TRAVEL, CONFERENCE or SCIENTIFIC EXCHANGE REPORT 2018

Part 1 - Summary Details

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

CRDC Project Number: **CRDC1916**

Project Title: **10th Australasian Soilborne Diseases Symposium**

Project Commencement Date: **5th September 2018**
Project Completion Date: **7th September 2018**

CRDC Research Program: Choose an item.

Part 2 – Contact Details

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Signature of Research Provider Representative: _____
Date Submitted: _____

Part 3 – Travel, Conference or Scientific Exchange Report

(Maximum two pages)

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

CRDC sponsored ASDS to enable an international Verticillium speaker to present. As part of this sponsorship, CRDC has been provided with complementary registration for one participant. Brendon Warnock is taking this registration. It was also determined that it would be beneficial to have a Southern perspective at this event, and as such an invitation was extended to Todd Peach

2. What were the:

a) major findings and outcomes

i. Breeding resistant cultivars: the one theme that came to be apparent across all industries was the need for successful breeding of "resistant" (not tolerant) varieties to combat soil diseases as all other approaches or mgt practices e.g. chemical, rotations etc appeared to always be inconsistent and that trying to reduce inoculum levels in the soil maybe beyond current abilities/tools.

ii. Disease complexities: The difficulty all pathologist from all industries face dealing with trying to solve disease complexities, e.g. disease interactions with each other, environmental stresses or influences, varietal interactions, growth stages, quantity of taxa yet to be even classified, inoculum influences.

iii. Integrated approach: cliché but often forgotten. "Must look at the whole system" not just soil diseases as a stand-alone issue and not just focus on chemical, but also physical manipulation of the soil and biological approaches as well as cultural practices

iv. See point 4 below also

b) other highlights

i. disease management by other industries: there were many other industries presenting how they are mitigating disease impacts so for me this was the biggest highlight as it made me curious to know and hence challenge what we are doing as an industry and if we can learn or adopt any of these methods if not already doing? This includes various methodologies in science as well as farm management practices that could be adopted.

ii. Predicta B: advancement and adoption of this tool by so many other industries and countries was eye opening. I believe we are for verticillium, but should we also continue to see how we can use for BRR in addition to Microbiology Laboratories Australia. However, we must acknowledge or question that it is one thing to get a number from any test but it's another thing to interpret the assessment of risk if the test gives both dead and alive values such as the Predicta B does. The onion industry had similar comments also. However, the grains industry believes it is a good tool to provide a soil biology rating on a regional benchmarking level and for monitoring management changes so how can we do it?

iii. Bio fumigation crops: in addition to the chemical effects of ITC's USDA is finding that there are other benefits from these crops, such as the biological benefits of the manipulation of and or production of good bacteria and these may even outweigh the benefits of the ITC's. Another case study was the Broccoli rotations in potatoes to reduce Verticillium. Can Dr Gupta Vadakutta and team at CSIRO assist or guide our industry further regarding the assessment of this approach or even in our own

trials of vetch where we subjectively believe we have seen this? Some caution (as we are aware) was given by TAS DPI Robert Tegg, who eluded to these cover crops/green manures can also increase inoculum levels thus why we must look at all 3 soil characteristics i.e. chemical, physical and biological benefits. Another speaker highlighted that there was not as much need for large biomasses of these biofumigant crops as initially thought? This will need further investigation but promising given the issues with dealing with large quantities of biomass of green manure crops. Another good resource to whom it may be beneficial for the industry to talk to regarding bio fumigation is John Duff QLD DPI.

iv. Biocontrol: in general, but also specifically with the awareness of Endophytic Actinobacteria (albeit to combat crown rot in cereals) and how they can be used to produce bioactive compounds with the recent adoption of genome sequencing. This also sparked interest in our own pathologists to follow up to see how we can adopt into our industry research/issues particularly given it was applied as a seed treatment. Suggest our industry sends a representative from our plant breeding program to the next ASDS. Additionally, it was mentioned though that specific species will need to be identified given some e.g. Trichoderma were found not to survive over summer.

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 entire 10th Australian Soilborne Diseases Symposium (ASDS) was held at The National Wine Centre of Australia in Adelaide from Wednesday 5th September to Friday 7th September 2018.
- There were over 50 presentations given by equally as many presenters and thus is too comprehensive to detail here, however see the following link of the program schedule that outlines the talks given and the associated person presenting them and their organization.
  http://www.asds2018.com.au/ASDS2018%20Program%20book%20web.pdf

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

Absolutely and I will be doing this (see last point section 5 below). Some of which include

i. Soil workshops: conducting or continuing soil and root health workshops like SARDI do using various demo sites (see SARDI demo sites website) which look at things like soil health as a result of various crop rotations or lack of i.e. Dr Gupta Vadakattu (& team) recent work on how fallows impact on soil degradation thus potentially increasing BRR by reducing the biology – this contrasts to older work and also paddock observations – would be good to follow up and have Dr Gupta Vadakattu team more involved in our industries plight

ii. Plant Breeding: have our plant breeders discuss with other industries regarding their methods of plant breeding against diseases even if it is an older method – do we need to review? E.g. wheat industry has had success against RLN using molecular markers to deploy resistance. Can we breed or select for varieties that have more or maybe less vigorous root systems that otherwise attract or detract pathogens. Are we or can we use newer (?) techniques such as Genomic selection like AGT are with their wheat breeding program? Good presentations were given by Russell Eastwood of AGT and Stephen Neate of USQ. Idea of designer root systems e.g. on sub soil sodic soils (such as those more

experienced in western and southern valleys) have cv's with a horizontal network vs deep soils where ideal cv's would have more vertical roots to chase moisture – this would be good for the dryland system on the softer soils of Darling Downs and Liverpool plains perhaps. Other novel ideas included breeding for waxy leaves to reduce Evapotranspiration. So again, (in addition to our industry pathologists attending) perhaps it may be beneficial for our breeders to attend this symposium also to see if any of the latest scientific approaches can fast track the cotton breeding program. A scenario of knowledge gain like this, by our breeders appeared to occur at the Cotton conference this year.

