TRAVEL & CONFERENCE REPORT

Part 1 - Summary Details

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

CRDC Project Number: **CSP1001**

Project Title: Whitefly ecology and management study: Arizona and California

Project Commencement Date: 09/09/09 **Project Completion Date:** 21/09/09

Research Program: 3 Crop Protection

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.

I. To evaluate the risk of Q-biotype whitefly for Australia
II. To gain hands-on knowledge about whitefly management in cotton
III. To assess the importance of horticultural industries in whitefly management (eg. vegetable and ornamentals)
IV. To learn field techniques for whitefly research experiments
V. To assess and improve on current Australian whitefly resistance testing based in Toowoomba

2. What were the:

a) major findings and outcomes

I. To evaluate the risk of Q-biotype whitefly for Australia

- In the US (Arizona), Q-biotype has never been found in the field, only in glasshouses and in the Tucson area only. The most common findings are from poinsettia plants in nurseries and garden centres at Christmas.
- In some areas of China, Q-biotype has displaced B-biotype in the field. While Q biotype can be controlled with a different set of chemicals from B-biotype, little is known about the characteristics (trehalulose content) of its honeydew and how lint contamination would affect the spinning of cotton (better, worse or equal to honeydew contamination by B-biotype).
- It is known that Q-biotype is not fit enough to survive amongst B-biotype in the glasshouse or field unless there is intense spray pressure where its resistance characteristics would give it an advantage over B-biotype. It is uncertain whether such a situation has occurred in Australia in BGII cotton or non-Bt cotton. The apparent identification of Q-biotype field samples in Queensland and NSW has not been verified and no further information about the samples has been provided.
- Australian Q-biotype samples were identified using an esterase test which is, according to Dr. Xianchun Li (University of Arizona, Molecular mechanisms of insect resistance), rather subjective in the interpretation, not always showing clear banding differences between Q-and B-biotypes (as opposed to PCR techniques). However, Dr. Frank Byrne and James Bethke (also insect resistance researchers) of UC Riverside said all their esterase tests had been verified by PCR methods and were shown to be reliable.

OUTCOME:
Q-biotype identifications in Australia have not been verified by other methods or researchers. According to research in the US, it is unlikely that they would occur in the field in the presence of predominantly B-biotype populations and in the absence of high spray regimes. It is also believed that high temperatures and other environmental conditions affect Q-biotype's ability to establish. Despite the lower risk factors, it is, however, important to continue monitoring for Q-biotype as they are considered a bio-security risk. While their presence may not have immediate implications for BGII cotton in the field, it would for glasshouse breeding and research facilities as well as for horticulture and floriculture industries (eg. especially glasshouse/greenhouse situations). To determine the risk to cotton production the Q-biotype honeydew characteristics would need to be investigated.

II. To gain hands-on knowledge about whitefly management in cotton

- Whitefly management depends on the predominant crop type in an area, eg. where cotton predominates (Tucson), priority to use a certain chemical group is given to cotton growers, while in a predominantly vegetable growing area (Yuma), the horticultural industry gets priority use of certain chemical groups.
- In areas where pastures, vegetables and cotton are grown, there is continuous contamination with whiteflies as they move from crop to crop.
- Sucking pest control: a novel IPM insecticide, flonicamid (Carbine), has been registered for control of lygus bugs (miridae) in cotton and two others have registration pending (pyrifluquinazone, metaflumizone). All control sucking pests and have novel modes of action that minimise the risk of cross resistance with other insecticides.
- On average, Arizona cotton growers apply one spray for lygus bugs and one spray for whiteflies per season in Bollgard II crops. Whiteflies are largely controlled by predators so insecticides that are hard on predators are counterproductive. Aphids are generally not a problem.
- Mild, wet winters promote whitefly outbreaks early in the season and increase the risk of whitefly-born cotton leaf crumple disease.
- Imidacloprid efficacy has reduced from 45 days to 25 days when used as a soil injection at planting. It also does not control adult whiteflies well in this form.
- Q-biotype is resistant to imidacloprid and pyriproxifen therefore management differs markedly from B-biotype management.

