Final Reports 2001/2002

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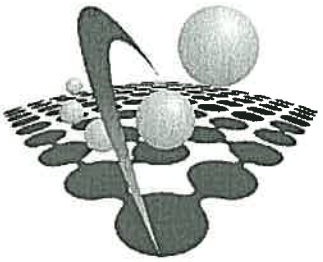


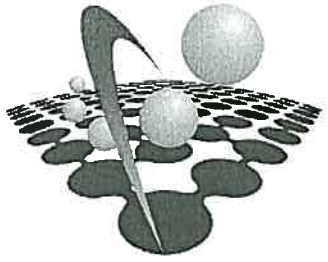
INSTITUTE FOR **Rural Futures**

Draft

Cotton Consultants Australia Lower Namoi Valley Aphid Management Survey

UNIVERSITY OF NEW ENGLAND, ARMIDALE NSW 2351

Cotton Research and Development Corporation



INSTITUTE FOR **Rural Futures**

Cotton Consultants Australia Lower Namoi Valley Aphid Management Survey

Brendan Doyle, Ian Reeve and Elaine Barclay

Draft Report to Cotton Consultants Australia

October 2001

INSTITUTE FOR RURAL FUTURES
UNIVERSITY OF NEW ENGLAND,
ARMIDALE NSW 2351

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Finally we are indebted to the CCA members and cotton growers who took the time to talk with us and relate to us the situation with Aphids throughout the Lower Namoi Valley.

All errors and omissions remain the responsibilities of the authors.

Executive Summary

Until recent times, aphids were considered to be a secondary pest in the Australian cotton industry. With the introduction of Ingard cotton varieties and now concern over outbreaks of cotton bunchy top, the prominence of aphids as a pest has increased such that infestations can result in large control costs with impacts on yield that can result in economic losses.

In light of these developments, the Cotton Research and Development Corporation funded this research to gather the views of consultants managing cotton areas and a sample of growers. Their opinions were canvassed early in October 2001. The survey sought to gain an appreciation of aphid infestations across the Valley, comparing characteristics in quantitative, qualitative and spatial terms. Data were collected for 91 farms covering some 41,000 green ha from 14 consultants and 7 growers. Spatial data included; a rating of aphid infestation by farm and variability in infestation; patterns in aphid build-up; aphid species and beneficials and the identification of chemical resistance as a problem. Data were also collected on whether or not CBT was observed, which varieties proved to be susceptible or resistant to CBT, and ratings of the problem.

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1. Background

Cotton aphid (*Aphis gossypii*) and green peach aphid (*Myzus persicae*) are prominent pests in many of Australia's cotton regions (Figure 1). The importance of aphid has increased in recent times due to their association with cotton bunchy top (CBT) disease. This report outlines the results of face-to-face and telephone interviews conducted with 15 consultants and seven growers from the Lower Namoi Valley.

1.1 Method

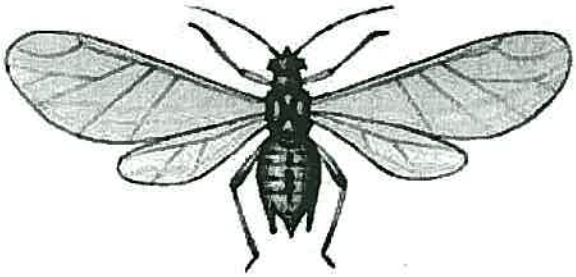
The views of consultants managing cotton areas and a sample of growers were canvassed early in October 2001. The survey sought to gain an appreciation of aphid infestations across the Valley, comparing characteristics in quantitative, qualitative and spatial terms. Data were collected for 91 farms covering some 41,000 green ha (figure 2). Spatial data included; a rating of aphid infestation by farm and variability in infestation; patterns in aphid build-up; aphid species and beneficials (figure 1), and the identification of chemical resistance as a problem. Data were also collected on whether or not CBT was observed, which varieties proved to be susceptible or resistant to CBT, and ratings of the problem.

Qualitative data covered management approaches for aphid and CBT. These data included observed patterns in aphid and BT infestations, associations with hard and soft chemical approaches and a rating of commonly used aphid insecticides. Opinions were canvassed informally regarding the individual's aphid management philosophy and what information could be provided that might improve aphid and CBT management.

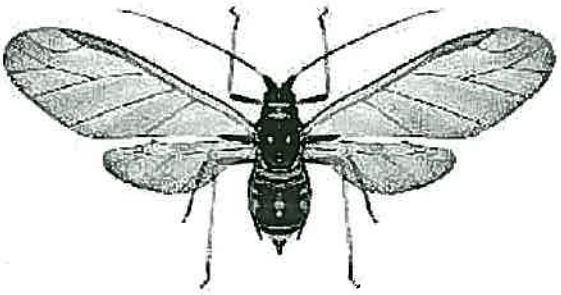
The survey (Appendix 1) was posted to consultants in the first week of October 2001 and face-to-face interviews were conducted the following week. The fieldwork associated with the study coincided with planting and emergence in the Lower Namoi Valley, increasing the amount of work that consultants were engaged in at the time. Due to these pressures, no individual field data were collected on chemicals used and aphid prevalence, hence the analysis in this report is conducted at the farm level. References to individual fields and management areas were collected in the verbatim comments.

The report is in two main parts. The next section, 2 covers the results for the qualitative and quantitative data collected at the consultant and farm level. Spatial data are considered in the section 3 with GIS maps that represent data from the 91 farms across the Lower Namoi Valley.

Figure 1 - Lower Namoi Valley Aphid Species and Predators

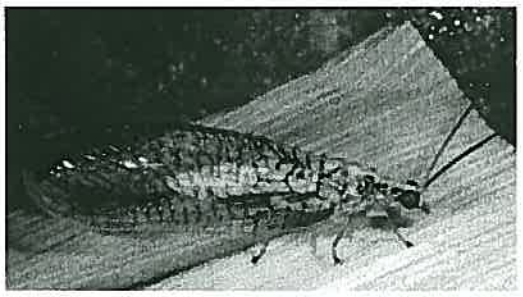


Cotton Aphid - *Aphis gossypii (Glover)*



Green Peach Aphid - *Myzus persicae (Sulzer)*

Ladybird - *Hippodamia variegata*



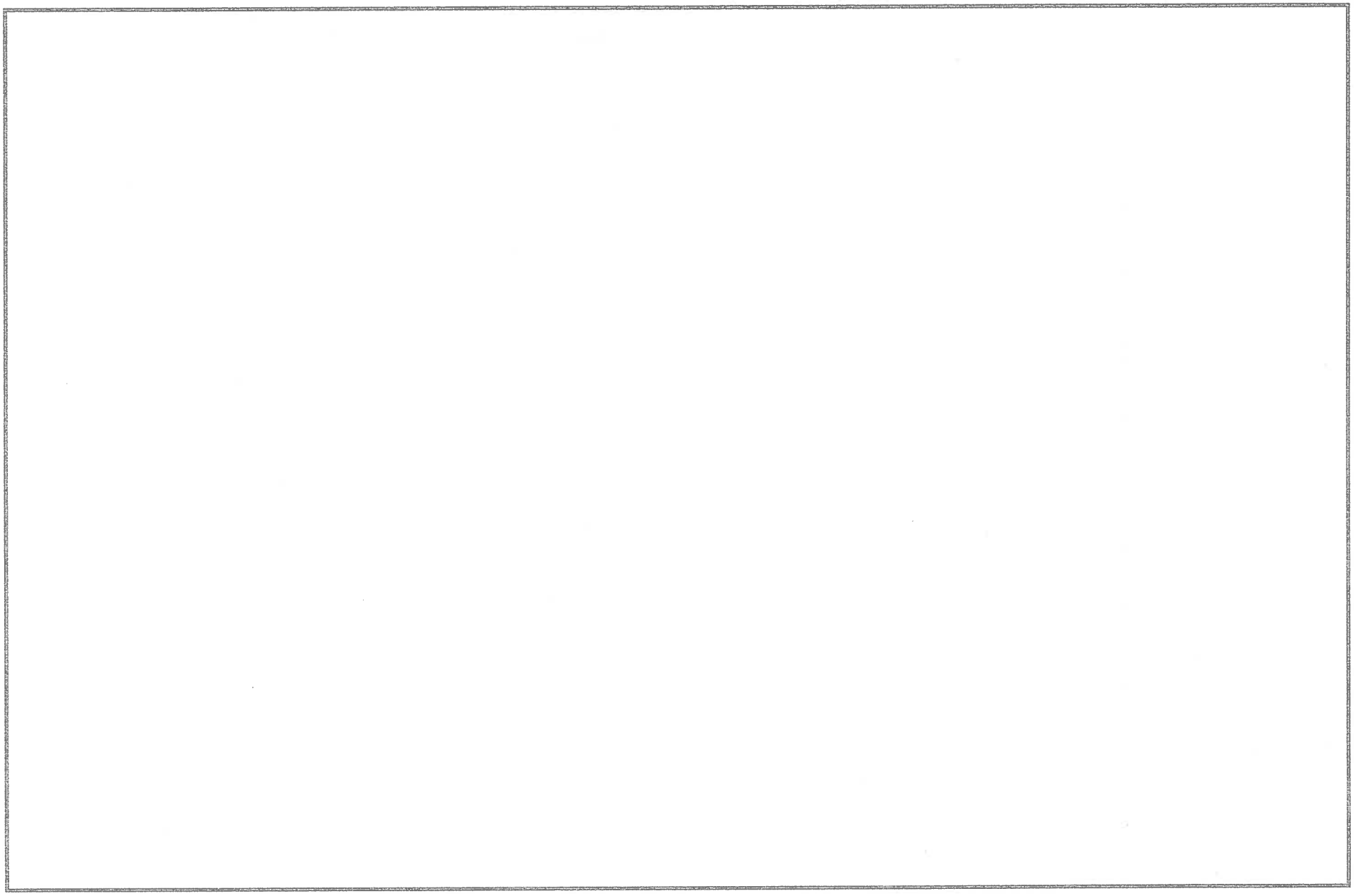
Lacewings - *Mallada signata* -

Bigeyed bug - *Geocoris lubra Kirkaldy*

Hover fly - *Simosyrphus grandicornis*

Parasitic Wasp - *Lysiphledus testaceipes*,

Figure 2 – Respondents' Management Areas



2. Results

This section focuses on the responses to the qualitative questions and outlines the quantitative analysis of data collected at the farm level.

