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Draft

INSTITUTE FOR **Rural Futures**

Cotton Consultants Australia Integrated Pest Management Survey

UNIVERSITY OF NEW ENGLAND, ARMIDALE NSW 2351

Cotton Research and Development Corporation

INSTITUTE FOR **Rural Futures**

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Draft Report to Cotton Consultants Australia

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Finally we are indebted to the CCA members who took the time to respond to the survey. Our understanding of IPM issues would not have been possible without their help. Our thanks go to them for taking the time to respond during the small break that is available between cotton seasons.

All errors and omissions remain the responsibilities of the authors.

Executive Summary

The concepts associated with Integrated Pest Management (IPM) are central to insect control and management across the Australian cotton industry. This report outlines the results of a survey conducted to explore IPM practices with agronomic consultants during August and September, 2001.

The survey covered five broad areas of IPM; aphid management, endosulphan usage, IPM guidelines and practices, area wide management groups and the management of beneficial insects and spiders. Survey respondents were drawn from across the cotton growing districts of Australia, with 35 Cotton Consultants Australia members contributing survey data.

Aphids have traditionally being acknowledged as a secondary pest in most cotton growing systems. The advent of Ingard cotton varieties and recent outbreaks of cotton bunchy top, have increased the prominence of aphids as a pest that can result in significant expense to control with impacts on yield that can result in economic losses. The survey sought to understand the types of pressure experienced in recent seasons, thresholds used to assist in spray decisions and information about the types of sprays used to control aphids. Generally, consultants were concerned to keep on top of aphids with the trend appearing to be a reduction in the thresholds, however the reported aphid pressure across valleys was variable with approximately half of those surveyed indicating that they reduced aphid thresholds last season due to the threat of bunchy top. Most consultants were reporting the need to be careful with the sequencing of chemical types, specifically to avoid organophosphate/carbamate resistance.

Endosulfan is still an important tool that is used throughout the industry. The survey found that two thirds of consultants report using endosulfan on less than 50 per cent of fields. When used, endosulfan is almost exclusively applied by ground-rig and aerially by Large Droplet Placement (LDP) spray, the majority by ground-rig. The efficacy of LDP spays were assessed by respondents to be acceptable overall.

The IPM guidelines were widely used by respondents to the survey with the majority of consultants who used the guidelines finding them particularly useful. Most consultants sourced the guidelines through Cotton Consultant Association Inc. meetings, seminars or mail-out. The other source most often mentioned was the 'Entopak', supplied by the Cotton Cooperative Research Centre. Survey respondents went into depth reporting the key elements they were working to implement. In a general sense, these elements reflected the content of the guidelines. Regional differences were evident however, highlighting the variability in production contexts across cotton production valleys. Consultants suggested that the IPM guidelines will need to be reviewed regularly to keep the information current. Similarly, in-depth recommendations regarding beneficial populations, and their impact on pests would improve the guidelines.

The philosophy underlying area wide management groups appeared to be well supported by survey respondents. Unfortunately, the practical application of this philosophy is proving to be a challenge for growers and consultants alike. A large amount of frustration was reported by consultants who seemed unable to generate a commitment to AWM principles beyond the planning and planting period of each season. The breakdown of communication and collective planning by individual groups was reported as often being associated with the first programmed spray failure, or, when grower's workload found them unable to attend meetings. Suggestions to improve AWM effectiveness centred on increasing communication within AWM groups through the use of independent coordinators. Survey respondents also indicated that growers needed to have ownership of the process or be in control if they are to commit fully to the process.

Beneficial insects and spiders were mentioned by respondents throughout the survey. Maintenance of beneficial populations is constantly strived for across valleys, with the 'soft' chemical options frequently referred to as being the type of chemistry that should be used for as long as possible. In excess of 90 per cent of respondents sampled crops for beneficials, the majority of these consultants sampling two to three times per week. Approximately 80 percent of survey respondents used the information on beneficial insects and spiders when formulating spray decisions, abundance and predator/prey ratios being nominated as the most useful data.

The results of this survey show that agronomic managers in the Australian cotton industry are working hard to embrace integrated pest management strategies. The level of commitment exhibited across the valleys is being tested by some practical and social barriers. In other words, there are a range of areas where IPM is performing well and others where improvements will bring benefits to individual, consultants, growers and the industry as a whole.

Contents

Introduction

In his paper to the 2000 Australian Cotton Conference, Greg Kauter quotes the 1999/2000 IPM guidelines;

'Cotton integrated pest management (IPM) is a constantly evolving approach to managing insect and mite pests in cotton. The goal of IPM is to integrate all means of managing pest populations with the aim of reducing insecticide use whilst maintaining profitability.'

This survey was designed to collect data that is consistant with, and useful in quantifying industry movement towards this definition. These data include quantitative and qualitative information on aphid management, endosulfan usage, integrated pest management guidelines, area wide management groups and beneficial insect and spider management from agronomic management consultants across Australian cotton growing valleys.

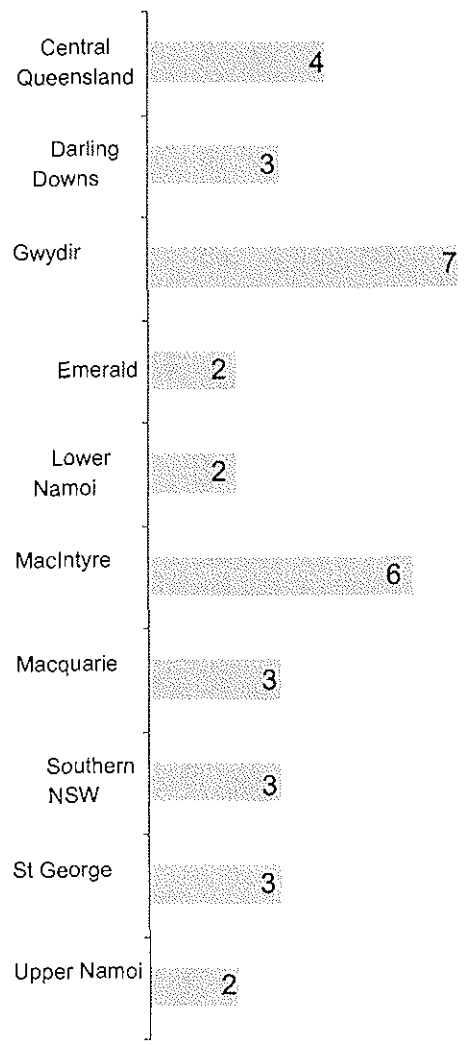
The number of respondents from each region are displayed in Box 1. Given the low number of responses for some individual valleys, no cross valley quantitative analyses have been undertaken. However the information provided by respondents has assisted in building a comprehensive picture of integrated pest management practices and associated issues in aggregate.

An electronic mailable survey was sent by email and facsimile to 173 members of Cotton Consultants Australia Inc. 35 useable responses were received[1]. After adjusting for redundant email addresses, the response rate was 22%.

