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: DAQ1704

Project Title: "Participate in the 12th International Verticillium Symposium – Linda Smith"

Project Commencement Date: 18/7/2016 **Project Completion Date:** 12/10/2016

CRDC Research Program: Choose an item.

Part 2 – Contact Details

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Part 3 – Travel, Conference or Scientific Exchange Report

(Maximum two pages)

A brief description of the purpose of the travel.

Verticillium wilt is one of the most important pathogens many cotton growers are facing at this time. Two highly virulent strains of *Verticillium dahliae* are widespread and current management strategies such as crop rotation (cotton/wheat/long fallow/cotton rotations) are not effective and host resistance is temperature sensitive and therefore fails to manage this pathogen effectively. A better understanding of pathogen/host interaction, soil population and disease development, and practical strategies to manage this disease are needed. International collaborators, Prof. Jiménez-Díaz, and Prof. Subbarao are key note speakers at this symposium and attendance will enable professional relationships to be further developed, as well as developing new relationships with researchers who are developing management strategies for Verticillium wilt.

1. What were the:

a) major findings and outcomes

1. Informed of the latest research towards fast detection of *Verticillium dahliae* using a portable instrument (ICGENE) and a molecular kit using LAMP technology suitable for use in the field. This kit using plant tissue is cost effective and more sensitive than real-time qPCR assays. The device can be operated using batteries and can therefore be taken into the field for on-site identification and the analysis only takes 1 hour. I am in communication with the company representative that was at the symposium and have asked for information on cost and availability. Purchase of this kit would be extremely beneficial for quick identification of *V. dahliae* on-farm, particularly when a new field has plants expressing wilting symptoms with vascular discolouration, given the difficulty to differentiate between Fov and Verticillium. Quick analysis to determine if weeds present in an infested field are hosts of *V. dahliae* would also be highly beneficial. Note: This kit does not identify strain of *V. dahliae*.

2. Dr Dan Chellemi and Prof. Krishna Subbarao, USA
   Dr Chellemi presented a paper on ways to promote the biological buffering capacity of soils by integrating ecologically-based principles into the design of crop production systems. For 50 years growers in the USA have been fumigating the most resistant phase of the Verticillium lifecycle – microsclerotia. Pre-plant disinfestation is a flawed approach for disease control. What we need to do is target the most susceptible stages. Current control methods ignore the reproductive and dispersal phases of the lifecycle and fail to take advantage of the competitive incompetence of *V. dahliae* in soil ecosystems. Adding soil amendments such as broccoli residues and chitin to increase the population of beneficial microflora in the soil, results in disease suppression.

   Prof. Subbarao followed on from Dr Chellemi's talk and presented data on the microorganisms responsible for control of Verticillium wilt. For many years it has been believed that the mechanism for controlling Verticillium wilt in cauliflower with the incorporation of broccoli residues was the production of volatiles toxic to the pathogen. New research presented at this symposium has shown that a shift in the soil microflora is responsible for disease suppression, with Myxobacteria breaking down the melanin in the fungal pathogen.

   In conversation with Prof. Subbarao following his presentation he said that forage sorghum as a green manure crop would have the same potential as broccoli to alter soil microflora to manage disease. Once forage sorghum is 1m to 1 ½ m tall, chop and incorporate into the soil. Soil must be moist to enable microorganisms to become active and break down vegetation. Forage sorghum would be a more suitable crop than broccoli for Australian cotton producers to include in there cropping regime and should be investigated for its effectiveness in controlling Verticillium wilt.

3. Detailed discussions with Prof. Jiminez-diaz on soil solarisation to reduce inoculum population in the soil pre-plant suggests that this approach would be effective to control *V. dahliae* in cotton in Australia. Soil preparation is very important for this approach to be effective. Soil needs to be cultivated sufficiently to break down clods to a fine tilth and watered to field capacity to enable heat penetration at depth. In trials in Spain with cotton, soil solarisation for 6 to 10 weeks reduced the population of *V. dahliae* in the 0- to 40-cm soil layer to undetectable or very low levels. Under these criteria the beneficial effects lasted 3 years. This management strategy is directly applicable to the Australian cotton industry and will be trialled for effectiveness against Verticillium wilt of cotton in Australia in collaboration with Dr Paul Grundy.

4. Further developed collaborations with Prof. Jiminez-diaz (Spain) and Prof. Subbarao (USA), world leaders in Verticillium wilt research.

5. Professional networks and potential collaboration was developed with Prof. Bart Thomma (University of Wageningen, Netherlands) and Prof. Epaminondas Paplomatas (Agricultural University of Athens, Greece) with aims to share isolates of *Verticillium dahliae* from cotton to better understand pathogen evolution, and develop collaborative projects. Dr Navas-Cortes (Spain) has offered to provide advice regarding the development of risk maps for fields, regions etc. and early detection of Verticillium wilt using thermal and hyperspectral imagery.

other highlights

1. Dr Radisek (Slovenia) mentioned that in England, it took 30 years for resistant varieties of hops to become susceptible to Verticillium wilt, and this is because Verticillium developed more virulent strains over this time period. I found this interesting because this is a similar time-frame that we are looking at in Australian cotton. Have more virulent strains developed over this time-frame?
2. It was suggested that the strain VCG 2A in Australia not be referred to as 'non-defoliating (ND)' based on a positive response to ND specific primers if it does in fact defoliate cotton. Refer to strain as 'VCG 2A'.
3. Dr Chellemi does not use molecular tools to estimate soil populations of V. dahliae as he wants to determine the viable propagules in the soil. He felt that molecular tools would always need a soil plate test, which requires a lot of hard work, to validate the molecular results, so he suggests do the hard work to start with.
4. A few participants asked why in Australia we conduct disease surveys the way that we do when it obviously uses a lot of resources and time to survey the large distances required. I was asked 'Is it worth it?', 'What does it mean?' and 'Can you gain the same information more efficiently and only travel to fields if there is a concern?' I considered these questions and have some ideas on how we could conduct disease surveys in a different way which would be more cost effective and gathers the information we need. We could utilise the expertise within each region (consultants and CottonInfo members) to gather a lot of the survey information required. If there are concerns, photos and/or samples could be sent to a pathologist, and if necessary, a farm visit could be organised to further investigate the issue. This would free up time and resources to focus more on diagnostics, season issues and research towards managing diseases of cotton.

2. 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.)

No persons or institutions visited.

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

- Foster the professional relationships developed at this conference.
- Investigate purchasing an Enbiotech kit for *Verticillium dahliae* and trial effectiveness in the field.
- Consider conducting trials to investigate managing Verticillium wilt in cotton using green manure crops to shift the soil microflora to enhance disease suppression. This would require additional funding for Dr Vadakattu to analyse the microbial soil populations to determine if shifts in the composition occur and if this is the mechanism of control.
- Potential to use thermal and hyperspectral imagery for early detection of Verticillium wilt and the development of risk maps for fields, regions etc.

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

Earlier detection and faster identification of *Verticillium dahliae* on-site enables management strategies to be implemented sooner. More options to choose from to manage verticillium wilt will lead to better control.

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

This information will be shared via:

- Personal communication over the phone and email.
- Extension via Spotlight or newsletter of the role soil solarisation and green manure cropping may play in managing Verticillium wilt.
- The use of green manure to alter soil populations of beneficial organisms to manage diseases and reniform nematode was discussed at two grower workshops in Central Queensland (18/10/2016 Emerald and 20/10/2016 Theodore).