2.1 Management lessons for the 2001-2002 Season

The 2000-2001 season left a number of key messages with consultants interviewed for this study. There responses are listed in tables 1 and 2. Those who had crops that suffered from CBT in the previous season were not going to take any chances with aphid this season. Similarly, consultants who had seen CBT in seasons previous to last year were very wary of seeing it happen again:

> *Since I first saw it* [CBT] *a few of seasons ago, I have always been hard on them* [aphids].

Generally, consultants expressed the opinion that aphid and CBT were related but some had observed CBT in the absence of aphids:

> *I have seen it* [CBT] *running down the field from the head ditch into the fields in strips, I feel there is definitely a relationship between plant stress, channel or head ditch sterilisers and CBT, but I'm not sure how it works* [consistency of the relationship].

Consultants were adamant that they would not double-up on the use of Organophosphate/Carbamate treatments as this would lead to aphid chemical resistance. It was mentioned a number of times that Temik/Thimet at planting followed by foliar OP/Carbamates would result in resistance and this would be avoided at all costs in the coming season. The 'rotation of chemistry' was seen as the basis for successful aphid management in conjunction with acting early. Suggested thresholds for aphids ranged from 10% to 60%. The majority of consultants, however, said that they would keep on top of aphid (most will act on 10% to 30% infestation).

The perceived usefulness of beneficials was quite variable among consultants. Some were prepared to use more expensive soft chemical regimes to promote populations and expose crops to the risk of economic damage. Other consultants would stay 'soft' as long as possible but only to the point where losses seemed probable.

A small number were sceptical of their usefulness, expressing little confidence in the ability of predators to suppress aphid across the 'run of mill cotton block'. The exception to this rule being fields in riverine environments or small areas completely surrounded by pasture or non-irrigated farming areas (isolated blocks).

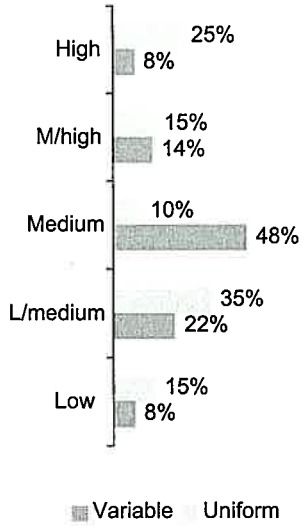
Relying on beneficials to keep aphid in check in these situations was considered as being 'worthwhile' by virtually all consultants.

Respondents indicated that aphid infestations were variable on about half of the farms in the study (56%). Figures 3 and 4 display the average aphid infestation and timing of the build-up across farms reported as having uniform and variable infestations. Approximately 50% of farms with variable infestations were reported as having medium level infestations while only 10% of farms with uniform infestation reported medium levels of aphid[1]. This result is not surprising given that uniform infestations were at either end of the scale and well remembered by consultants as being either particularly light or heavy (*that farm was as clean as a whistle all season* **or** *the plants were dripping aphids from day one!!*).

Table 1.
Aspects of the 2000-01 season that will have greatest bearing on aphid management approach.

1. *Use of softer chemicals early, trials with spray oils & fertilizer mixes.*
2. *Rotate chemistry - don't double up on seed dressing to folio Act early!!.*
3. *Threshold 10-30% should be kept.*
4. *Reduce amount of early OPs used particularly Pirimor. Increase threshold levels.*
5. *Take no risk in IPM with aphid - make sure you don't get bunchy top at all.*
6. *Did not spray early on Green Peach and was successful.*
7. *No early Endo on Ingard, but aphid flared so may change. If resistance is suspected again I will act early.*

Figure 3
Average Aphid Infestation Rating



Have had CBT issues since November 1998 in Moree and Edgeroi, and new problems each season since with aphids and CBT. No definite conclusions except that CBT is associated with early aphid infestations and then comes yield loss

[1] χ^2=16.79, d.f. 4, p<0.005

8. *Yes more prudent selection of aphicides and seed treatments, as well as more reliance on predators if possible and identification of species and possible resistance.*
9. *YES - Late OP - resistance. Poor performance on Confidor on heavy aphid pressure.*
10. *Suppression of aphid numbers early, balancing aphid population with up-coming egg lay populations to ensure predators are not primarily fed on aphids, use of SP late for residual effect with Dimethoate. Use of below label rate applications.*
11. *YES - assumptions on resistance, reduce threshold - last years product performance (Endo vs Confidor).*
12. *Chemical rotations, weed control.*
13. *No OP/Carbamate planting insecticides. Delay use of OP/Carbamates for as long as possible. Assess Predation/Parasitisim activity, incorporate findings in management. Use Endosulfan by grounding, investigate potential of oils.*
14. *Have had CBT issues since November 1998 in Moree and Edgeroi, and new problems each season since with aphids and CBT. No definite conclusions except that CBT is associated with early aphid infestations and then comes yield loss.*

Table 2.
Comments on the average infestation across farms.

1. *No average situation - isolated problems on different farms*
2. *Not changing chemistry groups initially was the source of the problem*
3. *Aphids were not a real concern. I was severe on them always.*
4. *Variability was observed across the farm late season. Early season was more uniform.*
5. *One bigger farm. Light aphid all season.*
6. *All Ingard was similar i.e. a problem. Conventional wasn't a problem (due to early endo) regardless of variety and/or location.*
7. *Farms which had most aphid problems were those with most Ingard cotton.*
8. *All farms had constant aphid infestations - Various control methods provided different outcomes. Early treatment with OP/Carbamates resulted in the biggest problems.*

The differences in the pattern of aphid build-up were not significantly different between farms reported as having variable and uniform aphid levels.

In aggregate, 22% of all farms reported early infestation, 26% early to mid and 36% reporting mid season infestation. The balance of farms was reported as having medium late (13%) and late infestation of aphid (5%).

The majority of consultants described early aphid infestations as being a difficult problem. In situations where chemical resistance was present or suspected, Diafenthiuron (Pegasus) was reported as having good results as did the use of Endosulfan. Respondents rated common aphicides for the efficacy, the result of these ratings are presented in figure 5.

This graph shows that Endosulfan performed well as an Aphicide in the 2000-2001 season. Concern was expressed however, that Endosulfan was not a viable option in some situations:

> *Environmental considerations can mean that Endosulfan cannot be sprayed in some areas on farms, also I am reluctant to 'use up' an Endo spray just on aphid and would prefer to wait until I had Helie's to spray as well.*

Consultants discussed situations where organophosphates and carbamates worked well and were effective. The Imidacloprid, Confidor was criticised by some consultants for not performing to expectations. It was acknowledged that Bayer had addressed some of the application-based problems that arose through the season with new Confidor application guidelines released for the 2001-2002 season.

As outlined above, consultants generally expressed the view that if chemicals were rotated as per the resistance management recommendations described in Herron, Wilson and Gibb (2001) (Appendix 2), they hoped to avoid problems in managing aphid this season. This view is consistent with the comments made by respondents in reference to seed treatments and their effectiveness. These comments are outlined in table 3.

Planting insecticide strategies implemented by Lower Namoi consultants this season were largely influenced by last seasons experience. As mentioned above, awareness of chemical rotation issues were generally high, particularly for those who had experienced significant pressure in previous seasons. Consultants who had reported few problems with aphid in past, discussed their intention to recommend insecticide in light of the wider experience across the valley.

Figure 4
Pattern of Aphid Buildup

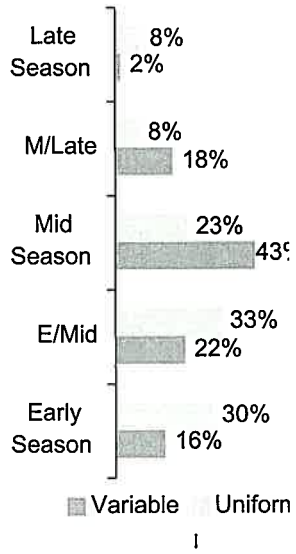
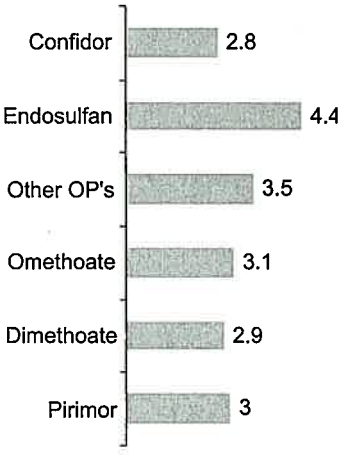


Figure 5
Average Rating of Pesticide Efficacy Against Aphids

(Ratings Scale: 5 = High Efficacy, 1 = Low Efficacy)



Among the examples of planting insecticide strategies discussed by consultants, was the case where a group of farms had problems with resistance that was attributed to chemical resistance generated by Thimet/Temik application in the 2000-2001 season. To manage resistance this season, the farms have been planted with Lorsban to control for cut-worm, leaving open the full suite of foliar options for improved aphid control. The grower in this case indicated that chemical resistance was a concern and hoped this approach would give more flexibility in the upcoming season.

