Changes in Attitudes to Integrated Pest Management in the Australian Cotton Industry: 1997-2001 and Attitudes to Area Wide Management

A Focus Group Study
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SUMMARY

This study followed on from a series of focus groups run throughout the cotton industry in 1997 to increase the understanding of issues impacting on the adoption of Integrated Pest Management (IPM) technologies and strategies in the industry. They explored the social, economic and technological aspects of IPM.

The 2001 study revisited industry attitudes and use of IPM in the cotton industry. It sought to identify any changes in understanding and attitudes since 1997 through the eyes of participants, identify new issues affecting IPM use and management, and provide further guidance for research and extension strategies into the future. It also sought feedback on Area Wide Management (AWM), which was a relatively new initiative in IPM strategies.

Key changes to industry attitudes and practices towards IPM are summarised in Table 5 (p13-24), together with key activities that have been undertaken and recommendations for the future.

Conclusions from this study were as follows:

1. *It was clear that the principle of IPM has a wide level of acceptance throughout the cotton industry as an integral part of overall farm management.*

2. *IPM was universally 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.*

3. *Growers in many regions are taking increasing responsibility for insect control decisions on the farm and many are prepared to try "softer" options (ie more selective insecticides). Decision making appears to be moving toward a partnership between grower and consultant. Most growers rely heavily on their consultant for decision making but many are now more actively querying and discussing recommendations. 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 is considerable variation between regions in the sharing of decision making between grower and consultant.*

4. *There was strong support for the Industry Development Officer / extension role and the need for on-going information dissemination and education programs about IPM in the industry.*

5. *The research work being undertaken was widely supported by industry stakeholders. This was reflected in requests for a higher research presence in regions, increased emphasis on commercial implications and consultant participation in research.*

6. *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.*

7. *The introduction of 'Bollgard®II' was viewed by all groups as the next major advance in IPM with a comprehensive management strategy needed to ensure that it lasted and that secondary insects were kept in check.*

8. *The future for IPM was seen to be with a fully integrated farming systems approach involving cooperation with other crop management systems.*

9. *CottonLOGIC was valued as a recording package but there was a perception*

identified that it was too complicated to use as a decision support tool.

10. *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.*

Specific recommendations emerging from the study were:

I. *Support Area Wide Management (AWM) Groups as a significant vehicle for increasing the understanding and adoption of IPM in cotton growing regions.*

II. *Develop and promote a fresh extension/education IPM program to coincide with the introduction of 'Bollgard® II'.*

III. *Integrate IPM thinking and planning into a farming systems context, with greater involvement of other cropping systems.*

IV. *Increase knowledge and understanding of the impact of whole crop management on IPM – including nutrition, rotations, soil management, etc.*

V. *Modify CottonLOGIC, or develop other tools, to enhance the IPM function and to allow rapid sharing of data between AWM groups to assist with decision making throughout the season.*

VI. *Revise and promote the IPM Guidelines and IPM training – IPM Short Course (for growers) and the Cotton Production Course (for consultants).*

VII. *Offer alternatives for growers and consultants not involved with AWM groups. For example, interactive forums with researchers.*

VIII. *Support activities that encourage bringing growers and consultants together to learn about and develop confidence in IPM systems.*

IX. *Collate case studies and benchmarking of IPM systems to demonstrate the benefits.*

X. *IDOs continue to conduct regional trials in collaboration with researchers where key questions or situations arise.*

XI. *Identify risk areas for IPM. Develop mechanisms for assessing and negotiating risk at the farm and consulting levels.*

XII. *Ensure that BMP is up to date with the IPM guidelines.*

XIII. *Undertake further research to establish the economic significance of secondary pests and IPM approaches for these pests.*

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ACRONYMS

AWM	Area Wide Management
BDI	Beneficial Disruption Index (ranking of impact of insecticides on beneficial insects)
BMP	Cotton Best Management Practices program
Cotton CRC	Australian Cotton Cooperative Research Centre
CRDC	Cotton Research and Development Corporation
IDO	Cotton Industry Development Officer (Cotton extension officers, supported by CRDC / Cotton CRC)
IPM	Integrated Pest Management
PAMP	Pesticide Application Management Plan (requirement for communication with neighbours and operators prior to Endosulfan application)

"Soft" options are selective insecticides that are less disruptive to at least some groups of beneficial insects.

Changes in Attitudes to Integrated Pest Management in the Cotton Industry 1997-2001 & Attitudes to Area Wide Management

PURPOSE OF STUDY

An understanding of industry attitudes towards Integrated Pest Management and Area Wide Management provides valuable direction and feedback for research and extension programs in this area.

This study follows on from a series of focus groups run throughout the cotton industry in 1997. The 1997 focus groups were designed to…*increase the understanding of issues impacting on the adoption of IPM technologies and strategies in the cotton industry.* They explored *the social, economic and technological aspects of IPM as they were raised by participants*. The information gained through the focus groups helped to guide research and extension programs in increasing the awareness and adoption of IPM in the industry.

This 2001 study revisited industry attitudes and use of IPM in the cotton industry. It sought to identify any changes in understanding and attitudes since 1997 through the eyes of participants, identify new issues affecting IPM use and management and provide further guidance for research and extension strategies into the future. It also sought feedback on Area Wide Management (AWM), which was a relatively new initiative in IPM strategies.

BACKGROUND

The issue of insect resistance to chemicals and biological control of pests in the cotton industry continues to be a major driving force of research and extension in the cotton industry. Five years ago, limited choice of chemical options and issues related to contamination of other rural products through the use of existing pesticides were putting increased emphasis on the need for an Integrated Pest Management (IPM) approach to pest control in the industry, with reduced insecticide use the main goal.

Area Wide Management (AWM) Groups are part of the overall strategy to support growers in developing their interest and knowledge in IPM. AWM groups are designed to provide an opportunity for networking, information sharing and planning strategies. They also have a goal to include other stakeholders including grain growers.

METHODOLOGY

The methodology chosen for this study was to duplicate as much as possible the study from 1997. Focus groups were run across the industry based on homogenous groups in each district – for example consultants, growers, researchers and extension officers were interviewed separately from one another.

Focus group training was given to all of those who facilitated or recorded the focus groups to ensure that the necessary skills and consistency were present. Established groups were avoided to

maximise the free flow of opinion and views and facilitators worked in districts apart from their normal location to minimise their influence on the outcome.

Importantly focus groups provide the range of experiences, views and attitudes within a given community concerning an area of inquiry. They do not provide statistical data. They do provide some indication of the weight of opinion related to particular views and attitudes. The repetition of focus groups provides some assurance that most of the existing attitudes have been captured and reinforces some of the weight attributed to different attitudes expressed.

Table 1: Focus groups conducted.

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

Focus group reports were completed by each facilitator/recorder team following each focus group. A debrief of facilitators and recorders was held following the focus groups to pull out key themes that emerged across groups. An independent researcher (Dr Jeff Coutts) pulled together the summary report based on the individual focus group reports, notes from the debrief and access to the 1997 report. The summary table of key changes was then compiled by the independent researcher listing the attitudes in 1997 against those in 2001 and Cotton CRC participants identifying what had been done, the implications for IPM and what could be done next.

FINDINGS IN 1997

The 1997 study found that there was a high level of awareness of IPM at a general level amongst **growers** and of the range of IPM tools being used or promoted at the time. There was a positive attitude about the need to reduce reliance on chemicals and an increase in the adoption of these tools was viewed as *inevitable* over time. Traditional (less selective) chemicals were the primary method of insect control, and although some individual IPM components were being used, there appeared to be a lack of widespread adoption of comprehensive and integrated IPM strategies on farm. There was a lack of a coherent IPM strategy.

There appeared to be a lack of confidence and understanding about the use of IPM approaches in practice by **growers**. This lack of confidence and the low cost of broad-spectrum chemicals appeared to be limiting the adoption of IPM. Local trials and experiences were identified as having significant potential for increasing this level of understanding and confidence. The need to influence the management of neighbouring crops was also raised as a critical issue for the success of IPM. It was felt that consultants - as well as growers - needed to be targeted through education programs.