OUTCOME:
Whitefly management in Arizona relies largely on neonicotinoids (imidacloprid) and insect growth regulators (buprofezin and pyriproxifen). The Q-biotype is resistant to all three. Imidacloprid resistance by the B-biotype is increasing in both cotton and vegetable crops. While the cotton industry is managing whiteflies quite successfully, the vegetable industry often still employs older, harsher and cheaper chemistry as IPM in vegetables is not viable. This practice may increase resistance in whiteflies as they move between crops. There are implications for areas of Australia where the cotton and horticultural industries overlap (eg. St. George, Emerald, Burdekin) with respect to whitefly management and resistance buildup. For example, intense selection in the horticultural industry could render products ineffective in the cotton industry.

III. To assess the importance of horticultural industries in whitefly management (eg. vegetable and ornamentals)

- In areas where both industries are represented, co-operation between growers needs to be co-ordinated with respect to chemical use. Arizona growers that plant both cotton and vegetables generally have better management practices than those that grow cotton or vegetable crops only. The cotton industry is government subsidised to maintain agricultural infrastructure, therefore growers are not under pressure or have the incentive to adhere to best management practices to grow the best and most economic crop they can (so pest control can be lax because they are not going for maximum yield). The horticultural industry is serviced by PCAs (Pest Control Advisors), many of whom are contracted to large companies whose bottom line is to service consumer demand for a perfect, blemish-free crop as cheaply and reliably as possible. To achieve this, older and cheaper chemistry is often employed. To enable area-wide management, cotton and vegetables should not be grown in the same area, however, this is considered impractical by many growers.

- Ornamentals, especially poinsettias, are deemed responsible for the spread of Q-biotype whitefly. With the shipping of poinsettias at Christmas time, sampling for Q-biotype peaks, in particular at garden centres and supermarkets.

OUTCOME:
It is difficult to efficiently manage whiteflies in cotton in areas where vegetable growers use different management strategies. James Bethke suggested that poinsettia was a most likely source of introduction for Q-biotype whitefly in Australia as plants reared for the Christmas season may have been propagated from overseas stock. Sources of commercially sold poinsettias in Australia would need to be verified and it would be advisable to sample poinsettias for Q-biotype incursions as this plant species is an excellent whitefly host.

IV. To learn field techniques for whitefly research experiments

- We went to the field to learn about detailed life cycle studies of whitefly, how to implement these studies and how to assess the different stages of whitefly development, differences in parasite species and factors that affect whitefly nymph survival.
- Lifecycle work is involved and labour intensive, but made a little easier by the fact that settled nymphs remain stationary. First instar nymphs on leaves are circled with a marker and their development is checked every second day. Their state is specified and, if dead, a reason for death is given (predation, parasitism, dehydration, wind or rain dislodgement).

OUTCOME:
The field studies will help us to design better whitefly experiments with realistically defined parameters to understand the pest's lifecycle and effect of mortality factors in Australian cotton growing systems.

V. To assess and improve on current Australian whitefly resistance testing based in Toowoomba

- We discussed whitefly resistance testing techniques with various researchers and observed their techniques in the laboratory. The discussions centred around rearing lab generations from field collected specimens, mortality rates, chemical application and interpretation of results

OUTCOME:
Zara Ludgate and Richard Lloyd identified several issues with the techniques they use that can be improved by changing some of their procedures. This should help to make resistance testing more efficient and reliable.

b) other highlights

We gave presentations of our work to researchers at the Arid Land Agricultural Research Centre in Maricopa. Dr. James Hagler remarked on the effect that salt had on the efficacy of a half-rate Rogor application and suggested we carry out some mirid feeding experiments to investigate how salt affects food (and chemical) intake. We believe this may be a good student project (eg. summer scholarship student). We also discussed protein marking techniques to investigate the role of predators.

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.)**

   (See attached Appendix 1)

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

- Continue sampling whiteflies in the Namoi area to send to Zara and Richard for resistance testing of B-biotype and identification of Q-biotype. Also consider sampling ornamentals (poinsettia) and greenhouse populations in various coastal areas to detect Q-biotype.
- Ensure area wide resistance management strategies in areas where horticultural industry and cotton co-exist to preserve the lifespan of insecticides that currently control B-biotype whitefly.
- Research whitefly ecology to identify the impact of predators and parasites and other sources of mortality in managing this pest.
- Evaluate some of the system risk (spray regime) x genotype (Bollgard II, Conventional, Okra-leaf) interactions with B-biotype outbreaks.
- Contact chemical companies to explore their intentions with some of the compounds identified for lygus (mirids) or whitefly control that may have a good fit in our IPM system (a rotation option for Admiral with a selective mirid control would be desirable)
- Develop a small project to understand the effect of salt as an additive
- Understand honeydew breakdown

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

All of the above outcomes are relevant to the Australian Cotton Industry as they give us guidelines as to how we should monitor and manage whiteflies in order to avoid a massive pest build up which could cause losses to the industry.

