

Appendix One

Growers Attitudes Towards the Use of Predators for Pest Control.

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Introduction

Since the introduction of IPM in the mid 1970's there has been a range of information published to assist growers and pest managers to plan IPM programs. This information comes in various forms such as books, ute guides and computer packages, and is produced by a variety of sources (Johnson *et al.* 2000). The majority of extension material is aimed at cotton growers and consultants. However, the insect identification manuals are equally useful for grain pests and beneficials. Has all this information actually lead to the incorporation of beneficials into the decision making process? Furthermore, has there been a reduction in synthetic insecticide usage as a result of wider adoption of IPM?

The use of predator counts in pest control decision making in Australia began in earnest with the development of the predator to prey ratio for cotton. Murray and Mensah (1996) suggested that no action was required if *Helicoverpa* spp. larvae were at thresholds and there were three to four predators per square metre in the crop. Another count was then conducted two days later. This ratio was used again by Mensah (1997, 2002a,b) along with Envirofeast[®] food sprays, and lucerne strips to maintain beneficial numbers in cotton. Guidelines on the use of predator to prey ratios in cotton has been supplied to growers and consultants. How often this ratio is used for pest management decisions is unknown. No such ratio has been developed for other crops that may have different *Helicoverpa* spp. thresholds. One criticism of the ratio is that it considers all predator species and lifestages to have the same predatory potential (Johnson *et al.* 2000). However, in the absence of specific, quantified data on the predatory potential of individual species this generalisation cannot be avoided.

More recently computer based decision support packages have been developed to assist in total farm planing and IPM. Computer programs such as CottonLOGIC allow the user not only to identify cotton pests and beneficials, but also to enter predator counts and parasitism rates in order to calculate pest to beneficial ratios. A survey was conducted one year after the introduction of CottonLOGIC to determine the level and type of use of this program. Bange *et al.* (1999) found that 57 percent of respondents used the package. However only 35 percent used the package for crop management, the other 22 percent used it only for record keeping. What percentage of users recorded beneficial data is unknown. Those that used the package were generally happy with its performance, and said they would continue using it in the future. The development of more computer based decision support packages is a positive step

towards integrating beneficials into IPM, however anecdotal evidence suggests adoption rates remain generally low.

Collaboration of groups of farmers into area wide pest management units has led to a greater awareness of the practical side of IPM. An area-wide *Helicoverpa* spp. management strategy on the Darling Downs utilises chickpea trap crops, destruction of overwintering pupae along with regular crop checking for pests and beneficials, and careful management of insecticide applications, particularly early in the season (Ferguson *et al.* 2001, Tuart 1999). A range of extension material has been published to support and inform such grower groups, including information on the overall impact of the commonly used cotton insecticides on predatory groups (Wilson *et al.* 1999, 2002). Information about the use of alternative “softer” insecticides and attractant sprays is now widely available to growers, and utilised in area wide management plans. However it still remains uncertain how predators can be fully incorporated into area wide pest management programs.

Despite the abundance of information, a survey of growers in 2000 stated that the north coast soybean industry was characterised by a poor understanding of pest management and effective spray application (Coleman 2000). The author indicated, “the use of chemicals in soybeans should be used to tip the balance in favor of the predators, rather than total eradication of the target pest”. I conducted a survey to get first hand information on the extent to which scouting for predators is practiced amongst grain growers and consultants, and to identify the methods used by growers and consultants. The respondents were asked what importance they placed on predators when insecticide spray decisions were being made.

Materials and methods

The EziGrain web site (<http://www.ezigrain.com.au>) is an industry initiative by AusBulk Ltd. that provides information and services to people involved in the Australian grains industry. The web site runs regular surveys that can be answered by people logging on to the web site. The editors of the site were asked to run a single question on predator scouting, with the option of a yes or no response. The question asked was:

Do you scout for insect predators (e.g. ladybeetles, spiders) in your grain crop?

