Australian Government
Cotton Research and Development Corporation

TRAVEL & CONFERENCE REPORT

Part 1 - Summary Details

Please use your TAB key to complete Parts 1 & 2.

CRDC Project Number: **CSP1003**

Project Title: **USDA Trip for Bollgard II and Pest Management.**

Project Commencement Date: 4/6/2010 **Project Completion Date:** 16/6/2010

Research Program: 2. Farming Systems

Part 2 – Contact Details

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Signature of Research Provider Representative: _____

Part 3 – Travel Report

(Maximum two pages)

1. A brief description of the purpose of the travel.

Travel to the USDA Kika De La Garcia Agricultural Research Centre at Weslaco in South West Texas. This is an area of mixed cropping that includes cotton, sugarcane, soybean, corn, and a range of other crops. Dr John Adamczyk, who is based at this institute, visited Narrabri in 2007 to review research on IPM and develop collaborations (costs were largely covered by USDA). Dr Adamczyk has extensive experience, especially with the implementation of Bt-cottons and evaluation of factors affecting their field performance and efficacy. He also has considerable experience with management and research on other cotton pests. He visit was valuable, especially in planning some of our own research to understand the interaction between mirid control and mite outbreaks. The discussions also significantly benefitted Cotton CRC PhD student Baoqain Lu in planning his research to understand how susceptible *Helicoverpa* larvae survive in cotton and the economic significance of the damage they cause.

Dr Adamczyk invited me to visit in June to review cotton research they are doing with the natural enemy complex in the cotton/soybean system. However, I spent most of my time on other issues including reviewing progress with Bao's thesis, mostly directly related to cotton production, but some related to management of other pests in different systems – which I thought may be a source of ideas that could be relevant to cotton. I was asked to present a seminar on cotton research in Australia, especially in relation to management of mirids in Bollgard II cotton systems.

Dr Adamczyk generously covered accommodation and living expenses and CRDC generously covered costs of flights to and from Weslaco (Figure 1).

