it, is important to growers. Many growers and consultants see the "honest broker" an important part of the public extension role and lament the high turnover of extension staff that makes it difficult for them to build relationships.

Motivations for learning and change

A variety of factors motivate people to expand their knowledge about an issue or to implement change. Cotton growers and consultants have been found to have a culture of actively seeking information and

knowledge, as descibed above, but this may not always follow through to changed practices. A diversity of enablers and barriers to change in the cotton industry were identified, including crisis, economics, community perception, practicality of fit within the farm systems, labour, resources, etc.and uncertainty about future water allocations. It should be noted that the research was based on some 90 interviews of growers, consultants and R&D leaders. Future research could explore how these 'self reports' link to actual behaviours and evidence of new or revised practices.

An evaluation of the Best Management Practices program (the cotton industry's environmental management system) found that BMP "believers", tend to have one or more of the characteristics: larger farms; Higher workplace health and safety and public liability risk profile; Committed to the cotton industry; Industry leader; Individuals prepared to put the industry good ahead of individual good; and/or See advantage in having an external party look at their business (Macarthur-Agribusiness 2004).

Information Overload

Whilst cotton growers and consultants are active seekers of information, many find that there is simply too much information at their fingertips or a few mouse-clicks away to be able to make sense of it all. Extension was seen to have a knowledge brokering role in accessing, validating and digesting information that could be made available in "short dot-points" in a timely manner (eg CottonTales newsletters) with linkages to more detailed information.

Incremental and Substantial Change

"*How people like to learn is not necessarily how they do*" was commented at a recent industry forum about knowledge management and is a concept also widely established in extension literature. Sometimes growers like to learn by gradually assimilating information, observing others and testing new approaches, but sometimes changes are stimulated rapidly in response to a crisis.

Research exploring knowledge systems in irrigated cotton management .now that cotton growers are experiential learners and make incremental changes by sourcing information, consulting peers, attending field days attended, generating ideas and testing many of these to make improvements to the management system. If this works it may be then used across the whole farm. This approach works well for making incremental changes such as improving the efficiency of a furrow irrigation system.

More challenging are the substantial change decisions that involve infrastructure and capital expenditure such as investing in a centre pivot irrigator or trickle irrigation. Some innovative growers have been able to apply the usual experiential learning model by partnering with equipment suppliers who a keen to undertake trial on the property of a leading cotton grower identity who's experience will influence his or her peers. However, in many cases we need to rethink the knowledge system where substantial investments are required in order to improve a management system. Some of these mechanisms for building experience were identified in the irrigation knowledge research:

- Use of case studies – practical examples of how other growers have implemented a changed practice – including economics and practicalities;
- Use of computer simulation models and decision tools – scepticism about computer models is being replaced with a view of them as a useful tool to stimulate thinking about options.
- Leveraging knowledge through learning groups – grower groups may form or adapt to focus on issues relevant to people at the time. Some of this occurs now.

A role for Decisions Support Systems

Computerised decision support systems have been widely used in the Australian cotton industry for pest management decisions for over twenty years (Hearn and Bange 2002). These systems have largely served in aiding immediate pest management decisions by recording and compiling information on pest populations and drawing together the wealth of science about pest management into a readily accessible decision tool Reporting functions associated with these tools are also used to review and reflect on strategies used through the past season.

DSS can continue to play a key role in knowledge systems by providing a learning avenue that is based on simulated rather than actual experience. Through this experience of simulated scenarios, DSS can help deliver a knowledge pathway for complex, major investment decisions where incremental change is not

possible and financial risk is high. For water and irrigation management HydroLOGIC, part of the CottonLOGIC suite of DSS, offer significant opportunities to assist with knowledge system delivery. The appropriate means of delivering these technologies is subject to ongoing research in the cotton and grains industry (Carberry and Bange 1998). DSS can also provide frameworks for action research involving researchers, consultants and growers (Carberry, Hochman *et al.* 2002).

Case Study: Integrated Pest Management

One of the most significant changes in the industry has been a shift towards Integrated Pest Management (IPM) systems that reduce the reliance on insecticides. IPM has been a major area for investment of research and extension efforts and a focus for growers and consultant IPM champions. IPM is now widely accepted throughout the industry as an integral part of farm management. Adoption of IPM principles in the cotton industry was matched with a shift towards growers taking increasing responsibility for insect control decisions (Coutts, Christiansen *et al.* 2001). Decision making had moved towards a partnership between growers and consultants with reference to research and increased communication with peers.

Continued and increasing pressure concerning pesticide use (eg Endosulfan) and the introduction of Ingard® technology (genetic modification of plants for improved pest management) triggered growers' and consultants' interest in learning about and applying IPM principles. Innovators played a key role in testing, developing and applying the IPM system and encouraging their peers. Research, extension and educational activities focussed on IPM, including learning groups, research and demonstration trials, field days, seminars, and a Short Course in IPM. IPM Guidelines were developed with practical information about IPM (Mensah and Wilson 1999). Positive economic returns identified from benchmarking were influential.

Conclusion

The cotton industry is a knowledge thirsty and highly knowledge serviced industry. Growers and consultants actively seek to learn and improve their systems when issues are important to them. This is the finding of some qualitative research, it could be followed up with further qualitative and quantitative studies. Understanding the mechanisms that motivate the need for knowledge acquisition and that accommodate the varied learning styles of different people in the industry are needed. Further research needs to continue to understand these processes to better enable research and extension services, in partnership with the private industry sector, to support, research and promote future innovation and change necessary for sustainable Australian cotton systems.

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Knowledge, Know-How, Information and Change in Irrigation

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Abstract

Industry interest in improving water use efficiency has increased greatly in the past few years. To achieve this, growers are seeking more information and practical knowledge about how to improve water management and the relative value of different systems. Extension programs for water management vary across the industry, as does the availability of irrigation consulting services. Interviews of all sectors of the cotton irrigation industry have identified the needs and preferences for accessing and developing knowledge about irrigation.

There is clearly no one option – different people learn in many different ways and a package that combines different approaches is needed. Many consultants are looking to provide irrigation and nutrition services to supplement their business, and have identified a need for training. An extension and services model is being developed to partner public (government and industry extension) and private (consultants) sectors to provide growers with information and advisory services, trials, case studies and training for irrigation management. The Australian Cotton Cooperative Research Centre (Cotton CRC) will develop this with the CRC Irrigation Futures (CRC IF), providing cotton irrigators with greater access to broader irrigation research.

1.0 Introduction

Water scarcity combined with increasing awareness of the opportunities to optimise yield through precision irrigation have all led to a growing interest in making changes to maximise the profit from the megalitres of water available. This has been a significant shift in the past two years, and was largely influenced by limited water. It is likely to stay a focus due to both water reform and also the high yields that were obtained by some irrigators with limited water. New approaches, management techniques and economics are clearly a key part of improving water management practices, just as they are with any element of farm management.

Knowledge about irrigation is developed through research, through growers' experiences and through the experiences and trials of consultants and suppliers. Understanding how this knowledge flows through the industry, how growers make decisions about irrigation, how they access

information and what influences changes in irrigation management will help the Cotton CRC to better target our research and extension efforts in irrigation.

Until recently, pest management has dominated the focus of management, consulting services and research in the cotton industry. Information about pest management is readily available to growers through a number of avenues including research and extension, consultants, field days, information resources, CottonLOGIC, Area Wide Management groups, seminars and agribusiness. Does this model suit equally well for irrigation? There are a few key differences to be considered: the industry has far fewer researchers working in irrigation; most growers employ a consultant for pest management but few do for irrigation other than scheduling services; there are only a few consultants highly skilled in irrigation in the industry. Also, some of the changes that are needed are substantial decisions that can not all be practically made by trial and development – for example change of irrigation system type. Equipment and skills for measuring irrigation set-ups are specialised, time consuming and often will need to be done on an individual basis for each field.

Understanding these issues, a Cotton CRC research project, funded by the National Program for Sustainable Irrigation, has looked closely at the knowledge patterns and strategies of all industry sectors, specifically in relation to irrigation. From this will be developed strategic approaches to irrigation extension and education in the future. This aims to provide irrigators with the necessary information and services to improve water use efficiency (WUE) and optimise yield and quality.

2.0 Approach

Over the 2003-04 summer, 90 interviews were conducted to determine how information about water management is being sourced and used in irrigated cotton and grains. This included predominantly face-to-face, and some telephone interviews of: 39 cotton and grain irrigators; 4 grain irrigators; 30 consultants and irrigation suppliers/designers; 10 members of the cotton extension network; and 7 members of research agencies. Extension staff from cotton, grains and horticulture met to be trained in interview techniques, conduct the initial interviews and debrief on early findings before travelling home to do more interviews.

Interviews and training were done under the guidance of Professor Victor Callan, a specialist in learning organisations in the business sphere. He then analysed the interview reports to prepare a detailed draft report (Callan, Christiansen *et al.* 2004). This was circulated prior to an industry workshop in Moree. This workshop, with representatives of most sectors of the industry, worked through the recommendations in details to advise a future model for irrigation extension.

The project steering committee played a key role in guiding the project and then in assessing and integrating the recommendations to develop an extension model. It should be noted that this study was conducted under a severe drought year where water was the most limiting resource for many.

3.0 Findings

3.1 Key issues affecting water management

The key issues that affect water management for cotton and grain irrigators were: the availability, continued security and cost of water; Returns per megalitre; Water quality; and Water scheduling.

A number of other issues were frequently mentioned in interviews, including:

- Various ranges in climate and rainfall, and how these influenced decisions on irrigation management and cotton variety;
- Public attitudes about irrigators, and water conservation;
- The use of cheaper ways to monitor more areas using probes;
- The need to better understand and manage waterlogging;
- The relationship between soil types and irrigation choices;
- More understanding of deep drainage & management;
- Ways to increase capacity to store water;
- Ways to minimise labour requirements around the most appropriate choice of irrigation method (NB some have identified potential economic value in increasing labour crews in order to save water);
- Improved tail water reticulation;
- Managing irrigation and soil erosion problems;
- Alternative crops to cotton given changes in water availability and its cost.

Uncertainty about water security was particularly influential in limiting the willingness of irrigators to invest in major changes in their irrigation systems and design until they knew how much water they would have.

There has emerged a very strong focus on $ returns per megalitre. Many growers indicated that they would choose the crop that was most profitable for the water they had available. Currently this was cotton for most irrigators, though most had no commitment to grow cotton if another crop was more profitable per megalitre. In most cases, water has become a greater determinant than land area.

3.2 The nature of information, knowledge and knowledge sharing

All sectors believe that the cotton industry is responsive to change, willing to experiment and continually learn, and that growers, consultants and extension officers were very willing to share information and knowledge. Across all sectors, there was the general opinion that the cotton industry was an innovative one. ~~The c~~Cotton could be regarded as a knowledge crop.

> *"Between us on this farm we read just about everything that's related to the industry, go to events, have trials on-farm and talk with other growers and agronomists. Then we talk about how these ideas fit with our systems and plan what we can do better."*

Driving innovation and the sharing of knowledge is the relative youthfulness of the industry, the good financial returns that have encouraged a willingness to share information, and an acceptance that good information is critical to successful change. New research by Plowman (2004, *Pers. Comm.*) has also identified these as key factors that place cotton as one of the most innovative rural industries in Australia currently. The grower culture is clearly one focussed upon innovation and trail-and-error learning.

Considerable information is available to growers and consultants. A major concern, among growers and consultants, was the need for the information to have been tested and applied to determine its relevance and applicability to specific regions. A number of farmers talked of "giving it the acid test", about "getting a real buzz" from on-farm trials, often "pushing the boundaries" by experimenting with different options and how their own trials and small experiments built up their confidence for larger changes.

3.3 Knowledge Pathways

The primary knowledge source for almost all growers was personal experience. The major other "people" sources were consultants, researchers and other growers. The major "resources" were trial data, field days, *Cotton Tales,* grower experiences and case studies. These are detailed in Table 1. Consultants indicated fairly similar preferences.

Figure 1. Relative importance of various information sources for irrigation.

Resource	Most Important	Somewhat Important	Less Important
People	Researchers Irrigation consultants Other growers Crop suppliers Crop consultants Other consultants	Farm staff Bankers Water suppliers Other farmers Family Grower groups Extension staff	Resellers Chemical representatives Spray contractors
Resources	Trial data Field days Cotton Tales* Grower experience Case Studies	Benchmarking Legislation Magazines COTTONpaks^ Soil characteristics Soil monitoring Weather bureau Decision support systems	Media World Wide Web Formal courses Cotton conference Knowledge research directory BMP manual

* ***CottonTales** are local, fax out newsletters prepared by the Cotton Industry Development Officer in each region. 1 pager, weekly-fortnightly*

^ ***COTTONpaks** are detailed compendiums of information about a given topic eg SOILpak, ENTOpak – a WATERpak is under development.*

Some observations about growers' means of developing their knowledge about irrigation can be made:

1. Growers like a mix of contact.
2. Growers are especially very positive about contact that is one-on-one.
3. A lot of information was seen to be too general and not tested for the climate, soil type and water quality of specific regions. Growers and consultants emphasised the value of greater grower/consultant/extension partnerships to conduct farm trials to deal with local concerns. Growers wanted to see more research being funded for their own region. They wanted region-specific trials rather than the research being done on an experimental farm in a region with quite different conditions.
4. Growers are clearly combining various sets of information over periods of 1 to 2 years to make their decisions.
5. Local papers or cotton-specific media (eg *Cotton Grower* magazine) were seen to be a more significant source of useful information than the larger media (eg *The Land*, newspaper articles). The media and magazines were especially useful to consultants.

6. Many farmers felt that there had been too many courses and too many meetings to transmit information.
7. Growers come together around tangible reasons (eg field trials, demonstration of a new technology).
8. Many consultants, growers, consultants and extension officers believed that there is a real shortage of experienced irrigation consultants, particularly consultants who can merge the agronomic and engineering aspects of water management.
9. Growers judged resellers as being less useful sources of information than consultants.
10. Consultants were by far the major "people" source of information for growers, and consultants also believed that this was the case.
11. Resources like *Cotton Tales*, *COTTONpaks* and magazines needed to shift their focus more towards water management.
12. While benchmarking was identified as a valued resource, growers felt that appropriate benchmarking was a highly complex and difficult task that needed to be managed for them by researchers and public providers. Consultants valued benchmarking as an activity more than did growers.
13. Growers called for short, concise information like in the form of dot-points that was relevant to what they needed at the time and that provided links to other information. Growers indicated that links to other information, including websites, could help growers to access and digest the relevant and trustworthy information from all that is available.

Experience

There was a particularly strong emphasis on own experiences as a key knowledge source. Growers generally liked to try a new technology or practice and see how it went in terms of management, yield and economics.

> *"If my on-farm trial or another in my area is successful, I will possibly put in a field and then see what the results are. Cash flow finally determines if we implement this on a farm scale."*

The experiential learning was also reflected in a desire to know more about how growers had practically implemented a change in irrigation practice, the practical management and economics of that change. Case studies (written or field days) that outlined this experience of other growers were sought after.

Consultants

Growers felt that consultants (irrigation, crop, other) were the dominant source of information. Many other growers shared this grower's point-of-view:

> *"My consultant is a major sounding board. He suggests that I go to field days to see what can be done, and helps me think through the changes. I have irrigation scheduling tools like C-probes to help my day-to-day decisions along with regular visits from my consultant. The consultant works closely with me in planning our crops."*

A consultant reported his relationship with his group of growers as follows:

> *"I have direct day-to-day contact. Because of the water restrictions with growers, we do a review at the start of the season, look at crop types, look at 'what ifs', and I work closely with growers during the season advising on water."*

Consultants tended to have long-term relationships with individual growers built upon a deep understanding of the grower's experience, risk profile, soil and water conditions, as well as high levels of trust based on many years of contact and in making good decisions with those farmers. Consultants were a key resource in terms of bringing into the decision-making framework for growers the experiences of other growers in similar regions and conditions with the same issues. At the same time, growers also emphasised how they worked independently, accessing research findings either directly from researchers by email/telephone/reading reports, or through getting the assistance of other consultants and extension officers.