The question was left on the web site for 21 days in March 2001 and during that time 12 people responded. A more detailed written survey was then conducted.

A simple written survey was devised that would take 10 minutes or less to complete, and be understood by growers and consultants (see end of Appendix one). This survey was initially handed out to participants at a GRDC grains research update for growers in Dalby in 2001. A stamped self-addressed envelope was included. A copy of the survey was e-mailed to cotton consultants through the CCA mailing list. Many of these consultants scout grain crops as well as cotton and so were eligible to participate. Further surveys were sent by mail, with a return envelope, to individual growers and consultants. Extension agronomists, seed and agricultural sales personnel, and researchers suggested the names and addresses of potential respondents. Growers and consultants I had met through my research were also asked to complete the survey.

All of the results were calculated as percentages. If more than one box could be ticked for a question, all the ticked boxes were totalled and used to calculate a percentage for each response. If the respondent answered a question incorrectly (that is not as per the instructions given) this question was not included in the results. If the respondent answered the remaining questions on the survey correctly their answers were included.

Results and discussion

Of the 12 respondents to the EziGrain web survey, two thirds (67%) said they did scout for insect predators in their crop. One third (33%) said they did not. The web format was amenable only to a single, simple question. As a result not many conclusions can be drawn. The higher than expected number of affirmative answers could be the result of the respondents interpretation of the question. “Scouting” may mean anything from wandering through a field and examining plants on an *ad hoc* basis to a replicated sampling protocol. This problem, and the low response rate was the impetus to conduct a more detailed written survey.

In total 32 people completed the survey 52 percent were grain growers, 45 percent consultants and a single person said they acted in both roles. The respondents came from grain growing regions in southeast Queensland and northern New South Wales (fig. 1). The majority of

respondents came from the Darling Downs region, primarily due to the fact that the growers' meeting was held in Dalby.

A wide range of crops were grown (or scouted) by respondents (table 1) with wheat/barley (17%), sorghum (13%), and cotton (12%) being the most common. The crops that took the most pest management time were soybean (23%), chickpea (20%), sorghum (17%) and mungbean (17%) (table 2).

All but one respondent said that they scouted for insect pests in their crops. A little over half (53%) the respondents said they could identify insect pests moderately well, and 43 percent were more confident and said they could identify the pests very well (table 3). Most (87%) of the respondents scouted for predators in their crops; 13 percent did not. This is higher than the result obtained for this question through the web survey. If we assume that the respondents were a representative sample of grain growers and consultants, this is a higher than expected number of respondents scouting for predators. It is more likely that only those growers and consultants interested in IPM, and therefore predators responded to the survey. So the result may be an over estimate of the true proportion of grain growers and consultants who scout for predators. There was very little that could be done to avoid this bias with the type of survey utilised. Horne *et al.* (1999) conducted surveys to investigate the awareness and adoption of IPM by Australian potato growers. Asking respondents if they thought they had beneficial insects in their crops assessed awareness of IPM. In Queensland 57 percent of potato growers responded 'Yes' and 30 percent had adopted IPM on their farms. Much higher figures were obtained for similar questions in the grain grower's survey.

Growers and consultants were generally less confident at identifying predators than pests. Three quarters (74%) could identify these predators moderately well, 15% could identify them very well, and 11 percent could identify them poorly (table 4). This question did not test the identification ability of the respondents in any way, and it would be interesting to check if confidence is related to actual identification ability.

When scouting for predators the most popular methods were the visual examination of the whole plants (32%), beating the plants onto a sheet (27%) and visual examination of plant terminals (13%). Less popular methods included beating plants into a bucket (11%), sweep netting plants (6%), and vacuum sampling (2%). Some respondents (9%) used no set method

and relied on casual observations as they walked through the crop. Studies have shown that beat sheets sample significantly more predators from cotton than visual examination and vacuum sampling (Scholz *et al.* 2001). Other studies have shown visual examination to be one of the least effective sampling techniques in grain crops (Kogan & Pitre 1980, Bechinski 1982, Brier 1998). The advantages of visual examination include that little equipment is required and this technique can be used early in the season when the plants are small. Conclusions cannot be drawn as to why respondents choose one method over another.