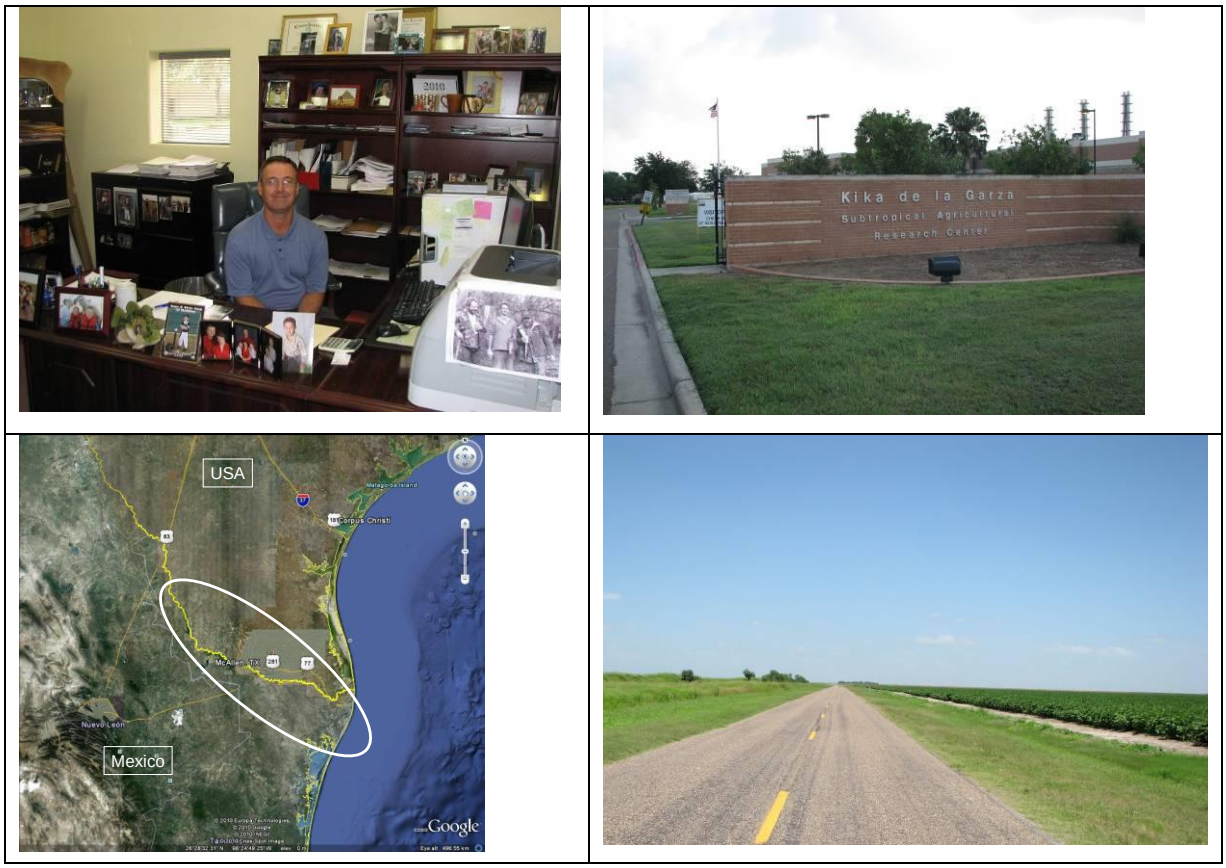

Figure 1. Dr John Adamczyk and the Kika De La Garcia Agricultural Research Centre, which is located in the heart of the Rio Grande Valley in south western Texas.

2. What were the:

a) major findings and outcomes

The Research Centre is located at Weslaco, in the Southern end of the Rio Grande Valley. Irrigation draws from a mixture of river and groundwater – though most of the irrigation is within close proximity to the Rio Grande River. Cotton area varies, but last year was about 100,000 ha. Urban expansion along the highway the follow the river from South Padre Island inland is gradually pushing agriculture further out, but there is still a patchwork of urban areas right next to cropping. Other crops include sugar cane, soybean (just starting with a tropically adapted variety) and corn. During the 5 days I spoke with a range of researchers, attended a field day and toured through a significant portion of the area searching for cotton volunteers. Some of the key impressions I formed were;

1. Control of volunteer cotton is very well managed in this part of Texas due to the need to ensure that there are few hosts for boll weevil through winter. This area of Texas is one of the few areas warm enough for boll weevil to remain active through winter. Hence, volunteer cotton is a potential impediment to boll weevil eradication, and Dr Randy Coleman is surveying to quantify the abundance of volunteers and their infestation levels. He has found up to 60% of bolls infested, half of which produced adult weevils (See images in Figure 2). Our volunteer control is poor and while this has the obvious risks that have been extended to industry a further risk is related to bio-security. If boll weevil were to enter the country, volunteers and ratoons would provide a substantial summer and overwinter habitat for this pest and substantially undermine attempt at control or eradication. This pest would be absolutely devastating and its management expensive and very disruptive of our IPM systems. This is discussed further below.

Figure 2. Volunteer plants were rare and tended to be the result of seed cotton that had been floated off-farm on rainwater into nearby creeks where a small amount was able to lodge in suitable areas and grow (top left) and dried boll from a volunteer showing boll weevil exit hole (top right). Dr Randy Coleman sampling volunteers for the presence of boll weeveil (bottom left) and boll weevil (bottom centre) and affected boll (bottom right) (bottom two images R. Coleman).

2. Poor management of Lygus in the south eastern USA has resulted in significant problems in some regions. Over-reaction to this pest in Bollgard cotton especially with pyrethroids led to localised areas of resistance and difficulty in management of this pest. We need to maintain a good understanding of mirid management strategies in Australia – and to continue to press for 'sensible' management approaches.

3. *Creontiades signatis* (green mirid), a species related to the local *Creontiades* species is an occasional pest in cotton in this area of the USA. Research has mirrored that conducted in Australia – including caging mirids on bolls to look at effects on growth, use of pectinase injections to understand effect of timing of damage. Current work is focussing on thresholds – they are tagging flowers then caging mirids on the resulting bolls at different ages after flowering.