In relation to irrigation, many growers were actively developing knowledge about irrigation management themselves. One consultant observed:

> *"As consultants, we find that growers are getting more sophisticated with water scheduling, C-probes and continuous recording of soil moisture. Consultants need to keep pace with growers who will lead the way now as they get their own data rather than us. Our task is now to problem-solve and brainstorm with them on the alternatives they might consider to maximise dollar returns per hectare."*

Field days

As grower experience was a core resource, field days that showcased grower experiences were considered valuable. They were seen as a great opportunity for growers to share their experiences, and to hear and most importantly to see what else was possible. There was a clear preference for short (2 hours to half a day), informal field days that focussed on 1 or 2 issues in detail and gave an

opportunity to looks at other growers systems and the application of research. One grower explained the impact of his experiences from a field day as follows:

> *"Here is an example of how a field day changed my mind. After going to a field day and hearing an irrigation consultant, and seeing results, I made some changes almost straight away. I split a field in half, and compared one siphon and two siphons. The whole farm went to two siphons. An improvement of about a bale to half bale has meant I've stayed with the new system."*

Interestingly, some growers who indicated a preference for field days had not attended their recent regional field days. Reasons for this were described as a preference for short field days or farm walks (1-2 hours) that were held nearby and covered only one or two topics. Full day events, drinks and the related social activities were not considered necessary and were too time consuming.

Information Resources

Both growers and consultants made variable comment about the amount of information available. Some felt that there was information overload whilst others felt that more information was needed. There was a high demand from growers for extension services to help by sorting the vast amount of information available to present short, concise, timely, locally relevant summaries "*just the dot-points on 1 page*". CottonTales were considered to be a good format for this that could have more irrigation content and also provide links to other, trusted sources of information.

There was some call for more readily accessible information about water. WATERpak is currently under development and will meet some of this need.

Cotton Conference

There was a lot of comment by growers about the value of the Cotton Conference held every two years, and many felt this and the proceedings were a great source of information and ideas. At the same time there was some concern about the style of the most recent conference, and its immediate value for growers. A grower explained his concerns:

> *"The cotton conference has been a great source of information. However, I feel that the conference is drifting from research findings, and a different sort of conference strictly focused on research would be useful."*

Groups

Many farmers mentioned the value of grower groups. Several commented that the groups that had been meeting to discuss IPM (eg Area Wide Management groups) were now focussing more on discussing water management issues. There was a feeling that groups could more purposively address water issues, particularly as some AWM groups had not been active over the past season due to the reduced area of cotton, low pest pressure or other reasons. This was particularly so for those groups that viewed themselves as solely IPM groups.

> *"I see great benefit in getting grower groups together to discuss irrigation methods. We have done this in the past and it has been quite effective. You get a good response from growers because they are the ones who are most interested."*

Another reported:

> *"We are currently doing benchmarking as part of a grower group. It is working quite well. So far 87 paddocks have been benchmarked. Grower groups with more field days, trials and benchmarking linked into them, are a good way to go in getting and applying new information."*

Decision Support Tools

HydroLOGIC had been launched in the season of this study. It was not widely mentioned but some growers did comment that they had seen increasing value in using simulation models to aid their thinking. They referred particularly to the use of crop models to aid in deciding planting area for the water available. Workshops by researchers early in the season using crop models for this purpose were considered very helpful by the few who mentioned them.

There was also interest in climate forecasting tools – particularly if these could be integrated with other water management tools.

3.4 What influences decisions?

In addition to the water reform process that is shaping the context within which growers and consultants are making decisions, other factors influence decisions. Personal experience and that of other growers, particularly in the local region, was a prime factor in decision-making. Decisions were made over a period of time of building up ideas. One grower described it as:

> *"My decision-making usually takes about a season or two. I let the idea take shape in my mind, and before discussing it with anyone. I look for evidence from local and international research, using magazines, CDs and the internet. I then discuss this idea*

with my consultant and agronomist to get their feedback. I might also pick up feedback at growers' meetings, but not always."

Another talked about his decisions as follows:

> *"Our decision-making about planting takes time and preparation. Everything is prepared throughout winter to ensure we could plant everything if water becomes available. Country that came out of fallow was planted solid, and country that had a crop was planted double skip to hedge bets and make the decisions a bit safer. In the end there was no water from the river and we had to rely on bore. This reliance on bore ultimately limited what we could do."*

The driving forces for positive actions to improve water efficiency are:

- evidence of the benefits of a new practice, technology or strategy based on the findings or facts from in-house and outside trials and experimentation on their farm or other farms;
- cutbacks in water availability;
- the drive to continue to gain the best financial return for a farm, and now that pest management was thought to be under control, the focus was upon maximising returns through reducing the management costs per megalitre of water;
- the long-term sustainability of the farm and the soil;
- the support, advice and experience of their consultant agronomist;
- the need to save labour costs associated with irrigation;
- the introduction of neutron probes and other scheduling tools.

The barriers to changing practices are the lack of practical evidence that the changes will actually work on their farms, and the financial and labour costs of introducing new technologies and farming practices.

Whilst information was gathered over a period of time and experiences built up through trials, a key impetus or crisis was a strong driver in actually implementing changes in practices. In reference to the severe water restrictions caused by the drought, a comment was made:

> *"We've talked about WUE for 2 years but last season we really had to do something about it."*

3.5 Role of public and private service providers

A key observation to make here was that, at least in relation to irrigation, growers themselves are playing a key role in generating information and knowledge, as described above.

Growers saw the research and extension (public) role as being about identifying growers' needs, and to get research completed and communicated back to growers to address their needs about irrigated crops and related issues. Consultants saw the role about commissioning research and communicating it back to the industry, with the implication that the consultant's role was more about identifying growers' needs than it was for the public provider. Consultants believed that they played a more hands-on role or day-to-day role in working with the grower to decide and to implement the crop and water management strategies for the season. At the same time, growers expected to see a cooperative relationship between consultants and extension. In general, growers and consultants felt that there was a lot of cooperation though the sharing of materials and knowledge between research and extension providers and consultants.

> *"I see the public/industry extension role to be about getting data out and communicating this out to all of us. The private role is to get these messages out to the growers through one-on-one contact. The challenge is that we need to be more confident about the usefulness of the outcomes from research to be convinced that we can use it."*

Another opportunity for cooperation between extension and consultants was in the organisation of benchmarking. Working together, it was felt that public and private providers could drive more opportunities for benchmarking that combined public funds and private sponsorship, with grower groups being central to these benchmarking partnerships. As one consultant commented:

> *"We need to work together by doing field trials on farms, like case studies and benchmarking. By working together, consultants have all of the information, and can exchange with extension staff to write it up and put it out there."*

New and emerging issues were seen to benefit from extension work in developing local understanding, undertaking trials and benchmarking, and communication of findings to raise awareness on an issue. Some growers and extension staff indicated that once "the ball gets rolling" then consultants would provide the services and day-to-day support needed for growers to manage it, driven by both growers and consultants. Depending on the issue, this may take a year or two of extension input to develop the understanding and the capacity in the local industry. The focus of extension tended to be more about the bigger issues facing the industry.

> *"Extension tends to work on the issue until it gets its own legs and then we move on to another issue. We tend to focus upon the bigger picture rather than the nitty gritty that consultants work with. Once an issue gets its own steam than we are able to cut back and move onto other issues, and other information as it becomes available"*

Most consultants have focussed primarily on pest and crop management and have their strongest skills in pest monitoring and management. Due largely to Bollgard®II, consultants are looking for other services that they can provide to maintain the viability of their business. For this reason, many are keen to develop irrigation and nutrition as a part of their consulting service. However, may do not currently have the skills for this and will either recruit the skills or require training to develop these skills. The Cotton CRC's Cotton Production Course was frequently mentioned as a key way to develop skills and the Cotton CRC would be well placed to deliver irrigation training for consultants.

It is envisaged that there will be a need for several levels of consulting expertise in optimising irrigation – the highly specialised irrigation design engineers such as are currently operating in some regions of the industry complemented by agronomic irrigation consultants. Some growers stressed the need to merge both engineering and agronomic considerations, and believed the agronomic aspects of irrigation management were currently lacking in the industry.

Participants in the stakeholder workshop concluded that "extension" includes both public and private sector services. To ensure that growers have access to skilled consulting services in irrigation, the public and private sectors can work in close partnership to build both the demand for and supply of these services. That is, the research and extension (R&E) sector focuses on raising awareness and demonstrating the value of improved water management practices (Figure 1) and in developing, testing and demonstrating new technologies. Parallel to this is the need to attract specialised irrigation skills to the industry or deliver training to up-skill existing consultants to deliver irrigation services. Both the supply and demand will need to be built in parallel as depicted in Figure 1.

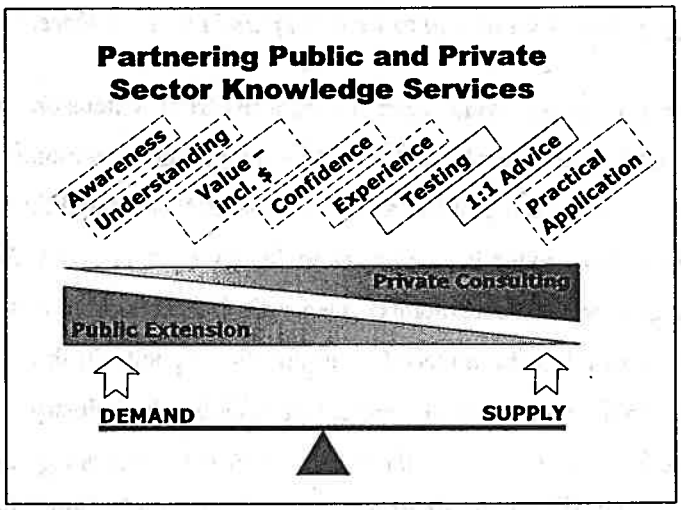

Figure 1. Partnering public and private sector services to meet industry needs for optimising irrigation management.

3.6 Further research, development and extension needs

Growers, consultants and suppliers identified a long list of issues that they felt required more in-depth research. Common to their lists were water scheduling, production and efficiency figures for different irrigation systems, salinity management, loss of water research and waterlogging.

Several people stressed that WUE is about managing the whole system well – not just making changes to a few small parts of the system. They stressed that optimising yield per megalitre required careful management of the whole crop and farm as a system. Understanding how to manage WUE in a Bollgard®II crop was one example.

Research needs to be locally tested and demonstrated to be practical. Much information comes from the experience of growers and consultants, and there needs to be a two-way flow with research. There was a clear need for demonstrated benefits of new technologies. Growers in particular were wary of "making change for change sake", particularly where they had seen other growers invest in new equipment such as a lateral move and later abandon this.

> *"If it is not going to give me an extra quarter of a bale or more per hectare, I won't bother. You need to show me the evidence that changes will make a real difference."*

4.0 Where to?

The current knowledge pathways in the cotton industry relies very much on growers and consultants developing their experience. Through trial and development growers and consultants are testing new ideas and figuring out how they may apply in their situation. This pattern has worked well for incremental gains in water management and for many other aspects of cotton crop management. There are some obvious challenges with this model where substantial system changes are needed, such as investment in a new irrigation system. Extension strategies are needed that provide some form of experiential learning for these major changes. This may include communication of other grower's experiences or the use of simulation tools.

Any extension package for irrigation management needs to include a variety of mechanisms to suit the varied preferences across the industry. Clear, concise, practical information is needed, backed up with more detailed information, examples of practical application and economic analysis. Both static information and interactive opportunities are needed for all sectors to develop their understanding and to share tacit knowledge. Partnering with private consultants is a key part of the system.

On the recommendation of the steering committee, an irrigation knowledge system is now being developed by the Cotton CRC in partnership with the CRC Irrigation Futures. This project will be

funded in part by the National Program for Sustainable Irrigation for the initial 2 years. This will provide a "one-stop shop" for growers, consultants, extension and irrigation suppliers to access information and training about irrigation management. This will include print and internet resources, direct contact with irrigation specialists and researchers, case studies of on-farm experiences and training. Step-wise training modules, to be offered in regional centres, will provide growers and consultants with varying levels and options for training. A system for accrediting skilled irrigation consultants will be investigated together with the Irrigation Association of Australia (IAA) and other relevant groups.

As growers are clearly ready to choose a variety of irrigated crops, it is important that the irrigation management effort is approached as an "irrigation industry" rather than solely the cotton industry. By developing this irrigation knowledge service with CRC Irrigation Futures (CRC IF), the Cotton CRC is taking a lead in developing this "irrigation industry" focus as well as ensuring that the cotton industry has close interaction with the research from CRC IF. This irrigation knowledge model will be developed further and evaluated. If successful, this model may de developed in other regions of Australia by the CRC IF – which will enhance the flow of information about irrigation management and critical issues for irrigation between industries and regions.

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Collaboration: The key to developing research, development and extension priorities for cotton farming systems in Australia.

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Abstract

Collaboration between industry stakeholders, researchers and extension agents is widely regarded to increase the impact of farming systems research. Industry participation in research can occur at several levels – from planning through to trial operation. With time constraints ever increasing as growers and consultants balance a wide range of issues and management roles, research and extension agents are challenged to find means for effective stakeholder participation that are not highly time demanding.

This paper examines the role of a farming systems forum as one method to facilitate a close collaboration between growers, agronomists, researchers and extension staff in developing ideas and setting priorities for farming systems research and extension in the Australian cotton industry. Hosted by the Cotton Research and Development Corporation and the Australian Cotton Cooperative Research Centre each year, these forums engage key stakeholders, identify gaps and opportunities, highlight current knowledge and encourage communication and collaboration. From this, research, development and extension priorities are progressed. This forum is able to engage a broad range of stakeholders, including those who may be less willing or able to commit to participate in trial operations due to time constraints.

These participative farming systems forums provide opportunity for interaction between growers, agronomists, researchers from several agencies and universities, and extension specialists. Australian and international attendees at these forums have commented on the high level of constructive interaction that is achieved between all stakeholders. Since their inception in 1997, the forum structure has evolved from a technology transfer based consultation format to an interactive forum where opportunities and ideas are generated, captured and progressed by all participants. Feedback from research managers and growers indicates that the forums are achieving valued stakeholder participation in farming systems research.

Introduction

Stakeholder participation is valuable at several stages of the research and development process. Close participation of stakeholders in research is widely regarded as an effective methodology for facilitating change in complex farming systems (Collinson, 2000). One of the key limiting factors to participation is time. Time constraints are escalating, not only for research but also, perhaps more significantly, for the stakeholders. Farmers have numerous demands on their time including involvement in research programs, industry committees, catchment associations, their regional communities and so on. All of these are in addition to managing the farm and making timely decisions about crop management. Cotton, in particular, is a crop that demands a high investment of time from both the grower and the consulting agronomist.

These time constraints force growers, consultants, researchers and extension practitioners alike to make choices about which issues, if any, they can participate in at a detailed level. Some will choose a broad-brush participation in many issues whilst others will choose one or a few areas of interest in which to be more closely involved.

So, on the one side we have demonstrated benefits of participatory action research, on the other we have time limitations of the stakeholders who could benefit most from the participation. What approaches can research and extension providers take to balance this dilemma?

Cotton research and extension programs have used a mixture of approaches to develop ownership of issues and research and to facilitate the development of management strategies (Christiansen, et al., 2002; Hearn and Bange, 2002); Williams, 1998). These range from planning forums, grower trials, on-farm research (Hulugalle, 2001), and research/extension evaluations. The type of participation varies to suit the purpose and the time availability of the stakeholders. Through this range of mechanisms, growers and consultants across the industry have an opportunity to be involved in a way that suits them, and to develop some ownership of research developments. This paper focuses particularly on grower and consultant participation in the research planning process.

Participation in research planning

Research, development and extension activities in the Australian cotton industry engage growers, agronomists, researchers and extension staff in the early planning phases to develop ideas, identify gaps and opportunities and set priorities for research and extension investment.

Growers, consulting agronomists and other stakeholders have opportunities to be involved in the research and extension planning process through several avenues including:

- The Australian Cotton Growers Research Association, which includes mostly growers with some agronomists, cotton ginners and seed companies.
- The Cotton Research and Development Corporation (CRDC) Board.
- The Australian Cotton Cooperative Research Centre (Cotton CRC) Board.
- Cotton Grower Associations in each valley– some of which have research or technical subcommittees.
- Regional reference groups that provide the local Cotton Industry Development Officer with direction and support – in some cases these are the same group as above.
- Cotton Consultants Australia's R&D sub committee.
- A range of groups, working parties and committees for specific issues such as insecticide resistance management, disease strategies and research, etc.
- Area Wide Management groups – grower driven groups supported by the Cotton Industry Development Officers – these groups' primary aim is communication and updates, particularly in Integrated Pest Management. Through the process groups regularly identify numerous research questions and some undertake trials or monitoring.
- Forums such as the annual CRDC/Cotton CRC Farming Systems Forum.
- On-farm trials such as the long-term farming systems rotation trials.