During the season the maximum scouting interval was twice per week for 42 percent of respondents. Other respondents scouted once per week (23%), three times per week (12%), and once every two weeks (12%). A few respondents (8%) had no set schedule and scouted whenever they had the time. A single respondent noted that they scouted for predators when checking for pests.

It is important that a common sampling technique and sampling regime be widely adopted so that we can begin to compare predator numbers between, and within growing areas. This will become increasingly important as more area wide pest management programs develop. The survey did not ask any questions about how many replicates of the sampling regime was used for a given field size. The number of samples taken will directly effect the accuracy of the final abundance figure. Information on the minimum sample number used by growers and consultants is necessary.

Most of the respondents (78%) used tools to help them identify the predators in their crops. The most popular tools were picture books with predator photos (37%), the expertise of other consultants (26%) and the expertise of extension officers (19%) (table 5). Horne *et al.* (1999) found a similar result with most Queensland potato growers getting information on IPM from other growers, crop consultants and magazines. The tools that grain growers felt would be most useful for improving their understanding of predators included more picture books with photos (36%), small group workshops held on farms (26%) and computer-based pest management programs (15%) (table 6). Only one respondent felt no extra tools were required.

Question eight, which asked why particular respondents did not scout for insect predators, produced ambiguous results. This is partly due to the fact that only four of the 32 respondents

were required to answer this question (i.e. four respondents said they did not scout for predators in question six). Additionally the responses were ranked from most true to least true, which proved confusing for some respondents. In addition some respondents answered the question when they were not required to, that is they had previously said they did scout for predators. The main reason why they did not scout for predators appeared to be because there was no point in doing so (the information was not utilised). However, this question requires more correct responses before the reasons why growers and consultants do not scout for predators can be determined. A separate survey aimed only at those growers and consultants that do not scout for predators is necessary to fully answer this question. Horne *et al.* (1999) found that lack of adequate information was the main reason that potato growers did not adopt IPM and adoption was highest in districts where advice was given in person by advisors.

The final question asked the respondents to rank what factors they felt were most important when deciding whether or not to spray an insecticide (fig. 2). The answer involved ranking up to five of the listed factors from most important to least important. This question proved difficult for some, but was answered correctly by 28 of the 32 respondents. The most important factor was pest abundance from scouting data (61%), the second most important factor was predator abundance from scouting data (39%), the third was crop susceptibility at time of spraying (21%), and the fourth and fifth most important was the weather (19%, 25%).

Some respondents commented that they took all factors listed into consideration and it was difficult to rank them because some were equally important. Predator abundance from scouting data was ranked highly by a number of respondents and is clearly used by growers when making spray decisions. This conclusion is supported by an American survey of cotton growers that found that 65 percent of respondents considered natural enemies when making control decisions (Brower 2002). The information on predator abundance is probably used in an *ad hoc* manner; if predator abundance is deemed “high” a spray may be delayed. More accurate use of predator data, including information on the predatory capacity of individual species, is necessary if we are to fully incorporate predators into IPM programs.