This is a relatively low response rate for a survey of this type, however feedback from consultants has indicated that although upwards of 80 per cent of CCA members had valid email addresses, a much smaller number use them frequently, or check their email during the off-season. Response to the survey would be improved in the future by notification of the email via post.

The report is in five sections, each providing an overview of a component of the IPM strategy. Verbatim quotes comprise a large part of this report. Quantitative data is present in graphical format wherever possible. Section one over-page looks at aphid management.

Box 1: Regional Responses



[1] Four respondents indicated that they had not checked cotton last season, leaving a sample of 31 for analysis.

1. Aphid Management

This section outlines the results of the survey, highlighting the comments of consultants in relation to aphid pressure and associated management techniques.

Aphid thresholds used to guide spray decisions were reduced during the 2000-01 season by 52% of the consultants responding to the survey. Aphids were judged as being harder to control by 47% of respondents.

Aphicides were reported as being rotated by 88% of consultants. Respondents nominated chemicals that were sprayed to control aphids and failed. Chemicals used to re-treat the field were listed. These paired chemicals are listed in Box 2 at the bottom of this page.

1.1 Aphid management 1999-00 compared to 2000-01 season

Figures 1.1 and 1.2 present the data for responses to the question:

> Did you experience overall, a higher aphid pressure this season (2000-2001) compared to last season (1999-2000)?

The graphs show that approximately 20% of survey respondents experienced similar levels of aphid pressure across the two seasons.

Ingard cotton varieties were reported as having experienced higher pressure by 42% of respondents and lower levels by 36%. Conventional cotton varieties were reported as having experienced higher aphid pressure by 42% of respondents and not higher by 42%. The following comments about aphid pressure are presented by valley.

Central Queensland:

Aphid pressure was very high and constant from mid-December onwards. Fairly good control was achieved with OPs, but we desperately need more chemistry, but preferably more information on thresholds, damage etc., or purchasing in predators to control the aphids.

Both years had very high aphid pressure.

Emerald:

Pressure high in both seasons

Gwydir:

Had resistant aphid on 2 farms and needed to control with Pegasus – very expensive aphid.

OPs were not working well by the end of the season.

Aphids were more prevalent this year, especially on the Ingard.

Aphids were present as soon as the Temik ran out (10 wks).

Lower Namoi:

Any crops treated with Regent early had bigger aphid problems.

The western end of the valley has higher pressure and more resistance.

The presence in conventional fields was lower than Ingard fields, but still higher than last year.

Figure 1.1
Aphid Pressure in 2000-01 Versus 1999-2000 Ingard Cotton

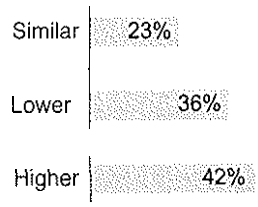
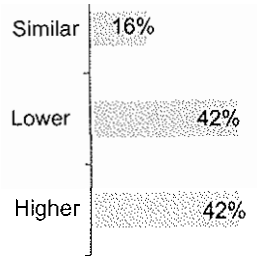


Figure 1.2
Aphid Pressure in 2000-01 versus 1999-2000: Conventional Cotton



Box 2: Aphicide Treatments

Chemical that Failed	Re-treated With
Central Queensland: →	
Dimethoate 400EC (Perfekthion)	Chlorpyriphos-methyl EC/UL (Rescue)
Pirimicarb 500WG (Pirimor)	Diafenthiuron 500SC (Pegasus)
Imidacloprid 200SC (Confidor)	Dimethoate 400EC (Perfekthion)
Gwydir:	
Dimethoate 400EC (Perfekthion)	Diafenthiuron 500SC (Pegasus)
Pirimicarb 500WG (Pirimor)	Diafenthiuron 500SC (Pegasus)
Imidacloprid 200SC (Confidor)	Chlorpyriphos: 300EC/UL (Predator)
Lower Namoi:	
Profenofos 500EC (Curacron)	Endosulfan 350EC
MacIntyre:	
Pirimicarb 500WG (Pirimor)	Diafenthiuron 500SC (Pegasus)
Imidacloprid 200SC (Confidor)	Pirimicarb 500WG (Pirimor)
Upper Namoi:	
Dimethoate (Rogor®)	Diafenthiuron 500SC (Pegasus)

A slight increase in aphid pressure from last season. Our pressure was probably a bit more persistent than in previous seasons. No control problems were experienced however.

Macquarie:

The numbers were not higher than usual and they were not harder to control. But the time taken to reinfest the crop seems to be increasing. We have not detected any OP resistant aphids at this stage.

St George:

No, overall thought aphid pressure was similar to previous year.

Upper Namoi:

Minimal aphid pressure throughout the year. A few isolated patches that posed no significant control problems.

Variable between fields and varieties. No real reason for it.

Consultants were also asked to estimate the number of dedicated aphid sprays that they used throughout the season. Their responses are summarised for Ingard and conventional varieties in figures 1.3 and 1.4.

1.8 Aphids and the 2001-02 season

Survey participants were asked to comment on:

> Whether/how you will change your aphid management and thresholds for the coming season (2001-2002).

Their responses are presented by valley.

Central Queensland:

Would aim to initiate treatment earlier to allow for failure or rapid increases in numbers.

Will concentrate more on the appearance of honeydew more so than actual aphid numbers. This is because of the variation of colonies in field (see original DT).

Will take the advice of Lewis Wilson on observing the number of winged aphids in the population and delaying the spray decision until it looks like the population is increasing. I would like to encourage predators, particularly ladybirds and their larvae, as they do a good job of keeping aphid levels manageable. I hope to use a high threshold, but decrease it as bolls start to open.

Restrict Tracer spray as long as possible to keep aphid parasites working.

Darling Downs:

We are very aware of the problem that can arise due to prolonged high population of aphids and therefore, we will be closely monitoring all our fields for aphids from emergence to defoliation.

The Downs experienced significant CBT problems in 1998-99. Consequently, my threshold up to boll opening has been reduced to 10-20% of plants infested with aphid colonies, not winged adults. As yet, we do not know what causes CBT and we do not know how many aphids are required for how long in the crop to cause CBT symptoms. I am very concerned about litigation if aphids are allowed to persist in a client's crop and the crop suffers significant yield loss due to CBT. The symptoms don't appear till 6-8 weeks after the aphid infestation. I lost two major clients in 1998-99 due to CBT induced yield losses. In the past, I had felt comfortable with a low level of aphid infestation in the crop because I found aphid to be the best attractant and food source for beneficials in a cotton crop. I am now very reluctant to follow this practice. In the future, I will probably encourage growers to plant CBT resistant varieties provided they have the appropriate combination of yield, quality, standability, and disease tolerance. In irrigated cotton, there has been a swing towards the use of Aldicarb such that 90% to 95% of the crop is now treated with this product at planting. Aldicarb is not being used to control aphid specifically but to give the cotton plant sufficient seedling vigour to withstand the cold shocks often experienced on the Downs, to increase yields, and to combat Fusarium Wilt, which is endemic on the Downs.