The 1997 study indicated that the pressure on **consultants** to maximise yield was a significant constraint to trialing softer chemical options – particularly in the absence of convincing economic data for IPM approaches. Increased grower education and local trials demonstrating good yields and profits were seen as critical to increasing the use of IPM.

There was lack of clarity amongst **extension officers** about the 'ideal' IPM

strategy with its regional variations which appeared to be constraint to their promotion of IPM in the industry. They saw the need for on-going educational programs - which included the sharing of positive grower experience - as essential in changing attitudes and encouraging growers to take greater responsibility for IPM management decisions.

There was a perception amongst **researchers** that the industry lacked a comprehensive IPM strategy – with the piecemeal release of new products and the differing emphasis by different people complicating the development of such a strategy. Biological control supported by the strategic use of selective chemicals was seen as a key element of an industry strategy.

ACTIONS 1997-2001

In response to this study, the cotton research and extension community have:

- Developed a comprehensive set of IPM guidelines;
- Gathered and analysed data comparing the economics of IPM and traditional systems;
- Developed an IPM Short Course that has been operating with pilot groups in the 2001 season;
- Continued to update IPM training in the Cotton Production Course;
- Extended the Area Wide Management concept;
- Integrated IPM into the Cotton Best Management Practices program.
- Supported Area Wide Management Groups with extension/coordination and research.

RESULTS FROM 2001 STUDY

Growers

Attitudes to IPM

There has been a significant increase in understanding and acceptance of the value and need for IPM in all regions. There is some variation between regions in terms of the level at which they have embraced and applied the IPM concept and tools

IPM appears to be increasingly viewed as an economically viable option and a realistic alternative to conventional farming based on chemical control alone. There is a general view that IPM is not a recipe or formula but an integrated approach to using a range of available tools and techniques to modify management appropriate to the farm and season. A range of growers referred to the impact of IPM in terms of economics, biology and sustainability. There appears to be a high proportion of growers with a high level of broad understanding about IPM.

IPM appears to be more entrenched in the thinking and practice of cotton growers than in 1997. There is evidence of an increased openness to different practices and ways of doing things and incorporating IPM components into their overall management strategy. There is a perception that there is a small proportion of growers who still view IPM as restrictive – or who lack confidence in it – which limits the adoption across a district or industry.

The introduction of *Ingard*® appeared to have had a significant impact on the perception about and confidence in IPM among growers. This appeared to have been accompanied by an increased flow

of information about IPM management. The introduction of the two-gene (Bt) cotton ('Bollgard®II') is seen to be a further boost to IPM adoption, however with a resulting increasing emphasis on the control of secondary pests.

There was a strong acceptance by growers across all regions that they were primarily responsible for managing the risk on their farms – with a decreasing tendency to leave the decisions solely up to the consultant. Growers were increasingly asking such questions as 'do we need to spray – and why?' Consultants, however, were highly regarded and were seen as critical to the decision-making process through their knowledge of the many factors involved and their experience with other farms. Risk minimisation remained a priority for both consultants and growers. Pre-planting meetings with their consultant were highly valued by some growers.

Low cotton prices were a concern to growers in terms of the economics of adopting further IPM technology.

Use of IPM

Most growers were able to point to one or more IPM components that they used on their farms, as listed in Table 2.

There remained a belief that many growers did not fully understand all of the techniques available and their practical use and implications, and were yet to have a fully integrated approach to IPM on the farm. A number of growers had ENTOpak (including the IPM guidelines). Decision-making aids such as check sheets, fruit retention and growth stage guides, pheromone traps, lepton tests, recommended thresholds and weather outlooks were being used by a number of growers – providing the practical 'how-to' of IPM adoption. CottonLOGIC was mentioned by some growers with mixed views – with its record keeping function being used more than its decision-aid function. The Beneficial Disruption Index (BDI) was also mentioned – with some finding it more useful than others.

Table 2: The main IPM Tools identified by growers.

Use of beneficials*
Foodsprays* and oils
Pheromone traps
Delaying pyrethroids
Softer chemical options**
Soil biodynamics
Bed renovating
Stubble retention
Pupae busting**
Rotations
Controlling excess growth in the cotton crop
Green manure crops to improve soil
Trap cropping* – spring and autumn
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
Bt cotton/Ingard®*
Control of planting/flowering dates

* indicates most frequent mentions

The need for increased contact with researchers and having research that was practically and commercially orientated was seen as critical. Issues of economics and efficacy of IPM were raised as needing further work. Emerald growers expressed a feeling of isolation from research being undertaken.

IPM was generally seen to impact on planting decisions and *early management* of the crop. The choice of chemicals which worked, however, was the main decision referred to late in the crop cycle. Likewise peaks in pest pressure during hot periods also added pressure on chemical efficacy.
The aim of IPM was generally viewed as reducing the use of chemicals – using appropriate chemicals more strategically. Some growers, however, saw a future without spraying as the ultimate goal of IPM.

There was some concern expressed about the high cost of IPM technology (eg. new softer chemicals and Bt cotton) and the lack of information about economic benefits. Low cotton prices were seen by some to work against the use of IPM strategies.

Area Wide Management

There was a generally positive attitude towards the role and potential role of AWM groups – although involvement varied across districts. The groups were seen by those involved to be a mechanism for increased communication and information sharing between growers with input from Industry Development Officers (IDOs) and consultants. Having consultants present who worked with the growers in the group was seen by some as very beneficial.

Some regions saw AWM groups as providing the framework for communication and information dissemination in the industry. The groups were seen to have a key role in reinforcing an area wide management strategy. One view expressed was that AWM groups played a role in keeping growers enthusiastic about IPM and awareness of their impact on neighbours.

Information sharing appeared to be working in some groups better than others with some groups lacking the skills or willingness to share experiences. There was some suggestion that large diverse groups appeared not to be working as well as smaller more homogenous groups, and in some areas groups were difficult to establish because of lack of time, interest or perceived benefit. The issue of formality was raised with a preference expressed for smaller groups with a more informal approach. There was a view that groups needed to demonstrate their benefit to growers by increased returns as a result of involvement.

Issues discussed within AWM groups included: planting windows; spray programs; incidences of spray failures; and developing pre-season insect management strategies (eg. trap crops).

AWM was widely seen by those in AWM groups as critical to achieving IPM on individual cotton farms. The involvement of dryland cotton growers and growers of other crops was seen as very important in managing insect populations in a region – as well as for responsible use of chemicals. There was a perceived community benefit for cotton growers to be involved in AWM groups.

Improved management and coordination of AWM groups was seen by most participating growers as critical to their success. An independent consultant or IDO was seen as the ideal facilitator/coordinator of groups in an area. On the other hand, AWM groups were seen to need to be driven by growers themselves. The driver, facilitator and 'executive officer' type roles were seen as critical. Interaction between groups within a region was seen by some as potentially beneficial.

Future issues for IPM and AWM

An industry management strategy for the introduction of 'Bollgard®II' was seen as vital step in progressing IPM. This concern was driven by the need to ensure that it 'lasts' and the fear about an expected rise in secondary pests as a result of its introduction. The need for the industry to address public acceptance of gene modifying technology was raised as an accompanying issue.

There was quite a widespread interest in growers understanding the 'science behind the technologies' better so that the strategies make more 'common sense'. Issues such as the crop-soil-climate dynamic, insect population dynamics and how beneficials work were some of knowledge related issues raised. The eduction of consultants continues to be widely supported based on the direct flow-on benefits to growers.

There continues to be a widespread expressed need for research to be practical and locally relevant. There was one call for local research officers and increased interaction between growers and researchers.

Economic, environmental and efficacy issues are still of significant concern to many growers and impact on their decisions related to IPM adoption. More research is called for in these areas. Benchmarking by growers was raised as another important tool for this purpose.