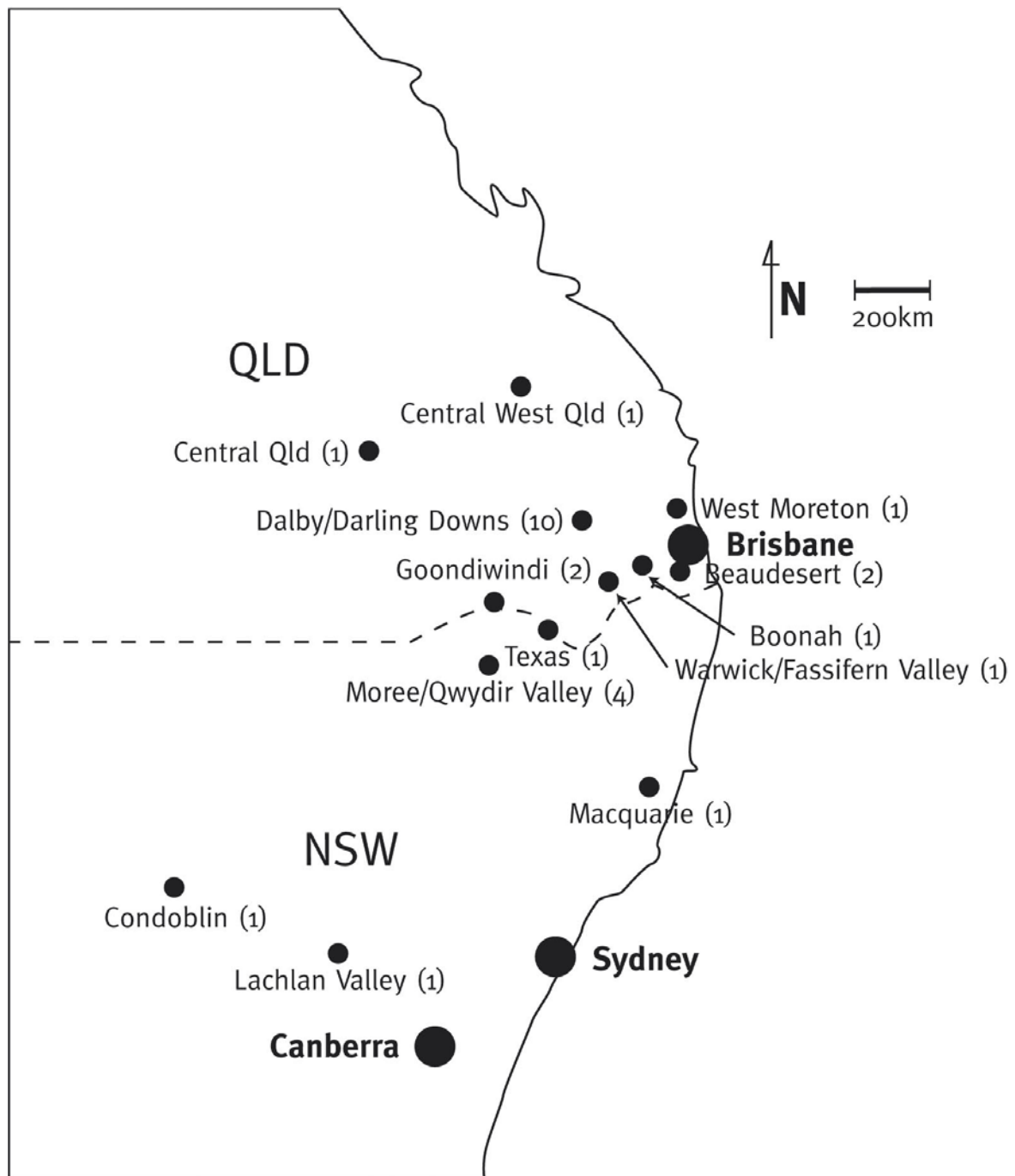


Figure 1. The regions in which the respondents to the predator survey worked. Numbers in the brackets indicate the number of respondents.

Table 1. Respondents answers to questions two: Which crop(s) do you regularly grow, or regularly scout?

Question 2.	%
Wheat/barley	16.78
Sorghum	13.42
Cotton	12.08
Maize	10.74
Mungbean	10.74
Chickpea	9.40
Lucerne	8.72
Soybean	8.05
Sunflower	3.36
Other	2.68
Canola	2.01
Fababeans	2.01

Table 2. Respondents answers to questions three: Which crop takes up the most pest management time?

Question 3.	%
Soybean	23.33
Chickpea	20.00
Sorghum	16.67
Mungbean	16.67
Canola	13.33
Lucerne	6.67
Fababeans	3.33

Table 3. Respondents answers to questions five: How well do you feel you can identify the PESTS in your crop?