Due to the IRMS and concerns about aphid insecticide resistance, the first spray for aphid, if they should appear early in the season, will have to be either Endosulfan or Confidor. Endosulfan is likely to be the first choice because of its better fit in an IPM program. Until varieties tolerant to Fusarium Wilt and

Figure 1.3
Number of Aphid Sprays - Ingard Cotton

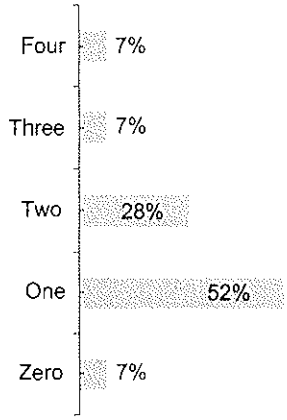
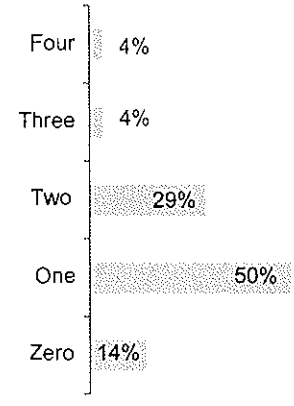


Fig 1.4
Number of Aphid Sprays Coventional Cotton



CBT are available, it is unlikely that irrigated cotton farmers will swing away from using Aldicarb.

[illegible]:

Probably use a lower threshold than industry standard to ensure products like Confidor work. Also due to some 'Bunchy Top' concerns.

However, did not get 'Bunchy Top' last year even in heavily infested crops.

Will use lower thresholds on farms in sensitive areas (generally close to town) where it is not possible to use OPs such as Predator or Profenofos. Some of this will be to ensure that a second application of Pegasus is possible taking into consideration label periods between applications and withholding periods. I do not believe Pirimor is an option. OPs (particularly Predator) were working better last season but still had a total failure with Pirimor.

Gwydir:

Rotate all chemistry to consider aphids and their resistance. Hopefully keep thresholds at industry threshold but I will be a little conservative or act as directed by the grower.

Will be more of aphid chemistry and rotation for management of aphid populations. Will maintain conserv-atively lower thresholds (i.e. not 90% but more 50%), as experience has shown it is difficult to maintain suppression of high populations.

No.

Aphids are becoming a major pest. So far this year, the wheat has a population already, so am predicting that it could be a similar year to last year. The chemistry will be rotated to control resistant aphids, Endosulfan will be used more to take out early resistant generations. Thresholds will be varied, depending upon pressure and time of crop. Certainly Bunchy Top is in the back of my mind when aphids are about. We are planting more deltapine lines that are 'Bunchy Top' resistant.

At planting we use Temik, so this puts us in the hardest situation for our first aphid spray if it needs to be early, as our only options are Confidor, Pegasus and Endo. Confidor is not terribly IPM friendly and expensive and not 100% effective, Pegasus is not for early season as it needs a full canopy for fumigant action and we don't use Endo due to environmental constraints. Pirimor is our choice because of IPM fit, but it is in the same group as Temik, so I am not sure what we will do yet – hope for no early season aphids I suppose!! We need another aphid product that is not an 1B or 1A Group and that is IPM friendly for early season use. We will probably have to let our thresholds go a little higher than we would like due to the fact that we run an IPM program and we don't have a product that fits early season, and also so that we can stick to the IRMS. Or hope that beneficials will help us out! The conventional threshold is too high, but based on last season I will use a threshold based upon Hoverfly numbers, I found that they reduced the numbers from as high as 60% plants infested down to around 20% The spray threshold will be up around 50% mid-season depending on beneficials.

Lower Namoi:

Using a system of not targeting one pest at a time. If thresholds are at 30% infestation, hold off till there is a problem that requires heavy application and take out beneficials as well. Use beneficials as a guide and use chemistry that will allow for the beneficials to re-enter the field quickly.

Yes: 1) No, Regent early regardless of thrip or mirid activity. 2) Explore spray oil alternatives. 3) Endosulfan next option.

Macintyre:

I think I will leave my aphid strategy the same as last season, making sure that I rotate chemistry.

In the western end of the valley we will change from granular at planting treatments to Gaucho seed treatment. This will let us rotate to Pirimor as the first in crop spray and Pegasus late season.

Will continue to use a low threshold. Will avoid the use of Dimethoate to avoid resistance. Will be more aware of seed dressings and treat on the first spray with a different chemical to the seed dressing.

I will follow the aphid strategy guidelines. I will rotate chemistry including soil insecticides. Preserve my beneficials for as long as possible. Farm hygiene.

Our strategy will be to still keep our thresholds reasonably tight due to threat of CBT. Will probably look at 10% to 20%

We will probably have to let our thresholds go a little higher than we would like due to the fact that we run an IPM program and we don't have a product that fits early season and also so that we can stick to the IRMS. Or hope that beneficials will help us out.

Aphids are becoming a major pest. So far this year, the wheat has a population already, so am predicting that it could be a similar year to last year. The chemistry will be rotated to control resistant aphids, Endosulfan will be used more to take out early resistant generations. Thresholds will be varied, depending upon pressure and time of crop.

threshold depending on the client. We are encouraging growers to be more strict about their farm hygiene this winter so as not to get a population build up on weeds like milk thistle. Our insecticide strategy will be to mainly use Gaucho as a seed treatment (this product has variable results as a foliar), if aphids build up and Heli pressure is quiet or in Ingard we will use Pirimor, or if Heli pressure is an issue we will use Endo. If aphid pressure is an issue later in the season we will look to use Pegasus and control later season spider mite at the same time. This strategy is similar to the one we used last season except for the increase in farm hygiene as well as taking into consideration the seed treatment used when looking for chemistry rotation.

Macquarie:

Keep field perimeters free of winter weeds that act as hosts for over wintering aphids. Control aphids when numbers are low (below 50%). Rotate chemistry (if aphids are present early season use Endo or Confidor) avoid using OP early in the season. Encourage beneficial populations by using softer chemistry in Stage I and II, where possible.

Probably the same as last season.

Southern NSW:

Pirimor gave a better result than Dimethoate. Dimethoate sprayed block had one extra insecticide than the pirimor sprayed blocks for heliothis control.

St George:

Depending on what the season brings. If the aphid pressure is higher then I will consider changing my management of aphids.

Will have no change compared to the past two seasons.

Upper Namoi:

I will be very wary of aphid infestations and will not tolerate significant infestations. Due to the IPM and Area Wide Management approach. I will avoid OPs control as long as economically possible.