Figure 3. Clockwise from top left. Cages used to exclude pests from cotton plants, Tagged fruit that will be infested with mirids at particular ages to assess the affect of boll age on susceptibility to mirids, modified blower-vac used to 'blow' mirids into a catching bag, mirids aspirated from the catching bag – these will be used in experiments.

4. There is very interesting and relevant research on the role of spiders in pest management. Drs Bob Pfannenstiel and Joe Patt, have conducted a range of elegant studies that have highlighted (i) that some spiders, especially sac spiders (similar to pale night stalkers), cover large areas of cotton searching for prey (ii) for these species virtually all searching and predation occurs at night – so their roles as predators is usually grossly underestimated (iii) they will eat non-moving prey, especially *Helicoverpa* spp. eggs and other Lepidopteran eggs (iv) they will supplement their diets with plant based food when prey is scarce, such as pollen and nectar. This is an area ripe for research in Australia.

Figure 4. Dr Jo Patt (left), with apparatus used to test responsiveness of sac spiders to scented or non-scented nectar and Dr Bob Pfannenstiel (right) with apparatus used to examine effect of provision of sugar (nectar) on foraging of sac spiders.

Dr Pfannenstiel also showed me the beet board they use – this is an alternative to a beat sheet and is a tin sheet, bent to have a catching tray along the bottom. Plants are beat against the board and insects slide down to the catching tray. From here they are quickly brushed into jars for later counting. Dr Pfannenstiel claims this technique lets them collect samples faster with less escapes.

Figure 5. Beat board, about 1m2, against which plants are beaten (left) and then dislodged insects brushed into a jar for storage and counting (right).

5. With Dr Adamczyk and Coleman I found some volunteer cotton which I suspect is infected with a CBT like disease. The plant was in a protected site under a highway bridge. Aphids are a common problem on seedling cotton in this part of Texas and it is really surprising that they don't seem to have problem with any of the aphid vectored viral disease. It may be that no disease is present – though the symptoms on this plant were very similar to CBT – small leathery leaves, small fruit, reduced internode length and characteristic leaf mottle. As the plant was adjacent to a healthy plant the symptoms arte unlikely to be related to the site. This is currently being tested using a developed real-time PCR test developed by CBA.