Question 5.	%
Very well	43.33
Moderately well	53.33
Poorly	3.33

Table 4. Respondents answers to questions seven (part one): How well do you feel you can identify the PREDATORS in your crop?

Question 7.	%
Very well	14.81
Moderately well	74.07
Poorly	11.11

Table 5. Respondents answers to questions seven: Do you use any tools or extension material to help identify the PREDATORS in your crop?

Question 7.	%
Picture books	37.21
Other consultants expertise	25.58
Extension officers expertise	18.60
Computer programs	11.63
DPI information and handouts	4.65
Other growers expertise	2.33

Table 6. Respondents answers to questions seven: What additional tools or extension material would be most helpful?

Question 7.	%
Picture books	35.85
Small group workshops	26.42
Computer programs	15.09
On farm assistance by consultant	11.32
Big group workshops	7.55
None: no extra tools required	1.89
More details on life-cycles	1.89

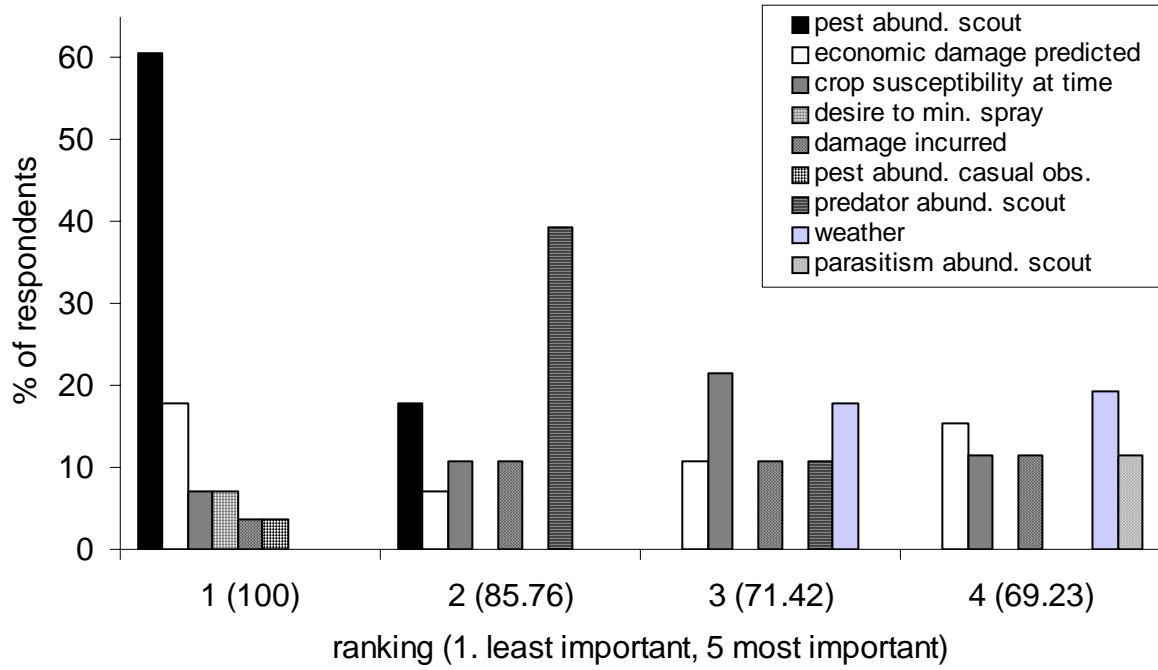


Figure 2. Respondents answer to question nine in which they were asked to rank a number of factors that they felt were important when making spray decisions. The most popular responses for the first four rankings are shown. The number in brackets next to the ranking is the total percentage that the displayed responses represent.