Farming Systems Forums

One of the mechanisms by which cotton industry stakeholders are engaged in the farming systems arena is through an annual forum hosted and funded by the CRDC and the Cotton CRC. These farming systems forums evolved as a means to improve the focus and profile of soils and farming systems issues in the cotton industry.

The aim of the farming systems forums is to discuss results of current research, improve communication and coordination, raise awareness, identify gaps in our knowledge and prioritise research and extension needs of the industry. Growers, researchers, consulting agronomists and post-graduate students attend the forum as equals.

Forum structure and operation

Since their inception in 1997, the farming systems forums have reviewed and integrated knowledge and developed research needs for a range of specific topics including Stubble Management (Narrabri, 1997), Ultra-Narrow Row cotton farming systems (Hillston, 2001), Soil health (Narrabri, 2001) and Salinity, Sodicity and Hard Setting Soils (Narromine, 2002). Other forums (Narrabri, 1998 and Dalby, 2000) have been more general, covering a wide range of agronomy, environmental, soils, water, precision agriculture, nutrition, pathology, and pest management topics. The topics of the forum are on evolving needs, identified through discussions with growers and researchers.

Holding some forums away from the main Australian Cotton Research Institute at Narrabri has allowed more local growers to attend and has exposed researchers and other industry participants to the unique concerns of growers in different geographical areas. Growers appreciate having researchers in their region, addressing their priorities. They, and the researchers, can also better appreciate the relevance to their systems of research from other regions.

To enable interaction and participation, attendance at the 1-2 day workshops is limited to about 120 people, invited as representatives of a range of sectors. For example, the last forum involved 54 growers, 38 researchers/students, 10 consulting agronomists and 14 people who have other industry roles. Generally some researchers from outside the cotton industry are invited to broaden the richness of discussions and to ensure a wider technical resource base.

With such a large group, careful workshop process is needed to provide opportunity for participants to interact and actively learn, integrate thoughts, develop new ideas and identifying needs. A team of extension, research and research management specialists from within the Cotton CRC facilitate this process. The process also needs to ensure that all participants have ownership of the conclusions and recommendations reached at the end of the forum. Generally, the forum program includes a mix of presentations and discussion sessions. A range of speakers, including growers, agronomists, researchers, students and extension officers are invited to present to ensure that a diversity of perspectives on a specific topic are shared and discussed. This mix of research concepts and practical management needs adds particular value to the forums.

Speakers' notes are provided at the forum and a written summary of the forum discussions is sent to all participants and other interested parties shortly after the meeting. A field tour is included where relevant, providing increased opportunity for informal interaction between the participants. As well as helping to visualise the issues, the field tour sets the scene well and is a good ice-breaker to enhance interactions between researchers and growers. At the 2002 forum, where the bus tour was cancelled due to wet weather, growers and researchers were paired as "buddies" for introductions to promote interaction and to avoid a segregation of growers and the visiting researchers. Both growers and researchers thoroughly enjoyed this session as they broke down barriers.

An evolving process

The farming systems forums have evolved over the past decade from meetings arranged by CRDC to encourage soil scientists to get together and discuss their research. Initially, the meetings were dominated by soil structure research, but with increasing input from soil chemists, soil biologists and agronomists. As the areas of discussion broadened, the focus turned to integrating the presentations to deal with specific problem areas with the cotton industry.

Over the past two years, the forum has changed from the traditional "conference" format of presentations and short questions to a workshop style, participative forum. This has shorter presentations, longer question and discussion times and a focus on small working groups. The small groups, with a mix of growers, consultants, researchers and extension officers are actively engaged and challenged in developing their ideas frequently throughout the program. Gradually the workshop process has moved from technology transfer based consultation to an interactive forum where opportunities and ideas are generated, captured and progressed. More recently action learning activities have been incorporated into the forum.

The shift from trying to cover all the farming system issues in one forum to focussing in detail on a specific topic has generated greater depth to the discussions and outcomes. Perhaps broader forums are also needed in the future to develop the whole farming systems context.

How do research and extension managers respond to the input?

Engaging stakeholders in the planning phase brings with it an ethical commitment to act on their recommendations. As it is impossible to invest in all issues identified at a forum, it is important that the workshop concludes with a group consensus on which issues are of highest priority within budget means. Researchers are then invited to develop projects to meet the highest priority needs. Subsequent research investments are communicated back to forum participants and the industry as a whole to develop a sense of ownership in the new projects as well as a satisfaction that the time invested has been valued.

Outcomes of the forums have been progressed in different ways. In relation to the Soil Health forum many needs for research were identified and the Cotton Research and Development Corporation responded by funding about one million dollars worth of new research on projects that had been directly developed from the forum. At the Salinity and Sodicity forum most of the priority issues related to extension needs, perhaps as much had already been invested in research in this area. Since this forum, the National Cotton Extension Network (Christiansen, et al., 2002) and research managers, in collaboration with some key researchers, have developed and progressed extension plans for these issues. Some research arenas have taken longer to develop. For example, deep drainage, an issue raised during an early forum, required two subsequent technical meetings to clearly specify future research needs, in which CRDC and the Cotton CRC have now invested.

Research managers have indicated that they feel that the farming systems forum is a key avenue for research ideas to be discussed and prioritised, assisting them in targeting research investments – "a bigger bang for our buck". (Ralph Schulze, Executive Director, CRDC, *pers. comm.*).

Differing perspectives – Similar Objectives

Bringing together growers, agronomists and researchers allows an issue to be challenged and developed from multiple perspectives. At times growers and researchers have similar views on the issues and priorities and other times they differ greatly. As an example, all participants were surveyed at the start of the salinity and sodicity farming systems forum (2002) and their perspectives on the issue can be compared.

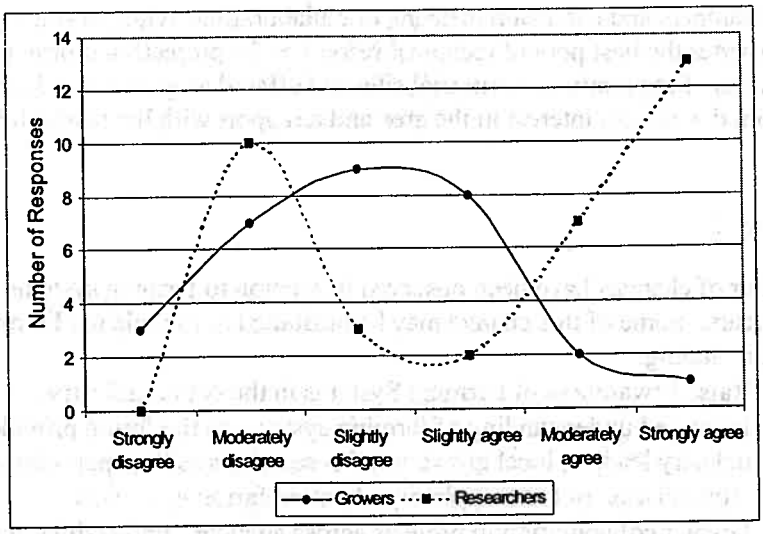

Figure 1: Responses to the question: Is salinity more a problem than sodicity? Survey of participants at the start of the 2002 Farming Systems Forum, Narromine.

In relation to the question; "Is salinity more a problem than sodicity?", the growers' response is similar to a normal distribution (Figure 1). Very few strongly agreed with the statement, perhaps as they were unsure or perhaps as the extension effort in past years has focused on sodicity more than salinity. In contrast, the researchers were divided between moderately disagreeing and strongly agreeing and had a range of opposing views (Figure 1).

When asked another question; "Salinity will be a major problem for cotton growers in the next 10 years?", the majority of both growers and researchers agreed with this statement (Figure 2).

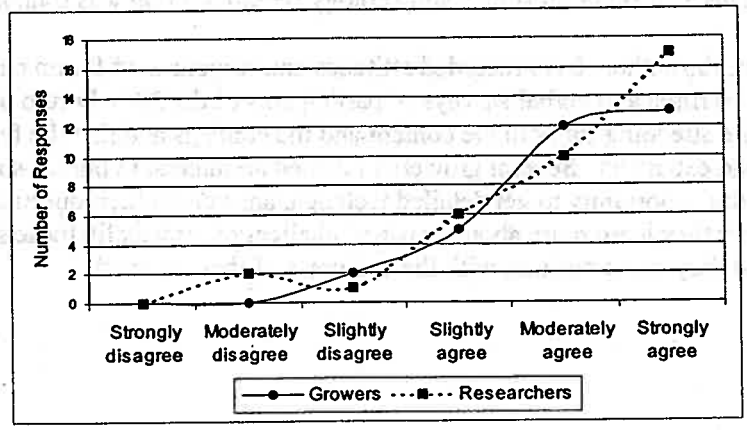

Figure 2: Responses to the question: Salinity will be a major problem for cotton growers in the next 10 years? Survey of participants at the start of the 2002 Farming Systems Forum, Narromine.

The detailed discussion between growers, agronomists and researchers helps both the science and the on-farm management to inform each other. In this way, the science can be matched to management options and vice versa – or areas of mismatch can be identified so that sustainable, science based management practices can be developed and science can be undertaken where management challenges exist. Stakeholders also come to understand and appreciate each other's skills and expertise, providing a good platform for research planning and activity.

The rapport developed between forum participants as they actively discuss issues and socialise together one would expect to be beneficial. For example, research fund managers indicate that collaboration in farming systems research is generally greater on projects that evolve from the forums. These may include collaborations between researchers from different organisations, collaborations

with researchers and extension officers, or collaborations with consulting agronomists and growers. This provides the best pool of technical resources for projects and provides resource allocation efficiencies. Frequently on-farm trial sites are offered as growers and consultants who participate in the forum develop an interest in the area and a rapport with the researcher or extension officer.

Progress

A number of changes have been observed in relation to farming systems in the cotton industry over recent years. Some of this change may be attributed to the role the Farming Systems forum has played, including:

- Raised awareness of Farming Systems in the cotton industry.
- Increased understanding of farming systems as the forum provides a knowledge update for industry leaders, local growers and researchers as they participate.
- Appreciation of the complexity of cotton farming systems.
- Greater collaboration in projects across agencies, universities and industry.
- Increased industry and research ownership of farming systems research programs.

The forum has not been able to resolve every question, particularly for complex issues such as soil health. Instead, through the integration of several disciplines it has consolidated the questions, identified the main gaps and initiated research. Through discussions with key stakeholders, the authors have used reflective and observant evaluation to consider the forum's outputs and outcomes using (Coutts, 1997) three rings of extension evaluation (Figure 3). Frameworks to measure key 'triple bottom line' indicators of farming systems changes are currently being developed (Roth, 2003; CRDC, 2003).

Following the forums some growers have contacted their local extension officer to undertake related activities with other growers and consultant agronomists in their region. Some consultants have developed forums or services for growers in their regions following the forums. Following the 2001 Farming Systems Soil Health forum, a soil ecology research group was established.

In recent years, the authors have recorded attitudes and responses of forum participants. All respondents to written and verbal surveys of participants of the 2002 Forum indicated that they felt it was worthwhile attending for both the content and the contacts and that the forum provided directions for research and extension. Several growers indicated an interest to pursue some of the issues further. Growers like the opportunity to get detailed technical answers to their questions from researchers. Researchers say they learn more about growers' challenges, especially those subtleties that vary with geography and they value meeting with the end users of their research.

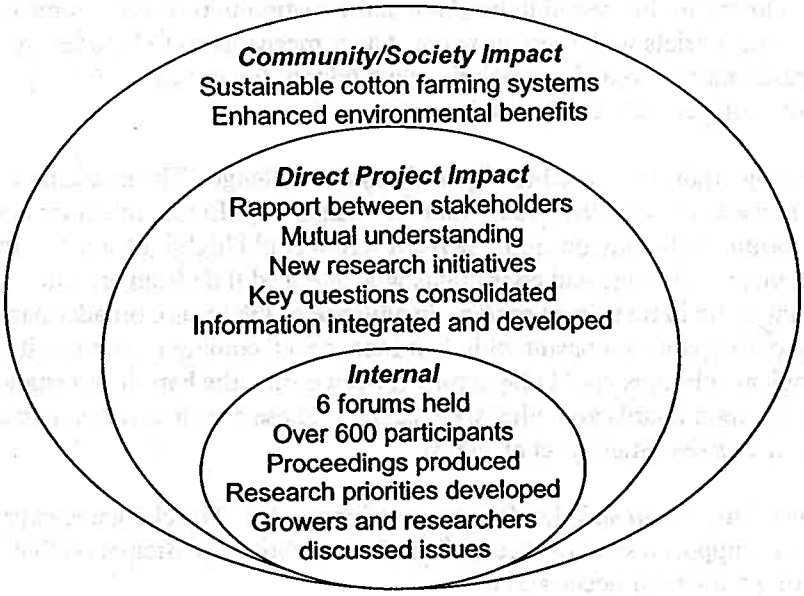

Figure 3: Outputs and Outcomes of the Farming Systems Forums. The inner rings are the directly linked to the forums. The outer ring is the overall impact it aims to contribute towards, together with many other activities. Observant and reflective evaluation – Roth and Christiansen.

Future

The dynamic nature of farming systems means the forum format should not remain static. Variety is needed to continually challenge and engage participants. Re-evaluating the purpose and objectives for each and every forum will help organisers to develop a worthwhile experience for participants and to achieve change.

Concept of Farming Systems

Over the next five years a greater emphasis will be placed on improving and integrating our understanding of soil health, crop nutrition, sodicity/salinity management, crop rotations, and improving water use efficiency (CRDC, 2003). Innovative precision agricultural systems will play an important role. The introduction of more transgenic traits is changing farming systems dramatically and means that some management issues that are well known for conventional crops will need re-visiting for the transgenic varieties.

There has evolved a greater appreciation of the complexity of the farming system. However, the cotton industry research approach to the farming system still tends to focus on the component parts, in particular the soil. This is perhaps due in part to the strongly technical base of the research community. The full concept of farming systems will no doubt evolve to include economic, social, environmental and production issues across the landscape. In particular, this will expand the understanding and value of the human dimension of farming systems.

A true farming systems concept will also require broader cross-industry links, in particular, grains in our case. This will include research and extension programs that consider the whole farming system, and the relative role of all crops in that system.

Participation

This forum is one avenue by which stakeholders can participate in farming systems research. With a national focus, commitment to develop new research programs and detailed information and discussion on a given topic, this appears to be a level of participation that suits the section of the industry involved with research committees and also appeals to many local growers. That is, they appreciate being involved in setting the research agenda and then learning from the results of the

research. Others are interested in hands-on participation in research. Some of this is met through locating on-farm trials with these growers. Other mechanisms to broaden the participation in farming systems research are needed to reach the remainder of the industry. Some area wide management groups are taking an active role in this regard.

How to engage industry more broadly is always a challenge. The media and other extension avenues could be more effectively used to promote to industry the forum outcomes and actions. Smaller regional forums following on from the main forum could highlight some of the key issues and develop extension plans. Growers and consultants who attended the forum are often the best advocates to progress the issue in their local region. In advance of the forum, broader participation could be sought by asking participants to consult with their local peers, coming prepared with issues from their region. Technological solutions could play a role in overcoming the barrier of distance through on-line meetings, bulletin boards and other web features. These are already being used in the Cotton CRC's educational courses (Stanley, et al. 2003).

Time constraints for all stakeholders are ever increasing. The challenge exists for change agents to develop and support a suite of mechanisms for stakeholder participation that are effective with limited time, suiting a range of needs and interests.

Conclusion

Time constraints need not be regarded as a barrier to participation in farming systems research. Rather, it is a challenge to find a range of mechanisms for beneficial participation of stakeholders with differing needs, objectives, resources and time. Different levels of participation can help to achieve integration, ownership and focus for farming systems research endeavours.

Participative forums that engage researchers, growers, and others are leading to a high level of constructive interaction and directions for a range of issues in cotton industry research and extension. The cotton farming systems forum has an excellent record of identifying priorities for further research, development and extension. The forums have raised the profile of farming systems research, increased the understanding of the complexities by both growers and researchers, and led to greater collaboration and ownership by all parties of the research projects and extension outcomes. The need for greater integrations across research and extension disciplines, including economic components is increasingly being recognised by the research community.