Table 3.
Seed treatments recommended - did they help?

1. *Thimet, Temik, Gaucho -all worked OK.*
2. *Gaucho / Temik / Thimet - helped as long as rotated first spray for aphids.*
3. *Gaucho, Thimet – Yes.*
4. *Temik and Thimet - YES Gaucho – poor.*
5. *Gaucho - sure helps for 3 weeks and Temik - OK for 6 weeks after planting.*
6. *Semevin Super - no, Thimet – yes.*
7. *The use of a Gaucho treatment (or cruiser) was recommended, as a soil applied insecticide where there was a preference in fields or areas where aphids were likely to be a problem.*
8. *Gaucho & Temik did help early.*
9. *Temik, Marshal, Gaucho, Lorsban, Super Semevin.*
10. *Thimet was used exclusively -part of the problem - selecting for OP resistance. Rain event late January, flooded fields then sprayed with Curacron. Those fields not sprayed required aphid treatment late season, Pegasus was successful.*
11. *Thimet, Temik, Semevin Super, Aphid numbers came too late after these treatments (i.e. didn't have aphid pressure when chemicals were active).*
12. *Gaucho worked very well for several weeks - Temik/Thimet efficacy was variable, in some cases, selected for resistant clones straight away.*
13. *Yes, Temik – Gaucho.*

2.2 Patterns in aphid infestation

Consultants generally felt that the presence of weeds or volunteer cotton in the crop or in areas surrounding fields would increase aphid activity. Aphids were reported to move into cotton fields that were adjacent to faba beans, chickpeas and other host areas such as pasture paddocks. Some growers mentioned planting varieties that were more resistant to aphid on the windward side of farms as trap crops because they consistently found increased aphid infestation on this part of the farm. Aphids were also reported to move into cotton fields from neighbouring farms or other crops nearby where chemistry had failed to be rotated. A number of consultants mentioned that early applications of Omethoate 'stirred up' aphid and caused problems from that point on.

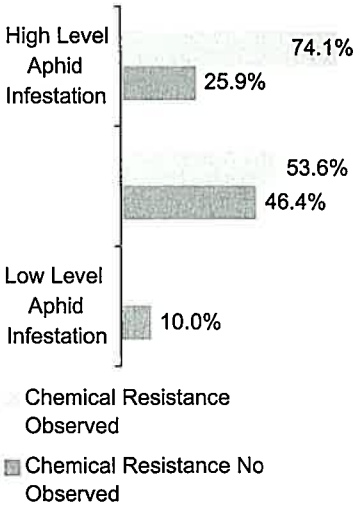
Consultants mentioned a variety of associations that they felt could be associated with increased aphid pressure. These included; the reduced number of ULV applications, use of herbicides in head ditch and channels and plants low in potassium with the suggestion being made that aphids were suppressed by the use of foliar K sprays. Comments about patterns in aphid infestation in general are listed in table 4.

Table 4.
Patterns of infestation.

1. *Aphids worst on Thimet/Temik treated country followed by OP/Carbarate early season sprays.*
2. *Crops near faba beans worse, crops sprayed with early 'hard' OPs worse.*
3. *Aphids worse near stock route fresh with weeds. Fresh outbreaks after rain events.*
4. *Late infestations occurred due to no spraying for a long time.*
5. *Early/mid-season aphids flared on Ingard, possibly due to low Endosulfan usage. Green Peach became present after cool November weather. Late season and resistant aphids flared from a neighbouring dryland crop that had successive spray failures with OPs.*
6. *Generally some evidence to show aphids came off pasture other crops, mainly chickpeas.*
7. *Used OP early - hard to control late. Confidor poor performance on heavy infestations (honeydew??).*
8. *In blocks with bladdar ketmia and thorn apple more so a problem. Neighbours spraying regimes main problem.*
9. *Farms with late faba beans were worse for aphids*
10. *Farms where Rogor was applied early on the cotton were worse for aphids.*
11. *Weeds adjacent to cotton, faba bean crops close by.*
12. *Infestations often started on borders (usually North-east = predominant winds) OP/Carbamate/Confidor would at best suppress, then flare populations - Any type of treatment suppresses beneficial populations.*
13. *No, only to say that last season was unusual. There was a very dry winter and those farmers that planted and irrigated up also brought up a lot of last seasons seedlings, which harboured aphids.*

The use of a Gaucho treatment (or cruiser) was recommended, as a soil applied insecticide where there was a preference in fields or areas where aphids were likely to be a problem

Figure 6
Chemical Resistance - Aphid Infestation Relationship



2.3 Aphid and Ingard cotton

Consultant's views about the difference between Ingard and Conventional varieties appear to fall into three groups:

1. The increased number of beneficials in Ingard fields were helping to keep aphids under control.
2. The reduced Endosulfan treatments in Ingard meant that the impact of aphids were much worse.
3. There was no difference, farms were uniform in their aphid levels across Ingard and conventional varieties.

Responses to the question are presented in Table 5.

Table 5.
Differences in aphid infestation between Ingard and Conventional?

1.	*Fields under some kind of environmental stress e.g. waterlogging, lack of fertiliser appeared to have bigger problems.*
2.	*Weeds were a trigger.*
3.	*Yes, Ingard seemed more affected when less conventional chemistry used.*
4.	*More pressure in Ingard particularly early on where Endosulfan had not been used.*
5.	*Yes, early/mid-season aphids flared in Ingard crops - Possibly due to low beneficials and no Endosulfan usage on Ingard.*
6.	*Early season possibly higher levels in conventional. Late season no apparent difference.*
7.	*YES, Huge difference, lack of Endosulfan in Ingard caused major aphid problems.*
8.	*Ingard cotton had higher levels.*
9.	*No - But predation was more effective in Ingard fields, which were left completely untreated (with any type of product, i.e. No heliothis or sucking pest treatment).*
10.	*Generally, earlier aphid infestation on Ingard. Also Ingard more variable. The conventional also had the infestation later and it was more even in the crop.*
11.	*No.*
12.	*No.*
13.	*No.*
14.	*No.*

2.4 Chemical resistance and spray management philosophy

As outlined in previous sections above, the issue of chemical resistance was central to the management of aphids in the 2000-2001 season. Essentially, when consultants had problems with OP/Carbamate resistance, finding a quick solution that fitted with the chosen management philosophy and grower's budget often proved to be a real challenge. One consultant commented that the resultant 'fixes' for resistance were '*a bit of a science experiment*' in that the aphids were harder to move than most previous experiences would suggest they should have been.

Data collected on individual farms were analysed to look for relationships between chemical resistance and a number of different factors. Figure 6 displays the relationship between resistance and aphid infestation levels. The graph shows that low-level aphid infestation was reported only on farms where chemical resistance was not observed. This is a contrast to high-level infestations, which were reported on 74% of the farms that were also reported as having chemical resistance. This relationship is to be expected and is statistically significant[2].

Cotton bunchy top (CBT) was reported on 32% of farms in the sample. The relationship between chemical resistance and CBT was tested and the results are displayed graphically in Figure 7. This graph shows that for farms where CBT had been reported, 69% also had chemical resistance problems, compared to 28% among farms where CBT had not been reported. This suggests that resistance and CBT are positively correlated whereby the incidence of CBT increases in the data as the number of farms with resistance increases[3]. The relationship between CBT and aphids will be examined further in section 2.5.

Consultants reported aphid predators present on farms under their agronomic management throughout the season. Figure 8 shows that almost all farms were reported as having Ladybird Beetles feeding on aphid with a lesser number of Lacewings, Hover-fly, Bigeyed Bugs and Parasitic Wasps. This relationship is displayed in figure 9. As with CBT, there is a positive association between the incidence of resistance and Hover-flies[4]. This is also consistent with the relationship established between resistance and aphid pressure suggesting that predation by hoverfly is proportionate to aphid infestation levels.