The Industry Development Officers are strongly supported by growers. Some growers in more isolated areas feel they have reduced access to IDOs and some feel that NSW Agriculture does not support extension in the cotton industry strongly enough. There is a preference against a reliance on e-mail and internet delivery of information because of slow access times and information management issues.

The AWM group strategy is already demonstrating broad acceptance and potential to improve information sharing and cooperation. Strategic coordination, management, make-up and support issues may need to be further addressed. Increasing the involvement of other stakeholders will need to be further addressed.

Consultants

Attitudes to IPM

IPM was generally viewed as involving a range of options and components integrated appropriately into the total farm management. It was also seen to be an evolving system with many gaps to be filled. A view expressed was that IPM aimed at reducing chemical inputs and producing a profitable crop. There was a view expressed by some consultants that IPM was more than just insect control – also weed and disease management. Some consultants emphasised the economic and ecological sustainability implications and positive community contributions.

IPM was generally agreed to be part of a continual cycle – related to the whole farming system. The increased number of tools and understanding were viewed as providing real alternatives. Openness to new ideas was also seen by some as essential for the success of IPM.

There was mixed experience about the degree to which growers took responsibility for crop management decisions on farm. Consultants in one region considered that they were the main drivers behind IPM. There was a strong underlying concern in some regions that the IPM story was still incomplete and

untested in heavy pressure seasons. Concerns about litigation should IPM measures fail were evident. Grower understanding of IPM and their commitment to it under pressure was questioned by some consultants. The need for growers to take ownership of IPM implementation on their farms was viewed as critical.

Most consultants believed that growers were more informed about IPM and more prepared to push the boundaries.

Approach to IPM

Growers were seen by most consultants as providing more input into the decision-making process – with some exceptions. Discussions with growers included such things as pest and predator numbers, options to take, possible risk factors – and how far to 'push' things, damage levels and weather conditions for spraying. Written reports are provided after visits.

There was a perception that grower education was progressing but at a slow rate. The introduction of *Ingard*® was referred to as providing an excellent education tool for consultants and their clients. Researchers were seen by consultants in one region to be failing in keeping growers up on research results – as well as leaving consultants out of the loop. IPM guidelines were thought not to be well-known in some regions although well known in others. The feeling was expressed in one region that IPM research was not being undertaken sufficiently with the commercial realities in mind and that consultants were not being involved effectively at all stages of the research process. It was pointed out that in some cases consultants learnt of new approaches after the growers were informed.

IPM tools mentioned by consultants included those listed in table 3.

Table 3: The main IPM Tools identified by consultants

Soft chemical options
Rotation of chemical groups
Use of pest and damage thresholds
Beneficial insects
Release of supplementary predators
Trap crops
Refugias
Farm hygiene
Ground preparation
Pupae busting
Weed control
Fertiliser strategies
Plant population
Fruit retention
Compensatory growth
Split nitrogen application
Green manure crops
Crop varieties
Cultivation
Soil health
Water management
Soil tests
Weather

A key approach to IPM was seen as keeping options open for later in the season. Spraying in one region was reported as having been reduced from 15 to 8 sprays per season without yield loss. One consequence of reduced spraying appears to be an increased workload for consultants as crops are checked more often, as well as the incorporation of predator monitoring and plant mapping.

Most consultants at Emerald were meeting weekly during the growing season to share information as well as interacting more formally. In other regions consultants also meet regularly - weekly, fortnightly or monthly.

Area Wide Management

Consultants had very positive attitudes towards AWM and would like to see the program accelerated. AWM groups were seen as vehicles for improved communication impacting on positive peer pressure, increased understanding of how growers actions affected their neighbours and improved integration of IPM across a region. This included such things as planning the use of trap crops. They were also seen as a way of pooling information and increasing cooperation between growers and consultants. A preference was expressed for smaller groups, as this would help to maintain comfort levels and encourage ideas to be expressed.

As with the growers, consultants in one region expressed the view that extension officers should not *drive* AWM groups – but rather be a facilitator and coordinator for grower-led groups. Others referred to the need for the 'right-size' (smaller) group with an IDO to communicate with. Mediation was seen to be a skill needed by the facilitator.

AWM was considered in one region to have increased the level of uptake of IPM as growers gain confidence through others' experiences, and to have reduced the incidence of 'spray cowboys'.

Consultants in particular were keen to see the involvement of non-cotton growers in AWM groups. Grain growers were seen to have a significant impact on pest dynamics in a region. Pulse Australia's education and accreditation programs were seen as successful and a possible vehicle for increasing involvement of grain producers in IPM and AWM programs.

There was some caution urged in one region about not 'going overboard' with the AWM approach before options were more fully understood and tested.

Future issues

A general view expressed was that the next step in IPM implementation is for it to be used fully – that is considering all operational inputs from ground preparation, weed control, fertiliser strategies, trap cropping, plant population and fruit retention. Decreased cotton prices were suggested as a trigger for increased crop rotation. This was viewed as beneficial in involving growers in a whole system rather than a monoculture.

The ideal IPM strategy for the future was seen to be one that fully encompasses broader boundaries and a wider range of crops. An on-going research approach to look at gaps and opportunities was seen as essential. Further research was suggested on such things as trap crops, moth migration, food sprays, wheat stubble, soil health, rotation crops and impact of chemicals on beneficials. More information was seen to be needed about beneficial insect species, including their economic benefits.

There were regional differences in consultant's views of cotton extension in terms of working with consultants. There were also differing views on their roles as facilitators rather than technical experts. There was general support for the need for good local information and attracting and keeping the 'right' extension person in a region. Relative experience levels and turnover rates were raised as a concern. The IPM short course for growers was supported. CottonLOGIC was used by most consultants but for record keeping rather than as a decision support tool. It was considered by some to be too information demanding. Benchmarking was supported as critical

to capturing the gains made through IPM adoption. Best Management Practice (BMP) was seen to be accepted across the industry (growers either having done BMP or were planning to do so) but that the audit process had difficulties. BMP was seen to be addressing community perceptions about environmental management within the industry. ENTOpak and SOILpak were seen by some to require updating.

The introduction of 'Bollgard®II' was seen to potentially have a big impact on IPM (but should not be relied on as the only answer). A rise in importance of secondary insect pests was expected as a result of this introduction.

The need for researchers to be forward thinking and to think "out of the square" was expressed. Increased involvement of consultants at all stages of research was seen as essential.

There was also an implication that the industry needed to address potential litigation issues that worked against reliance on softer approaches.

Shared Decision making

The variation between growers and consultants in the view of decision making was interesting. In some cases growers felt the consultants made the decision (with grower involvement) whereas the consultants felt the grower was the decision maker.

Researchers

Attitudes to IPM

Researchers were agreed that IPM was about using all possible control options to achieve pest control that was profitable, sustainable and having minimal environmental impact. Pesticides were viewed as a last resort.

There was agreement that a significant change in grower attitudes towards IPM and practice had been observed over the last 5 years. Not needing absolute control of pests and greater knowledge and skills in insect identification were cited as examples of this change.

Researchers identified a number of drivers for IPM. Profitability, farm sustainability, children and the environment were the main drivers, with others being such things as increasing resistance to insecticides, community expectations, transgenics and costs.

Approach to IPM

Beneficial insects were viewed as forming a key future component to IPM, with factors such as plant nutrition and fertiliser application also playing important roles. Soft chemical options, trap crops and plant architecture were raised as key planks in an overall IPM strategy.

The majority of researchers described their role as *providing and packaging pest management tools in easily assimilated laymen's terms*. They also *saw themselves as providing the knowledge base for all the components of the IPM system, leaving the implementation up to the industry*. Researcher input into industry 'ethics' was also raised as a role.

There was a general agreement that the partnership between researchers and IDOs was working well while recognising

that direct contact between researchers and growers was important. The importance of IPM being driven by the growers was also raised. There was a recognition of the critical role of consultants and the need for consultants to be kept informed.