Future farming systems forums will need to include greater coverage of social, environmental, economic and production issues across the landscape, re visit fundamental knowledge for the new transgenic crops and expand the understanding of the human dimension of farming systems. Technological solutions such as on-line meetings, bulletin boards and other web features may play a role into the future.

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Understanding IPM – How has the industry changed?

Ingrid Christiansen, National Cotton Extension Coordinator and Bill Dalton, IPM Training Coordinator
Australian Cotton CRC and QDPI

Significant investment has been made in research and extension to enhance the sustainable and economic management of insect pests in the Australian cotton industry. Two key studies of industry attitudes indicate that, over the past 4 years:

- *Integrated Pest Management (IPM) has become widely accepted by growers, consultants, researchers and extension officers in the Australian Cotton Industry.*
- *IPM is viewed by all sectors as the use of a wide range of tools to manage pests as a part of a whole farming system.*
- *The level of adoption of IPM varies between regions.*
- *Area wide management groups are highly valued for their role in enhancing communication and increasing confidence in IPM approaches.*
- *In response to the 1997 study, an IPM training course has been developed specifically for cotton growers to increase knowledge and practical understanding of IPM.*

Discussions with any number of people in the cotton industry will indicate that the move towards Integrated Pest Management (IPM) has been one of the most significant changes in the industry in recent years. As a pest management strategy that utilises a range of tools to achieve economic, environmental and sustainable management of pests, IPM has been essential for an industry facing significant public pressure as well as the need to economically manage pests that were showing an increasing resistance to conventional insecticides.

The use of crop checking and thresholds is an IPM tool that has been used by the industry for many years. Significant effort in research, development, extension and agronomic advice is refining and improving other elements of IPM programs, particularly for the management of insect pests. *With this in mind, how does the industry as a whole view IPM?*

Understanding Industry Attitudes to IPM

Regular evaluation, formally and informally, by the national cotton extension network provides focus for planning research and extension efforts. In addition to this, the Cotton Research and Development Corporation (CRDC) has commissioned specific studies to better understand and record the industry's changing attitudes towards IPM, including:

- Focus Group Assessment of Industry Attitudes towards IPM (Extension Network, 1997 and 2001)
- Qualitative IPM Attitudinal Survey (CCA, 2000 and 2001)

A range of other sources also depict trends in insect management strategies including:

- Cotton Industry Benchmark Survey
- CCA Market Survey
- Cotton Comparative Analysis (BOYCE)
- Benchmarking studies

Focus Group Study

In May 1997 and October 2001, focus groups were run across the industry with groups comprising either consultants, growers, researchers or extension officers. Facilitators (from the cotton extension network, DPI extension and Cotton Australia) interviewed groups in districts away from their normal location to minimise their influence on discussions.

Focus groups gather the range of experiences, views and attitudes within a specified group. They do not provide statistical data but do provide some indication of the weight of opinion relating to particular views and attitudes. By conducting a number of focus groups across all regions, most attitudes can be captured.

Focus groups were undertaken with:

Consultants	Darling Downs; Emerald; Goondiwindi; Lower Namoi
Growers	Darling Downs; Emerald; Goondiwindi; Gunnedah; Gwydir; Lower Namoi; Macquarie; Mungindi; St George
Extension officers	Across the industry X 2
Researchers	Narrabri

Jeff Coutts, Rural Extension Centre, Gatton, trained facilitators in the technique and compiled a summary across the whole industry based on the facilitators' individual reports and debrief.

CCA IPM Survey

The Institute for Rural Futures at the University of New England undertook this survey for Cotton Consultants Australia (Doyle et al, 2001) with funding from CRDC. On the basis of advice from cotton agronomic consultants, it aims to quantify the industry movement towards insect IPM in the cotton industry. The survey was emailed to 173 CCA members with 22% responding.

Quantitative and qualitative information was gathered regarding:

- aphid management,
- endosulfan usage,
- IPM guidelines,
- area wide management groups and
- beneficial management.

Key Findings

The following information is gathered from both the focus group study and the CCA IPM survey.

Understanding and perception of IPM

Integrated pest management has established a wide level of acceptance throughout the cotton industry.

- A high level, broad understanding of IPM principles and practices is evident across all industry sectors.
- The perception of IPM varies between regions.
- IPM was universally viewed as the use of a wide range of tools used in overall farm management (as listed in Table 1).
- The emphasis on different elements of IPM (such as beneficial insects, resistance management strategies, trap crops, damage levels) varied between regions.
- There was particular reference to the need to stay 'soft' as long as possible to avoid getting on the "merry-go-round" of needing to spray.

This represents a significant change from 1997 where there appeared to be a lack of understanding and confidence in IPM systems amongst both growers and consultants. The use of Ingard cotton, and particularly unsprayed refuges, has been regarded as a valuable educational tool in helping to better understand and experience IPM.

Many growers have made a deliberate decision to choose an IPM approach. Most have moved along gradually towards softer and softer approaches each year. Some indicated that their general approach has changed from one of ***"if in doubt spray"*** to ***"if in doubt, don't spray"***.

There is a feeling that the industry is only just starting to really understand and use IPM. ***"Profitability and Sustainability are the key two words. IPM has been bashed around the industry for decades and is something many growers have been playing with but is only coming to the forefront now and hasn't been used to its fullest extent and ability".***

However, in some regions, whilst they felt IPM was the way to go, there was some degree of concern of "being pushed into IPM" by the rest of the industry. High costs and limited option were the key concerns.

Table 1: Range of IPM Tools identified by growers *(*denotes frequent mentions)*

Use of beneficials*
Foodsprays* and oils
Softer chemical options**
Pupae busting**
Trap cropping* – spring and autumn
BT cotton/Ingard*
Pheromone traps
Delaying pyrethroids
Soil biodynamics
Bed renovating
Stubble retention
Rotations
Controlling excess growth in the cotton crop
Green manure crops to improve soil
Refugia crops
Predator/prey ratios
Drift control
Managing resistance
Using more IPM suited insecticides
Economic thresholds
Plant compensation
Larger spraying intervals
Correct spray application
Band spraying
Varietal choices
Control of planting/flowering dates

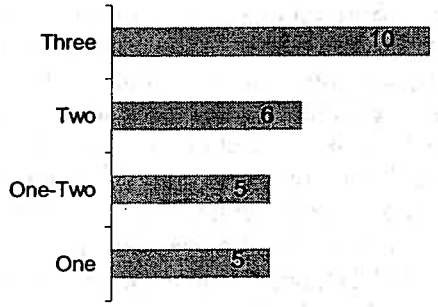
Monitoring

The move towards IPM has increased monitoring requirements with a general trend towards checking three times a week.

Many consultants (over 90% of survey respondents) now monitor beneficial insects and spiders.

A range of visual, de-vac, sweep net, plant shake or beat sheet sampling strategies are used for beneficial monitoring. Some consultants record beneficial insects as individual beneficials, others in the groups "insects and spiders" and some record all species together as one group. The frequency of sampling for beneficial insects is quite variable as indicated in Figure 1. Sampling for beneficials is often restricted to Stage I and II. This data is then used as an overall abundance or as predator : prey ratios for making decisions.

Figure 1: Frequency of beneficial insect sampling per Week
(from a total of 31 responsdents)
Source: CCA Survey



In addition, monitoring of the crop itself has increased with a focus on damage thresholds, fruit retention and fruiting factors.

Decision making

In many cases, making decisions on insect control measures appears to have moved more towards a partnership between grower and consultant. Many growers consider they are more involved in discussing and questioning the need to spray.

"Five years ago if your consultant said jump you'd ask 'how high' – now if your consultant says jump you ask 'why'?"

"The importance of the relationship with the consultant has increased because of the higher cost of chemicals".

Some growers also feel that they ***"rely on consultant to know all new chemicals and we are counting on his knowledge".***

The knowledge and experience of the consultant is highly valued, as is the current experience they bring from other farms. Growers are now more likely to discuss with their consultant the type of approach they wish to take and discuss each spray decision.

However, in some cases the growers tended to feel that the consultant is the prime decision maker about sprays – whilst the consultants considered that the growers are! These views are particularly important in light of the concerns amongst some consultants about potential for litigation if a crop didn't perform due to an IPM approach.

There is a clearly identified need for growers to take ownership of pest management decisions. The focus group study indicates that generally growers are accepting that they are primarily responsible for managing risks on their farm.

Communication

Both grower and consultants valued pre-season meetings as a forum to discuss the type of approach to take to the season.

There was a lot of discussion about the need to minimise impacts on neighbours. It was generally considered that the Endosulfan issues and are wide management groups have caused a significant change in this regard.

Area wide management groups provide a forum for communication between neighbours but there was a concern in some regions that non-cotton neighbours were not involved enough.

Economics

Economic studies of the costs and returns of IPM strategies have been undertaken on the recommendation of the 1997 focus group report which highlighted that the costs of softer options was a limitation to their use.

In 2001, there were highly variable views of the economics of IPM. Some regions expressed concerns about the high cost of softer options. In other regions, it was felt that a "cheap", disruptive chemistry may be the most expensive option by wiping out the beneficial population. Economics is considered to be a strong driver: ***"... if IPM was not affordable then it would not be carried out".***

Benchmarking within grower groups was considered a valuable tool. In the Goondiwindi region they felt that benchmarking had been a particularly valuable tool in the uptake of softer approaches. As a result of this change, the benchmarking exercise was now showing far less variation between farms.

Detailed information on the economics of IPM programs have been analysed in economic research by Ziaul Hoque and Martin Dillon (Dillon and Hoque, 2000) and also in the range of benchmarking activities undertaken with grower groups (eg. Quinn, 2001; Wicks, 2001). The Australian Cotton Comparative Analysis undertaken by BOYCE accountants with sponsorship by CRDC will also provide broader economic information.

There was a feeling in some regions that once a pest threshold is reached, "cheaper, nasty" chemicals are needed to get through to the end of the season: ***'You have to keep your finger on the trigger.'***

Area Wide Management

Area wide management (AWM) groups have established widely throughout the industry in recent years providing a forum for growers and consultants to share information and enhance cooperation within a local area. Overall both growers and consultants are very enthusiastic about these groups in helping to implement IPM.
"Individuals are limited with IPM without AWM"

There were some key factors that were considered by all sectors to aid the success of AWM groups:

- Must be grower driven.
- A key, respected grower willing to lead the group.
- Coordination and support from an independent facilitator (eg IDO)
- Need to actively maintain interest.
- Group size – preference for smaller groups.
- Informality (ie no formal meeting process).
- Difficult issues (eg high aphid pressure) created more interest.
- Both growers and consultants to be involved.

"All consultants need to attend and actively encourage their clients to attend meetings and participate."

One of the key objectives of many groups is to delay use of pyrethroids. Quite a few groups also take a coordinated approach to trap cropping.

The effectiveness of each of these groups was viewed as highly variable by consultants. Some growers have indicated that they are close to giving up on AWM because of the lack of interest amongst other growers in their area in using softer options. There was also frustration about AWM working well until pyrethroids were applied nearby. Others have indicated that AWM can be effective despite these products being used. In other areas, AWM gave a sense of responsibility to neighbours:
"you feel you let the side down if you do something wrong…if you are there by yourself it's a bit easy just to go.. 'it would be good to get 100% kill'."

There was a widespread feeling that to be truly effective, AWM groups need to actively involve other stakeholders, in particular grain growers.

Information Resources

There is a high level of awareness of the IPM guidelines, which are used regularly for reference. Surprisingly, 16% of consultants responding to the CCA survey indicated that they were unaware of the IPM guidelines. Others indicated that they sourced the guidelines through ENTOpak, the Cotton Pest Management guide, mail-out or on request from the Technology Resource Centre, from their IDO, at AWM meetings, the Pocket guide, on the CottonLOGIC CD, or at various industry events.
"…[the IPM guidelines] ***are great stuff, because*** **[they]** ***put this philosophy into words that people can apply to their own situations."***

Information on Beneficial Disruption Index and the effect of products on each group of predators and parasites was regularly referred to. There was a call for regular updates of this information. There was also demand for more understanding of predator ratios and what the abundance of each predator type means in practical terms.

There is a demand for more specific information on IPM in dryland cotton systems, particularly in relation to the ability of dryland plants to compensate.

Many would like to see researchers in the field more often and would like to be more informed on an on-going basis.

Consultants felt that growers needed to take more active responsibility for learning and making IPM decisions. There was support for the IPM training course in helping to achieve this. However, consultants were concerned that growers sometimes learn of a new approach to IPM before they do and felt they needed to be more involved in the "research loop".

Commitment to IPM

The level of interest in and commitment to IPM has clearly changed over recent years.

- In 1997 consultants indicated that growers pressured them to maximise yield and were reluctant to try softer options.
- Today, growers are far more willing to accept a level of damage and many will focus on conserving beneficial insects.
- In some cases, consultants felt that they are driving the IPM, whereas in others growers are the drivers.

There were clearly a range of factors that influenced the interest in IPM – some were driven by economics, others because conventional approaches were no longer considered effective and others from a desire to move towards a more sustainable system.

" Life has improved lots since we don't spray thrips like 15 years ago".

What about a "high pressure" year?

It was felt by some that IPM systems had not as yet been tested in a year with high insect pressure. Concerns were expressed about the level of commitment to IPM if/when high pressure was to be experienced. On the other side of that, some felt that the change in management with IPM is contributing to the lower pressure experienced in recent years.

Potential Issues for the Future

There was expressed a need to be able to measure the effectiveness of various IPM tools, this has been expressed particularly in relation to trap crops.

"...you need to be able to measure what you are doing, and I think that is the biggest problem that we have at the moment is that yes we are doing IPM, but is it working? We are doing trap crops but are we getting anywhere with them...."

IPM was considered by some to encompass weeds and diseases as part of an overall approach. However, IPM in the cotton industry is generally focussed on insect pest management.

Many were interested in how far IPM could be pushed. Some were hoping that in 5 years time there would be no need to spray conventional cotton, others were looking for systems with a maximum of 5 sprays. The release of beneficial insects, currently considered cost prohibitive, was regarded to be a key part of a future system. Secondary pests were considered a significant concern. There is concern that late season options for pest control in an IPM strategy are limited.

There was also an interest in manipulating other elements of the cropping system to grow a crop that is less attractive to insects.

"I really think it is going to go below the ground. We've been looking above the ground all these years and we have only just started learning about [soil health and crop functioning]. ***...if we are putting on pesticides...what are the impacts on the soil?"***

It was recommended that an extension strategy be developed for the release of Bollgard II.

With the high interest in beneficial insects, and also the experiences of 2001/02 where some regions experienced low beneficial numbers despite limited sprays, it would be timely to further explore opportunities to not simply preserve but to enhance and manipulate beneficial insect populations.

Product Usage and IPM

It is interesting to query how far the attitudes to IPM are reflected in the decisions about products choice. The CCA market survey data provides an average volume of product usage per hectare for each season since 1993/94.

Figure 2 shows the market survey data for Conventional cotton with products grouped according to their Beneficial Disruption Index (BDI). This gives some indication of the relative "softness" of programs each year. Unfortunately, data is not available on the number of sprays of each product. This would have a particular influence on how strongly products such as Spinosad (Tracer®) or Indoxacarb (Steward®), both BDI 3 picture in this graph as the volume of usage per spray is far less than would generally be the case for a pyrethroid (BDI 7) or OP (BDI 6). Nonetheless, the data does provide some interesting trends. The high pressure season of 98/99, depicted by the solid black bar in the graph, is clearly reflected in product usage.