Figure 7 Chemical Resistance - CBT Relationship

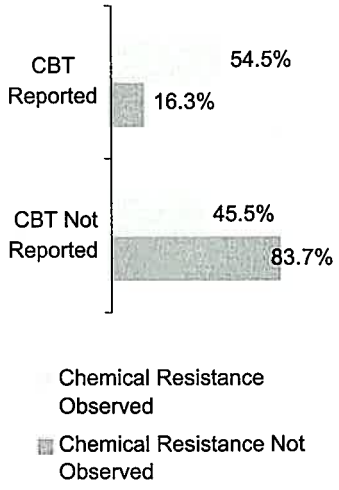
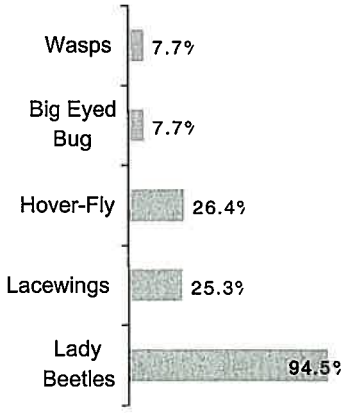
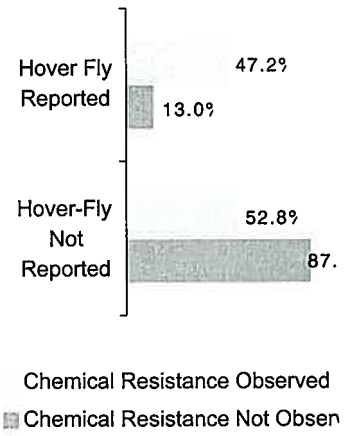


Figure 8 Main Beneficials Feeding on Aphids



[2] n= 90, χ^2=38.88, d.f. 2, p<0.0001, γ=0.868, t=9.129
[3] n= 82, χ^2=13.30, d.f. 1, p<0.001, γ=0.720, t=3.715
[4] n= 90, χ^2=12.96, d.f. 1, p<0.001, γ=0.715, t=3.567

Figure 9
Chemical Resistance - Hover Fly Relationship



Consultants were asked whether they noticed any consistent differences between hard and soft chemical approaches. The responses to this question are presented in table 6. Respondents suggested that the philosophy underlying the management of pests in cotton would be driven by a number of factors that often combine to give variable results for he same strategy on different farms in the same locality. In other words, pursuing a soft strategy might be plausible if the grower has a good understanding of the likely impacts on management and is in a position to respond quickly when intervention is called for. They must be comfortable with the pest thresholds and be prepared to use higher cost chemicals if or when required.

Table 6.
Hard versus soft chemical approaches.

1. *Early hard sprays tended to give more problems later in the season, but this was not always the case.*
2. *I don't believe that disturbing predators early was cause of aphid numbesr increasing. Simply, chemistry rotation.*
3. *Soft chemical - less aphids.*
4. *Aphid levels were mainly low enough to keep under control. When we were using OP - nil to low aphid numbers.*
5. *Softer chemistry was more 'easy' on aphids.*
6. *"Soft" would bring - aphid eventually, "Hard" would take care of them whenever they were present.*
7. *Lack of spraying and being softer on Ingard lead to aphid flares.*
8. *Yes - crops able to maintain beneficial insects by the use of soft chemistry generally had less total aphicide sprays.*
9. *Beneficials tended to be more efficient in no-spray situation. "Soft chemistry" had impact on beneficials. Confidor for instance made situation worse by affecting Ladybirds. Endosulfan seems to do OK on moderate infestations.*
10. *Yes - field near neighbour's resistance problems, more sprays delayed maturity and 3-aphid spray late in season.*
11. *No because all Ingard fields were treated the same. Roger - Pirimor - Confidor.*
12. *Beneficial numbers took too long to build up to control aphid numbers in soft approach.*
13. *Yes, hard approach in aphids gave poorest results and aphids become very difficult to control. Worst case = 8+ aphid sprays.*
14. *The harder the chemistry early, the more difficult the aphid became.*

The sophistication of management required for a 'soft' strategy can generally be contrasted with the 'hard' approach.

Several respondents mentioned situations where the grower did not want to follow the soft chemical approach. These growers were often characterised as been very conscious of chemical costs and were often not prepared to trade-off potential damage and lack of retention with the control offered by beneficials. Consultants mentioned situations where:

> *The grower just couldn't stand seeing the pest activity in the paddock so we ended up doing a 'feelgood' spray and then he could sleep at night.*

In short, some growers are suited to soft strategies and some are not. Unfortunately, this is not always apparent at the start of a season so the results are often variable. One grower estimated that he would spend as much as any grower (*'a fortune'*) in the Lower Namoi following the soft option and while he accepted that damage did occur, he was satisfied that on a financial cost-benefit basis they came out in

front. He also regarded the stewardship benefits that were generated with neighbours as vital!

Similarly, other factors such as the weather and resistance can '*blow a soft strategy out of the water*'. Aphid flare-ups and the disappearance of beneficials overnight were common in storm events and extended wet or cloudy periods. This variability meant that a soft strategy could be performing well then suddenly collapse. Again, the attitude of the grower dictates the final outcome and this is discussed further in section 2.6.

Yes, hard approach in aphids gave poorest results and aphids become very difficult to control. Worst case = 8+ aphid sprays.

Generally, consultants judged the hard chemical approach to be successful more often than not. Some, however, were revising this assessment in light of resistance problems from the previous two seasons. Soft approaches were judged to work well where predators were particularly prevalent, in riverine environments for example. A number of consultants felt that some parts of the valley were more difficult than others to attract beneficials into, and would bear this in mind when talking strategy with growers.

Beneficials tended to be more efficient in no-spray situation. "Soft chemistry" had impact on beneficials. Confidor for instance made situation worse by affecting Ladybirds. Endosulfan seems to do OK on moderate infestations.

A smaller number of consultants were enthusiastic about the potential for soft chemical regimes recommending food sprays and working hard with growers to look for innovative solutions. Overall, consultants were less positive about the potential for success in following the soft chemical approach for many of the reasons

outlined above. This being said, the majority expressed the view that they would welcome advances that make the soft approach suitable in a wider range of situations.

2.5 Cotton Bunchy Top

Cotton Bunchy Top was identified on 26 of the 91 farms sampled for this study. Half of the farms reported as having CBT had a few affected plants in fields. Approximately 40% of farms where CBT was observed had small patches affected throughout fields, while one in ten of these farms had large areas affected by CBT.

Analysis of the data across the full sample of farms showed a statistically significant relationship between the degree of aphid infestation and the occurrence of CBT[5]. This relationship is displayed in figure 10. This graph illustrates that where aphid infestation was reported as being low, CBT was observed in only 12% of farms, compared to the situation on farms reported as having medium and high level infestations. Of these farms, 44% had CBT.

Consultants were asked to identify varieties that were most and least affected by CBT. Of the 26 farms identified as having CBT infestation, there were 10 farms for which consultants were able to nominate most or least affected varieties. Table 7 lists the varieties, however, in the opinion of consultants and growers, nominating varieties without reference to the chemical management regime would have limited value. In other words, the management of fields for aphid was more important in reducing the likelihood of CBT than varietal selection.

Table 7.
CBT Effects on Cotton Varieties.

Cotton Varieties Most Affected by CBT	Cotton Varieties Least Affected by CBT
Sicot 189	Sicot 189
Sicot 289i	Sicot 289i
NuCOTN 37	DeltaOPAL
NuPEARL	NuOPAL
Sicalav2	Sicala 40
Siokra v16i	Sicala V-3i

Comments from consultants on CBT are listed in tables 8 and 9. Generally, most consultants were of the opinion that there was a relationship between aphid and CBT, although in the face-to-face interviews, many were at a loss to explain why aphid infestation did not always mean CBT. For this reason, a number of growers and consultants interviewed felt that the on-going research being conducted by the Cotton CRC and CRDC will be vital to understanding the 'true nature of the CBT occurrences'.

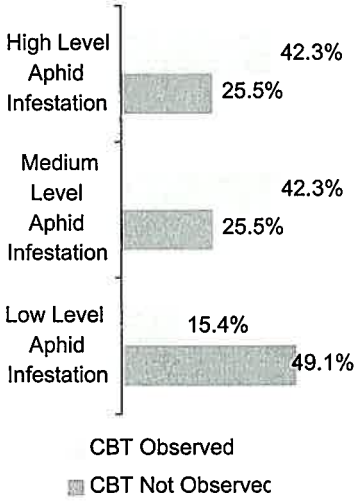
Table 8.
Trends in Bunchy Top in relation to Aphid Density.

1. *High density aphids gave CBT symptoms.*
2. *Hotspots centering on aphid colonies.*
3. *Yes where we had aphids in high numbers we had CBT.*
4. *Yes. BT seems to be heaviest where aphid papulation was heavy. Early light infestations did not cause obvious CBT.*
5. *High aphid density - CBT incidence.*
6. *Level of aphid infestations not clearly correlated to CBT incidence (all forms should have been severely affected with the number of aphids we had). However, direct aphid change was noticeable, probably caused more loss than CBT.*
7. *CBT only when aphid very heavy.*
8. *Have done in the past.*
9. *Bunchy top incidence was fairly variable and not totally related to aphid density or incidence.*
10. *No - low incidence.*
11. *No.*
12. *No*

Table 9.
Differences in CBT in relation to management approach, differing thresholds or number of sprays?

1. *Highest number of sprays gave most CBT symptoms.*
2. *CBT became an issue when high density (lots of honeydew + hundreds of aphids/terminal had been present).*
3. *YES? No Difference in CBT, seems directly correlated to difference in Aphid infestation. More CBT where populations were allowed to build up..*
4. *The softer and earlier you sprayed on low numbers then no CBT. Changed checking technique for aphid in Ingard.*
5. *Have not seen CBT for several years. Make sure we don't use susceptible varieties.*
6. *No - low incidence.*
7. *No.*
8. *No.*
9. *No.*
10. *No.*
11. *No.*

Figure 10
Aphid Infestation - CBT Relationship



Bunchy top incidence was fairly variable and not totally related to aphid density or incidence.

The softer and earlier you sprayed on low numbers then no CBT. Changed checking technique for aphid in Ingard.