Chapter summary

- I conducted a survey to get information on the extent to which scouting for predators is practiced amongst grain growers and consultants, and to identify the methods used. The respondents were asked what importance they placed on predators when insecticide spray decisions were being made.
- The EziGrain web site (<http://www.ezigrain.com.au>) runs regular surveys that can be answered by people logging on to the web site. The editors of the site were asked to run a single question on predator scouting. The question asked was: *Do you scout for insect predators (e.g. ladybeetles, spiders) in your grain crop?*
- The question was left on the web site for 21 days in March 2001 and during that time 12 people responded. Two thirds (67%) of respondents said they did scout for insect predators in their crop and one third (33%) said they did not. A more detailed written survey was then conducted.
- In total 32 people completed the written survey 52 percent were grain growers, 45 percent consultants. The respondents came from grain growing regions in southeast Queensland and northern New South Wales.
- All but one respondent said that they did scout for insect pests in their crops. A little over half (53%) the respondents said they could identify insect pests moderately well, and 43 percent were more confident and said they could identify the pests very well.
- Most (87%) of the respondents scouted for predators in their crops, and 13 percent did not. Three quarters (74%) said they could identify these predators moderately well, 15 percent could identify them very well, and 11 percent could identify them poorly.
- A higher than expected number of respondents said that they scouted for predators in their crops. It is likely that only those growers and consultants interested in IPM, and therefore predators responded to the survey. So the result may be an over estimate of the true proportion of grain growers and consultants who scout for predators.
- When scouting for predators the most popular methods were the visual examination of the whole plants (32%), beating the plants onto a sheet (27%) and visual examination of plant terminals (13%).
- Predator abundance from scouting data along with other factors were used by growers when making spray decisions. More accurate use of predator data, including information on the predatory capacity of individual species, is necessary if we are to fully incorporate predators into IPM programs.

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Copy of survey given to grain growers and consultants

Insect predators in your crop –
What do you know?

What do you want to know?

The aim of this survey is to determine the extent scouting for predators is practiced and to identify the methods used. The beneficial insects include predators (e.g. ladybirds, lacewings, spiders) as well as parasitoids (e.g. *Trichogramma*), however this questionnaire concentrates only on predators. This information, coupled with your thoughts on the importance of predators when insecticide spray decisions are being made, will assist the design and incorporation of predator counts into spray decision making protocols, in order to ultimately reduce the cost of pest management. The survey results will be most useful if you read the questions carefully before answering. I would appreciate your honest answer to the questions. Your responses will be kept confidential and the data will be presented as part of my Ph.D. thesis. All respondents will be informed of the survey results and conclusions upon completion. My contact details are listed below if you have any questions or would like to contribute any further information.

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Q1. Which description best applies to you? (tick one)

- Grower
 Consultant

Other (please specify).....

Which region do you work in? (please specify)

.....
.....

Q2. If you are a grower, which crops do you grow regularly?

Or, if you are a consultant, which of the following crops do you regularly scout?

- | | |
|-------------------------------------|---|
| <input type="checkbox"/> Cotton | <input type="checkbox"/> Maize |
| <input type="checkbox"/> Sorghum | <input type="checkbox"/> Mungbean |
| <input type="checkbox"/> Lucerne | <input type="checkbox"/> Soybean |
| <input type="checkbox"/> Sweet corn | <input type="checkbox"/> Wheat / barley |
| <input type="checkbox"/> Chickpea | <input type="checkbox"/> Sunflower |

Other (please specify).....

Q3. If you are a grower, which crop do you spend the most time on pest management (EXCLUDING Cotton)? (tick ONE crop only)

Or, if you are a consultant, which crop takes up most of your scouting time (EXCLUDING Cotton)? (tick ONE crop only)

- | | |
|-------------------------------------|---|
| <input type="checkbox"/> Maize | <input type="checkbox"/> Sunflower |
| <input type="checkbox"/> Sorghum | <input type="checkbox"/> Mungbean |
| <input type="checkbox"/> Lucerne | <input type="checkbox"/> Soybean |
| <input type="checkbox"/> Sweet corn | <input type="checkbox"/> Wheat / barley |
| <input type="checkbox"/> Chickpea | |

Other (please specify).....