If cotton is big enough with good canopy I will start with Pegasus because I will have used Temik, so OPs and Carbamates are out

We will continue to use a low threshold. Will avoid the use of Dimethoate to avoid resistance. Will be more aware of seed dressings and treat on the first spray with a different chemical to the seed

2. Endosulfan Usage

Applications of Endosulfan have been reduced over recent seasons. Graphs providing an overview Endosulfan usage for last season are presented in Box 3.

2.1 Endosulfan applications

Consultants were asked to indicate the percentage of fields under their management that were treated with Endosulfan. The results are presented in figure 2.1. This figure shows that two-thirds of consultants reported using Endosulfan on less than 50% of fields. Of the 22 consultants who reported using Endosulfan, figures 2.2 and 2.3 show the percentage of farms sprayed aerially by Large Droplet Placement (LDP) and ground-rig respectively. These grapbs include linear trendlines or least squares fits for the data. As expected, the trendlines show that there is an inverse relationship between application types, with ground-rig being used on the greater percentage of fields. One consultant reported using Endosulfan by air as an Ultra Low Volume (ULV) mix 100% of the time.

Respondents were asked to report their perceptions of aerial LDP efficacy. The results for this question are presented in figure 2.4. In this figure, only two consultants reported acceptable efficacy as being below 70%. This suggests that overall, the efficacy of aerially applied LDP sprays was considered to be good by the majority of consultants.

2.2 Large droplet placement sprays

As outlined above, LDP is an important method of applying pesticides by air. Consultants were asked the following:

> Where LDP applications gave un-acceptable efficacy, please comment on how this affected subsequent management or impacted on the crop.

Responses by valley follow.

Central Queensland:

Control of Helicoverpa was unacceptable with Predator, while aphid control was 90%. Thus leaving another spray to clean up residual grubs, while suffering another three days damage.

The fields required re-spraying with a different, more expensive chemical and significant square damage resulted from the failure.

Box 3 – Endosulfan Application Details

Figure 2.1
Percentage of Fields Treated with Endosulfan

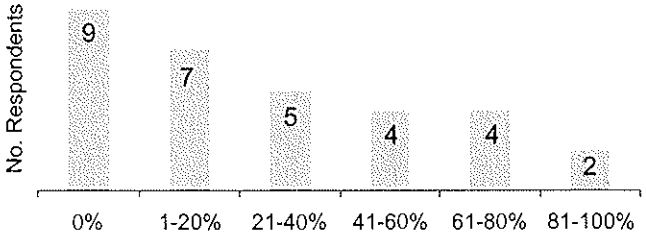


Figure 2.2
Percentage of Farms Sprayed with Endosulfan by air as a LDP Spray

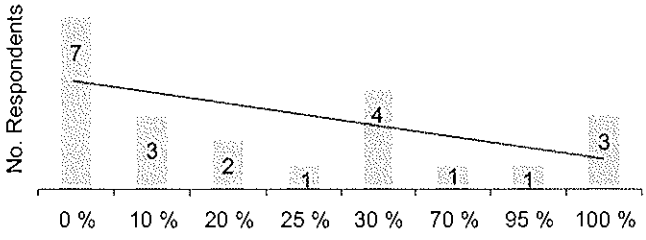
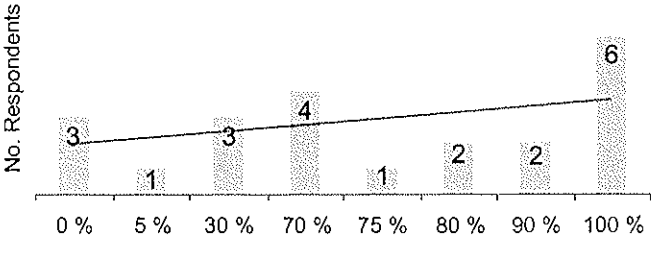


Figure 2.3
Percentage of Farms Sprayed with Endosulfan by Ground-rig



Darling Downs:

I would be very interested in the efficacy of LDP applications of Endosulfan against mirids, aphids and green vege bugs. Endosulfan is not used much for Heliothis control in my area because of the presence of significant populations of H. armigera early in the season and the high levels of resistance.

Emerald:

Resulted in extra spray as the period between applications was five days. The next application was required mainly on larvae that had come through the Endosulfan spray. Experienced significant fruit loss from larvae that grew to medium before control was gained. Also the respray did not totally clean up the crop due to the size of the larvae when it was applied.

Mundubbera:

Short residual due to poor coverage resulting in a respray with Tracer.

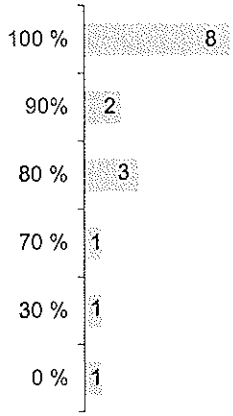
Impact as a result of poorer performance of LDP would be minimal due to the lack of heavy insect pressure. In a high pressure season, a poor job or a marginal job, which is affected by another egg lay straight afterwards, can lead to unacceptable crop damage.

Macquarie:

Endosulfan cannot be relied on to give good control by air, and was only used when it was too wet to get ground-rigs on farm.

The unacceptable jobs resulted in a quick turn around re-spray with a more expensive insecticide option to clean up escapes. In most cases, fruit retention suffered adversely and we were forced to reduce thresholds to avoid any more damage. Generally efficacy was affected by adverse conditions either during or after the application.

Figure 2.4
Acceptable Efficacy of LDP Sprays



3 Integrated Pest Management

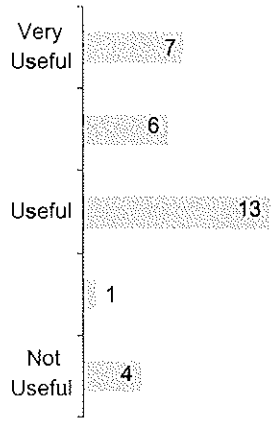
Integrated pest management (IPM) is an important management tool for the cotton industry. In this survey, consultants were asked a number of questions about IPM.

Awareness of the IPM guidelines compiled by Lewis Wilson and Robert Mensah was acknowledged by 84% of respondents. The remainder indicated that they were unaware of the guidelines.

Seventy-two per cent of consultants used the guidelines on farms they provide agronomic advice. Of these consultants, 63% indicated that they used the guidelines on 100% of farms. The balance ranged between 20% and 90%.

A rating of overall usefulness was provided by consultants. The results are displayed in figure 3.1. This figure shows that the majority of respondents felt the guidelines were useful to very useful.

Figure 3.1
Usefulness of IPM Guidelines



3.1 IPM guideline availability

The follow question was asked of survey respondents:

> Please indicate where you have seen the IPM guidelines.

Responses for this question are listed by valley below.

Central Queensland:

CCA Conference.

Mail out.

They are in my copy of Entopak.

Mailed out.

Darling Downs:

I was given these guidelines by David Larsen at a conference/seminar. They stay in my files in my scouting vehicle at all times.

CRDC publications.