[5] n= 81, χ^2=8.49, d.f. 2, p<0.05, γ=0.475, t=2.83

2.6 Grower influence on aphid and CBT management

The influence growers have in relation to aphid and CBT management was alluded to in section 2.4 above. In most cases it was felt that grower's influence was constant across all agronomic matters that they paid their consultant to manage, the situation with aphid and CBT was another agronomic management decision. There were growers who had little intervention in recommendations arrived at by their consultant:

> *I pay him top dollar to manage the crop, I am not about to try and second guess him and change recommendations unless something drastic happens after he drives off the farm.*

Others were more proactive due to the constant need in some cases to be economical with chemical costs. These growers did not intervine as long as the recommendations did not call for high cost options. The other type of grower was characterised as the well-organised producer who had a good grasp on the issues and time available to meet regularly with their consultant and spend time in the field with them. Growers who were in this situation had a large bearing on most agronomic advice and were seen as having '*at least their two bob's worth*' when aphid strategies were discussed.

Preparedness to use Endosulfan, and discussion about thresholds were mentioned as being common threads in discussions between growers and their consultant.

Table 10.
Will growers influence management strategy in relation to aphids?

1.	*Yes, huge difference.*
2.	*Yes, their own experiences, preparedness to use Endosulfan, maintenance of predators.*
3.	*Yes, neighbours actions and control measures.*
4.	*Yes, more closely monitor numbers and extra scrutiny and discussion on thresh-holds.*
5.	*Yes, cost and if farmers uncomfortable with "look of crop" Hence involved in making spray decision for farmer peace of mind.*
6.	*Chemical cost is often important to growers. I usually try to present reasons for using more expensive chemistry if I believe more costly chemical will give better result.*
7.	*Yes, Variable thresholds, "No Endo Zones".*
8.	*Yes, low threshold.*
9.	*Yes, (few), mainly no.*
10.	*No, all Ingard, treated the same.*
11.	*No.*
12.	*No.*

Table 11.
Will growers influence management strategy in relation to CBT.

1)	*Yes, (few) mainly no.*
2)	*Yes - neighbours actions and control measures.*
3)	*YES - Variety selection will be more critical on fields suspected of having possible incidence on bunchy top.*
4)	*At this stage, growers are usually happy to let me suggest strategies, realizing that more is yet to be learnt about CBT.*
5)	*Planting of resistant/ tolerant varieties - within context of overall planting / variety , choice.*
6)	*Yes, can't afford the risk of getting it..*
7)	*No.*
8)	*No*

Chemical cost is often important to growers. I usually try to present reasons for using more expensive chemistry if I believe more costly chemical will give better result.

At this stage, growers are usually happy to let me suggest strategies, realizing that more is yet to be learnt about CBT

Spatial Data

Geographic Information Systems (GIS) integrate spatial and quantitative data within a single analytical and visualisation framework. This offers the flexibility to combine data from a variety of sources or different databases. Using GIS, it is possible to illustrate connections, or visually observe relationships between activities, or data characteristics, based on geographic proximity. These are relationships that are often not considered when using conventional statistical analyses.

Without the use of spatial analysis, understanding how a system such as insect pressure operates across a cotton valley would be limited to testing conventional statistical relationships among variables that are amenable to quantification. This approach may ignore characteristics of the landscape that are difficult to quantify such as vegetation structure and cover, proximity to water or riverine environments and surrounding land use activities such as industrial or urban developments and dwellings, agricultural practices or environments sensitive to cotton production.

Patterns of association between aphid infestation and a number of factors have been tested for statistical significance throughout this report. Spatial data were also gathered to look for trends in aphid and CBT across the landscape. GIS diagrams were compiled using these data. Figure 11 displays a spatial map of average aphid infestation ratings for the 91 farms included in the study.

This map illustrates infestation levels across the Lower Namoi for the 2000-2001 season. The five point Aphid infestation scale is categorised into low, medium and high level infestations.

Two areas have been highlighted on the map where farms are reported as being under predominantly low and high infestation levels respectively. Figure 12 shows the spatial distribution for chemical resistance. As reported earlier, there was a statistically significant association between aphid infestation levels and the reporting of chemical resistance. When the lines bounding the farms with mainly high and low level aphid pressure are copied onto figure 12, it can be seen that there is a high spatial correlation between levels of infestation and of resistance.

Interestingly, when the farms that appeared to the group as having light and heavy aphid infestation levels are circled on figure 13, the 'Pattern of Build-up' map, there appears to no systematic association between build-up and infestation. Chi-square tests between reported time of build-up and infestation levels for the complete sample reflect this lack of association, proving not be significant.

The remaining figures outline the spatial representation of data collected for CBT, beneficials and aphid species. No conclusions have been drawn on the spatial contexts involved as supplementary data would be needed.

Agro-ecological systems are complex, the relationships described above could occur due to any number of factors. A cursory examination would suggest that the section of the Namoi River between Narrabri and Wee Waa is a low aphid and chemical resistance region as opposed cotton along the Pian Creek, Doreen Lane system out to Burren Junction. Further work could be aimed at identifying the specific factors involved in this spatial association.

Figure 11 – Aphid Infestation

Average Aphid Infestation Rating

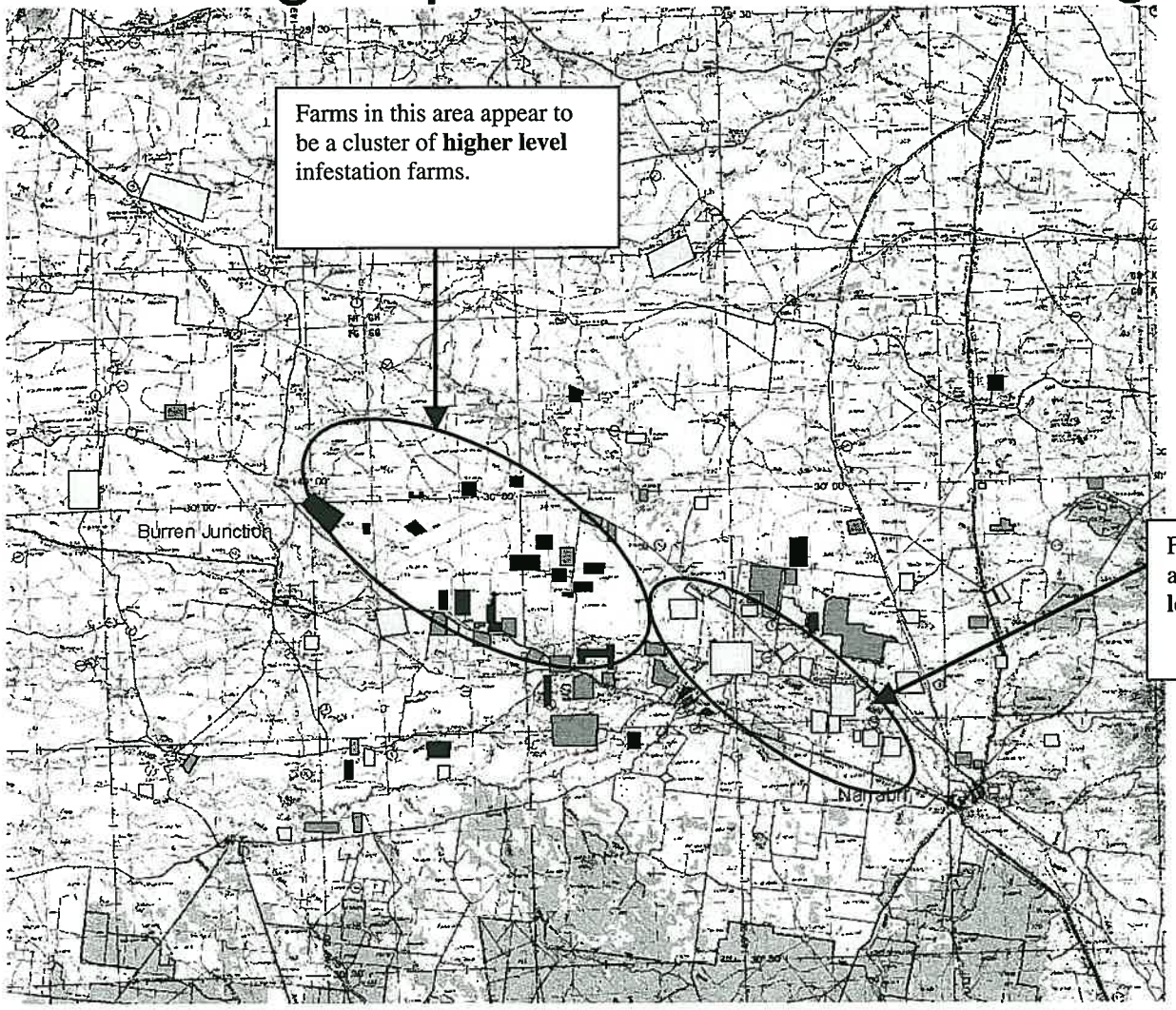


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Figure 12 – Chemical Resistance