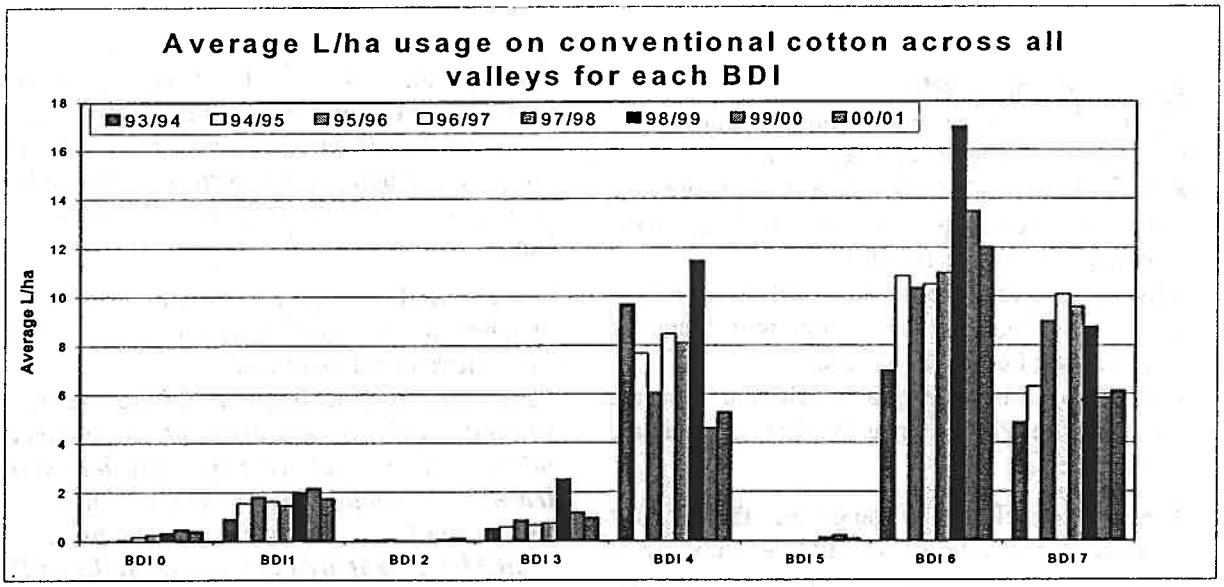


Figure 2: Average product usage per hectare for products grouped according to Beneficial Disruption Index (BDI) 1993/94 to 2000/01 for all valleys for conventional cotton. Analysed from CCA Market Survey Data.

Supporting the Industry through Education and Coordination

Extension

The Australian Cotton CRC's nationally coordinated Cotton Extension Network has Industry Development Officers covering every cotton growing valley in eastern Australia, funded primarily by CRDC. Supporting the uptake of IPM through trials, demonstrations, information resources and coordinating and supporting area wide management groups is a significant focus for the IDOs. Specialised staff in Area Wide Management, Spray Application and Water Use Efficiency roles provide further support and development. Feedback from the evaluations of attitudes towards IPM outlined here will be used to help set priorities for the coming seasons.

IPM Short Course

The IPM Short Course was developed in response to recommendations of the 1997 focus group study which identified the need for greater knowledge, understanding and confidence amongst growers for IPM to be successfully adopted.

The Australian Cotton CRC has developed a national competency based, grower-focused IPM short course. Bill Dalton, who replaced Greg Kauter, coordinates the development and delivery of the course. Timed to suit the cotton production season, the IPM short course moves through 3 phases: pre-season, in-season and post-season as outlined in Table 2.

The 2-day 'information transfer' component in winter, with presentations from researchers and other industry figures, develops the fundamentals of IPM, reviews contemporary research and allows practical experience of IPM. This is followed up by two half-day sessions in the field each at appropriate times with the aim of firming the theory into practice. Finally a ½ day session at the completion of the cotton season acts provides opportunity to review how participants managed their crop, what they have learnt and to apply that to their plans for the future.

Participants receive a resource kit with a comprehensive reference manual (see Table 3), a

Table 2: IPM Short Course Structure

Structure	Duration	Broad Content	Broad Objective
1st Component Winter component Pre-season	**2 days**	Define IPM and establish an understanding of its importance and knowledge of components	Understanding how components of IPM can be utilised in Australian cotton production
2nd Component Summer Field day Early season	**½ day**	Early squaring practical - plant growth, pests, predators and crop management	Knowledge of the role of effective monitoring and confidence in early season IPM practices
3rd Component Summer Field day Late season	**½ day**	Post flowering practical - plant growth, pests, predators and crop management	Knowledge of the role of effective monitoring and confidence in late season IPM practices
4th Component Post –season review	**½ day**	Post season review and evaluation of individual IPM programs	Evaluate the implementation of changes in pest management

course workbook and several handbooks.

In order to refine and target the course, three pilot courses were held in the 2001-02 season – in Trangie, Wee Waa and Dalby. The interaction and feedback from these courses has been extremely positive. Some of these groups have indicated a desire to meet as a group again on a regular basis.

To allow maximum interaction and participation each IPM short course is restricted to no more than 15 participants. The IPM short course will be held in each region this winter at dates and venues arranged with local groups.

The fee for the IPM short course is $250 for growers, farm managers and staff eligible for FarmBis subsidy. An immediate family member can attend the same course for a fee of $50. For those not qualifying for FarmBis, the cost of the course will be $350 with a maximum of two of these positions per course.

Table 3: IPM Short Course Reference Manual Chapter Headings

Chapter	Title	Learning Outcomes
1.	Understanding IPM	Defining the elements and understanding the importance of IPM.
2.	Resistance and IPM	Describing the development, impact and management of insecticide resistance.
3.	Planning, Communication and Recording IPM	Plan and implement short and long-term insect and mite control strategies. Understand the importance of communication in IPM and establish and maintain a record keeping system.
4.	Economics and IPM	Determine the impact on the 'bottom line' from adopting a 'softer' approach to pest management.
5.	Know your Cotton Pest	Identify and understand the life cycle of the major pests of cotton.
6.	Know your Cotton Beneficials	Identify and understand the life cycle of the major predators and parasites of cotton pests.
7.	Know your Cotton Plant	Describe and monitor the development of the cotton plant.
8.	Crop Management and IPM	List and describe the impact of cultural aspects of cotton production on pest management.
9.	Pesticide Selection and IPM	Determine chemicals and biological agents for pest control.
10.	Implementing IPM	Implement an Integrated Pest Management program.

Conclusions

Both of the key evaluations of industry attitudes discussed here support the view that the industry has moved substantially towards IPM approaches in recent years. Whilst IPM poses a riskier and more complex system, growers and consultants are generally highly positive about the benefits it offers.

Current IPM systems have a strong focus on "softer" options and the preservation of beneficial insects. There is perhaps room to further explore the use of other IPM tools.

Grower driven area wide management groups are highly valued for information, communication and social reasons. Groups benefit from the commitment of growers and the support of independent coordinators.

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Thank you

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Also thanks to the Cotton Extension Network, Cotton Australia and DPI Extension staff who conducted and reported on the focus groups and to Jeff Coutts who provided training and drew together the focus group report.

CRDC provide funding for the National Cotton Extension Coordinator and IPM Training Course.

Cotton Conf. 2000

EXTENSION AND PROFITABILITY – IMPLEMENTATION OF PROFITABLE AND SUSTAINABLE APPROACHES

Ingrid Christiansen[1] and the National Cotton Extension Network[2]
Australian Cotton Cooperative Research Centre / Qld DPI, Toowoomba
Australian Cotton CRC / Qld DPI, NSW Agriculture and CSIRO, Emerald to Griffith

Cotton Extension Network – a Resource for the Industry

Distributed across every major cotton growing region, the Australian Cotton CRC's National Extension Network aims to enhance the returns to industry accruing from the implementation of research and development. Industry Development Officers (IDO), District Agronomists, specialist officers in the areas of Water Use Efficiency, Irrigation, Integrated Pest Management (IPM) and Spray Application Technology and a National Coordinator provide a close link between industry and research. In addition to their local role, each member contributes to a national extension effort through one of the Insects, Farming Systems, Environment, Diseases & Weeds or Water focus teams. These teams work closely with researchers and their ACGRA members to ensure that consistent messages are extended across the industry with minimal duplication of effort.

The cotton extension network is not alone in delivering to industry. The decision support group and many researchers, along with numerous industry participants, take an active role in the communication of results to industry. In addition, Cotton Australia's grower services managers play a key role in the implementation of Best Management Practices (BMP) and participation in key issues which impact on industry profitability in the political arena such as water reform.

Information and Confidence to Implement new Technologies

The extension network aims to provide profitable and sustainable outcomes for industry through influencing the awareness of, knowledge of and attitudes towards the adoption of technologies. This is achieved through information transfer (from researchers, consultants and growers), confidence building and demonstration. Using the principles "Tell me and I forget, Show me and I remember, Involve me and I understand", a range of tools are employed by the National Cotton Extension Network to promote profitable and sustainable practices. These can be categorised into five major activity areas: Information Transfer; Trials and Demonstrations; Groups; Benchmarking; and Education. Through each of these is threaded evaluation to ensure that activities are reaching the mark and achieving positive outcomes for industry.

Information Transfer

A wide range of media are utilised to communicate relevant information gathered from research and from the actions of growers and consultants. These include:

INFORMATIONpaks ENTOpak, SPRAYpak, MACHINEpak, SOILpak, NUTRIpak and WEEDpak are a compendium of relevant information on their specific issue for the cotton industry developed by researchers with support from extension teams. Designed as reference manuals they aim to take information from the filing cabinets and brain cells of researchers, consultants and growers to collate it in one, easy to reference source.

Newsletters Regional fax-out or email newsletters such as Cotton Tales and WaterWorks aim to provide timely, concise, locally relevant information to the industry.

Media A host of public media services the cotton industry and is an effective means for raising the awareness of new technologies and regional issues.

Field Days are a widely used forum for observing the results of trials, hearing from researchers and promoting discussion between industry participants. Figure 1 indicates some of the reasons people attend field days. The format of field days varies based on regional preferences and purpose. They range from short farm walks focussed on a single topic to full day bus tours covering a wide range of issues. Regional committees play a strong role in arranging field days.

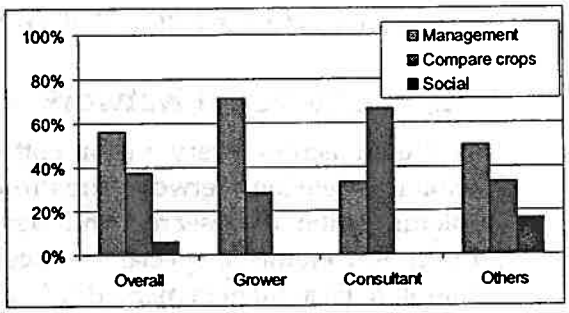

Figure 1: Reasons people attended the 2001 Upper Namoi Field day. 90% of those attending felt the day provided ideas for management changes. *Source: Hickman 2001*

Workshops on specific issues such as spray application technology allow the issue to be discussed and demonstrated in greater detail.

Collation, distribution and interpretation of regional data such as pheromone trap results for timely use through the season.

Web The Cotton CRC website hosts a wide range of information resources and tools such as day degree calculators. Freely accessible, the website has been redesigned to enhance the functions it can offer. Forums and chat rooms will soon be operational. An average of 2 500 web pages are accessed by over 500 visitors per day with web hits increasing following the posting of a CRC e-News.

Computerised Decision Support Decision Support Tools, in particular CottonLOGIC have been developed to aid the accessibility of research information and to make it more readily usable. Further tools such as the OZCOT crop simulation model have been developed initially for research and are being developed as a crop management tool (Carberry and Bange 1998). A water use efficiency calculator is currently under trial and HydroLOGIC, a decision support for irrigation management is under development.

Technology Resource Centre Cotton CRC's Technology Resource Centre acts as a central point for the development and distribution of information resources. It also maintains industry distribution lists and develops the CRC website. It coordinates multiple format delivery such as the IPM guidelines which are available as a CRC Update, in ENTOpak, the Cotton Pest Management Guide, Insect Pocket Guide, CottonLOGIC CD or the Cotton CRC website.

Link with Research The extension team provide a channel to enhance two-way communication between research and industry. This is particularly important with the increasing size and distribution of the industry.

Are the information tools effective?

Several evaluation mechanisms indicate that the information resources delivered to the industry are valued. *"The most advanced agricultural industry when it comes to information transfer from the development corporations."* Information resources are generally regarded to be useful – very useful (Figure 2) and 97% of industry participants indicated that the on-going development of information resources for the industry to be worthwhile (Cotton CRC Extension Network, 2002). CottonTales newsletters are valued as *"a very valuable source of current, valley specific information. Please keep them coming."* 100% of respondents to a survey of the Central Queensland CottonTales indicated they are useful with 63%

ranking them as very useful (Kelly 2001). Similar views are held in the Gwydir valley where 82% indicated that they read every issue *"a fantastic snapshot of relevant issues"* (O'Halloran 2002) and elsewhere in the industry (Figure 2).

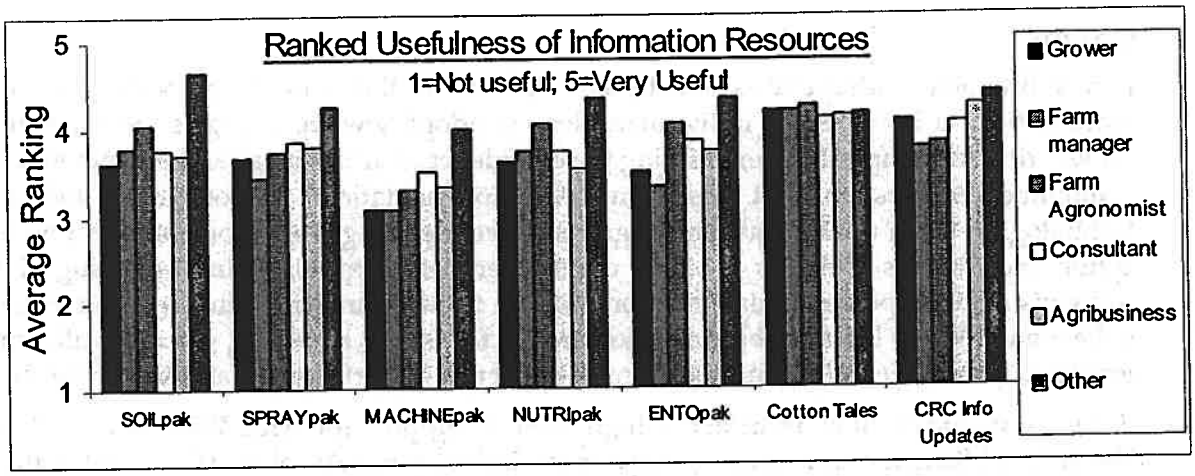

Figure 2: Usefulness of Some of the Information Resources provided to industry.
Source: Cotton Information Resources Survey 2002.

INFORMATIONpaks are utilised predominantly as an easily accessible reference. *"I have always found publications to be very informative and definitely worthwhile. I definitely prefer receiving the information as a comprehensive book that is easy to refer to at a later date."* Finding the time to utilize available resources was a problem raised by many respondents to the recent survey (Cotton Extension Network 2002). To help overcome this problem, IDOs utilize the paks in planning field days, meeting notes and newsletters.

Independent evaluation (van Beek 2000) of CottonLOGIC indicates stakeholders value it for its scientific basis. It is utilised for a range of purposes including: supporting decisions about insect control, recording farm operations, chemical use, insect identification, estimating yields, learning about pest management and informing neighbours. Consultants indicated that the time taken to enter data was one of the main reasons behind not using all the functions of CottonLOGIC, a difficulty that some expect will be overcome with the PalmOS® version. *"CottonLOGIC is a good back-up and verification tool. I would be very upset if it was not regularly upgraded".*

Trials and Demonstrations

Conducting on-farm, regional trials has been a key part of the Cotton Extension effort from the outset. The initial IDO positions were established for the purpose of conducting regional trials to test how the science undertaken at Myall Vale and other regions applied elsewhere in the industry. Trials can be utilised for the purpose of groundtruthing and gathering local data, building confidence in recommendations or techniques, benchmarking and for developing technologies. Trials, and a strong technical base continue to be an important role for the extension team. IDOs conduct nationally coordinated trials to gain information from all regions on priority issues. They also conduct local trials developed in collaboration with growers and consultants. Water Use Efficiency officers undertake a range of benchmarking and developmental trials.

Trial results are communicated to growers and consultants via regional trial books, field days and newsletters. Growers and consultants who collaborate in trials gain even greater benefit. Perhaps one of the most well known examples is the Early Season Damage (Tipping Out) experiments. Coordinated by Lewis Wilson in collaboration with the

Extension Network, these trials rapidly gathered data from all regions and built confidence in the ability of the cotton plant to compensate allowing growers and consultants to more readily implement early season IPM.

Groups

It is well known within circles of extension theory that the more complex the issue, the more difficult it becomes for individuals alone to adopt new technologies. Self directed, grower driven groups assist in building the confidence, sharing ideas and equipment and communicating results that assist in the implementation of both new and old technologies. Area wide management groups have rapidly gained momentum across the cotton industry as growers look to each other for support in implementing IPM. Recognising that pest populations don't know farm boundaries, the communication, debate and shared learning between neighbours facilitated by AWM groups is allowing greater opportunities in the management of insect pests (Christiansen and Dalton 2002).