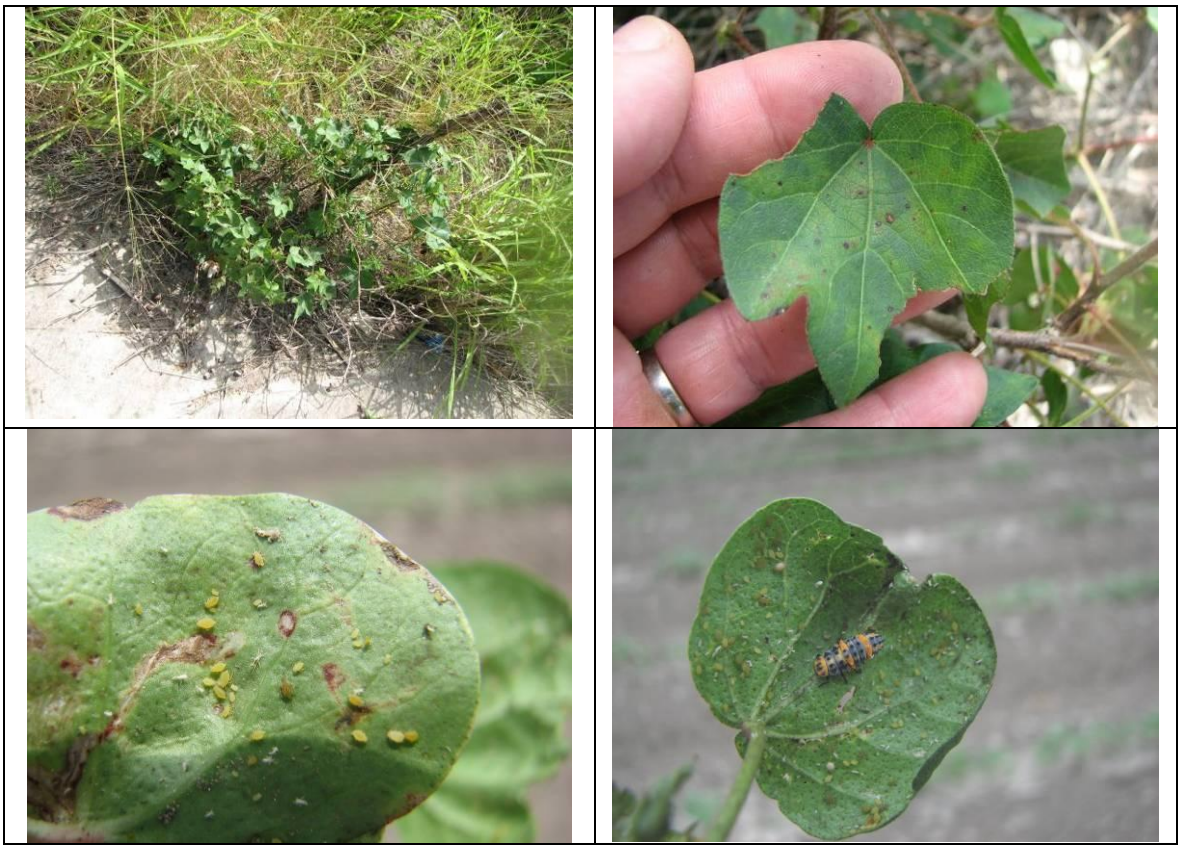

Figure 6. Clockwise from top left. Volunteer plants near a highway bridge. The plant in the foreground had small leathery leaves which showed mottling very similar to CBT disease - samples were collected and are being tested for presence of CBT. Aphids are a common problem on seedling cotton – but are controlled by seed treatments and/or beneficials such as ladybeetle, the larvae of which can be seen here.

6. The system in the USDA at Weslaco is very different to ours and researchers tend to have much less pressure to interact with industry. The strong connect between research and industry, but also between research and extension is a critical feature of the successful uptake of research in Australia and something we should work to maintain and improve.

7. Dr Adamczyk reviewed some of Bao's PhD research – especially the chapter investigating the relationship between boll age and damage in Bollgard II and made a number of useful suggestions for the analysis.

b) Other highlights

I also spent a day with Dr John Goolsby and his Post Doc, Dr Alex Racelis. Dr Goolsby has a large project investigating the potential for bio-control of giant Arundo Grass. This is a very tall, fast growing grass that colonises river banks and shallow waters. It is a pest because it leads to sedimentation and reduced water flow, uses water, acts as a cover for smugglers across the USA/Mexico border, and also harbours cattle ticks. Dr Goolsby and Dr Racelis have evaluated a number of bio-control options, both wasps, one of which causes death of the growing tip which stunts growth, and the other which colonises the rootstock or rhizome. They have developed an aerial release technique for the wasps which enables them to be released over significant areas.

Figure 7. Dr Alex Racelis and Dr John Goolsby (top left), Dr Goolsby next to Giant Arundo Grass (top right), wasp introduced to sting terminals (bottom left) and reduce growth (bottom right).

3. Detail the persons and institutions visited, giving full title, position details, location, duration of visit and purpose of visit to these people/places. (NB:- Please provide full names of institutions, not just acronyms.)

The only site visited was the USDA ARS Kika De La Garcia Research Centre at Weslaco in South West Texas. At this site I had discussions with:

Person	Title	Discussion
Dr John Adamczyk	**Supervisory Research Entomologist**	**Management of Bollgard II, including variability in expression. Research with mirid damage. Management of Boll Weevil.**
Dr Randy Coleman	**Research Entomologist**	**Management of cotton volunteers in relation to boll weevil and other pests. Management and eradication of boll weevil. Assessing mirid damage.**
Dr Bob Pfannenstiel	**Research Entomologist**	**Spider hunting behaviour and feeding. Prey consumption, use of alternative prey and nectar. Odour-based recognition of nectar in cursorial spiders.**
Dr Joe Patt	**Research Entomologist**	**Spider hunting behaviour and feeding. Prey consumption, use of alternative prey and nectar. Attractants/synergists for management of Asian Citrus Psyllid which spread citrus greening disease**