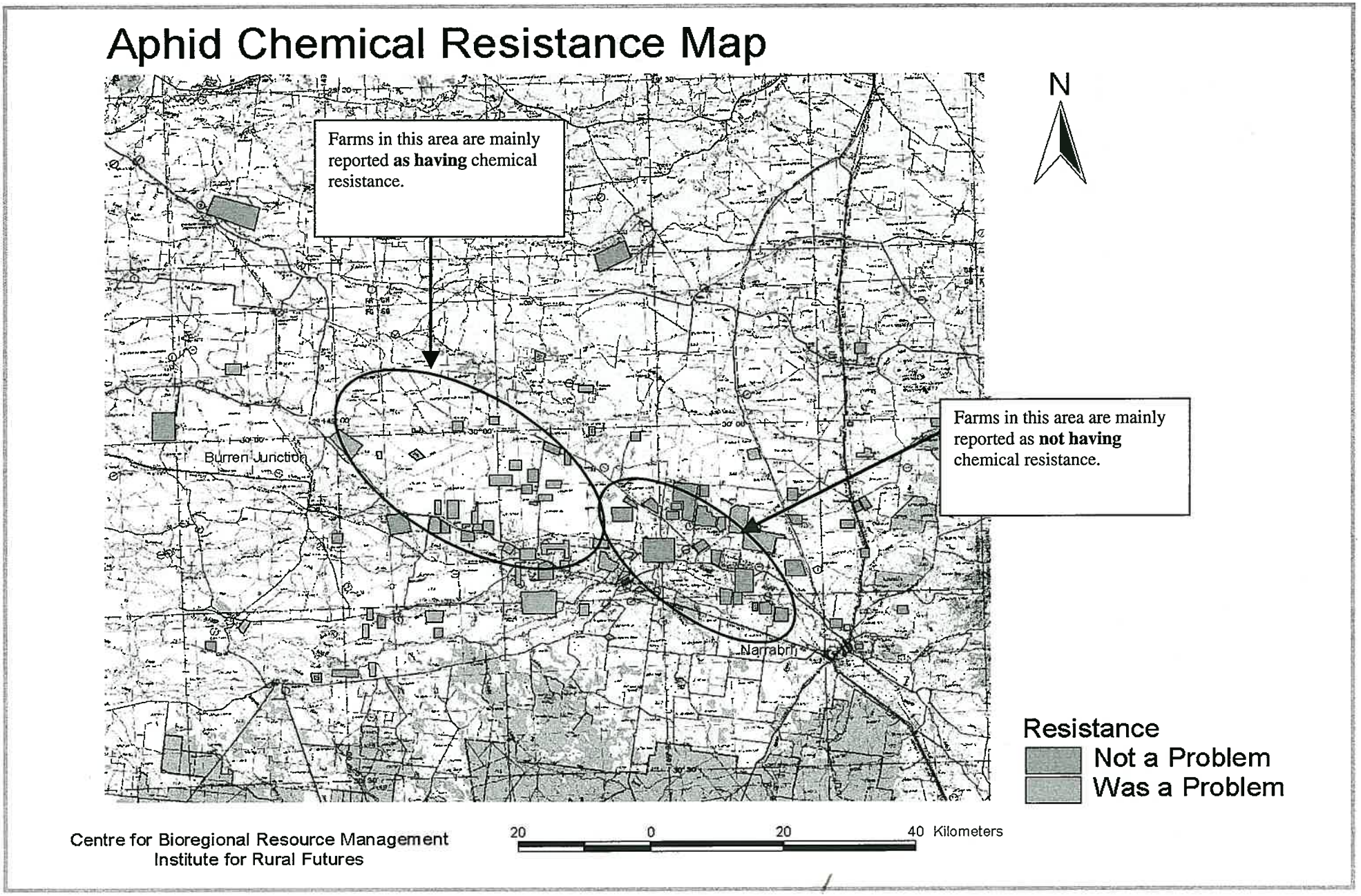


Figure 13 – Timing of Aphid Pressure

Pattern of Aphid Buildup

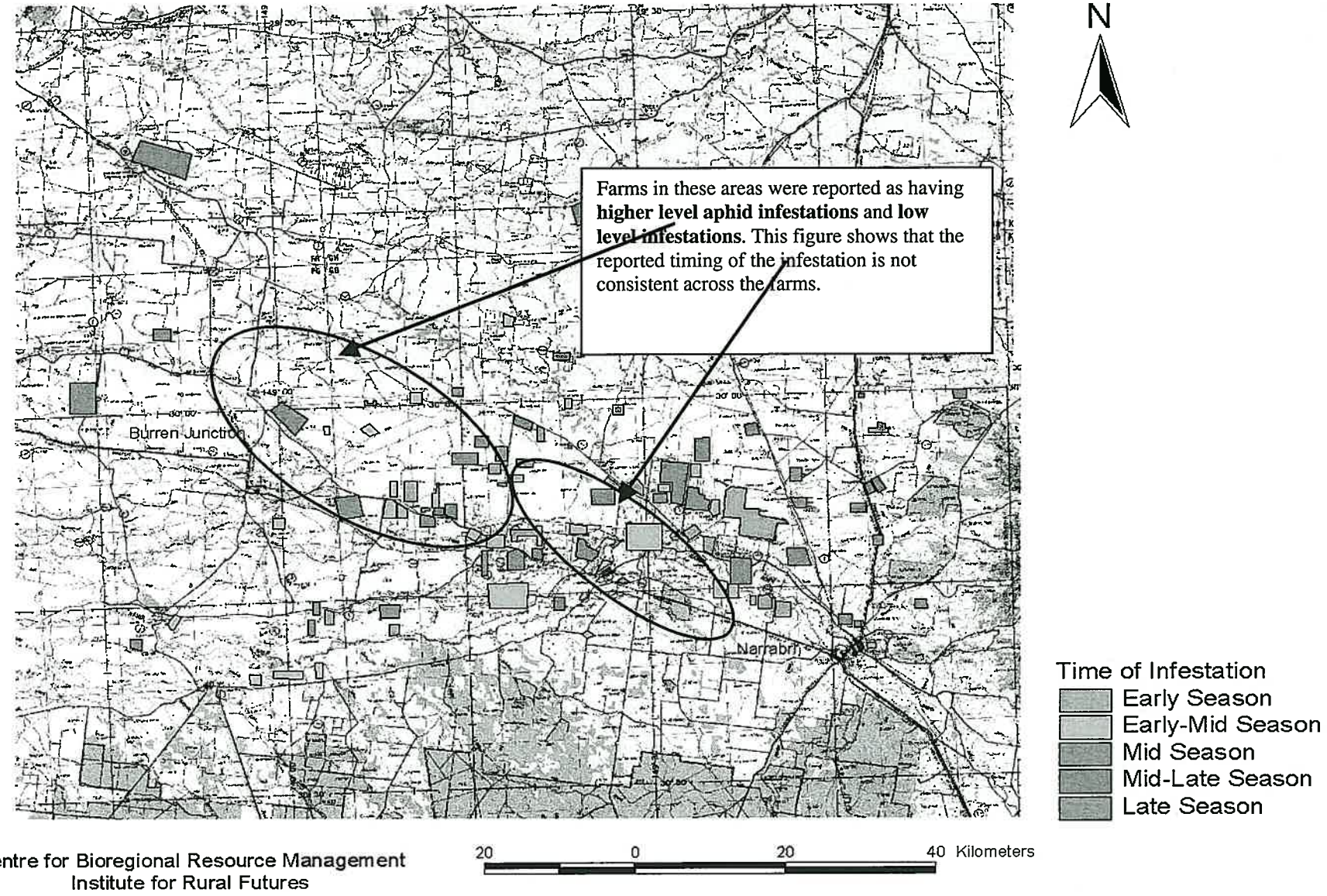


Figure 14 – Cotton Bunchy Top Incidence