Area Wide Management

The researchers saw AWM groups as primarily providing a forum for sharing information and identifying common management goals. Information sharing was suggested as encouraging growers to try new things. The use of AWM groups in putting in place area wide management of such components as trap crops was a suggestion as opposed to information sharing alone. It was pointed out that AWM groups could also tackle issues that were not IPM related.

Future issues

Good management of "*Bollgard®II*" was seen to be essential – involving education as well. There was disagreement about whether *Helicoverpa* may become a minor pest in the process. It was pointed out that the industry could not afford to rely on GMOs alone.

Research, extension and farmer groups (and communication between them) were seen to be critical in the ongoing process of making *IPM the norm* within the broader farming system. Beneficial thresholds was identified as a key area of research. It was suggested that CottonLOGIC be modified to allow easy sharing of data for AWM groups and to deal better with beneficials.

Extension Officers

Attitudes to IPM

There was a strong view expressed that IPM was using a whole of farm or regional approach using all available process and tools to manage insects, weeds and diseases. It was also mentioned that IPM meant productivity and financial viability. Long term management of insects was raised as the aim of IPM – rather than seasonal solutions only.

Extension officers were in strong agreement that there had been major changes in attitudes and practice with respect to IPM in the industry over the last five years. This was evidenced through softer chemical options early in the season and acceptance of AWM and BDIs – as well as strong interest in such approaches as assassin bug releases. The use of PAMPs (Pesticide Application Management Plans) was seen as a major driver for change and in improving communication between growers and consultants. There was a feeling expressed that (many) growers were using IPM *components* but not in a whole systems context.

Approach to IPM

The general view was that extension's key role was in maintaining information flow between themselves and growers through mechanisms such as: information sheets (Cotton Tales), localised research trials, local field days and AWM groups. This included sending information back from the growers to research and extension organisations (including the Australian Cotton CRC and CRDC). Communication with consultants was also raised as being an important extension role.

Table 4: The main IPM components mentioned by Extension Officers

Pupae busting
Trap crops
Refugia
Cultural and agronomic processes
Fertiliser strategies
Beneficials
Controlling weeds that are pest hosts
IRMS thresholds
Plant compensation considerations

Benchmarking was viewed as important in highlighting the economics of IPM to growers – however it was time consuming and there was a reluctance by many farmers to put the personal effort into it. There was a suggestion that a 'Benchmarking Extension Officer' could provide a valuable coordination and data collecting service.

Monitoring and sampling of insects were seen as important. There was general agreement that CottonLOGIC wasn't widely used as a decision support tool because it was viewed by growers as too complex. (Refer to van Beek 2000 for detailed evaluations of CottonLOGIC).

The IPM short course was seen as useful to assist both growers and consultants in having confidence about IPM approaches. There was view expressed that IPM guidelines were not being used – with the counter view expressed that they were for reference and not as a day to day tool.

The important role of consultants in IPM was acknowledged as were their pre-season and post-season discussions with growers. They were seen to be increasingly pro-IPM. Consultants were seen as playing a significant role in the decision-making process with growers relying too much on them. It was felt that grower ownership was important and increasing but that they needed to have a stronger role in the decision-making process. The issue of litigation was raised as an issue for consultants prepared to recommend a more IPM approach.

Research was seen to need to be grower driven with direct contact between researchers and growers. Proactive research was raised as being preferable to reactive.

Area Wide Management

A general view expressed was that Area Wide Management was…*managing pests in a cooperative approach across a district and working together and exerting friendly pressure to do things for the good of the area.* AWM groups were seen as providing a mechanism for those growers with experience and confidence in IPM to make decisions. A perception expressed was that there was a distinct mistrust between (some) growers with most reserving their right to do their own thing – limiting the value of cooperation.

AWM groups (along with other grower groups) were seen as playing an important role *in communication of information, ideas and technology on IPM.* The general feeling was that the groups provided an opportunity to share information and experiences and to build confidence in using IPM. Economics and benchmarking was a key focus for AWM groups according to some officers. There was a concern expressed that if AWM groups became too 'top heavy' and regulatory growers then could get 'grouped out'.

Extension was seen to have a role in *helping the groups work effectively acting as a facilitator and organiser of meetings, to coordinate activities and disseminate information (two-way)* – but is was strongly agreed that the groups had to be grower driven. Other extension roles expressed were: establishing new groups; providing

information on the whole farming system; and providing industry workshops for the whole industry.

Some concern was expressed that (some) companies used AWM groups to promote their own products.

It was noted that non-cotton growers were involved in some AWM groups, however the cotton-centric nature of the groups were working against such participation.

Future Issues

There appeared to be a general positive outlook towards IPM for the future. Improving information management and marketing was seen as a key driver. It was suggested that improvements could be made to software and information packages with more effective evaluation built into their use. AWM groups, use of case studies and group visits were identified as good mechanisms for information dissemination.

It was considered that the introduction of 'Bollgard®II' would not eliminate the importance of *Helicoverpa* management. Management of secondary pests was considered likely to become more of a problem in these crops.

Low cotton prices and water shortages were seen as contributors to use of other crops and having a whole farming systems approach to IPM. The role of IDOs in the context of a broader cropping system was raised. There was interest in a more systematic interaction between IDOs and consultants – and researchers.

KEY CHANGES FROM 1997–2001

Table 5 summarises the differences detected in industry attitudes towards IPM in 1997 and 2001. In relation to each of these points it also summaries the key activities (including research and extension) that were undertaken in that time. Implications of the changes in attitudes and recommendations for the future are suggested.

KEY CHANGES IN COTTON INDUSTRY ATTITUDES TO IPM FROM 1997 TO 2001

Table 5 Compiled by Bruce Pyke, Ingrid Christiansen, Melina Miles, Lewis Wilson and Jeff Coutts

	1997	What did we do	2001	Implications for IPM	What do we do next?
Decision Making					
- Consultant/ grower	Consultants generally made spray decisions within the parameters of growers' limited understanding about IPM and emphasis on limiting risks to yields and profits.	AWM groups Greater access to information for decision making in an IPM context.	There was strong acceptance by growers that they were primarily responsible for managing risk on their farms. Consultants saw this as variable and themselves as the main drivers. Extension officers felt there was still too much reliance by growers on consultants for decision making.	Shared responsibilities needed. Grower's desire for IPM may be limited by consultant's attitude to risk and vice-versa.	Promote IPM course Promote IPM Guidelines Support growers in taking an active role in AWM Help devise strategies for decision making that support IPM and reduce feeling of risk. Grower/consultant/research forums on IPM – link with IPM course – perhaps with discussion led by previous course participants. Decision support tools for growers to increase their capacity to discuss recommendations with consultant. CottonLOGIC could "flag" risks. Concerns if growers consider CottonLOGIC too complex. Demonstrate (economic benchmarking, case studies, demonstration trails, etc) to consultants & growers that IPM is not equivalent to greater risk. It may involve greater expenditure on management rather than insecticides.

	1997	What did we do	2001	Implications for IPM	What do we do next?
Decision Making cont'd					
- Relationship with consultant – Pre-season/ during season	Small growers who adopted IPM were seen to have a very good relationship with their consultant – trust issue. The onus was on the consultant to make spray decisions. Most consultants were concerned with the risk if they recommended softer options.	PAMP & AWM groups have increased communication between neighbours, sometimes with consultants.	Consultants expressed concerns about litigation and some questioned growers commitments to IPM. Farmers as a whole were seen as more informed and more prepared to push the boundaries. Discussions about management and risk between grower and consultant were increasing and increasingly pro-IPM. Growers took more responsibility for spray decisions.	Requires discussion of risk – reinforces importance of pre-season planning. Positive for IPM if this is done. Negative for IPM if not done.	Benchmarking and case studies of IPM – documenting decisions and risks – highlight decision pathway. Tools to help growers and consultants to review pervious year and set agreement for next season. Identify risk areas. Tools to minimise miscommunication between grower and consultant with respect to establishing acceptable levels of risk and approach to pest management. Work with CCA and CGAs to develop solutions to litigation risks of IPM.
- Record keeping and decision tools	Reference was not made to record keeping.	On-going refinement of and training for CottonLOGIC Palm version developed	CottonLOGIC was used by a number of growers and most consultants - mainly for record keeping. Note that Cotton LOGIC evaluations indicate >50% use it, and a significant proportion use it for decision-making.	Records helpful for looking back at IPM options and outcomes.	Use of Decision Support function – enhance CottonLOGIC to better support IPM or develop other task specific IPM decision support tools. Training in using summary graphs to compare outcomes, patterns and impact of different decisions – by individual growers on-farm and within groups. Enhance capability of CottonLOGIC to do season analyses.