All following questions refer only to the single crop you selected in Q3.

Q4. Do you scout for insect PESTS in your crop?

- No (go to Q6.)
 Yes

Q5. How well do you feel you can identify the insect PESTS in your crop?

(tick ONE answer)

- Very well – I can identify all the pests I encounter in my crop
 Moderately well – I have trouble identifying some pests, but I can identify most of the common pests
 Poorly – I cannot identify the majority of pests in my crop

Q6. Do you scout for PREDATORS in your crop?

- No (go to Q8.)
 Yes:

What methods do you most often use for scouting for predators? (tick a few)

- Visual examination of whole plants
 Visual examination of plant terminals
 Vacuum sampler
 Beating plants onto sheet
 Beating plants into bucket
 Sweep net
 No set method, just casual observations as I walk through the crop

Other (please specify).....

What is the maximum number of times you would scout for Predators in your crop throughout the season? (tick ONE answer)

- Once every two weeks
- Once a week
- Twice a week
- Three times a week
- More than three times per week
- No set schedule, whenever I get the time

Q7. How well do you feel you can identify the PREDATORS in your crop? (tick ONE answer)

- Very well – I can identify all the insects that are predators in my crop
- Moderately well – I have trouble identifying some insects as predators, but I can identify most of the common ones
- Poorly – I cannot identify the majority of predators in my crop

Do you use any tools or extension material to help identify the predators you see?

- No – I do not use any tools
- Yes, I use:
 - Picture books with photos of predators e.g. the cotton pest & beneficial guide**
 - Computer-based pest management programs e.g. cottonLOGIC, BugMatch
 - Other growers expertise
 - Other consultants expertise
 - Extension officers expertise

Other (please specify).....

What tools or extension material do you feel would be most useful for improving your understanding of insect predators in your crop? (tick one or more)

- None – no extra tools are required, I already have an adequate understanding
- The development of more picture books which show photos of predators e.g. cotton pest & beneficial guide.**
- Computer-based pest management programs that show pictures of predators and allow you to enter predator counts e.g. cottonLOGIC.
- Small group workshops held on farms to teach identification and scouting techniques for predators.
- Workshops held in town centres to teach identification and scouting techniques for predators e.g. Accredited TAFE or University short courses.
- On-farm assistance from a suitably qualified crop management consultant

Other (please specify).....

Go to Q9.

Q8. Why do you NOT scout for predators in your crops? (please rank all 5 responses , with 1. being most true, to 5. being least true out of these statements)

- Too time consuming
- Too costly to hire consultant to scout for predators as well as pests
- I can't recognise which are the predators
- I don't know what technique to use for scouting for predators
- No point in scouting for good insects because I don't use this information when I spray

Other (please specify).....

Q9. When you are making the decision whether or not to spray an insecticide on your crop, which factors do you feel are the most important to consider? (rank up to 5 of the following factors, from 1. being most important to 5. being least important)

- Pest abundance from scouting data
- Pest abundance from your casual observations
- Predator abundance from scouting data
- Predator abundance from your casual observations
- Parasitoid abundance from scouting data
- Parasitoid abundance from casual observations
- Weather conditions
- Regional Insecticide resistance management protocols
- What other growers in your region are doing
- What previous sprays you have put on the crop
- Crop susceptibility to pest damage at time of spray
- How much damage the crop has already incurred
- The rate at which economic damage is deemed likely to occur
- Cash flow and financing spraying operations
- General desire to minimise spraying in crops
- Proximity to environmentally sensitive areas and risk of spray drift

Q10. Are there any other factors not listed in Q9. that you feel are important to consider when making spray decisions? (please specify)

.....
.....
.....

You have now completed the questionnaire
Thank you for your time

Would you be willing to participate in any further interviews on this topic?
If YES, please write your name and contact details below