Dr John Goolsby	**Research Entomologist**	**Identification and development of rearing and release techniques for potential biocontrol options for Giant Arundo Grass and biology of biocontrol agents. Integrated Pest Management of Potato Psyllid to Minimize the Incidence of Zebra Chip in Potatoes.**
Mr Eloy Rodriguez	**Agricultural Science Research Technician**	**Culture of mirids**
Mr Carlos G Gracia	**Biological Science Technician**	**Culture of Heliothis**

4. a) Are there any potential areas worth following up as a result of the travel?
This trip really highlighted to me the benefits of international interaction and collaboration. I felt I provided the US researchers with some useful new perspectives on their research, and I certainly saw plenty of opportunities for fruitful collaboration that would add extra value to both the Australian and US cotton industries. These include;

(i) The research being done with mirids has taken and extended on some of our approaches. The use of the large mesh-house combined with boll tagging is an approach we have not used much and would be of value in further defining boll age susceptibility to damage from mirids and also other sucking pests such as cotton stainers. Dr Adamczyk is intending to visit Australia in February 2011 and it will be interesting to review the outcomes of the experiments I saw when I was there, especially those seeking to understand boll susceptibility to mirids. There is definite value in further interaction with the US group to better understand the relationship between mirid density and damage, mortality factors and ecology.

(ii) The USDA researchers have developed very simple and robust rearing methods for mirids – which allows them to have them available for experiments when needed. It would be valuable to discuss this in more detail – perhaps with Dr Grant Herron to evaluate if the US approach is more successful than ours. A simple rearing system would help Dr Herron in evaluating resistance in mirids to insecticides.

(iii) As a part of Baoqain Lu's thesis he studied the relationship between boll age and susceptibility to damage from *Helicoverpa* survivors. Bao used two approaches, the first similar to that developed by Dr Adamczyk, the second modified to control more strongly for difference in the *Helicoverpa* culture used over time. Neither approach provided a very strong relationship. Given ongoing issues with *Helicoverpa* survivors in Bollgard II, especially at the start of the 2010-11 season, this is an area where both labs would benefit from collaboration in improving experimental design and analysis to provide more easily interpreted outcomes, and greater confidence within industry about Helicoverpa thresholds in Bollgard II.

(iv) Subject to confirmation of the presence of CBT in the USA it would be interesting to investigate the nature of the causal agent and its similarity to CBT. The fact that this disease has not been recorded before is unusual and could reflect that very strong control of cotton volunteers which are potentially an important host.

(v) Another notable issue was the research with spiders. We have tended to ignore or dramatically downplay spiders and their contribution as predators in the system. They are a diverse group with quite different prey capture strategies. Several group of sac spiders, including the Anyphaenidae, Miturgidae and Clubionidae tend to hide during the day. Much of their activity is unseen at night, and they have highly developed strategies to survive in periods of lower prey abundance such as by consuming nectar and pollen. This would be a prime area for collaboration, especially through students or scientific exchange to help us gain a better understanding of the role of spiders in our system.

b) Any relevance or possible impact on the Australian Cotton Industry?
There were many areas of relevance to the Australian Cotton Industry.

(i) The most notable was the stringent management of cotton volunteers in this area of Texas, despite a very suitable climate for them. This really highlighted to me the dire situation we would face if boll weevil were to enter the country. I think it would be good for the cotton industry to consider the issue of volunteers more broadly and include the bio-security risks they may pose.

(ii) Mirids still strike fear into the hearts of many growers, despite excellent research with thresholds, compensation, sampling and control. I think that some carefully planned research, perhaps mirrored on both continents, could help provide greater confidence in understanding the relationship between mirids and yield.

5. How do you intend to share the knowledge you have gained with other people in the cotton industry?

When the next meeting of the Cotton Industry Biosecurity Group occurs I will highlight the issue of volunteers and boll weevil. I have passed onto Baoqain Lu suggestions from Dr Adamczyk that he incorporated into his thesis. I have presented a report on my travel to CSIRO staff at ACRI.