	1997	What did we do	2001	Implications for IPM	What do we do next?
Understanding and practice of IPM					
- of concept of IPM	There appeared to be a very positive attitude towards the concept of IPM and its theoretical use in the cotton industry. There was a general recognition that chemicals were not a long term solution. IPM was viewed as being primarily about controlling insect pests with minimal chemical usage. Often associated with the perception of low yield and delayed maturity. Consultants and extension officers appeared to have a broader understanding of IPM than growers. Lack of a clearly defined concept of a way to put tools together to form a management system.	- Clearly defined what IPM was, tools to achieve it and how to put these tools together in the farming system. - IPM information made available – incl. IPM Guidelines - Focussed research - Support of AWM groups - Extension with a consistent message. - Benchmarking - Damage and compensation trials The Cotton CRC / UNE Cotton Production Course has been updated, providing a solid training base in cotton production, farming systems and IPM, particularly for consultants.	IPM was entrenched to a degree in the thinking and practice of growers. The aim of IPM was seen as reducing the use of chemicals – using more strategically. Some saw a future without spraying as the ultimate goal. Some consultants emphasised the IPM was more than just about insect control – also weed and disease management.	Positive Continued focus on pesticides and reducing their use. Relying on soft options may be limiting the concept of IPM as a truly integrated management system. However, use of soft options does seem to have been a good starting point, providing a "safety net" while confidence is building in IPM. Move towards whole farming systems	Continue to evolve the IPM system. Extension activities to address broader issues / IPM in farming systems context. - Include components in IPM course; - Support AWM groups in moving towards other issues - Provide a conduit between growers and researchers to help information flow and keep extension message up-to-date Harness the growing interest in whole farm / regional planning to facilitate IPM eg managing/enhancing natural enemies using grain crops and/or non-crop vegetation. Cross industry linkages needed. Support joint GRDC/CRDC research to focus progress this. Benchmarking across all crops.

	1997	What did we do	2001	Implications for IPM	What do we do next?
Understanding and practice of IPM cont'd					
- of IPM tools and options	There was a high awareness of the range of IPM components by both consultants and growers. It was perceived that most growers were using some tools/ options however there was lack of comprehensive and integrated strategies. Traditional chemicals remained the cornerstone of insect control. There was a perception by consultants that there was a lack of IPM tools.	AWM groups IPM Guidelines Damage threshold trials Damage monitoring techniques Awareness of options Benchmarking financial benefit of options Delayed SP use Understanding of beneficial insects role and monitoring techniques (incl. pest/predator ratio) Promoted relative impact of products on beneficials – Beneficial Disruption Index Spray application extension	Most growers could point to one or more IPM components they used in farms. Some use of the Beneficial Disruption Index (BDI). Band spraying and improved monitoring of ground rigs. Consultants expressed that the increased number of tools and understanding was helping. Benchmarking was gaining support. Some frustration amongst growers/ consultants that research was not providing answers to their questions about how to manage particular pests in a soft context. Possible disruption to IPM due to uncertainty of managing sucking pests.	1997 – aware of tools 2001 – broader understanding, knowledge and use of tools; better idea of integrating tools, high appreciation of value of beneficials. Delayed use of SPs has been the start of many IPM programs. Lack of confidence with some IPM tools because of lack of experience using them	Continue extension on how tools can be applied and integrated – particularly focus on using IPM as a basis for managing sucking pests and other emerging pests in the system. eg incorporating mirid management in IPM. Development and extension – taking basic research and fitting it to an IPM framework with consideration for implications of using the different components. Demonstration and discussion of IPM component tactics & IPM programs. Could include AWM groups, IPM course, case studies, video. IDOs undertake small, targeted experiments in collaboration with researchers where an opportunity arises – eg a specific pest problem. Needs to be very focussed. The approach to damage compensation RD&E is a good framework.

	1997	What did we do	2001	Implications for IPM	What do we do next?
Understanding and practice of IPM cont'd					
- issues impacting on the use of IPM	Lack of economic data; Lack of confidence in thresholds; Lack of confidence in some options. Extra cost of monitoring for higher thresholds. Lack of selective chemicals. Resistance Mixed messages. Grower education seen as necessary. Localised research and extension was seen as necessary. The Resistance Management Strategy was identified as being about optimising earliness.	Each of these issues addressed through: - Benchmarking & economic study - compensation/threshold trials - IPM guidelines - IPM Course - AWM groups - Grower/consultant experience with new options - IDO network & trials operate locally – have also demonstrated some things don't vary greatly between regions - IRMS roadshow and draft discussion with regional CGA and CCA - IRMS starting to be structured to help support IPM.	Low cotton prices affecting economics of IPM - also a trigger for crop rotations. Introduction of Bollgard®II The use of Pesticide Application Management Plans was seen as a major driver of change. Relatively low pest pressure especially *Helicoverpa* – IPM/soft approach may have been used by default	Previous issues addressed, new issues arising Perceived high level of commitment to and use of IPM – how strongly will this remain when high pest pressure is seen again?	- on-going benchmarking to demonstrate where IPM can be more profitable (incl. at low cotton prices) and to maximise benefits from Bollgard® II® - Threshold trials for Bollgard® II® - secondary pests Measure "genuine" commitment to IPM – which bits will stay when pest pressure increases. (NB difficult to separate as the low pressure may have been a catalyst to developing a longer term commitment) and work out how best to support IPM in this situation. Aspects of IPM to focus on in high pressure years. What are the attitudes and drivers in high pressure years?

	1997	What did we do	2001	Implications for IPM	What do we do next?
Best Management Practices					
	Best Management Practice was not raised or discussed as a concept associated with IPM.	IPM component in BMP manual in line with IPM guidelines. BMP focus on minimising off-target influences.	Best Management Practice was accepted as a direction to pursue.	BMP can serve as a vehicle to support adoption of IPM.	Ensure BMP is up-to-date with IPM guidelines. Solicit feedback on ways to make BMP help the process of increasing IPM strategies on farm.
Monitoring					
Pests – *Helicoverpa*	Consultants were seen as opting for the safest approach with spray decisions as crop yields were seen to be equated to consultant effectiveness. Grower's saw *Helicoverpa* monitoring and management as the driving force of IPM. Earliness was seen to be a prime driving force of most farm operations.	Damage thresholds and monitoring techniques Trap crops Pheromone traps Population dynamics	*Helicoverpa* was still regarded by consultants and growers as the major pest to monitor and manage. Early crop damage also monitored and a greater level of damage accepted. Some perception that Bollgard®II will eliminate *Helicoverpa* control as an issue for these crops. Greater awareness of need to sample more often in IPM so crop management doesn't' get out of control – provides time for beneficials and soft insecticides to work.	IPM requires greater emphasis on monitoring pests, predators and damage.	Evaluate and compare different sampling strategies for Bollgard®II. Evaluate the impact Ingard®/Bollgard®II in conjunction with IPM is having on the whole *Helicoverpa* population (desktop study?).