Emerald:

Cotton Pest Management guide 2000 to/ 2001. Regarding the guidelines – do not follow the guidelines as such – i.e. I do not generally use food sprays etc. But many of the principals and practices in the guideline are followed as a normal practice around Emerald as the best way to get from the start to the end of the season – not just where trying to follow IPM system.

Gwydir:

They are filed in my copy of Ento Pac.

CCA workshop.

Yes.

CCA meetings.

I have a copy and received it from James Quinn at our AWM meeting last year some time.

They were mailed to me by Dave Larsen. They were also available at the cotton trade show.

Lower Namoi:

From the book, and from lectures provided by Lewis Wilson and Robert Mensah.

Pesticide guide.

Macintyre:

IPM notes supplied at a IPM meeting.

IPM guidelines publication.

Ento pak, Pocket guide to insect management.

Was sent to the office. Has also been handed out at CCA meetings.

Insect pest management strategy guidelines.

Entomologic program.

Pesticide guide and booklet.

Macquarie:

Pest control handbook and involved in some of the early development

We have the IPM Guidelines in the Entopak supplied by CRC.

Publications through mail.

St George:

Ento pak.

Cotton pest management guide.

Ento pak.

Regarding the guidelines- do not follow the guidelines as such - i.e. I do not generally use food sprays etc. But many of the principals and practices in the guideline are followed as a normal practice around Emerald as the best way to get from the start to the end of the season – not just where trying to follow IPM system.

Cotton pest management guide insert Insect management in cotton – pocket guide.

[illegible]

Cotton Pest Management Guide 2000- 2001. Talks at various meetings.

1. *Meetings.*
2. *Pocket guidelines were mailed out.*

3.2 Important elements of IPM

Consultants are well placed to judge the importance of various aspects of IPM. With this in mind, the following question was asked:

> List the key elements of IPM you seek to implement on farms you provide agronomic advice for.

Responses are listed below, valley by valley.

[illegible]

The use of all available options. Choosing the lowest impact option that will achieve the desired outcome. Preservation of beneficials (i.e. soft sprays). IPM adherence. Damage control (fruit) and no thresholds.

Use of beneficials to assist in pest control. This is achieved by using the pest to predator ratio and the use of predator foods.

1. *The rotation of selective chemistry to control pests i.e. Gemstar, Bt, Endosulfan, Tracer etc.*
2. *Accepting a certain level of damage in the crop, especially from secondary pests, and recognising the plants ability to compensate.*
3. *Checking every second day and often every day to keep well informed in what is going on in the crop.*

Higher Heliothis thresholds pre-bloom. Try to stick with Endosulfan sprays early for reduced aphid and mirid pressure. Newer 'softer' chemicals to be used specifically by which predators are found in the fields. The planting of nursery crops for predators.

[illegible]

1. *Pupae busting.*
2. In dryland crops, I encourage the retention of stubbles from previous crops e.g. wheat, sorghum because they seem to attract beneficials
3. *Encourage the use of granular insecticides, such as Aldicarb, so as to avoid the use of early season Organophosphate sprays for sucking pests (thrips, mirids), to promote seedling vigour and to combat Fusarium Wilt.*
4. *Choose the least disruptive sprays for as long as possible while staying within IRMS. I do not like the crop to become a nursery for Heliothis. Will recommend DiPel and Gemstar pre-squaring and early squaring to prevent many larve from going to ground and pupating. Beneficials are not always present in sufficient numbers.*
5. *Aim to manage Heliothis in all crops on the farm – promote AWM.*
6. *Liaise with resellers in winter months to ensure supply of products that you want to use in your IPM program.*
7. *Encourage the planting of trap crops, particularly in spring in our area. Use other crops e.g. commercial sorghum, late corn as a trap for Heliothis. Use Gemstar on sorghum on client's farms even though Heliothis population may be below threshold to encourage a NPV epidemic in the district.*
8. *Encourage experimentation with crops such as lucerne and niger to act as beneficial nurseries*
9. *Actively participate in AWM and IPM groups in the local area, and encourage growers to become involved.*
10. *In future, look towards biopesticides and releases of beneficials e.g. Assassin Bugs.*

Year-long plan, Delay SPs, beneficial/pest monitoring, plant mapping.

[illegible]

Rotation of chemistry – within IRMS guidelines. Use of soft options for as long as possible. Avoid SPs for as long as possible – hopefully at least until January 1st. Monitor beneficials. Use dynamic thresholds early with damage assessment as part of decision-making process.

[illegible]

Soft options for as long as possible. Higher thresholds all season particularly if there is plenty of total fruit. Grower has final say.

To remain focused on soft options.

Try to stick with Endosulfan sprays early for reduced aphid and mirid pressure. Newer 'softer' chemicals to be used specifically by which predators are found in the fields.

Grower participation. IPM is not going to work without grower participation and commitment. An area-wide management approach is indispensable for IPM to work.

Soft chemistry early with D-Vac sampling and visual predator sampling used to gauge necessary treatments.

Trying to reduce the number of sprays put down, and thus lowers resistance to existing chemistry, by utilising predators.

Ingard, soft option products for a long as possible. Use of envirofeast/pred feed to attract beneficials. Lucerne strips planted all around the farm. Trials with Robert Mensah on refuge crops, oils etc. Good 'out of cotton' weed control. Use Lepton Test kits for species identification. Try to put Gemstar in with the last spray, if there is enough available, pupae destruction. Use C-probes and Neutron probe for water scheduling. Have a spray management plan for all pesticides, not just Endo. Use of Temik.

Using softer option chemistry. Encouraging beneficials and monitoring beneficials into the fields. Avoid using non-selective chemistry for as long as possible. Adopting an AWM system.

Use of soil applied insecticide for thrip control reducing the need for early season sprays.

Lower Namoi:

Reduce early insecticide usage. Greater beneficial numbers. Maintain soft options as long as possible.

Macintyre:

Agreement with the grower or farm manager that you are going to run an IPM program. Plant mapping. Beneficial numbers and species. Cost/ha.

Preservation of beneficial insects at all costs. A dynamic threshold covering fruit factors, predator/prey ratios and pest numbers. Balanced use of nitrogen and water. Use of softest products first. Rotation of chemistry within the IRMS. Trap cropping in spring and autumn. Pupae busting.

Weed control, monitoring beneficials and parasites, using soft chemistry for as long as possible.

Grower participation. IPM is not going to work without grower participation and commitment.

An AWM approach is indispensable for IPM to work. Research support and consultant commitment. Benchmarking is a useful tool to gain confidence in the program. Chemical supplies should get more involved in IPM trials. IPM workshops are a very good idea if grower attendance to it.

Maximise area planted to Ingard cotton. Get client involved in an area-wide management group if one is available. Encourage the planting of chickpea trap crop and pigeon pea refuge for Ingard. Encourage the use of band spraying with ground rigs for early season pesticide applications. Monitor beneficials as well as pests for informed spray decisions. Extensive use of plant mapping to mid flower to monitor fruit loads. Use chemistry that is target specific for as long as possible. Rotate active ingredients used and follow the IRMS and IPM guidelines.