iii. Cultural practices:
    1. Tillage: what does our tillage do or not do? E.g. one of the recommendations against common root rot in cereals is tillage. Has this been investigated? Revisit the idea of permanent beds and advantages or disadvantages as now the cereal industry is rethinking about intra vs on row sowing and how the different diseases are favoured by one system over the other. I.e. need to think of the whole system and what is the disease we are trying most to avoid.
    2. Rotations: need's further work done especially on BRR as a lot of time and resources has gone into verticillium and thus have come along way on rotations with verticillium in cotton but not as far with BRR?

iv. Seed Meal as biofumigant: Use of seed meal as liquid spray on biofumigant vs green manure crops to achieve bio fumigation. Types, rates and mixes of seed meal need investigating USDA has had success in apple orchards. Simpler logistics than green manuring?

v. Anaerobic soil disinfestation: can we use this principle to change either or both the bacterial and fungal populations to mitigate disease pathogens. If so what carbon source is best for the ASD i.e. grass-based carbon input or compost based? Or do we need to be more aggressive and adoptive with the chemical-based fumigants as below – can we be with current legislation? I.e. will the availability of the soil chemical-based fumigants be short lived given Methane Sodium is generally not allowed to be used any longer in most agricultural industries.

vi. Plastic films/soil fumigants: this has been looked at and continues to be investigated with modified plastics from that of 15 years ago, however one industry has found the use of more permeable film for better sealing of soil chemical fumigants – can these more permeable options be adopted practically in our large scale broadacre system and what soil chemical fumigants are available for our industry? Can we use these to remove the "bad" biology without destroying the "Good" biology? If not, then what biological based products could be utilized to bring our soil health back and if so can we do this economically?

vii. Biological spores: Use of biological spores against pathogens e.g. spores for parasitism on nematodes can we adopt this approach from any of our issues – disease related or not (some insect work currently being done with this approach)

viii. Crop stress/disease dynamics: continue to understand the disease complex as a result, of the impacts of environmental and management stress.

ix. Mulches: can we apply practically and economically these as the coffee industry has had success with sugar cane and Lucerne hay trash to improve microbial activity and thus enhance suppression to *P.Coffeae,*

should we commence investigating this against the exotic and concerning Reniform Nematode that has been recently identified.

x. Plant Traits: Selecting plant traits to recruit microbes in the Rhizosphere against pathogens
xi. Inoculation: what or if (?) can we add to our cotton seed e.g. Bacterial inoculants such as plant growth promoting rhizobacteria (PGPR). A combination of bacterial inoculants called OPPP's was shown (in wheat) to encourage siderophores, IAA, and solubilize inorganic phosphate together with ACC deaminase activity; all of which is thought to be supportive for better nutrient contents and plant growth stimulation thereby assisting in healthier plants?
xii. Fertiliser and herbicide practices: like all areas of biology we still have a gap of knowledge on how these management practices affect or influence our soil biology.

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

Farm biosecurity needs to continue or be revived, and this includes seed hygiene. Is there additional scope to further this as part of the BMP training?

i. Maybe education about the $ return on investment of prevention vs reaction i.e. grape industry 1 in 100 vs 1 in 5 once happened
ii. Education and awareness of always looking out for the unexpected and where to and how to access hotlines such as the exotic plant and pest hotline.
iii. Use of plant biosecurity planning booklets – can these be useful to us? Are they more detailed in nature than current modules in BMP etc? CA already doing things along this line?
iv. Can we or should we implement Website monitoring tools based on platforms such as flight aware or marine traffic of exotic pests e.g. SLWF, Mealy bugs but more recently Reniform Nematode. Raises issues of privacy albeit industry utilises public platforms such as cotton map and beeconnected etc. Other monitoring programs that could also be looked at was the Victorian crop safe program.

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

- I will be writing up a more in-depth summary which will be shared internally with my four-colleague agronomist/consultants which they in conjunction with me will then be able to disseminate the information to our grower base.
- I will also be discussing (as I have already done) the learnings I had with my growers and implementing some trials based on what other industries are doing.
- Additionally, I will be discussing the talks given with other Consultants/Agronomist/Reseller organisations.
- I will also be following up with other stakeholders in the industry such as the researchers, plant pathologist and plant breeders to confirm if they have or will considered some of the scientific techniques that other industries are adopting as outlined during this symposium. E.g. DNA marking techniques, genomic testing/selection, diagnostic soil testing, can cloning assist in screening against diseases as it does in sugar cane all of which or any of which may help or question if fast tracking plant breeding methods can.
- Will contact some of the researchers for assistance, direction or involvement with our own trials.
- I would also like to contact several presenters to understand their work more and enquire if there is any potential for their findings/research to be adapted to our industry.