	1997	What did we do	2001	Implications for IPM	What do we do next?
Monitoring cont'd					
Secondary Pests	There was some concern that INGARD® usage would result in an increased problem with secondary pests.	Research and extension on monitoring techniques, thresholds CottonLOGIC	Consultants were concerned about the rise in importance of secondary pests as a result of the introduction of Bollgard®II.	Potential threat for IPM if not well understood Surveys are not showing many sprays for these pests – is this possibly due to IPM knowledge? Lack of "soft" options for these pests.	Research and extension on secondary and emerging pests. Establish whether they are pests of economic significance – thresholds Explore both chemical and non-chemical control and management tactics.
Beneficials	Awareness but not much knowledge or interest in beneficial insects – although identified as important in Goondiwindi. Often not seen due to spray regimes. Desire expressed for sprays which did not kill beneficials.	Research and extension on role of beneficials, impact of chemicals (BDI rank), monitoring techniques and enhancing environment for beneficials (foodsprays, refuges, etc). Beneficial ID walks with AWM groups	Both consultants and growers identified use of beneficial insects as a key component of IPM. Extension officers reported strong interest in assassin bug releases. Greater field-by-field management of pests rather than "whole farm" - unsprayed field refuges for sprayed fields.	Greater confidence in beneficial insects. Accepted as an important part of the system in many regions. Increased beneficial activity associated with lowered use of broad spectrum insecticides	Research and extension on role of beneficial insects, techniques for increasing beneficial populations particularly for sucking pests and non-target effects of insecticides. Beneficial ID training for growers and consultants. This is covered in IPM course also. Which beneficial insects are effective species? Monitoring techniques. Means of increasing reliability of beneficial populations, esp. after disruption, incl. site-specific application so untreated areas serve as refuges.

	1997	What did we do	2001	Implications for IPM	What do we do next?
View of Economics of IPM					
- Growers	Economics surrounding the use of IPM was not well understood by growers. Extra costs of INGARD®, soft chemicals, perceived lower yield, delay, etc were seen to decrease gross margins.	Economic research on soft option IPM Benchmarking with grower groups Key consultants supporting IPM involved in economic comparison of "softer" vs "harder" insecticide strategies	Issues of economics and efficacy were raised as needing more work. There was concern about the high cost and lack of information about economic benefits.	Interest in economics and value of local studies. Also scope for growers sharing costs and benefits.	Continue to promote and enhance economic studies. Benchmarking to include secondary pests Offer benchmarking for AWM groups if this is a concern – need to define if this is a RD&E or commercial activity. Develop cases studies to highlight economics of IPM – as a tool for discussion with AWM groups. Focus on gross margin/profits rather than yield. Include economic analyses of different tactics as part of R&D process.
- Consultants	Consultants felt constrained in using more IPM approaches because of the economic dictates of growers. They reported a lack of clear economic context for IPM.		Consultants were seeing IPM as a way of reducing costs and increasing profits.	Greater confidence in economic benefit of IPM. Need to have local benchmarking data.	
- Researchers	Economics were seen to play a big part in working against IPM adoption – the costs of chemicals were see as low in relation to their benefit. Object to control pests but beneficial disruption not considered	Researchers involved with AWM groups in doing economic comparisons.	Profitability was seen as a driver for IPM introduction.	Greater confidence in discussing the value of IPM with industry.	
- Extension	The cost and risk factors were seen to combine with the 'stress relief' of putting on a spray as impediments to adoption.	Benchmarking highlighted risks of not following IPM – "treadmill effect" – and, along with local trials, also showed that IPM was not associated with low yields or delay.	Benchmarking was viewed as important for highlighting the economics of IPM to growers. Economics and benchmarking were seen as a key focus for AWM groups.	A new tool to help promote the value of IPM and greater confidence in the IPM concept.	Continue to offer / support benchmarking where valuable to address different issues raised by groups. Particularly valuable for regions less confident in IPM or in different climate – eg Macquarie. This may in some cases be delivered through commercial providers. Move to a culture of talking profit rather than yield.

	1997	What did we do	2001	Implications for IPM	What do we do next?
Extension and information					
- Perception of extension role	Improving exposure and sharing between growers trying new approaches was seen as beneficial. Localised research and on-farm trials were also seen as beneficial. Educational packages and increasing grower understanding of basics raised. The lack of extension officers to undertake local activities was seen as a limiting factor.	IDO network increased – now one officer in each region – local focus in national context – group support, information delivery, trials.	Industry Development Officers were strongly supported by growers. Some regions felt reduced access to IDOs. General support for the need for good local information and attracting the 'right' extension person to a region. Concern that AWM groups must be grower driven – not a departmental agenda.	Very strong support for extension role in supporting communication and providing information for IPM. Importance of continuity of extension service highlighted. Direct link to research network.	Some vacancies at time of focus groups. All positions now filled, IDO position created in Narrabri and Trainee IDO positions established to avoid gaps. Roles and activities promoted. Continue to support groups driven by growers. Degree of support/driving by IDO will vary – negotiate locally. IDOs generally willing to support researchers with specific problems including local trials.
- access to and value of IPM information	There was a perceived lack of economic information re IPM. Conflicting information was seen as a barrier (eg pupae busting vs zero till). There was high awareness of IPM components. Extension Officers saw a lack of clarity about the ideal IPM strategy with its regional variations.	Information on IPM made more clearly defined and available through ENTOpak, IPM guidelines, etc. IPM guidelines have helped to address problems of mixed messages – the process of development was valuable as well as the information. All materials available in multiple formats. High demand for information.	A number of growers had ENTOpak – IPM guidelines. Not all growers or consultants were aware of them. There was widespread interest in growers understanding the 'science behind the technologies'. A preference was expressed against a reliance on e-mail and internet information dissemination. Consultants perceived that grower education	That growers now actively want more science behind the recommendations highlights the increasing level of knowledge and interest. Growers no longer want to rely on consultants for all their pest management information. Demand for direct access to researchers may impact on R&D.	Need to resource the information demand. Promote IPM Short Course for grower education. Follow up information for course graduates. Focus on communicating research information on IPM to both growers and consultants. Move away from consultant only forums with researchers – include growers. RD&E to take a proactive role in this. Interactive research forums on IPM for growers and consultants, perhaps as a follow up from IPM courses.

	1997	What did we do	2001	Implications for IPM	What do we do next?
			was progressing at a slow rate.		Encourage and assist growers to undertake meaningful on-farm trials to test ideas.
- role of grower groups in IPM implementation	The potential value of improving sharing of information – including economic - between growers and learning from others was raised. The TOPCROP example was proposed as a good model.	AWM groups established by growers and consultants in many regions. Supported by extension and research. Benchmarking groups.	AWM groups were seen by consultants in one region to have increased the level of uptake of IPM.	Strong role in communication and confidence building for IPM implementation. Some activities eg pupae busting/trap cropping have an area wide focus. Beyond that, little management is truly on an "area wide" basis but many consider area wide implications of individual actions. Challenge of including non-cotton growers within area wide groups – there is a tendency for group meetings to focus on cotton specific issues.	Continue to support AWM groups. Must be grower driven – focus determined by group – groups defining objectives New ideas to maintain momentum. Novel ways for groups meetings/function. Promote IPM course. Promote IPM guidelines. Consider implications of drought and group fatigue. Explore ways of supporting groups to achieve objectives when they don't want to meet. Some may move towards broader IPM in farming systems context. Alternatives for growers not interested in AWM groups – eg Small farm walks / meetings/ web chat forum, etc. Provide tools to help group evaluate successes and failures.