A range of studies have indicated a high level of support for Area Wide Management, Water Use Efficiency and similar groups in the industry (Coutts et al 2002). Even in those regions where groups are less active there is much enthusiasm and interest in AWM groups. The most effective groups are those that are grower led and driven. The role of Extension in these groups is largely regarded as one of support and coordination. *"Having an IDO in the region makes leading AWM as a grower just so easy."*

Benchmarking

Benchmarking through physical trials or desktop data interrogation allow growers to view themselves on a continuum amongst their peers. Ultimately, profitability is a key driver for changed practices and benchmarking has allowed variations in gross margin returns under different practices to be explored. The Australian Cotton Comparative analysis (Boyce and CRDC 2002) presents the variation in costs of production and profitability across the industry. Further exploring elements of the production cycle allows growers to identify specific means for improvement. Benchmarking also allow the extension network to focus efforts on the elements of the production that show the greatest variability between farms, and therefore can make an impact on profitability.

Insecticide usage comparative analyses comparing gross margins with the beneficial disruption index (BDI) of a spray program (including Hickman 2001: Hoque & Dillon 1998; Quinn 2002; Wicks 2002) have contributed to changes in pest management approaches by demonstrating profitability (Figure 3). The Central Highlands season summary pools data across the region to allow comparison of yields across a range of characteristics including soil type, variety, district and planting time (Kelly 2002).

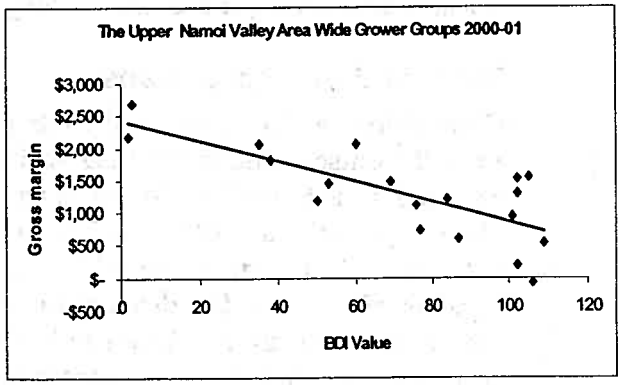

Figure 3 BDI /Gross Margin analysis of spray program of farms in area wide groups in the Upper Namoi including Ingard and conventional fields. *Source: Hickman 2001.*

Last season, the Qld Rural Water Use Efficiency group conducted 29 on-farm water use efficiency trials in collaboration with growers. These participatory trials have allowed growers to assess the efficiency of their irrigation practices relative to others in their region (Hood 2002) and have identified significant variability between farms. BMP

provides another format for growers to rank their practices in terms of sustainability, safety and community.

Education

Cotton is a particularly knowledge demanding crop to cultivate. As such, the development of a strong skills base for industry is crucial.

Cotton Production Course

This university certificate course aims to provide scientific and practical skills that promote sustainable and profitable cotton production. It is targeted to enhance the skills of people already in the industry and for those entering the industry in the future. Students who have completed the course have all indicated that it is useful to their work and 93% consider it to be a valuable training role for the industry (Roth, 2002).

IPM Short Course

A key recommendation of a focus group study conducted in 1997 was the need to provide training to assist cotton growers understand IPM systems and to increase their confidence in insect management decision making. In response, the Cotton CRC has developed a national competency standard IPM Short Course specifically for cotton growers. A pre-season, 2-day 'information transfer' component develops the fundamentals of IPM, reviews contemporary research and provides hands-on experience. Early and late season field sessions firm the theory into practice. Finally, a ½ day post-season allows participants to review how they managed their crop, what they have learnt and incorporate that into their plans for the future. Restricting enrolments to a maximum 15 participants per course allows it to be very interactive. The three pilot groups have indicated a desire to meet again on a regular basis.

Participants receive a resource kit with a comprehensive reference manual, a course workbook and several handbooks. The feedback from participants in the three pilot courses held in the 2001-02 season has been greatly appreciated and has refined the course. The IPM short course is now offered in all valleys on demand through discussion with IDOs. *"I think the course was the single most important thing I have done to improve my farming practices in the 30+ years I have been in business."*

Is Extension Delivering Profitability and Sustainability?

With the significant investment made in extension, it is worthwhile asking whether the program is delivering outcomes for the industry. With this in mind, and for the sake of on-going improvement, the extension network regularly conduct evaluation of their activities and maintain close contact with industry groups to set priorities.

Focussing on key priorities for the local industry

Close contact with industry is a key element of the mode in which the extension network operates. Regular participation in local meetings, events and forums along with individual contact allows the extension officers to keep in touch with local issues and give feedback to research programs. Industry reference groups operate for the Industry Development Officers, Queensland Rural Water Use Efficiency Officers, Decision Support Program, IPM Training Course and during the development stage of the Cotton Production Course. In some cases these are independent groups, in others the already active technical committees of the Cotton Growers' Associations take on the role. These groups provide a forum for growers and consultants to provide direction and priorities

for the extension effort – growers and consultants are encouraged to actively contribute. They also provide a forum for support and bouncing of ideas for the extension officer.

The National Extension Network allows extension officers to draw on knowledge and experience from other regions. It also allows key national priorities to be addressed. A key example of this has been the *"Come Clean – Go Clean"* farm hygiene message that has been promoted uniformally across all regions (regardless of whether or not Fusarium Wilt was highlighted as a priority at a regional level) by the extension team under the leadership of the Diseases Focus Team. The recent review undertaken by Pat Colyer (CRDC 2002) indicates that the adoption of farm hygiene practices has significantly slowed the spread of this disease. Whilst it is recognised that management approaches need be the focus for the longer term, the profitability returns from slowing the spread of Fusarium wilt, even if only for a few years, are substantial.

Along with industry, State and Federal governments are key contributors to research funding. Greater focus on sustainable natural resource management in a broader sense is likely to be required in the future to meet the objectives of this group.

Meeting Core Outcomes

The key outcome from CRDC's research investment, identified by industry and government is: "A more sustainable, competitive and profitable cotton industry providing increased economic, environmental and social benefits to regional communities and the nation". Table 1 lists the strategies developed as a part of CRDC's strategic planning process together with a few examples of extension activities addressing these priorities.

Table 1: Core strategies of CRDC and some examples of related extension activities.

Strategy	Example of some Extension and Research activity
Improve chemical and non-chemical management of insects	▪ Support for Area Wide Management Groups ▪ Early season damage trials
Improve chemical and non-chemical management of diseases and weeds.	▪ Farm hygiene – *Come Clean – Go Clean* ▪ WEEDpak
Environmental management systems encompassing relevant catchment management strategies	▪ Water Use Efficiency trials and extension
Improve farm management strategies	▪ Rotation options and impacts ▪ NUTRIpak ▪ Herbicide drift damage trials
Improve potential for returns throughout the production chain and assist in development of market opportunities	▪ Fibre quality trials and communication of information – Neps, Micronaire
Assess economic, environmental and social impacts on regional communities and the nation; identify and develop appropriate involvement opportunities.	▪ Community education – including school visits and public events.
Involve industry personnel in regional adaptation of research and effectively transfer new techniques, strategies and discoveries	▪ Key focus of all extension activities - Information transfer, Reference groups, AWM groups, WUE groups, Regional trials ▪ Computerised Decision Support tools
Develop and engage creative, innovative and highly trained human resources	▪ Cotton Production Course ▪ IPM Short Course ▪ Trainee Industry Development Officers

Industry Attitudes Towards IPM

As insect pest management is such a significant focus for the industry, focus group studies conducted by the extension team in 1997 and 2001 have been complemented by independent surveys to assess industry attitudes towards IPM (Christiansen and Dalton, 2002). Key conclusions are that IPM has established a wide level of acceptance

throughout the cotton industry with a high level, broad understanding of IPM principles and practices was evident across all industry sectors (Coutts et al 2002). This represents a significant change from 1997 where there appeared to be a lack of understanding and confidence in IPM systems amongst both growers and consultants.

Benchmarking practices

A industry benchmark survey conducted in 1996/97 and 1999/2000 by the cotton extension network allows a comparison of industry practices over time. Some key changes over that period are: General increase to more cotton and less rotation; Increasing Nitrogen (N) usage; Increasing use of N fixing crops in rotations; Increased use of K fertiliser on some farms; 78% practicing farm hygiene for disease control and an Increased usage of CottonLOGIC (McIntyre, et al 2002). This survey allows the extension network to assess change over time and to focus extension activities.

Key Changes in Information Transfer in the Future

As in all other facets of the community, information transfer technologies will continue to evolve and most likely be adopted at a rate far exceeding expectations. For example, in the month December 2001 Telstra customers sent 81 million Short Message Service (SMS) messages with a continuing uptake of 8-9% per month. Thinking beyond our current square is crucial to ensure we meet the needs of tomorrow's industry. Development of decision support software for the Palm hand held computers has perhaps been regarded by some in the industry as too advanced – perhaps this is a similar vein to the former CEO of IBM now famous for once predicting that there would only ever be a market for 3 computers worldwide!

We can expect communication technologies to be more readily accessible, utilised for a range of purposes and extend into the field. Results of a recent survey by the Extension Network indicate that 90.8% of industry participants currently have access to the internet. Of these, 95% utilise the internet at least weekly (Figure 4). Electronic media will move from paper-based formats pasted on the web to highly interactive formats – utilising the capacity of the technology.

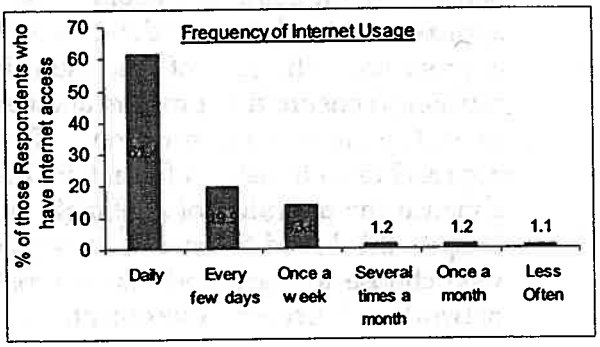

Figure 4: Frequency of internet usage amongst the 90.8% of industry participants who have internet access.
Source: Cotton Information Resources Survey 2002

However, the bombardment of information "clutter" in a range of formats is also likely to increase. The challenge for the extension effort is to provide information resources in a short, sharp format that is timely, relevant and useful. People contact will perhaps increase in importance as growers look to each other for support in finding practical application for all the information being received.

True area wide management may be the only profitable means to achieve management of pest populations – requiring increased communication between neighbours. Some AWM groups are already developing websites for communication within their group. There is a strong interest in returning to centralised databases to follow daily pest pressure within some regions. Whilst futurists may envisage communication relying on advanced

telecommunications, it's unlikely that the social aspects of communication and the desire to "have a beer together" will to be entirely superseded by technology.

Challenges

"I nearly lost control of a field [and so chose to take a new approach]*...I have learnt more in the last 3 years than the previous twenty."* This statement captures the concept that until someone chooses to take a new approach it is difficult to implement new ideas. A challenge for the extension network is in keeping ahead of the needs of the progressive, innovative sector of the industry whilst also working to encourage those less actively participating.

Extension activities aim to target the whole industry – with a range of trials and information activities for those who are interested in learning more, through to awareness level activities for those less interested. Groups assist with this process as many of those less active in seeking new technologies are often attracted to the informal, local and social nature of their meetings. They also provide a support for sharing of ideas and equipment needed to implement new ideas.

The turnover of industry participants also poses a significant challenge. It is necessary to constantly reinforce messages and repeat activities as many new agronomists and growers are entering the industry all the time. The cotton production course and IPM short course contribute towards developing the skills and confidence of new players. AWM and WUE groups assist in helping all participants to learn from each other's experience.

Optimising on-going profitability and sustainability at a farm level requires a long term approach taking into consideration each farm's specific set of circumstances, attitudes and approaches. The role of extension lies in facilitating communication and information transfer to ensure that growers and consultants are in the best position to make decisions to suit their unique situation. The Cotton Extension network utilises a range of approaches to transfer information, build the confidence and facilitate communication to enhance the adoption of profitable and sustainable practices across the entire industry. Despite this broad focus, it is those people who are open to and actively seek new ideas, who choose to learn and take the risks that will gain most benefit from the extension network and research investment.

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Background Abstract

The Australian Cotton CRC's National Extension Network aims to enhance the returns to industry accruing from the implementation of research and development. Industry Development Officers, District Agronomists and specialist officers in the areas of Water Use Efficiency and Irrigation, Integrated Pest Management (IPM) and Spray Application Technology provide a close link between industry and research. National extension focus teams work closely with researchers and their ACGRA members to ensure that consistent messages are extended across the industry with minimal duplication of effort.

The extension network aims to provide profitable and sustainable outcomes for industry through influencing the awareness of, knowledge of, confidence in and attitudes towards the adoption of technologies. For this purpose extension activities cover a range of approaches in the areas of:

- Information Transfer – including newsletters, media, field days, farm walks, computerised decision support;
- Trials and Demonstrations – ground-truthing, generating local data, confidence building, nationally coordinated or locally developed;
- Groups – Area Wide Management, Water Use Efficiency;
- Benchmarking – including on-farm benchmarking trials, economic comparative analyses, regional season review.
- Education – IPM Short Course, Cotton Production Course.

Close linkages with industry through reference groups, local activities and a range of forums as well as being a part of a national network allows the extension group to be responsive to local industry needs as well as meeting key national priorities for the industry.

On-going evaluation at several levels helps to ensure that extension activities are reaching the mark and achieving positive outcomes for industry profitability and sustainability.

Cotton Conf 2002

UNDERSTANDING IPM – INDUSTRY ATTITUDES, PRACTICES AND EDUCATION

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Australian Cotton CRC and Qld Department of Primary Industries, [1]Toowoomba and [2]Goondiwindi

Discussions with any number of people in the cotton industry will indicate that the move towards Integrated Pest Management (IPM) has been one of the most significant changes in the industry in recent years. As a pest management strategy that utilises a range of tools to achieve economic, environmental and sustainable management of pests, IPM has been essential for an industry facing significant public pressure as well as the need to economically manage pests that have shown an increasing resistance to conventional insecticides.

The use of crop checking and thresholds is an IPM tool that has been used by the industry for many years. Significant effort in research, development, extension and agronomic advice is refining and improving other elements of IPM programs, particularly for the management of insect pests. With this in mind, how does the industry as a whole view IPM?

Understanding Industry Attitudes to IPM

Regular evaluation, formally and informally, by the national cotton extension network provides focus for planning research and extension efforts. In addition to this, the Cotton Research and Development Corporation (CRDC) has commissioned specific studies to better understand and record the industry's changing attitudes towards IPM, including a Focus Group Assessment of Industry Attitudes towards IPM (Cotton Extension Network, 1997 and 2001) and a Qualitative IPM Attitudinal Survey (CCA, 2000 and 2001). A range of other sources also depict trends in insect management strategies including the Cotton Industry Benchmark Survey, CCA Market Survey, Cotton Comparative Analysis (BOYCE) and Benchmarking studies.

Focus Group Study

In May 1997 and October 2001, focus groups were run across the industry with groups comprising either consultants, growers, researchers or extension officers. Facilitators (from the cotton extension network, DPI extension and Cotton Australia) interviewed groups in districts away from their normal location to minimise their influence on discussions. Focus groups gather the range of experiences, views and attitudes within a specified group. They do not provide statistical data but do provide

some indication of the weight of opinion relating to particular views and attitudes. Conducting a number of focus groups across all regions can capture most attitudes.

Focus groups were undertaken with:

Consultants	Darling Downs; Emerald; Goondiwindi; Lower Namoi
Growers	Darling Downs; Emerald; Goondiwindi; Gunnedah; Gwydir; Lower Namoi; Macquarie; Mungindi; St George
Extension officers	Across the industry X 2
Researchers	Narrabri

CCA IPM Survey

Quantitative and qualitative information was gathered regarding aphid management, endosulfan usage, IPM guidelines, area wide management groups and beneficial management. In a survey undertaken by the Institute for Rural Futures at the University of New England with Cotton Consultants Australia (Doyle et al, 2001) on behalf of CRDC. On the basis of advice from cotton agronomic consultants, it aims to quantify the industry movement towards insect IPM in the cotton industry. The survey was emailed to 173 CCA members with 22% responding.

Key Findings

The following information gathers findings of both the focus group study and the CCA IPM survey.