Namoi:

Insect resistance strategy, Ingard – soft options early season, dynamic thresholds, beneficial conservation where appropriate, sensible N rates.

More grower and consultant interaction with neighbours/fellow agronomists and establishing AWM groups throughout the Valley. Plan to delay use of Pyrethroids as long as possible into Stage II of IRMS. We now have chemistry tools to delay the use of broad-spectrum chemistry. Promote the use of soft option chemistry during early season growth. However, low cotton prices this season will make this task a challenge. Monitor spring crops (such as Canola) pupae numbers and promote pupae busting post harvest if numbers are significant. Get the basics right with crop management – Nutrition, weeds, water and insects to achieve earliness and high yields. Advising and overseeing the planting of trap crops (if possible) and refuge areas for Ingard resistance management. Monitor beneficial numbers early season and using dynamic thresholds in conjunction with monitoring tools such as pest beneficial ratio, 1st position fruit retention, fruit counts and fruiting factors.

Area wide management. Insect thresholds.

St George:

Thresholds, trap crops, chemistry rotation, pupae busting, general farm hygiene, nutrition, variety selection, bed preparation.

Range of control measures (e.g. pupae busting, trap crops, seed dressings), Ingard, chemicals, control of over-winter hosts. Ensure no stub or regrowing cotton. Chemical intervention based on regular scouting and use of appropriate thresholds for crop stage – test results and consideration of beneficial complex and secondary pests.

'Soft chemistry early with D Vac sampling and visual predator sampling used to gauge necessary treatments'

Using softer option chemistry. Encouraging beneficials and monitoring beneficials into the fields. Avoid using non-selective chemistry for as long as possible. Adopting an AWM system.

Aim to delay use of highly disruptive chemistry for as long as possible. Use neutron probe to schedule irrigations to appropriate deficits. So don't over-water and use pix to enhance earliness. Select for indeterminate varieties. Stick to IRMS where possible.

Ensure pupae busting. Use of spring trap crops where possible (drought on the Downs makes this difficult this season). Nitrogen management and growth regulations to minimise rank growth. Use industry thresholds and softer options early to try and maintain beneficial numbers as longas possible. Manage crop for earliness.

Upper Namoi:

A balanced economic approach. Early season thresholds are raised sightly until squaring. Full use of seed treatments will be sort. Avoidance of SP and OP controls as long as possible. Weed control will be high priority including channels etc. The use of products such as Affirm will be considered early if mites are a threat (suppression is preferable to a blow out that will warrant a full miticide application). Gemstar and Predator attractants may be entertained if beneficial numbers warrant. The use of fruit retention counts will assist in determining the action to be taken against insect infestations

1. Soft chemicals early. 2. Keep beneficials. 3. Alternate cropping. 4. Plough downs.

3.3 IPM guideline Improvements

The comments of respondents in section 3.2 show that they are well placed to provide feedback and comments about the IPM Guidelines. Consultants were asked the following question:

> Can you suggest how the IPM Guidelines could be improved?

These suggestions are listed by valley.

South Queensland:

Some more work on fruit retention – more whole plant. Lot more information on what beneficials do what (more specific).

Incorporate them with Cottonlogic i.e. be able to click on a button and the appropriate info will appear on screen e.g. the table that lists the selectivity of each chemical. Lazy, I know, but it would be handy.

Guidelines are only a guide anyway. Just need as much info as possible because different things work in different areas.

Darling Downs:

They will need to be continually updated as new products, biopesticides and technologies are developed. We need to know what affect the products have on the various predators and parasites. As the information becomes available, the relative 'importance' of each species of predator/parasite in controlling 'pests' would be interesting.

Supply current control options for pests.

Gwydir:

Continually update the chart on effect of products on beneficials. Information on 'predative' value of each predator – I know research is in progress in this area. A chart of product effects on secondary pests would also be good. i.e. Tracer kills thrip – flaring of Mite. Do not leave it untouched from season to season – update and keep interest and commitment high.

Sent out to all growers and consultants for viewing

For a start, some people may not realise that they are the 'IPM guidelines' as the folder they came in has not even got IPM written on it at all, just Entopak!! So for a start they need to be called the IPM Guidelines or something that has IPM in the heading. I think the core part of it needs to have the info in it that does not change regularly, i.e. the basics of IPM and then you have the supporting documents at the back which need updating fairly regularly. This is how it is pretty much set out at the moment but there just needs to be a few minor changes. On the whole it is set out very well. Maybe a little bit non-reader friendly though with writing after writing.

More threshold work and some more detailed information on reasons why the predator prey ratios do or do not work with certain pest pressures.

Lower Namoi:

Flexibility in thresholds. More information provided in reference to the feeding patterns of beneficials as to where beneficials are primarily eating aphids or Heliothis as to whether an insecticide would be needed. Suppressive effects of chemistry on types of insects, both beneficials and pests.

Thresholds, Trap Crops, Chemistry Rotation, Pupae Busting, General Farm Hygiene, Nutrition, Variety Selection, Bed Preparation.

We need to know what affect the products have on the various predators and parasites. As the information becomes available, the relative "importance" of each species of predator/parasite in controlling "pests" would be interesting.

Time is needed for consultants and growers to become comfortable with the change in management practices.

Macintyre:

More info on life cycles of beneficial insects. More on the disruptability of different products at different stages of crop growth. Update products and their BDI. Break up the text with pictures or light humour.

More ideas for IPM in dryland, double-skip systems. With reference to ability of dryland to compensate.

Guidelines need to evolve as new techniques and tools are being adopted by growers.

Macquarie:

No, just continue with updated information as it becomes available.

St George:

Maybe could be enhanced and put in booklet form like the Cotton Pest and Management Guide.

Upper Namoi:

Better understanding in relation to predator ratios i.e., one spider per metre means what?

Flexibility in thresholds, more information provided in reference to the feeding patterns of beneficials as to where beneficials are primarily eating aphids or heliothis as to whether an insecticide would be needed.

4. Area-Wide Management (AWM)

Area-wide management groups offer cotton growers the chance to coordinate their pesticide and other management activities across a defined geographic area. AWMs are being actively promoted by the industry, with input from consultants being vital to the overall success of the program.

Seventy-seven per cent of consultants responding to the survey indicated that they participated in AWM or IPM groups. These consultants participated in one to five groups. Figure 4.1 outlines the number of groups that consultants were involved with.

4.1 AWM group operation

Respondents were also asked if they could indicate how well the AWM group(s) they were involved in functioned. Their responses are presented in Figure 4.2. This graph shows that there are cores of groups that are performing well. However, approximately 44% of respondents indicated that the groups they had experience with were not functioning well, with 22% of respondents indicating that the functioning of groups was relatively poor.

Respondents were asked for their comments regarding AWMs:

> Please comment on how well the AWM group(s) you participate in function.