	1997	What did we do	2001	Implications for IPM	What do we do next?
Communication					
- with cotton neighbours	Providing exposure and sharing between growers was seen as potentially beneficial. Strategies that were flexible (seasonal and regional) were seen as needed.	AWM groups PAMPs & BMP	There was a general positive attitude towards the role and potential of AWM Groups for information sharing. Involvement varied across districts. Pesticide Application Management Plans were being used.	AWM positive for communication and IPM	Promote value of PAMPS being used to prompt pre-season discussion. Consider value of the internet or other tools in helping growers / consultants to communicate. Promote the value of communication.
- with non-cotton neighbours	Family and community health and environment were seen as important considerations in influencing management decisions on farm – including reducing aerial spraying and hence drift.	Role of other crops and trap crops in insect dynamics promoted. Increase in use of groundrigs for pesticide applications, particularly in sensitive areas.	Involvement of dryland cotton producers and growers of other crops in AWM groups was seen as very important. Consultants viewed AWM groups as vehicles for improved communication and understanding of neighbours. They were keen to involve non-cotton growers.	Essential for area wide management of pests. Much greater awareness of regional dynamics. This was one of the key issues raised – high priority placed on it by growers and consultants. The lack of communication and participation exacerbates an "us & them" attitude in relation to management approaches and perceived contribution to pest problems.	Significant issue. Move towards a farming systems context. Highlight to ALL growers the value of communicating – key times of year, issues, etc. Link with GRDC and District Agronomists. IDOs help facilitate these linkages and activities. Joint extension activities. Farming Systems IRMS. Include disease, weeds and rotations as well as IPM. Softer options for other crops + timing of planting – open discussion.

	1997	What did we do	2001	Implications for IPM	What do we do next?
					Encourage involvement of non-cotton growers in AWM groups – or encourage similar grain-focussed groups that meet with cotton groups occasionally.
- with town community	There was some support for involvement in educational activities in schools.	INGARD® use in sensitive areas has allowed reduction of sprays near towns. Endosulfan awareness and care. AWM and IPM has reduced sprays in many areas. Best Management Practices Cotton Australia's education programs	Considered to be better. Far less community antagonism in relation to chemical usage. Growers more aware of benefit of BMP, etc	Community pressure and support for IPM approach and understanding of achievements is an encouragement for growers.	Wincott activities Schools Nat Res Mgmt / Production issue link IPM forum for agricultural teachers – modified from IPM short course.

DISCUSSION AND CONCLUSIONS

1. ***It was clear that IPM is accepted widely throughout the cotton industry in principle as an integral part of overall farm management.***

The level of understanding and acceptance of IPM and IPM principles and components appeared to be high amongst all sectors of the industry. Rather than appearing as something that…*was inevitable for the future*, IPM was clearly viewed as something that was happening in the present to varying degrees. The introduction of Ingard® appeared to be a major catalyst for the understanding, acceptance and introduction of a range of IPM components.

2. ***IPM was universally viewed in a holistic fashion with an acceptance that it was the appropriate use of the full range of available approaches and tools to improve insect control, farm productivity and sustainability.***

All groups interviewed strongly reflected this holistic and comprehensive view of IPM. This contrasted with the 1997 research where growers viewed it primarily as about controlling insects with minimal chemical usage. The knowledge of different IPM approaches and the range of components was high. The large variety of practices linked to IPM appeared to impact on the view that IPM was more than just an adoption of a single practice or technology. There was a strong consultant view that there remained a number of gaps in knowledge and hence there were holes in the available strategies.

3. ***Growers are taking an increasing responsibility for insect control decisions on the farm and many are prepared to try softer options.***

It was evident that most growers who participated in the focus groups saw themselves as taking a stronger role in insect management decisions on their farms. They perceived themselves as using the consultants as expert sounding boards rather than as the decision makers. There was a recognition expressed that a (small) number of growers remained cautious and unconvinced about IPM. The consultants also expressed the view that many growers were prepared to try new approaches and softer options in insect control, although there was still some way to go towards many taking full control and responsibility for decisions. Researchers commented on the greater openness of growers to accept some level of pest build up/damage in their management strategy.

4. ***There was strong support for the IDO/extension role and the need for on-going information dissemination and education programs about IPM in the industry.***

Increased understanding about IPM, management approaches and components was viewed as important to the developing momentum evident in the adoption of new practices. It was interesting to note that a number of growers called for a greater understanding of the 'science behind recommendations' rather than just the practical recommendation. In some places, it would appear as if the interaction between IDOs and consultants could be improved to assist in maximum cooperation and information sharing.

Strategies to keep consultants fully in the information loop may need to be enhanced. The work of the IDOs in localised trials and demonstrations was supported. CottonLOGIC was generally seen as useful for record keeping (with some comments about the information demand) but the decision support function did not appear to be widely used. More detailed studies of CottonLOGIC use have indicated good use of the DSS function (Van Beek, 2000; Hearn and Bange 2002).

5. ***The research work being undertaken was generally supported with calls for an increased emphasis on commercial implications, greater involvement of consultants in the research loop and a higher research presence in regions.***

There appeared to be strong interest across the industry in research on beneficials – as well such aspects as trap crops. Understanding the dynamics in the system appeared to be a common perceived need – including the economic and environmental implications. The direct researcher-grower/consultant link was viewed as important and not as evident as it could be in some areas. It was regarded as important, but it was not happening enough in practice from the perspective of some researchers, growers and consultants. New processes and mechanisms to link researchers and consultants may be needed to address this. Localised research remained a high priority.

6. ***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.***

Experiences with existing AWM groups appeared to be very positive, although a broad view expressed was that smaller, more informal groups worked better than larger 'mixed' groups. Most people saw their purpose and strength in information sharing and improving cooperation between growers and consultants. The increased understanding of neighbours' situations and the positive role of 'peer pressure' were also raised as advantages of the groups. Some saw the groups as real platforms to implement cooperative approaches to IPM in a region – for example in the design and location of trap crops. The view was expressed that it was an advantage to have growers and their consultants in the same group. Interaction between groups was seen by some as potentially beneficial.

There was agreement that groups should be grower driven. However there was also a need expressed for good group facilitation and support. There were different views about whether the IDO should be the facilitators of these groups or whether an independent facilitator was needed.

7. ***The introduction of 'Bollgard® II' was viewed by all groups as the next major advance in IPM with a comprehensive management strategy needed to ensure that it lasted and that secondary insects were kept in check.***

Just as '*Ingard*' was perceived to have been a significant catalyst in the understanding and practice of IPM in the industry, 'Bollgard®II' is widely viewed as the next driver for uptake of IPM. There was general concern about the rise in importance for secondary insects and for the longevity of 'Bollgard®II'. Both of these factors underpinned a call for a comprehensive industry strategy (including educational strategy) for its

introduction. There was mention for the industry to address community concerns about gene technology.

8. *The future for IPM was seen to be with a fully integrated farming systems approach involving cooperation with other crop management systems.*

It was pointed out that some cotton growers were also involved with other crops and this is likely to increase if low prices and water shortages persist. There was a call for non-cotton growers to be involved in AWM groups to improve understanding and cooperation.

RECOMMENDATIONS

I. Area Wide Management (AWM) Groups should be supported as a significant vehicle for increasing the understanding and adoption of IPM in cotton growing regions.

- In the light of these results, AWM groups should be reviewed to ensure that the most appropriate structures and support mechanisms are in place.
- The call for smaller, more informal groups needs to be balanced against the perceived need for range and diversity (non cotton growers) within groups.
- The role of IDOs as group coordinators as opposed to more 'independent' facilitators will need to be considered. The BestWOOL 2010 model in Victoria would be a useful model to explore.
- Consideration should be given to providing grower group members access to the *Working in Groups* [1]program.

II. A fresh extension/education IPM program should be developed and promoted to coincide with the introduction if 'Bollgard® II'.

- There were widespread industry expectations and concerns about the introduction of Bollgard®II and a likely increased openness to new techniques.
- A number of suggestions were made in this study about improvements to existing IPM guidelines and decision tools which could be addressed in such a promotion.
- Consultants and company representatives would need to be involved in the development of any accompanying extension/ education program.

III. Integrate IPM thinking and planning into a farming systems context, with greater involvement of other cropping systems.