Understanding and perception of IPM

Integrated pest management has established a wide level of acceptance throughout the cotton industry with the 2002 studies indicating:

- A high level, broad understanding of IPM principles and practices is evident across all industry sectors.
- The perception of IPM varies between regions.
- IPM was universally viewed as the use of a wide range of tools used in overall farm management.
- The emphasis on different elements of IPM (such as beneficial insects, resistance management strategies, trap crops, damage levels) varied between regions.
- There was particular reference to the need to stay 'soft' as long as possible to avoid getting on the "merry-go-round" of needing to spray.

This represents a significant change from 1997 where there appeared to be a lack of understanding and confidence in IPM systems amongst both growers and consultants. Many growers have made a deliberate decision to choose an IPM approach, generally moving gradually towards softer and softer approaches each year. Some growers indicated that their general approach has changed from one of ***"if in doubt spray"*** to ***"if in doubt, don't spray"***. The use of Ingard cotton, and particularly unsprayed

refuges, has been regarded as a valuable educational tool in helping to better understand and experience IPM.

There is a feeling that the industry is only just starting to really understand and use IPM. ***"Profitability and Sustainability are the key two words. IPM has been bashed around the industry for decades and is something many growers have been playing with but is only coming to the forefront now and hasn't been used to its fullest extent and ability".*** In some regions, whilst IPM was consider the way forward, there was some degree of concern of "being pushed into IPM" by the rest of the industry.

Monitoring

The move towards IPM has increased monitoring requirements with a general trend towards checking three times a week. Many consultants (over 90% of survey respondents) now monitor beneficial insects and spiders. A range of visual, de-vac, sweep net, plant shake or beat sheet sampling strategies are used for beneficial monitoring. Some consultants record beneficial insects as individual beneficials, others in the groups "insects and spiders" and some record all species together as one group. The frequency of sampling for beneficial insects is quite variable as indicated in Figure 1. Sampling for beneficials is often restricted to Stage I and II. This data is then used as an overall abundance or as predator:prey ratios for making decisions. In addition, monitoring of the crop itself has increased with a focus on damage thresholds, fruit retention and fruiting factors.

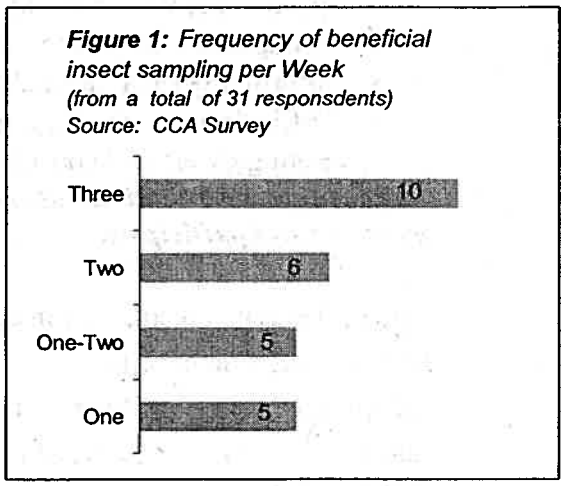

Figure 1: *Frequency of beneficial insect sampling per Week (from a total of 31 responsdents) Source: CCA Survey*

Decision making

In many cases, making decisions on insect control measures appears to have moved more towards a partnership between grower and consultant. Many growers consider they are more involved in discussing and questioning the need to spray.

"Five years ago if your consultant said jump you'd ask 'how high' – now if your consultant says jump you ask 'why'?"

"The importance of the relationship with the consultant has increased because of the higher cost of chemicals".

There is a clearly identified need for growers to take ownership of pest management decisions. The focus group study indicates that generally growers are accepting that they are primarily responsible for managing risks on their farm.

Communication

Both growers and consultants valued pre-season meetings as a forum to discuss the type of approach to take to the season. It was generally considered that the Endosulfan issues, BMP and area wide management groups have done much to minimise impacts on neighbours.

Area wide management (AWM) groups have established widely throughout the industry in recent years providing a forum for growers and consultants to share information and enhance cooperation within a local area. Overall both growers and consultants are very enthusiastic about these groups in helping to implement IPM.
"Individuals are limited with IPM without AWM"

Some key factors were considered to aid the success of AWM groups:

- Must be grower driven.
- A key, respected grower willing to lead the group.
- Coordination and support from an independent facilitator (eg IDO)
- Need to actively maintain interest.
- Group size – preference for smaller groups.
- Informality (ie no formal meeting process).
- Difficult issues (eg high aphid pressure) created more interest.
- Both growers and consultants to be involved.

"All consultants need to attend and actively encourage their clients to attend meetings and participate."

One of the key objectives of many groups is to delay use of pyrethroids. Several also take a coordinated approach to trap cropping. The effectiveness of each of these groups was viewed as highly variable by consultants. Some growers have indicated that they are close to giving up on AWM because of the lack of interest amongst other growers in their area. There was also frustration about AWM working well only until pyrethroids were applied nearby. Others have indicated that AWM can be effective despite these products being used. AWM was considered to give a sense of responsibility to neighbours: ***"you feel you let the side down if you do something wrong…if you are there by yourself it's a bit easy just to go.. 'it would be good to get 100% kill'."***

There was a widespread feeling that to be truly effective, AWM groups need to actively involve other stakeholders, in particular grain growers.

Economics

Detailed economic studies, undertaken on the recommendation of the 1997 focus group study, indicate that softer approaches can in fact enhance or at least maintain profitability (Dillon and Hoque, 2000; Quinn, 2001; Wicks, 2001).

In 2001, there were highly variable views of the economics of IPM. Some regions expressed concerns about the high cost of softer options. In other regions, it was felt that a "cheap", disruptive chemistry may be the most expensive option by wiping out the beneficial population. Benchmarking within grower groups had been a particularly valuable tool in the uptake of softer approaches in some regions. As a result of the benchmarking exercise, farms have moved towards similar approaches.

There was a feeling in some regions that once a pest threshold is reached, "cheaper, nasty" chemicals are needed to get through to the end of the season: ***'You have to keep your finger on the trigger.'***

Information Resources

There is a high level of awareness of the IPM guidelines, which are used regularly for reference. Surprisingly, 16% of consultants responding to the CCA survey indicated that they were unaware of the IPM guidelines. Perhaps due to a confusion as to their identity as others indicated that they sourced the guidelines through ENTOpak, the Cotton Pest Management guide, mail-out or on request from the Technology Resource Centre, from their IDO, at AWM meetings, the Pocket guide, on the CottonLOGIC CD, or at various industry events. ***"...*[the IPM guidelines]** *are great stuff, because* **[they]** ***put this philosophy into words that people can apply to their own situations."***

Information on the Beneficial Disruption Index and the effect of products on each group of predators and parasites was valued. There was also demand for more understanding of predator ratios and what the abundance of each predator type means in practical terms.

Commitment to IPM

The level of interest in and commitment to IPM has clearly changed over recent years. In 1997 consultants indicated that growers pressured them to maximise yield and were reluctant to try softer options. Today, growers are far more willing to accept a level of damage and many will focus on conserving beneficial insects. Some felt that IPM systems had not as yet been tested in a year with high insect pressure. Concerns were expressed about the level of commitment to IPM if or when high insect pressure was to be experienced. Alternately, some felt that the change in management with IPM is contributing to the lower pressure experienced.

There were clearly a range of factors that influenced the interest in IPM – some were driven by economics, others because conventional approaches were no longer

considered effective and others from a desire to move towards a more sustainable system. ***" Life has improved lots since we don't spray thrips like 15 years ago".***

Potential Issues for the Future

There was an identified need to measure the effectiveness of various IPM tools, particularly in relation to trap crops. ***"...you need to be able to measure what you are doing, and I think that is the biggest problem that we have at the moment is that yes we are doing IPM, but is it working? We are doing trap crops but are we getting anywhere with them...."***

There is significant interest in how far IPM could be pushed. Some were hoping that in 5 years time there would be no need to spray conventional cotton, others were looking for systems with a maximum of 5 sprays. Opportunities exist to not simply preserve but to enhance and manipulate beneficial insect populations. The release of beneficial insects, currently considered cost prohibitive, may be a key part of a future system. Secondary pests were a significant concern and late season options in an IPM strategy considered limited.

There was also an interest in manipulating other elements of the cropping system to grow a crop that is less attractive to insects and encompassing weeds and diseases as a part of an overall approach. ***"I really think it is going to go below the ground. We've been looking above the ground all these years and we have only just started learning about*** **[soil health and crop functioning].** ***...if we are putting on pesticides...what are the impacts on the soil?"***

Supporting the Industry through Education and Coordination

Extension

Supporting the uptake of IPM through trials, demonstrations, information resources and coordinating and supporting area wide management groups is a significant focus for Australian Cotton CRC's National Extension Network. Feedback from the evaluations of attitudes towards IPM outlined here will be used to help set priorities for the coming seasons.

IPM Short Course

The IPM Short Course was developed in response to recommendations of the 1997 focus group study which identified the need for greater knowledge, understanding and confidence amongst growers for IPM to be successfully adopted. The Australian Cotton CRC has developed a national competency based, grower-focused IPM short

course. Timed to suit the cotton production season, the IPM short course moves through 3 phases: pre-season, in-season and post-season (Table 1).

Table 1: IPM Short Course Structure

Structure	Duration	Broad Content	Broad Objective
1st Component Winter component Pre-season	**2 days**	Define IPM and establish an understanding of its importance and knowledge of components	Understanding how components of IPM can be utilised in Australian cotton production
2nd Component Summer Field day Early season	**½ay**	Early squaring practical - plant growth, pests, predators and crop management	Knowledge of the role of effective monitoring and confidence in early season IPM practices
3rd Component Summer Field day Late season	**½ day**	Post flowering practical - plant growth, pests, predators and crop management	Knowledge of the role of effective monitoring and confidence in late season IPM practices
4th Component Post –season review	**½ day**	Post season review and evaluation of individual IPM programs	Evaluate the implementation of changes in pest management

The 2-day 'information transfer' component in winter, with presentations from researchers and other industry figures, develops the fundamentals of IPM, reviews contemporary research and allows practical experience of IPM. This is followed up by two half-day sessions in the field each at appropriate times with the aim of firming the theory into practice. Finally a ½ day session at the completion of the cotton season acts provides opportunity to review how participants managed their crop, what they have learnt and to apply that to their plans for the future. Some groups who have completed the course have indicated a desire to meet again on a regular basis.

Participants receive a resource kit with a comprehensive reference manual, a course workbook and several handbooks. In order to refine and target the course, three pilot courses were held in the 2001-02 season – in Trangie, Wee Waa and Dalby. To allow maximum interaction and participation each IPM short course is restricted to no more than 15 participants. The IPM short course will be held in each region this winter at dates and venues arranged with local groups. Course costs are subsidised by FarmBIS.

"Great learning experience that I hope to pass on to my staff and other members of our area wide management group"

Conclusions

Two key evaluations of industry attitudes towards IPM indicate that the industry has moved substantially towards IPM approaches in recent years. Whilst IPM poses a riskier and more complex system, growers and consultants are generally highly

positive about the benefits it offers. Current IPM systems have a strong focus on "softer" options and the preservation of beneficial insects. There is perhaps room to further explore the use of other IPM tools.

Information, education and communication are crucial for the adoption of IPM. Grower driven area wide management groups have an important role to play and are highly valued for information, communication and social reasons. Groups benefit from the commitment of growers and the support of independent coordinators. Along with AWM groups, the IPM short course assist with providing growers with the information and confidence to play a more active role in IPM decision making.

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Thank you

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WCRC

Extension In The Australian Cotton Industry – A Team Approach.

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Abstract

A cohesive, well-focussed and coordinated extension team has been established in the Australian cotton industry. It has involved the state government departments of agriculture in New South Wales and Queensland, the Cotton Research and Development Corporation (CRDC) and the growers through the Australian Cotton Growers Research Association (ACGRA) in a strong industry partnership under the leadership of the Cotton Cooperative Research Centres.

The national extension team is based on and has emerged from the original extension services delivered by the two state departments – NSW Agriculture and Queensland Department of Primary Industries. Until 1990, there were several extension officers in each department with extension responsibilities to the cotton and grain industries in the cotton production regions of Australia. There was informal cooperation between the extension officers in each department. At that time the industry funded two new extension positions.

The Cooperative Research Centre for Sustainable Cotton Production (CRCSCP) that was established in 1993 included an Education and Technology Transfer Program. This program provided for the formation of a team of extension officers in both departments and two new additional extension positions. The CRC program ensured a formal cooperation of extension replacing the earlier informal collaboration that had developed over many years.

Today the Australian Cotton Cooperative Research Centre's (Cotton CRC) extension team consists of some 38 professional staff with 5 national focus teams that target key extension priorities led by a National Cotton Extension Coordinator. Extension methodology has progressed from a linear transfer of technology from research to grower to a model of participative action learning in which growers, extension staff and researchers learn together. The program also includes government subsidised, grower focused accredited training in aspects of cotton production such as Integrated Pest Management (IPM).

This paper describes the successful development of the current comprehensive extension team under the leadership of the Cotton CRC and the CRDC. Its development was greatly enhanced following an external review of cotton extension in 1995 conducted by James Supak of Texas A&M University and Allan Williams and Bruce Finney of ACGRA coordinated by David Hamilton, a CRDC Board Director at the time.

Introduction

The utilisation and application of research is vitally important to the sustainability of the cotton industry and is an integral part of the Cotton CRC objectives. The commercial benefit of the research flows to the growers, the region and to Australia through increased productivity and fibre quality; regional development; sustaining the resource base and the environment; reduction in the use of pesticides; and increased export earnings.

Under the leadership of the Cotton Cooperative Research Centres, a cohesive, well-focussed and coordinated extension team has been established in the Australian cotton industry. It has involved the state government departments of agriculture - New South Wales Agriculture (NSW Agriculture) and Department of Primary Industries Queensland (DPIQ), the Cotton Research and Development Corporation (CRDC) and the growers through the Australian Cotton Growers Research Association (ACGRA) in a strong industry partnership.

The national extension team has emerged from the original extension services delivered by the two state departments – NSW Agriculture and DPIQ. Until 1990, there were several extension officers in each department with extension responsibilities to the cotton and grain industries in the cotton production regions of Australia. Each department worked independently, without a national focus or direction and with only direct grower involvement at the local level. However, informal cooperation was established between the extension officers in each department during the mid seventies when a series of annual workshops for cotton research and extension officers were initiated. The workshops involved officers from CSIRO, NSW Agriculture, DPIQ and the University of Queensland.

At that time the CRDC funded two new extension positions complementing the existing extension officers with major cotton industry responsibilities in NSW Agriculture and DPIQ.

The Cooperative Research Centre for Sustainable Cotton Production (CRCSCP) that was established in 1993 included an Education and Technology Transfer Program. This program provided an excellent foundation for the formation of a coordinated team of extension officers in both departments. The CRCSCP program provided funding for two new extension positions and ensured a formal cooperation of extension replacing the earlier informal collaboration that had developed over many years.

The development of the extension team was further enhanced following a review of cotton extension in 1995 commissioned by the CRCSCP and CRDC. It was conducted by James Supak of Texas A&M University and Allan Williams and Bruce Finney of ACGRA and coordinated by David Hamilton from DPIQ, a CRDC Board Director at the time. It involved visits to all cotton producing regions to conduct consultation with growers and key groups associated with extension services in the industry.

The review found that the extension officer positions, largely funded by industry and administered by state government departments, played a key role in the process of adoption of improved practices within the industry.

This was largely due to their on-farm validation work and the coordination of activities and information across districts. The role was synergistic and complementary to the consultants working in the industry.

The review recommended that:

- Support for these positions be continued;
- New funding mechanisms be explored;
- A cotton extension specialist be appointed to coordinate extension efforts aimed at national priorities and, in particular, integrated pest management approaches;
- An industry wide protocol be developed to ensure that the CRC Technology Resource Centre (TRC) can develop its role of information support to the industry.

Subsequent to the review, the Cotton CRC and CRDC have funded the establishment of extension positions in every major cotton growing region and a National Cotton Extension Coordinator. In 1997, a focus group analysis of Industry Attitudes towards Integrated Pest Management (IPM) in the Cotton Industry (Coutts, 1997) identified a need for clearer information on IPM in cotton systems and training for growers. In response to this, CRDC has supported the development of an accredited Short Course in IPM (Dalton *et al* 2003). A full time training coordinator has been employed to develop and deliver this course.

Today the extension team consists of some 38 professional staff with a core group of extension officers are now referred to as Industry Development Officers (IDOs). Water use efficiency officers, specialists in areas such as IPM and spray application and the departments' farming systems extension officers, complement their roles. Each member of the extension network contributes to a focus team in Insect Management, Disease & Weeds, Environment, Farming Systems or Water to target key national extension priorities which are identified in collaboration with the extension network and the grower chair of the corresponding ACGRA committee.