While there is some uncertainty with some aspects of Q-biotype's potential to become a problem we still recommend monitoring to be continued. It is unlikely that Q-biotype will be confirmed, however, in the event, the industry should take the following actions to deal with this pest:

- Independent confirmation of the pest species
- Alerting relevant industry groups (horticulture/cotton)
- Pre-emptive development/planning of a management and spray regime that will control Q-biotype whiteflies

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

   1. Joint Spotlight and/or Cotton Grower article (Zara, Richard, Simone) report on Arizona experience and emphasize to the different cotton regions to be aware of issues with multiple hosts, host sequencing, farm hygiene and also adherence to the IRMS for SLW.
   2. Possible interview with CSD
   3. Present to CCA at meetings
   4. Zara will do a blog posting on their Beat sheet Blog

Start of Project (normally 1st July)

Appendix 1: Researchers visited during Whitefly Study Tour 09-13 September 2009

Person visited	Position	Organisation & Location	Duration of Visit	Purpose
Dr. Steven Castle	**Research Entomologist**	**United States Department of Agriculture Arid Land Agricultural Research Centre 21881 North Cardon Lane Maricopa, AZ 85138-3004**	**1½ days**	**Refer to 1. I. II. IV. V. Protein marking of insects**
Dr. Nilima Prabakher	**Entomologist**			
Dr. Steve Naranjo	**Research Leader & Entomologist**			
Dr. James Hagler	**Research Entomologist**			
Dr. Eric Hoffman	**Entomologist**			
Peter Asiimwe	**PhD Student**			
Dr. Peter Ellsworth	**IPM Specialist**	**University of Arizona Department of Entomology Maricopa Agricultural Center 37860 W. Smith-Enke Rd Maricopa, AZ 85238-3010**	**½ day**	**II. III.**
Dr. Xianchun Li	**Assistant Professor**	**University of Arizona Department of Entomology Forbes Bldg Tucson, AZ 85721**	**1 day**	**I. V.**
Dr. Yves Carriere	**Professor**	**University of Arizona Department of Entomology Forbes Bldg Tucson, AZ 85721**		**I.**
Dr. Judy Brown	**Professor**	**University of ArizonaTucson Department of Plant Sciences Forbes Bldg Tucson, AZ 85721**	**3 hrs**	**Cotton diseases, whitefly vectors**
Ben DeGaine Ginny Harpold	**Technical Officers**	**University of Arizona Department of Entomology Forbes Bldg Tucson, AZ 85721**	**½ day**	**V.**
Dr. John Palumbo	**Research Entomologist**	**University of Arizona Department of Entomology Yuma Agricultural Center 6425 W.8th St. Yuma, AZ 85364**	**2/3 day**	**II. III.**
Dan Fox	**Pest Control Advisor**	**Yuma – Farm Visit**		
Clint Dean	**Brassica Grower**	**Yuma – Farm Visit**		
Dr. Eric Natwick	**Research Entomologist**	**University of California Co-operative Extension 1050 E. Holton Rd Holtville, CA 92250**	**½ day**	**II. III.**
Dr. Frank Byrne	**Associate Research Entomologist**	**University of California Department of Entomology Riverside, CA 92521**	**½ day**	**I. V.**
Dr. Nick Toscano	**Extension Specialist Emeritus**	**University of California Department of Entomology Riverside, CA 92521**		
Dr. Loreta Bates	**Research Entomologist**	**University of California Co-operative Extension 151E. Carmel St. San Marcos, CA 92078**	**2 hrs**	**Diaprepes information**
James Bethke	**Floriculture Farm Advisor**	**University of California Co-operative Extension San Diego County 151E. Carmel St. San Marcos, CA 92078**	**½ day**	**I. II. V.**