- The importance of working together with all cropping systems to manage pests across the landscape was repeatedly raised.
- Increased communication with other growers in the region could be enhanced through area wide management groups having activities that focussed less on cotton-specific issues, pre-season meetings and general education and awareness for all.
- Increasing the understanding and value placed on IPM by all landholders will be an important part of this. A modified IPM short course for non-cotton growers may be of value – linkage with the chickpea accreditation workshops may achieve this.
- Strengthen linkages with GRDC and other grains industry groups (eg. Pulse Australia).
- Joint research and extension projects in IPM.

[1] "Working in Groups" is a Meat and Livestock Australia initiated program. The 2 day workshop aimed to provide people (group participants) with extra skills that help them make the most out of group participation. It was run quite widely, with Doug Graham from REC one of a 'private consultant group' that was contracted by MLA to run workshops.

IV. Increase knowledge and understanding of the impact of whole crop management on IPM – including nutrition, rotations, soil management, etc.

- There was growing interest in the concept of managing the crop to be less attractive to insects and more robust in tolerating damage.
- Research to increase the understanding of whole farming system IPM and techniques for monitoring and management may be valuable.
- Comparative analyses that consider insect pressure, spray regime, nutrition and soils may be of value.
- Case studies of different approaches could be of benefit.

V. Modify CottonLOGIC, or develop other tools, to enhance the IPM function and to allow rapid sharing of data between AWM groups to assist with decision making throughout the season.

- CottonLOGIC could be a basis for rapid, timely sharing of data across farms/growers/consultants during the season. This would assist with communication for those decisions that need to be made rapidly and cannot wait until a group meeting. eg could look at the current beneficial insect populations across a region to assist with decision of whether or not to spray.
- Develop CottonLOGIC to assist with making an IPM decision and to flag the risks for IPM decisions.
- Simpler, smaller software tools, possibly web based may be useful to support IPM. For example, trap crop forecaster, diapause predictor, emergence predictor, pupation predictor, etc

VI. Revise and promote the IPM Guidelines and IPM Training.

- The revised IPM guidelines are soon to be completed. It is recommended that the Insects Extension focus team work with the researchers to assist with the delivery, promotion and educational activities for the new guidelines.
- The cotton extension team could assist the IPM Training Coordinator with promotion of the IPM Short Course for growers in their regions.
- Encourage consultants to undertake the Cotton Production Course and ensure that this course is up to date with the evolving nature of IPM.
- There will need to be a process to review the on-going needs for IPM information and training following participation in the IPM Short course and the release of the IPM Guidelines.

VII. Offer alternatives for growers and consultants not involved with AWM groups. For example, interactive forums with researchers.

- Some people are not interested in forming a group or for various reasons find it difficult to establish a group with their neighbours. Extension strategies need to recognise that many growers and consultants will not be member of an AWM group but still have an interest in IPM.
- Whilst beneficial and worth supporting and encouraging, AWM groups should not be regarded as the only means of IPM information and support. The grower driven nature of these

groups (the importance of which has been strongly reinforced through this study), may mean that the direction and interest of some groups may not always relate to some key messages that are important to promote. Other avenues are also needed.

- Utilising a number of extension approaches (incl. forums, training, media, newsletters, benchmarking, trials) is recommended to reinforce messages and reach more people.

VIII. Support activities that encourage growers and consultants together to learn about and develop confidence in IPM systems.

- The sharing of decision making and risks for IPM has required both growers and consultants to develop their understanding of the complex and evolving IPM system. Learning together is an opportunity for growers and consultants to develop systems in partnership. This study indicated that this is starting to occur with some farms but that there is a need for more learning opportunities and support.
- AWM groups, regional research forums, training and benchmarking are some of the opportunities for growers and consultants to learn together.
- It is recommended that more opportunities be created for researchers to invest more time communicating in ways targeted for both growers and consultants and less focus on consultant or grower only forums.

IX. Collate case studies and benchmarking of IPM systems to demonstrate the benefits.

- There remained some concerns about the cost of "soft options" and IPM systems in general. This may particularly have an impact in high pressure years.
- Economic research has been valuable in comparing the benefits of IPM systems. Some consultants have offered some benchmarking as a part of their consulting package, some has been done by IDOs and some by commercial providers.
- Case studies of individual's or group's IPM approaches would be valuable.
- Benchmarking appeared to have the greatest impacts for growers who are directly involved with their own data. Determine whether this is a Research and Extension activity or something that the IDOs could facilitate a commercial provider to do.
- CottonLOGIC may be able to be modified to benchmark across farms.

X. IDOs continue to conduct regional trials in collaboration with researchers where key questions or situations arise.

- There was still a need to demonstrate the value of IPM approaches at a regional level.
- The model of collaborative trials between research and IDOS such as was used for the plant compensation trials could be applied to other issues – keeping trials simple and strategic to research and reinforce critical elements of IPM.

XI. Identify risk areas for IPM. Develop mechanisms for assessing and negotiating risk at the farm and consulting levels.

- Both growers and consultants expressed concern about the risks associated with IPM. Some consultants are concerned about potential litigation if the crop doesn't yield well due to an IPM approach, others have contract with their clients that take this into account.
- Identifying the key risk areas for an IPM system could help growers and their consultants to make informed decisions about these risks.
- It would seem worthwhile for the Cotton Consultants Australia to work with Cotton Grower Associations to develop mechanisms for developing agreements on how to manage IPM risks.
- Develop tools to allow growers to evaluate their progress in IPM. For example, comparing beneficial numbers and BDI across fields and benchmark profitability.

XII. Ensure that BMP is up to date with the IPM guidelines.

- To avoid mixed messages, it would be beneficial to ensure that the BMP manual and the new IPM guidelines are fully compatible.
- It is recommended to review the sections of the BMP Manual that may relate to IPM once the new guidelines are developed.

XIII. Undertake further research to establish economic significance of secondary pests and IPM approaches for these pests.

- Pests other than Helicoverpa were considered to becoming one of the major limitations for an IPM program, particularly in Bollgard® II crops.
- IPM systems for Bollgard II crops require further development in understanding economic thresholds, monitoring techniques and chemical and non-chemical management approaches.
- There would be value in research and extension working together with industry to develop this understanding and confidence.

REFERENCES

Cotton Extension Group and Rural Extension Centre (1997) Attitudes to Integrated Pest Management in the Cotton Industry. Cooperative Research Centre for Sustainable Cotton Production / Rural Extension Centre. May 1997.

Hearn, AB and Bange, MP (2002) SIRATAC and *CottonLOGIC*: persevering with DSSs in the Australian cotton industry. Agricultural Systems 74: 27-56

Van Beek, P (2000) CottonLOGIC – Impact Assessment Second Report. SyTREC Pty Ltd, Brisbane, Australia.

APPENDICES

The reports of each focus group are included as appendices in the attached file:
IPM Focus Groups_Appendices

These reports document the detailed discussions and key themes emerging from each of the meetings.

Extension Officer Focus Group A – Johnson S & Inglis G

Extension Officer Focus Group B – Neale T & Grabham M

Researcher Focus Group Narrabri – Parker M & Neale T

Consultant Focus Group Darling Downs – Beeston M & Spora A

Consultant Focus Group Emerald – Dalton B, Rourke K & Williams D

Consultant Focus Group Goondiwindi – Christiansen I & Watson C

Consultant Focus Group Narrabri – Dugdale H & Kerlin S

Grower Focus Group Darling Downs – Brown E & Whiteoak O

Grower Focus Group Emerald – Rourke K, Dalton B & Williams D

Grower Focus Group Goondiwindi – Watson C & Christiansen I

Grower Focus Group Gunnedah – Holloway R & Spragge A

Grower Focus Group Gwydir – Inglis G & Johnson S

Grower Focus Group Narrabri – Kerlin S, Grabham M & Dugdale H

Grower Focus Group Macquirie - Spora A, Christiansen I & Deutscher S

Grower Focus Group Mungindi – Deutscher S, Wigney V & Hickman M

Grower Focus Group St George – Hickman M, Deutscher S & Wigney V

IPM Focus Groups Debrief – Pyke B, Brown E & Rourke K