The wider extension team work closely with the Technology Resource Centre, CRDC, Cotton Australia, Cotton Consultants Association and the private seed companies, Cotton Seed Distributors and Deltapine Australia.

Extension Approaches

The objective of the program is to enhance the benefits accruing from research and development through the provision of a coordinated national extension service to the Australian cotton industry. The program strives to use modern techniques and delivery systems and work in partnership with growers and consultants to demonstrate, adapt and adopt new technology by:

- Expanding and enhancing the national cotton extension service within the industry;
- Promoting on-farm demonstrations and field trials with strong grower and consultant participation;
- Acting as a conduit of information to industry;
- Supporting grower based Integrated Pest Management (IPM) and Area Wide Management (AWM) support groups;

- Examining social barriers to technology adoption.

Through a process of continuous improvement extension methodology has progressed from a linear transfer of technology from research to grower to a model of participative action learning in which growers, extension staff and researchers learn together (Figure 1).

Extension programs employ both technology transfer and participative learning approaches, tailored to suit the issue and the local dynamics. They include extension activities in the broad areas of:

- *Information Delivery* - Regular "Cottontales" Newsletters (fax or email), media, Information Updates, Field Days, Seminars, Cotton CRC Website. The IDOs have contributed to and promote the SOILpak, NUTRIpak, WEEDpak, ENTOpak and Integrated Disease Management publications that, along with MACHINEpak, provide a comprehensive, valued reference resource for the industry. Water extension staff will be involved in the development of WATERpak in the next year;
- *Groups* – the extension network supports communication and learning groups of growers and consultants.. Grower driven Area Wide Management groups have initially focussed on insect management but are now focussing on many other farming system challenges;
- *Benchmarking* – Physical trials and financial/management choice comparative analyses allow growers to view their practices on a continuum with their peers. This has been particularly important in building confidence in IPM systems;
- *Trials and Demonstrations* - Initially the core focus of the Industry Development Officer roles, trials provide local data, build confidence in recommendations and are a focus for some groups. Regional trial books publish both research and grower trials;
- *Computer Based Decision Support Systems* developed by the Cotton CRC and CSIRO to assist with decision making and record keeping are another extension tool supported by the team;
- *Education* - The program includes a government subsidised, grower focused accredited training in Integrated Pest Management (IPM). It is complemented by the Cotton CRC's higher level course in Cotton Production offered through the University of New England;
- *Evaluation* is threaded through the extension programs to assist with on-going improvement, priority setting and to identify outcomes of the extension effort.

This range of activities are planned to be complementary to achieve overall objectives.

Effective extension programs are being, and will continue to be developed to communicate research findings to individual cotton growers and to industry.

The National Cotton Extension Network

The extension and adoption process established by the CRC Sustainable Cotton Production continues, under the Cotton CRC to provide for the development and coordination of the extension team including extension officers in NSW Agriculture, DPIQ and CRDC. It has a national focus on major industry issues and a prioritised list of regional problems. The Cotton CRC funds two officers in the extension team and provides the leadership and coordination of a team.

The CRC Cotton Extension Coordinating Committee comprising of representatives from New South Wales Agriculture (NSWAg), Department of Primary Industries Queensland (DPIQ), Cotton Research and Development Corporation (CRDC), Cotton CRC and the Australian Cotton Growers Research Association (ACGRA) provides leadership of the extension team.

The National Cotton Extension Coordinator has ensured a coordinated focus on national extension priorities and the development and implementation of the most effective delivery methods. The development of extension skills in the team and the establishment of industry wide linkages are key objectives for the coordinator. Evaluation of activities and outcomes has been increased to assist with on-going improvement and for staff to identify the relative value of different activities.

The establishment of two, CRDC funded trainee Industry Development Officer positions provides the opportunity for extension staff to develop skills in the team and work closely with a senior extension officer before taking on the responsibilities of a region. The trainee positions have been particularly beneficial in allowing the flexibility within the program to ensure continuity of service following resignation of staff or whilst staff have taken maternity leave. The immediate extension team now includes:

- Twelve IDOs including the two trainees and seven Water Use Efficiency extension officers located strategically throughout the industry;
- One Extension Technical Officer;
- Five farming systems extension officers and five irrigation extension officers in NSW Agriculture and DPIQ who contribute part of their time to cotton industry extension activities;
- Two spray application development extension officers;
- The IPM Training Coordinator in DPIQ.

The extension team has cooperated with extension staff in other programs and the Area Wide Management (AWM) Development Extension officer in DPIQ.

Balancing Local and National Activities

The IDOs have a strong regional role, particularly in small, regional centres where they are the contact point for cotton research, development and extension activities. They work closely with regional grower associations and

maintain strong links with research programs. Priorities for local extension activities are developed in collaboration with regional reference groups of growers and consultants. One of the particular benefits the industry has gained by developing the IDO network is the capacity to respond to emerging industry needs in a timely manner. For example, the outbreak of whitefly in central Queensland required an immediate response in 2002.

In the early years, the core activity of the program was centred on regional field trials and demonstrations in collaboration with researchers, consultants and growers to field test, evaluate and adapt the findings of research. The trials are still an important component of the activities but the role has evolved in collaboration with local industry and the IDOs now coordinate a range of activities and groups and act as a conduit for information.

The extension team has supported Cotton Australia and growers in the implementation of the industry Best Management Practice (BMP) program by providing technical resource support for growers developing and implementing management plans. Cotton Australia BMP facilitators and area managers manage the process and auditing procedures. BMP provides an effective vehicle for the delivery of new and advanced technical information and management strategies.

The extension programs are primarily directed to industry clients – growers, consultants and agribusiness. However, IDOs also contribute significant support to community and environmental groups by providing information, as members of community groups and by participating in educational activities often in collaboration with Cotton Australia. Liaison and communication with the broader community and environmental groups at a national level is a primary function of Cotton Australia and includes activities coordinated by the Cotton CRC.

In addition to this local role, the participation of IDOs in focus teams provides a national focus, reduces duplication of effort, enhances technical skills and provides an easy contact for the researchers. Table 1 provides a summary of the time spent by IDOs on each of these national focus issues. There is also a substantial commitment to water management extension from the full time water use efficiency and irrigation officers.

An annual cotton extension planning workshop provides the opportunity for the extension team, researchers and consultants to identify and prioritise national issues. Technical training has been provided in other workshops during the season. These forums provide not only planning and training outcomes but also help to develop a cohesive national network despite the 18 centres and the vast distances over which the extension network is spread (approximately 1600km from Emerald in Central Queensland to Griffith in Southern New South Wales).

Major activities of the program have included:

- Increased establishment of IPM and area wide management grower groups;
- A series of insect management, agronomy and farming systems trials in collaboration with research officers and growers;
- Detailed development and implementation of disease management extension;

- A large number of pesticide application workshops for growers;
- Continuing support of regional grower groups and demonstration trials in the Rural Water Use Efficiency (RWUE) project;
- Cotton Tales newsletters published at various intervals in all major cotton growing valleys;
- Publication of regional trial books;
- Publication of the Crop Rotation Chart;
- Completion of the second industry benchmarking study following the first three years ago;
- Evaluation of a range of extension activities and program outcomes including a Focus group evaluation of IPM and AWM and a Survey evaluation of grower use of information resources.

The extension team has direct linkages with ACGRA nationally through the ACGRA Chairman and the Research Committee chairpersons who link directly with each of the focus teams. Regionally, all extension officers are active participants in the regional Cotton Grower Association and their RD&E sub-committees. They also work closely with Cotton Consultants and a range of industry associations.

Local grower consultant groups assist IDOs with the planning the annual RD&E activities. These activities are linked to broader national issues prioritised by the industry. A review of key extension methods used by extension staff in 2000 showed that field trials and demonstrations are the primary extension methodology being used by the officers, (Table 2). Group processes are most important for insect and water management in accordance with project plans. Extension officers are expected to increase commitments to grower group activities over the next three years as more and more growers become involved in regional area wide and IPM groups.

Extension plans are developed to address key issues identified by the industry. These priorities are gathered in a range of ways – through regional reference groups, group consensus, consultation by the National Extension Coordinator, input from ACGRA and the Cotton Consultants Australia and reference to existing industry priorities such as the Cotton CRC and CRDC strategic plans. Table 3 maps a snapshot of extension activities against the core strategies of CRDC.

Implementation of strategies for IPM and AWM of insects continues as a high priority for the extension team with a program focussed on the establishment of IPM and AWM grower groups and the application of the IPM pest management guidelines. It is supported by the IPM Training Coordinator who has developed a grower focussed training program and by a project undertaking the economic assessment of IPM and insecticide resistance management (IRM) strategies. The assessment is based on data sets from IPM grower groups during the last two seasons and has demonstrated conclusively that fewer insect sprays can be associated with higher profit margins whilst deriving significant environmental benefits.

Response to the program

The program is strongly supported by the industry, with many growers taking active roles in extension planning. New IDO roles have been established in response to industry demand.

IDOs in promoting research outcomes to growers use a range of techniques. Results from the cotton industry benchmarking survey (McIntyre *et al* 2002) demonstrate grower's preferred methods of improving knowledge of technology in ranked order are:

1. Mini field days and farm walks;
2. Grower groups;
3. Field days;
4. Farm visits;
5. District trial books;
6. Training workshops;
7. Newsletters and product information sheets;
8. Rural press;
9. Radio and TV.

and that the five most important topics are:

1. Soft options for insect management – AWM and IPM;
2. Water Use Efficiency;
3. Disease Management;
4. Crop nutrition;
5. Ground spray application and drift reduction.

Up to 68% of growers indicated a willingness to participate in nationally accredited training courses related to insect, disease, soil and farming system management.

The more recent CRC Cotton Information Resources Survey (Christiansen *et al*, 2002) has indicated that currently 90% of grower have access to the internet and 38% use the CRC website.

The evaluation of IPM and AWM has demonstrated a wide level of acceptance throughout the cotton industry with a high level, broad understanding of IPM principles and practices evident across all industry sectors. This represents a significant change from 1997 where there appeared to be a lack of understanding and confidence in IPM systems amongst both growers and consultants.

Evaluation of the use of key CRC extension publications by growers and consultants has been shown that local one page weekly newsletters such as 'Cotton Tales' are an effective method of providing information to the industry. (Figure 2) CRC publications in pest management are also well recognised across the industry.

The Cotton CRC through DPIQ delivered the cotton and grains adoption project that is part of the Rural Water Use Efficiency Initiative of the Department of Natural Resources and Mines in Queensland as an integral part of the extension program (McIntyre and Goyne 2003). Its objective is to improve water use efficiency in the cotton and grains industries in Queensland. This four-year program provides for an adoption project managed and delivered by the project coordinator and five extension officers in DPIQ. A mid term review of the project has demonstrated good progress toward the achievement of the objectives. The CRC has continued to ensure the maintenance of effective linkages with a similar NSW Agriculture initiative that is also associated with the CRC.

The IDOs have provided significant contributions to decision support packages NutriPAK, DiseasePAK and WeedPAK and will be involved in the development of WaterPAK in the next year. Advances in the user-friendly crop simulation model, OZCOT has continued throughout 2001/02. The use of this model will provide an important extension tool in aspects of insect management, fertilizer use and water management. It will also allow growers to run a range of simulations to assist in risk management, particularly during periods of limited water, delayed planting or hail damage.

IDOs have continued to respond to a number of issues demonstrating the capacity of the extension team to address emerging industry needs in a timely manner. The outbreak of whitefly in central Queensland required an immediate response in 2001/02 Collaboration.

The IDOs collaborate with all research officers to ensure strong linkages between the CRC research and extension programs and with researchers in many other research organisations in NSW and Queensland.

Conclusions

Improving the skills base of growers, working in the cotton industry is essential if the industry is to grow and survive into the future. New technology and practices for crop and natural resource management are being developed every year. To keep pace with this change, effective educational and training programs need to be in place particularly for extension staff so that they are aware of new technology and practices as they are developed.

Prior to the establishment of the Cotton CRC extension services in the cotton industry were uncoordinated and staff lacked an effective training. Educational programs developed and co-ordinated by the Cotton CRC have helped develop a highly skilled extension service with support from a centralised informational resource centre (TRC). Today specific extension staff work within groups and activities are coordinated on a national level in partnership with industry.

A key aspect contributing to the success of the CRC educational and extension programs is the direct involvement of research staff and the development of decision support packages. These packages form an integral part of all training and support for extension staff as well as supporting the industries BMP program in crop and resource management. Extension services while retaining a focus on conducting grower demonstration trials are now involved in offering specialised training courses to growers and work with grower groups.

The cotton industry is seeing benefits through supporting a strong, nationally coordinated extension network. The activities and skills of the extension program have developed in response to changing industry needs and issues. Through close industry links, evaluation and national coordination, the extension network is able to assist the industry to develop in the face of new challenges. The extension program will continue to evolve in partnership with the research community and the dynamic industry that it services.

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Table 1. Estimated time spent on key national objectives.

National Focus	Time Spent
Insect Management	44%
Farming Systems	20%
Disease Management	19%
Weed management	9%
Environment	6%
Water	2%

Table 2. Time spent on key Extension methods.

Extension Activity	% Time spent
Trials / Demonstrations	30%
Meetings/ field days	27%
General Information exchange (newsletters, grower inquiries)	26%
Grower Groups	18%

Table 3. Core strategies of Cotton Research and Development Corporation and some examples of related extension activities.

Strategy	Example of some Extension and Research activity
Improve chemical and non-chemical management of insects	▪ Support for Area Wide Management Groups ▪ Early season damage trials
Improve chemical and non-chemical management of diseases and weeds.	▪ Farm hygiene – *Come Clean – Go Clean* ▪ WEEDpak
Environmental management systems encompassing relevant catchment management strategies	▪ Water Use Efficiency trials and extension
Improve farm management strategies	▪ Rotation options and impacts ▪ NUTRIpak ▪ Herbicide drift damage trials
Improve potential for returns throughout the production chain and assist in development of market opportunities	▪ Fibre quality trials and communication of information – Neps, Micronaire
Assess economic, environmental and social impacts on regional communities and the nation; identify and develop appropriate involvement opportunities.	▪ Community education – including school visits and public events.
Involve industry personnel in regional adaptation of research and effectively transfer new techniques, strategies and discoveries.	▪ Key focus of all extension activities - Information transfer, Reference groups, AWM groups, WUE groups, Regional trials ▪ Computerised Decision Support tools
Develop and engage creative, innovative and highly trained human resources.	▪ Cotton Production Course ▪ IPM Short Course ▪ Trainee Industry Development Officers

(Christiansen and Cotton Extension Network 2002)

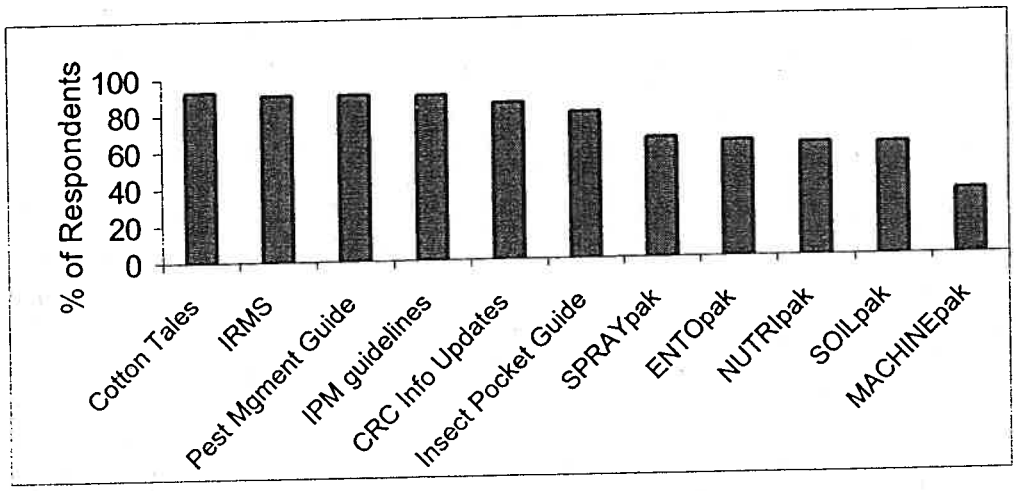

Figure 2. Percentage of respondents using resources.