These comments are presented below.

Central Queensland:

The group is only new this season and has a few areas to iron out yet. Over all commitment is very good.

This group has just started out and 2001-2002 season will be its first.

We are just starting an AWM group for this season, so we are yet to see how it functions.

Darling Downs:

Our groups have been quite successful. Maintaining an IPM approach throughout the whole season has been difficult in some areas as we do experience variable pressure even in smaller areas, which means one end could have very low pressure and the other moderate to high pressure. We have good communication within these groups which has helped.

To function well, the AWM group must have an active facilitator e.g. extension person or consultant and a key grower. All consultants need to attend and actively encourage their clients to attend meetings and participate. Growers must have 'ownership' of the concept and its implementation. Consultants and growers must be able to talk to each other either directly or through the AWM forum.

Less participation when everyone gets busy.

Gwydir:

My clients have just about given up as other growers in group just spray anything. They believe in going in hard and early, so it's hardly worth the effort of going to meetings. I have given up going as I was often the only consultant present at the meeting and the others (I think) thought I was out of my tree in trying to convince, cajole and beg to delay the use of SPs. The idea of a more expensive soft option was beyond comprehension, as was the notion of early damage. May I comment that growers usually adopt the opinion of their consultants in this area. I have been advised by a loss assessor that the use of IPM by a consultant puts the consultant in a position of 'risk' in so far a farmer may sue for loss of yield. What is the cotton industry's reaction to this notion???

Could be a lot better. It is a useful discussion forum but they do not create area-wide adoption of insect management in a co-ordinated manner – it is individual and haphazard.

Groups work quite well, mostly just to get growers together and discuss how the season is progressing for them and get ideas on what is working and what is not.

Worked well up till Pyrethroids were applied. Managed as a group to delay usage for a considerable time. Admittedly last year was a lower Heliothis year – whether we could get the same result in a high-pressure year is debatable.

Our AWM group would have to be one of the largest with quite a few growers, on-farm agronomists and consultants involved. Twenty-four faxes go out but there are more people involved due to reseller agronomists etc. It started out really well with good attendance and I think it may have been after the first bad aphid season. When it's good, everyone seems to vanish!

Figure 4.1
Number of AWM (or IPM) groups consultants are involved in

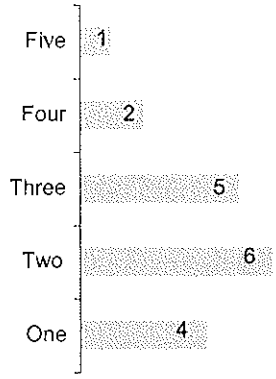
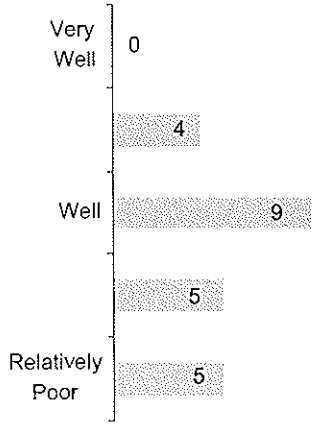


Figure 4.2
How well do AWM Groups Function



Another fellow and myself tried to start it again about one week ago with not much response, but we will keep trying. We may have to make it a smaller area to really get it going. Basically we know we will not get it going properly with the current group as there are people in it who we know will never ever show up or show any interest. I also think that it may get worse as we do not have a Cotton IDO anymore for this valley and he helped a fair bit with the running of the group.

The AWM group that I participated in was attended poorly by the grower that I was consulting to, also consultants were not included, the farmers wanted to have all growers which made it difficult to try and use chemistry to any sort of local strategy.

Lower Namoi:

Growers need to drive the groups. They are struggling with this. It is worse in areas where growers once never spoke to each other about activities on their respective farms.

MacIntyre:

Participation will depend upon what is being discussed. There is a lot of variation between groups and the reactivity, but in the MacIntyre, all groups are doing a good job of communicating and working towards a common goal of preserving beneficials and reducing disruptive spays.

More regular meetings could increase confidence within participants. Regional agronomist officers should coordinate meetings and field days. More communication between growers is required (share experiences). More communication between consultants should be encouraged.

Some AWM groups are more progressive than others. Success is based on the premise that they must be grower-driven to succeed. Tangible benefits need to be the outcome each season in order to maintain grower and consultant participation.

Macquarie:

The grower involvement in these groups is poor and there is a real need for a grower to take the lead and direct the group. The spraying of winter crops with SPs is also a major problem.

Most groups are in the initial stages of development. In a successful AWM group there needs to be one or two growers who

are the driving force behind the group. Unfortunately some groups all mean well, by setting goals, but they are only progressing very slowly, due to lack of direction. It is very difficult to organise a group of growers and consultants with different ideas and attitudes to move forward as one coordinated group. That is why a respected member needs to be the progressive leader of the group. Everyone who joins a AWM group is aware of the benefits to their operation but communication within the group at critical times lets them down. I'm sure with time this will improve because initially it is a cultural shock to some growers, but eventually the benefits are realised, which has been proven in other AWM groups in the industry. In the Macquarie we have a unique opportunity to establish AWM groups because the cotton industry participants (growers and consultants) have always been very open with their management practices and have shared successes and failures amongst themselves without any rivalry mentality.

St George:

We have just started one up for the coming season 2001-02.

Not cohesive groups yet.

AWM is just beginning to take off in St George and hopefully will be adopted by the majority of growers within the irrigation area. However, I have since moved to the inner Downs and hope to continue consulting and become involved in AWM groups in this area.

Upper Namoi:

Last season was our first attempt at AWM. Many of the growers were not committed or convinced (consultants can also be included in this group). An early Tracer failure that required a clean up interrupted the area early that was hoped for. The late heavy insect pressure seemed to cancel out the advantages and efforts of the early part of the season. Floods and heat waves did not assist in following our own guidelines.

Only started last season. Hopefully it will get better this season.

4.2 Improving AWMs

Many of the comments in section 4.1 above flow into methods for improving the operation of AWMs. Consultants were asked to comment on the following question:

Growers need to drive the groups. They are struggling with this. It is worse in areas where growers once never spoke to each other about activities on their respective farms.

Some AWM groups are more progressive than others. Success is based on the premise that they must be grower-driven to succeed. Tangible benefits need to be the outcome each season in order to maintain grower and consultant participation

How could the effectiveness of the area-wide concept be improved?

These comments are presented on a valley by valley basis below.

Central Queensland:

Too early to tell.

Darling Downs:

Better communication between neighbours and consultants. Aiming for similar planting dates (sometimes difficult with variation in rainfall events).

Any meeting should have an agenda or at least a specific point to be discussed. If people are going to be asked to speak at a meeting, they should be briefed beforehand.

Email linkup.

Gwydir:

There needs to be an incentive for the growers to get involved. Lord knows what would be powerful enough to do this other than money.