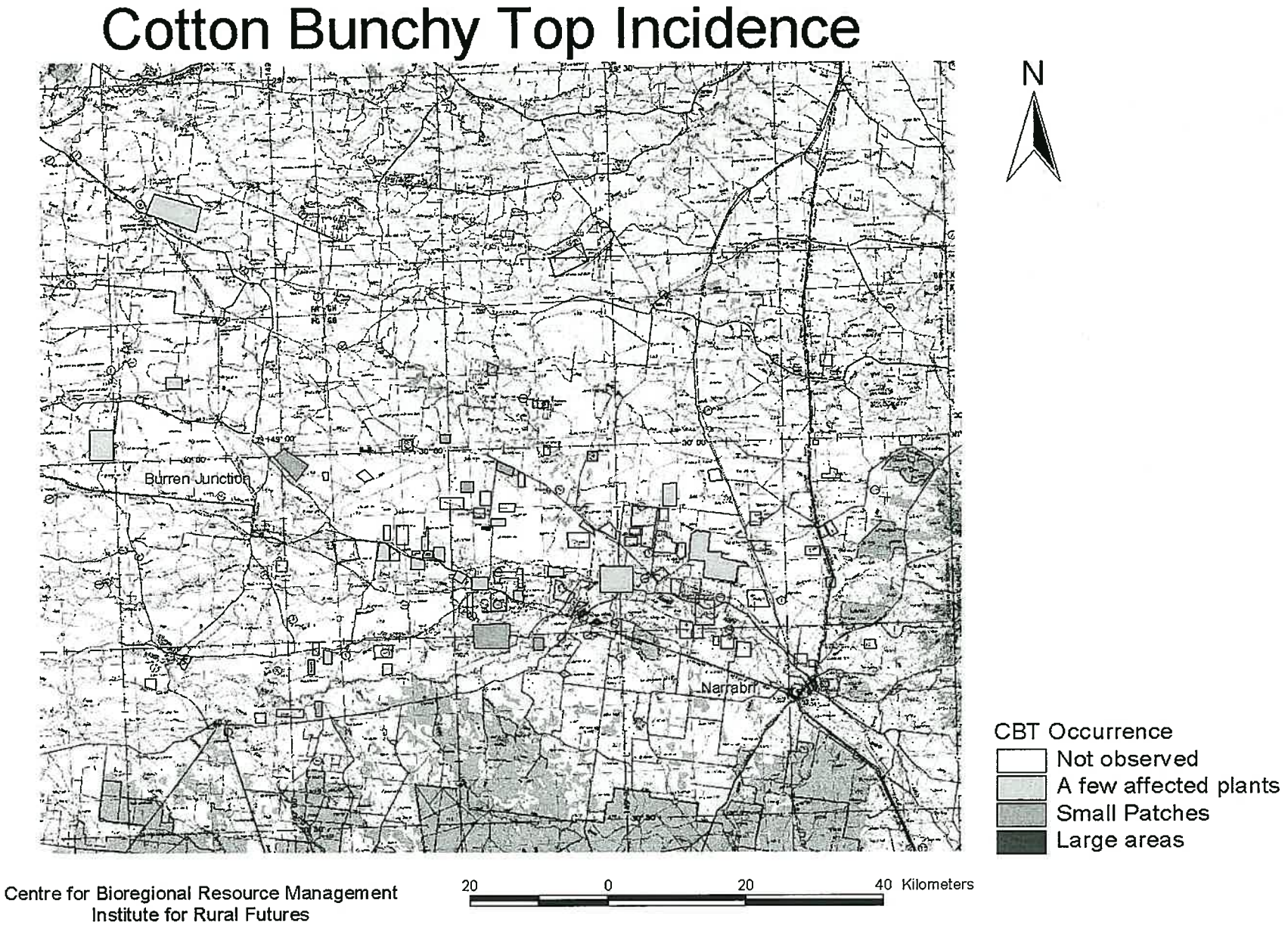


Figure 15 – Aphid Species

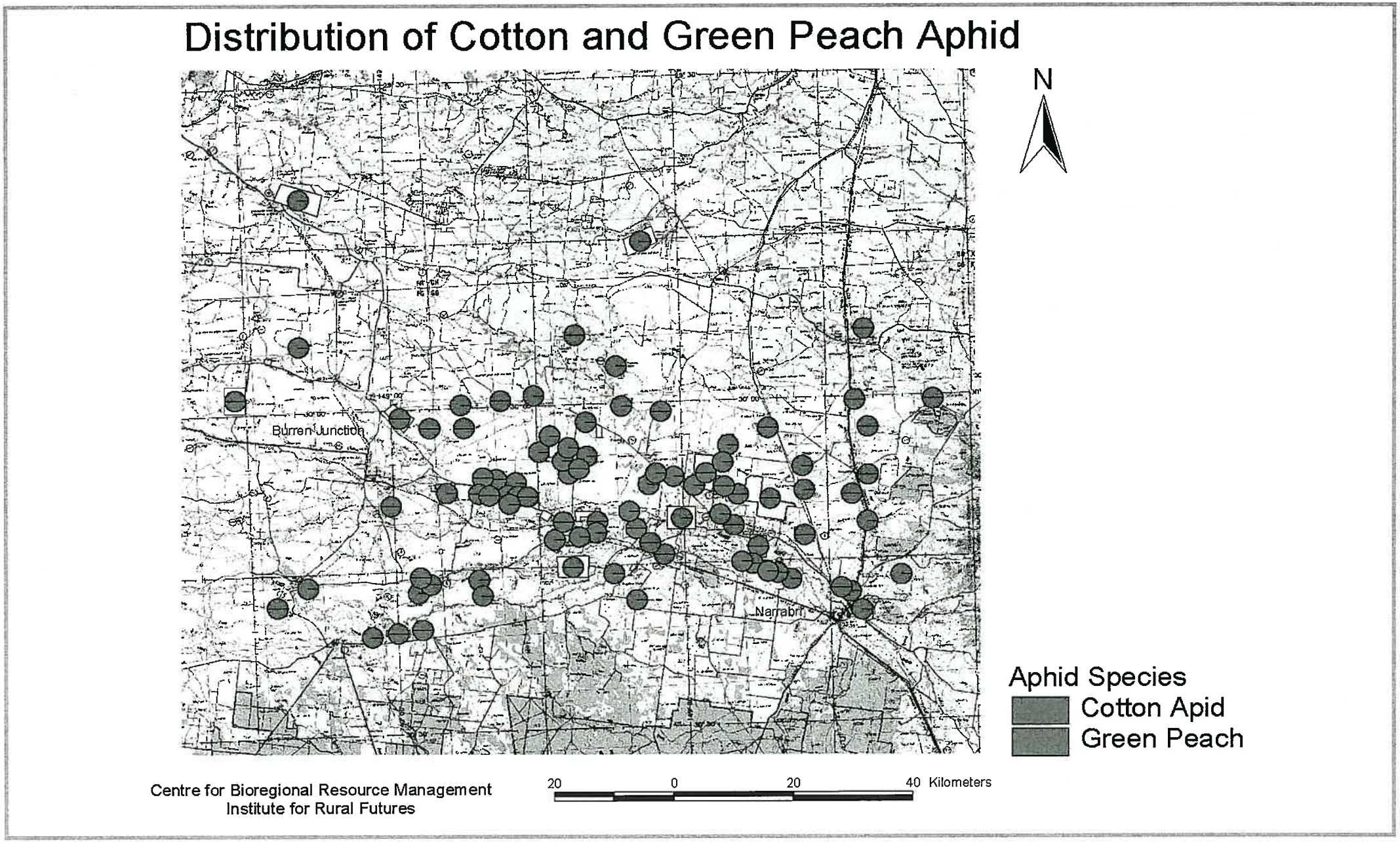
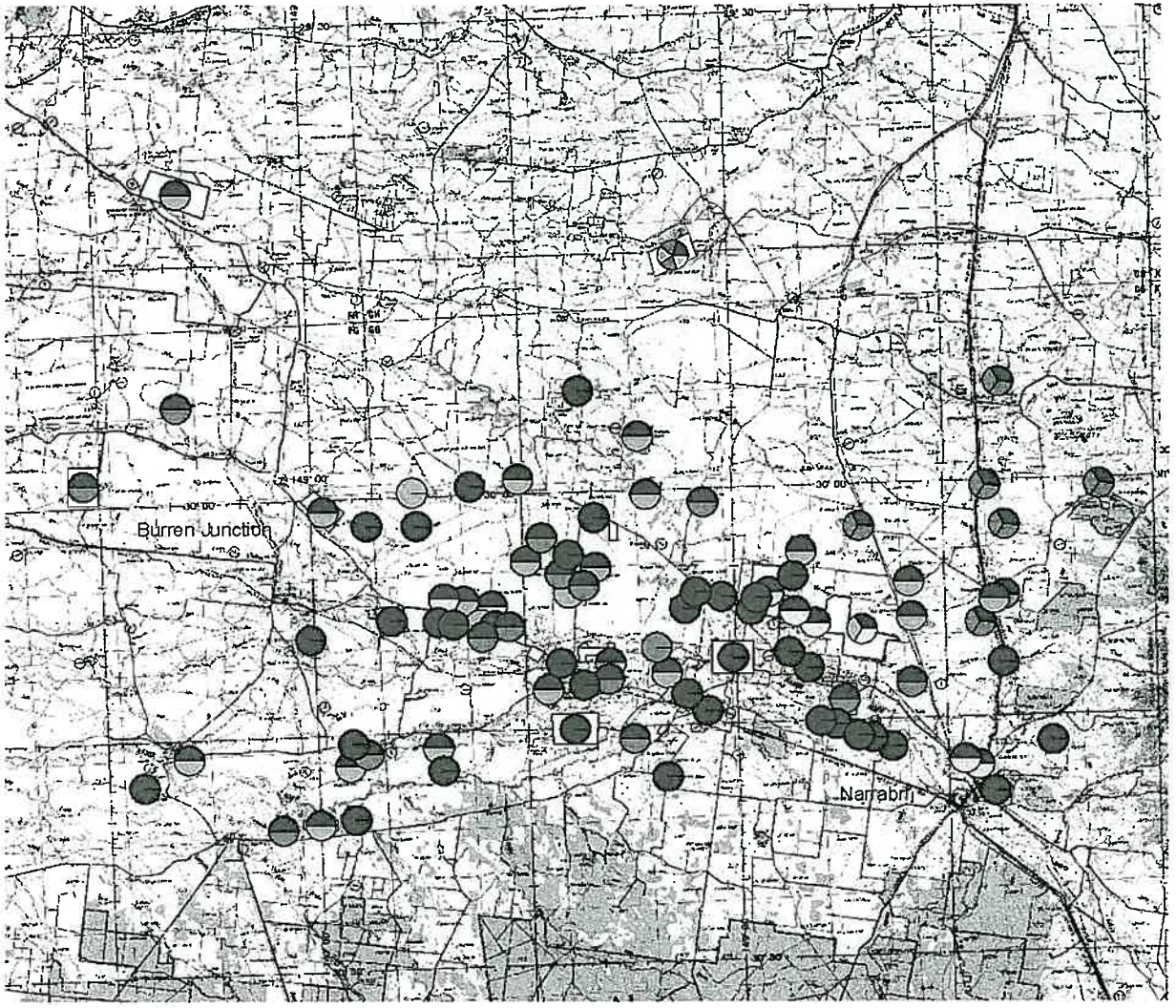


