Australian Government
Cotton Research and Development Corporation

TRAVEL, CONFERENCE or SCIENTIFIC EXCHANGE REPORT 2016

Part 1 - Summary Details

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

CRDC Project Number: **CSP1603**

Project Title: International Congress of Entomology

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CRDC Research Program: 1 Farmers

Part 2 – Contact Details

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Date Submitted: _____

Part 3 – Travel, Conference or Scientific Exchange Report

(Maximum two pages)

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

We (Lewis Wilson and Simone Heimoana) attended the International Congress of Entomology in Orlando to (i) present research outcomes from Australia relevant to other parts of the world and (ii) to inform ourselves of the latest research in IPM and pest issues relevant for our research in the cotton industry as well as other industries. Attending various symposia and discussions with researchers from other countries also gave us new ideas that could be incorporated into experiments. These discussions also provide opportunities to connect and collaborate with other researchers working on similar problems.

2. What were the:

a) major findings and outcomes

- See attached Summary Table 1 of presentations attended
- Entomological work critically underpins IPM which is by no means an exact science. It can fail at times when a component of the system changes or shifts , as seen in Arizona in 2015 where pesticide use for *Lygus* control increased and consequently destabilised the whitefly IPM which growers had relied on thereby jeopardising lint quality from honeydew contamination
- New pest incursions such as Brown marmorated stink bug or Bagrada bug could cause such shifts in Australian cotton IPM
- New insights into Hemipteran pest biology and ecology may help us manage such pests better
- We are quite successful at generating artificial insect infestations on a field scale to test chemicals and assess the impact of infestations on crops - other researchers are interested in our methodologies.
- Flupyradifurone (Bayer Crop Science) is proposed as an alternative insecticide for controlling sucking pest species—aphids, psyllids, stink bugs, and white flies—which are becoming increasingly resistant to currently available pesticide chemistries. It was approved by the APVMA in August 2016 for use in agricultural chemical products. Available data suggest that flupyradifurone may possess many of the undesirable attributes associated with neonicotinoids and other conventional insecticides and it would be worth testing for its effect on beneficial insects.
- Researchers in Arizona, led by Dr Peter Ellsworth, have developed a system to capture detailed information from pest advisors. In his presentation Dr Ellsworth demonstrated the power of this information in understanding what was being done, when and why. This is valuable both in identifying emerging issues or priorities but also in ensure that understanding of practice is accurate. Our current CCA survey capture part of this but it would be valuable to look at the Arizona system as there may be components that would be valuable here – both for understanding pesticide use patterns and documenting the uptake of new technology or changes which may be valuable for planning, extension and policy.
- Dr Fred Gould gave an excellent plenary presentation on the opportunities of gene editing (Crispr/CAS9) in agriculture. This technology offers enormous potential in cotton breeding but also potentially in management of pests. Dr Gould raised also the range of unknowns with this potential deployment of this technology in terms of managing the movement of the technology out into the environment and where it goes from there. This is an important emerging area to watch.

- Dr Yolanda Chen hosted an excellent symposium on rapid evolution in insect invasive species. A range of speakers outlined that often when a species colonizes a new area there is rapid change (evolution) in the species. This can be reflected in rapidly development of resistance to pesticides, rapid adaptation to new environments. Mechanisms are not clear but they seem to be able to overcome bottlenecks that would be expected with small numbers of colonisers and limited genetic diversity. There is speculation that increases in the numbers of 'transposable elements' may be involved. This has implications for Australia from invasive species, with a risk of host diversification and or resistance.
- Dr Toews (University of Georgia) presented an interesting paper on movement of stink bugs in a peanut/cotton/soybean system. He used protein markers sprays and ELISA (developed by Dr James Hagler, USDA Arizona) to study movement across the landscape. There is potential to use a similar approach to understand movement of particular pests (and beneficials) in cotton systems in Australia, for instance between crops, between crop types, identify influxes from external sources.
- Another of Dr. Toews' experiments aimed to quantify brown marmorated stinkbug populations in and around cotton, corn, and soybean fields in the US. Weekly population density and boll injury were estimated using pheromone baited traps, sweep net samples and visual inspection. Data suggested strong edge effects in all three field crops. Boll injury data from cotton fields indicated increased stink bug feeding on the edges of the fields followed by a linear decrease with distance from the field edge. Physical barriers (eg. forage sorghum planted at the interface of soybean/cotton crops reduced movement of stink bugs between crops. Considering the edge effects and attraction to pheromones of stink bugs, synthetic semiochemical could be used to attract and kill GVB around cotton fields.
- There was a valuable session on Brown Marmorated Stink bug with presentations by Dr Tom Kuher (Virginia Polytechnic Institute and State University) and Dr Michael Raupp (University of Maryland) that summarise current knowledge, including biology, ecology, ecology in agro-ecosystems, control options. It would be worthwhile to compile some of this information to have available should this pest arrive.
- There was a presentation by Dr Waseem Akbar (Monsanto Company) about the sucking pest resistant GM cotton. These provides suppression of sucking pests such as *Lygus* but also controls thrips. Thrips control could be a two edged sword in Australian cotton systems as thrips are a seedling pest but also contribute significantly to control of mite populations, both on seedlings and in the mid – late season..

b) other highlights

This conference was the largest ever entomology conference with 6682 participants from 102 countries and 5396 presentations. It astounded by its sheer scale and made me regret that I was able to take in only a fraction of what it had to offer (57 presentations). It was a worthwhile experience, in particular to see that entomology is alive and well in most parts of the world, and to reinforce its importance to virtually every aspect of human wellbeing. I valued the experience of connecting with other researchers in many fields to discuss parallels, similarities and differences. Oh yes, and the crumbed, deep fried pickled gherkin is worth mentioning!