Timing of sprays and products to control and ameliorate pests.

Difficult to say, other than having a co-ordinator for each valley whose job was specifically AWM, and who saw all growers regularly with result/progress reports to continually reinforce the issue.

If you are lucky to have either one consultant for the group of growers, a group of growers who care about what is going on around them, or a nice small area with a few keen growers. Chris Wicks has shown the benefits from his work with bench marking and that still does not entice people to get in the group.

I think that inter group transfer of information (perhaps through NSW Ag or QDPI officers).

The Gwydir seems to be a somewhat fragmented valley by comparison to the MacIntyre. The Goondiwindi group seem to co-operate much more smoothly, and embrace IPM ideals more readily.

Lower Namoi:

Time.

MacIntyre:

I think the concept needs more time before I can comment about improvement.

The growers must have ownership and there must be one main motivator within that group. IDOs can help with administration and co ordination but need more practical experience.

The key word is more communication between all people involved (researchers, consultants, growers and chemical companies).

Coordination and communication are the key. Growers and their consultants do not need more meetings for meeting sake. Our local IDO coordinates the AWM groups in this valley which is good and needs too continue but each group needs a grower too drive the agenda. IDO participation could possibly be a bit more progressive as opposed to passive or reactive.

Macquarie:

Growers need to take ownership of the groups

AWM group meetings, should record minutes and set goals in a more formalised manner. All the meetings are generally informal and provide useful information for growers and goals are set, however the following meetings appear to lack direction and goals are not achieved. Growers/agronomists need to put AWM higher on their priority list, because insecticide costs are increasing to unsustainable levels. There needs to be a person responsible to drive the whole group (a coordinator) and preferably a grower. This is going to take valuable time, but if the group is well organised the leaders should be able to delegate tasks to other members. Continue the grower experience information from other well-established groups.

St George:

Greater grower education.

Upper Namoi:

One group has worked together over the off season on their BMP manuals and this has help to develop a better level of communication and trust between the members and this will greatly help the cohesiveness of the AWM. A better understanding and bank of knowledge with the consultants will also promote confidence.

There needs to be an incentive for the growers to get involved. Lord knows what would be powerful enough to do this other than money.

It is very difficult to organise a group of growers and consultants with different ideas and attitudes to move forward as one coordinated group, that is why a respected member needs to be the progressive leader of the group.

The maintenanec of beneficial insects and spiders is central to IPM principles. Graphs providing an overview of beneficial insect and spider information are presented in Box 4.

Survey respondents were asked to indicate whether they sampled for beneficials in their normal crop-checking program. Most respondents (93%) indicated that they did sample for beneficials. Individual fields were sampled from one to three times per week. Figure 5.1 displays the break-up of the number of samples per week as indicated by consultants answering the survey. This graph shows that generally, more than half of consultants surveyed were sampling for beneficials two to three times per week.

Respondents indicated the length of time that they were checking fields for beneficials. Of the 26 consultants who indicated this time, two sampled during Stage One only and 13 during Stages One and Two. Eleven consultants, or approximately 30%, indicated that they were sampling for beneficials all season.

Figure 5.2 outlines the methods used to sample for beneficial Insects. Visual examination was the most common method used, this was followed by plant shake, vacuum and sweep net.

Consultants were asked to indicate the method used to record or categorise beneficial insect populations. The responses are presented in figure 5.3. Twelve respondents indicated that they identified beneficial insect groups or individual species. Grouping beneficials together or not differentiating between them was indicated by ten consultants, while insects and spiders were separated out by seven. The beneficial count was used to make management decisions by 84% of respondents. Figure 5.4 outlines the type of data used as a basis for these decisions. Consultants indicated that abundance and predator prey data were used in the decision making process as was the recorded presence of beneficials by a smaller number of respondents.

Box 4 – Beneficial Insects and Spider Data

Figure 5.1
Number of Samples per Week

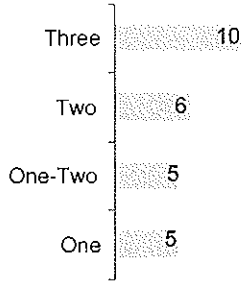


Figure 5.2
Sampling Methods

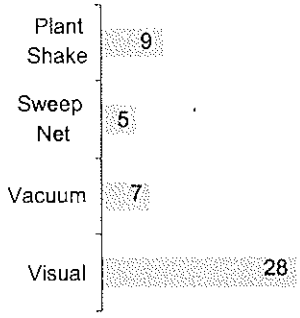


Figure 5.3
Recording or Categorising Beneficial Populations

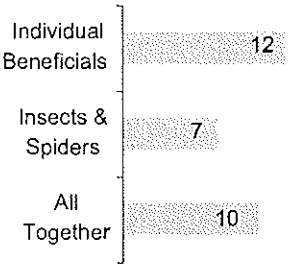
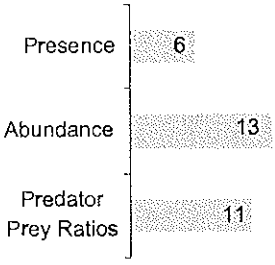


Figure 5.4
Information About Beneficials Used for Spray Decisions



6. Conclusions

The premise of this survey was to gain an appreciation of the practicalities associated with implementing and maintaining IPM systems across Australian cotton producing valleys. The results show that there are elements of IPM that are working well and by all accounts appear to be improving the management of insects and mites. Examples of these include:

- Success in limiting resistance through chemical rotations.
- Responsible and well targeted endosulfan use.
- Increased use of Large Droplet Placement Sprays.
- Increasing knowledge of the content of the IPM guidelines.
- Recognition that Area Wide Management Groups are a necessary structure to promote collective chemical strategy planning .
- Widespread adoption of pupae busting and farm hygiene awareness.
- The use of pest thresholds as a management trigger for consistent spray recommendations.
- The acceptance that beneficial insects and spiders are a legitimate pest management tool and willingness to 'protect them wherever possible using a range of 'soft' chemical options.

Respondents were frank in answering the survey, pointing to problems with concepts and at times the practical application of IPM components. Some of these include;

- Aphid management and the potential link to Cotton Bunchy Top
- Soft Chemical Failures
- Inadequate knowledge of pest and beneficial insect behaviour, tolerances, efficacy and feeding patterns, i.e. predator/prey relationships.
- Area wide management group problems, particularly keeping interest when season is busy and the apparent inability of growers to take ownership of AWM groups.
- Limitations in the IPM guidelines.

In a general sense IPM is well accepted by the consultants responding to this survey. It was not possible to ascertain non-response bias due to the limited time available to industry participants throughout the season. Analysis of these influences should be undertaken in future studies of IPM.

Similarly, experience has shown that the response rate should stand to be improved through changes to survey mailout/delivery to include a wider range of options.

As a strategy to reduce chemical applications and improve profitability and environmental outcomes, IPM is well place to evolve with the needs of industry and the community that supports it's operation.