Figure 16 – Beneficials

Distribution of Beneficial Insects



N

Beneficials
- Lady Beetles
- Lacewing
- Hover Fly
- Bigeyed Bug
- Parasitic Wasp

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20 0 20 40 Kilometers

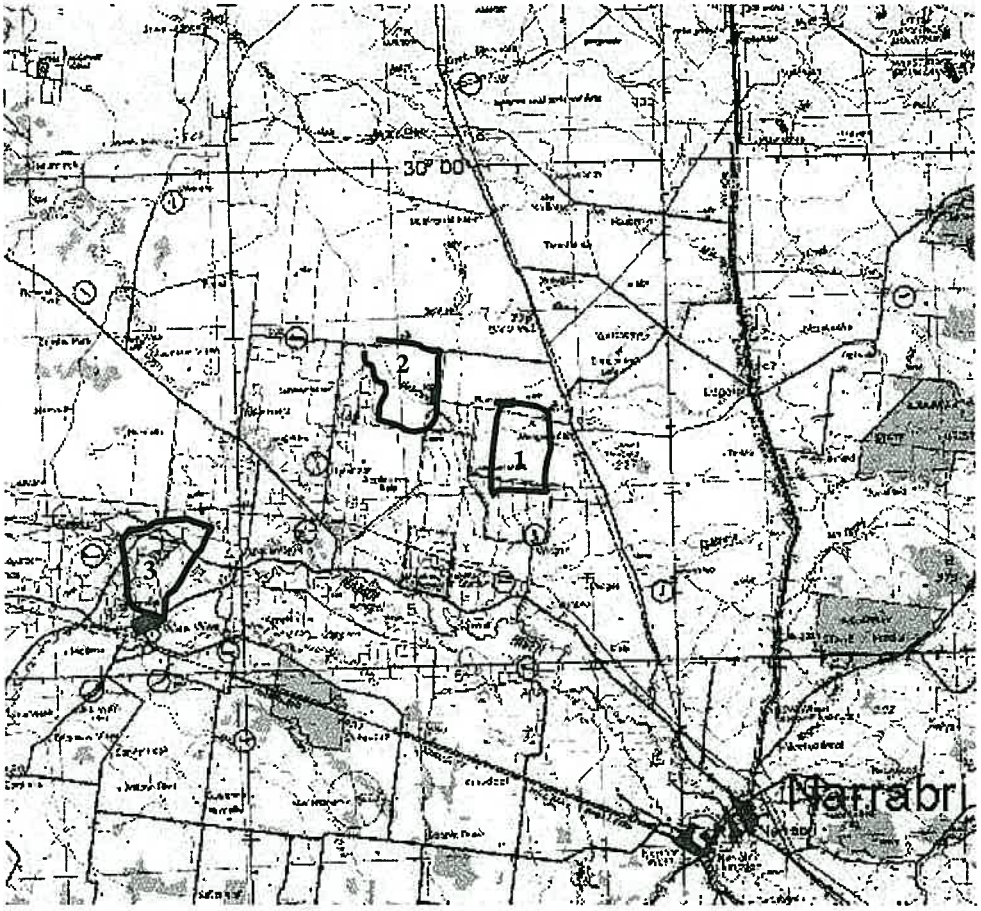
Appendix 1

Lower Namoi Aphid Management Survey

This survey is being conducted to collect data on Aphid infestation and management for the 2000-2001 cotton season in the lower Namoi Valley.

1. How many farms do you offer agronomic advice for _____

2. Using the attached map of the lower Namoi, could you please mark the farms or agronomic areas where you consult and number them.



Example only, please use the attached map.

3. In the table below, could you please indicate the following, where possible, for each of the marked farms or areas.

Farm Number (From Map) and Green Hectares		Was the Aphid Infestation uniform across the farm or Variable?	Average Aphid Infestation Rating 1=low, 5=highest	Pattern of Aphid Build Up Early Early-mid Season Mid season Mid-late Season Late Season	Aphid Species? Cotton aphid, Green peach aphid, Not identified	Main Beneficials Feeding on Aphids	Was Chemical Resistance a problem? Yes No	Was Bunchy Top Observed? If yes, did it develop into a problem? 1) A few affected plants 2) Small patches throughout fields 3) Large areas of fields affected.		Was there variability in the Bunchy Top infestation between cotton varieties? If Yes, which variety was least affected?		Which Variety was most affected and how? 1) Numerous affected plants but minimal effect on yield 2) Most plants affected but impact on yield low (< 5%), 3) All plants affected yield losses high > 5%)	
1	750ha	Uniform	3	Mid Season	Green Peach	Ladybird	No	Yes	2	Yes	Siokra-v16	Sicala-v31	2

4. With reference to the preceding table, which farm area(s) would you say was closest to the average for the farms under your management? _____

Comments _____

_____

_____

5. Would the experiences you have had with aphid management last season have an effect on the approach you take to aphid management in the upcoming season? Yes / No **(Please Circle)**

   If yes, could you list what it was about the 2000-2001 season that will have the greatest bearing on your approach to aphid management for next season?

_____

_____

_____

_____

6. Generally, did you observe any particular patterns, i.e. where the cotton was near another crop or weeds - the aphids were worse, or, if a certain insecticide was used the aphids were worse, or, where the worst field was where there was stubb cotton present or particularly weedy etc?

_____

_____

_____

_____

7. Did you notice any consistent differences in aphid infestation between Ingard and conventional cotton varieties?

_____

_____

_____

_____

8. Did you notice any consistent differences in aphid infestation between hard and soft chemical approaches (Eventual total sprays, aphid damage, bunchy top, beneficials etc.)? Yes / No

_____

_____

_____

_____

8. Any other possible associations? _____

_____

_____

10. Could you rate the pesticide efficacy against aphids - 1 = best 5 = worst (Please Circle)

Pirimor,	1	2	3	4	5	Didn't Use
Dimethoate,	1	2	3	4	5	Didn't Use
Omethoate,	1	2	3	4	5	Didn't Use
Other OPs,	1	2	3	4	5	Didn't Use
Endosulfan,	1	2	3	4	5	Didn't Use
Confidor,	1	2	3	4	5	Didn't Use

11. What seed treatments or planting insecticides did you recommend? Did these help with aphids?

_____

_____

_____

_____

12. With respect to **Bunchy Top (BT)** incidence, did you notice any trends eg. BT in relation to aphid density?

_____

_____

13. Did you notice any differences in BT in relation to management approach, differing thresholds or number of sprays?

_____

_____

_____

_____

14 Are there instances where the input from growers will influence your management strategy in relation to:

Aphids? _____

_____

Bunchy Top? _____

_____

_____

Thank you for taking time to fill in the survey, Brendan will be in contact to arrange a convenient time to pick up the survey.

Appendix 2

Excerpt from Cotton CRC publications.

Table 1: Chemical 'Mode of Action' groups available for rotation against aphids.

Option	Chemical Group[6]	Chemical Subgroup	Mode of Action	Seed treatments or 'at planting' insecticides[7]	Foliar insecticides[2]	Witholding Period Foliar Insectidides (days before harvest)
1	1A	Carbamates	Acetyl choline esterase inhibitors	aldicarb	pirimicarb	21 days
	1B	Organophosphates	Acetyl choline esterase inhibitors	phorate	profenofos	28 days
				disulfoton	dimethoate	14 days
					omethoate	21 days
					chlorpyrifos	28 days
					parathion methyl	14 days
2	4A	Chloronicotinyls	Acetyl choline receptor agonists/antagonists	imidacloprid (Gaucho®) thiamethoxam (Cruiser®)	Imidacloprid (Confidor®)	91 days[8]
3	12B	Diafenthiuron	Inhibitors of oxidative phosphorylation, disrupters of ATP formation		diafenthiuron (Pegasus®)	35 days
4	2A	Cyclodienes	GABA-gated chloride channel agonists		endosulfan	28 days[9]

Resistance Management

Our current resistance management strategy for aphids hinges on four main points:

1. A maximum of 2 sprays from any aphicide chemical group, unless the product is otherwise restricted
2. Rotation of chemistry, that is, do not use chemicals from the same mode of action group consecutively
3. The first aphicide spray should not be from the same chemical group as any seed treatment or at planting insecticide that slow controls aphids.
4. There is cross-resistance between carbamates (Group1A) and organophosphates (Group1B) and therefore they should be considered as the same group for aphid control.

To assist with points 2 and 3 of this strategy we have provided details of insecticide groups in Table1. It is critical that cotton growers and consultants plan ahead, particularly with their selection of seed treatment, or 'at-planting' insecticides so that they are aware of options they will have later in the season. Appropriate chemical alternation is still necessary late in the season even if aphids have not been targeted for control since the use of the 'at-planting' insecticide. This is because resistant clones, in fields where they are present, are likely to persist at some level season long.

[6] Chemical groups according to the Avcare Insecticides Resistance Action Committee, based on mode of action are highlighted on the front panel of product labels.
[7] Where only one commercial product containing a particular insecticide is available the 'Trade Name' as well as the active ingredient name is given and if there is more than one commercial product, only the active ingredient name is given.
[8] Withholding period under review – check label
[9] See label for use restrictions.