Robert Mensah, Megha Parajulee and Lewis Wilson hosted a small symposium on 'New Tools and Strategies for Integrated Pest Management (IPM) on Transgenic (Bt) and Non-Transgenic (conventional) Cotton Crops'. This symposium was only moderately attended – competing as

it was with 38 other concurrent sessions. Nevertheless, there was good interactions with the audience and valuable discussion between researchers at the end of the symposia. Simone presented research on developing an approach to research control options for green vegetable bug and potential implications for outbreaks of silverleaf whitefly. There was particular interest in how she had generated populations of green vegetable bug and silverleaf whitefly for these experiments.

Lewis presented on 'The role of Bt-cotton in global IPM' in a symposia on 'Insect-Resistant Genetically Engineered Crops: Current Status, Concerns and Future Prospects' hosted by Anthony Shelton and Jörg Romeis. This paper included input from co-authors from India (Prof Hari Sharma, ICRASAT and University of Horticulture and Forestry, Himachal Pradesh), China (Prof Kongming Wu, Institute of Plant Protection, Chinese Academy of Agricultural Science), Arizona (Dr Steve Naranjo, USDA ARS), Mississippi Delta (Prof Jeff Gore, Mississippii State University) and Brazil (Dr Silvana V. Paula-Moraes, EMBRAPA) and received positive feedback. It highlighted that though Bt-cotton forms strong foundation on which to build IPM systems, it also needs to be supported by IPM systems to provide effective and sustainable management of sucking pests and to help reduce the risk of resistance. There is emerging resistance to the Bt proteins in Lepidopteran target pests in India, China, SE USA and Brazil. This provides a strong indication of the value of the RMP to Australia, and given background levels of resistance to Cry2Ab and VIP3A it essential that the effectiveness of the RMP is maintained. Sucking pest have also risen to prominence in almost every system using Bt cotton and in the Mississippi Delta and in India are now costing more to control than *Helicoverpa* did, again a clear message that we need to continue to research and understand options to manage sucking pests, especially mirids, in Australian systems. The heavy mirid pressure in the early part of the 2016-17 season in Australia reinforces this issue.

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.)

International Congress of Entomology 2016, Orlando, Florida

Discussions were held with:

- Prof James Harwood (University of Kentucky) to review progress with the CRDC project CSPR 1303 P 'Identification of beneficials attacking silverleaf whitefly and green vegetable bug'. We reviewed results and agreed that Lewis would progress with developing the final report.
- Dr Steve Naranjo (USAD ARS, Maricopa, Arizona). Dr Naranjo is visiting Narrabri in December and will be working with Lewis and Tanya Smith to review and process results of life history studies on SLW. He will also be involved in a workshop to identify gaps in knowledge with SLW to be held at Moree during his visit. Lewis briefed Steve on the workshop, current research progress and the issues currently challenging consultants to help orient him for the workshop.
- Discussed the current situation with *Lygus* bug in the Mississippi Delta areas, contributing factors and plans to ameliorate problems with Prof Jeff Gore (Mississippi State University) and Dr John Adamczyk (USDA). They described the selection of OP and SP resistance in *Lygus*, effect of a changing crop system where cotton has become a sink for *Lygus* and generally lack of development of an effective IPM strategy to help manage the *Lygus* population in the system. As a result *Lygus* control is now costing more to manage than *Heliothis/Helicoverpa* did. Further, there is growing evidence of survival of *Heliothis/Helicoverpa* in cotton suggesting increases in resistance to the Bt proteins.

- Discussed with Dr James Hagler (USDA ARS, Arizona) current progress with using pest/beneficial populations marked with simple proteins (milk, egg, soy) to understand movement on the landscape.

4. a) Are there any potential areas worth following up as a result of the travel?

- Discuss with Bayer intentions (if any) to develop flupyradifurone (Sivanto, Bayer Crop Science, soil and foliar) for cotton.
- Synthetic semiochemical use to attract and kill GVB around cotton fields as well as physical barriers between soybean and cotton planted in closed proximity (eg. forage sorghum)
- Including economic analyses in future IPM experiments to add value and assess benefit to industry
- Review options with Dr Peter Ellsworth to capture pesticide use information.
- Assemble information on Brown marmorated stink bug.
- Given the emerging issues with sucking pests in GM cotton, we suggest to hold a workshop to review mirid management and opportunities to improve at the end of the 2016/17 season. It has been over 10 years since this was last done.

b) Any relevance or possible impact on the Australian Cotton Industry?

- Vigilance and protocols for invasive species that could incur economic losses and disrupt current IPM practices

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

Information on Brown marmorated Stink bug and Bagrada bug will be shared with the Cotton Biosecurity Committee.

Extension of research outcomes that have benefitted for the new knowledge and contacts gained by attending the ICE. Further, new initiatives will ultimately lead to future extension documents.

Please email your report 30 days after travel/conference to: research@crdc.com.au