

# **Horticulture Innovation Australia**

## **Final Report**

### **World Avocado Congress 2015 - Building research knowledge and capacity for the Australian Avocado industry**

Dr Elizabeth Dann  
The University of Queensland

Project Number: AV15702

## **AV15702**

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# World Avocado Congress 2015: Building research knowledge and capacity for the Australian Avocado industry

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## Summary

This project supported two research plant pathologists to attend the 8<sup>th</sup> World Avocado Congress held in September 2015 in Peru, and afterwards to participate in the study tour of orchards in Chile, organized by the Australian avocado industry. The objectives were:

1. To present recent research outcomes to an international audience, and promote HIA-funded Australian research
2. Share and consolidate the learning from the conference and study tour with participants AND the wider avocado industry who were not able to attend
3. To enhance the current research knowledge and build capacity for long term research leadership within the Australian avocado industry

The two researchers attended four days of conference presentations, and the field tour where they visited two orchards close to Lima. The sessions attended were primarily concerning orchard productivity, ie. Genetic Resources/Nursery Management, Pests and Diseases, and some presentations in the Cultural Management session. The presentations were mostly by researchers, but also commercial companies describing new avocado varieties, or diagnostic tests etc. The participants on the Chilean study tour visited large-scale high density orchards as well as a more conventional family-run business.

The two key outputs have been:

1. *Delivery of three presentations from projects funded through HIA.*
2. *Dissemination of new information, post-conference.*

Key outcomes:

1. *Enhanced knowledge and capacity for long term leadership within the Australian avocado industry.*
2. *Generated significant interest in the Australian rootstock evaluation program.*
3. *Enhanced productivity and fruit quality via adoption and incorporation of some key learnings.*

Some outcomes are of immediate benefit, eg. Outcome 1. above, while others will be realised over the medium (eg. Outcome 2.) and long term (eg. Outcome 3.).

Recommendations arising from the conference/study tour participation are provided later in the report, but include:

1. Articles to be prepared and disseminated to Industry in the next 2-3 months
2. Adopting key learnings. There were several presentations which were of particular interest and stimulated ideas and thoughts for inclusion into future HIA research projects.

## Keywords

Avocado, study tour, conference, networking

## Introduction

One of the key strategies for the Australian avocado industry is to “Develop industry leadership and capacity to secure long term sound stewardship of the Australian avocado industry.....” (1). It is thus important for Industry that they support the attendance of research leaders, and the next generation of leaders, at the World Avocado Congress, so that knowledge and capacity is enhanced for the long term.

The project supported participation at the 8<sup>th</sup> World Avocado Congress, (held in Lima, Peru), and 2 day Study Tour of Chilean avocado orchards, by Dr Liz Dann and Ms Louisamarie Parkinson. The World Avocado Congress (WAC) is held every four years, and brings together avocado growers and researchers from every global production region. The WAC presented an ideal opportunity for researchers to meet, present their research and have worthwhile interactions and initiate or continue collaborations. Attendance is essential for remaining up to date with the latest research findings and technologies, which otherwise would be difficult, as many research outcomes are either not published, are not published in accessible English language journals, or otherwise unavailable. The two day study tour from Santiago, Chile, was an ideal opportunity to compare and contrast South American and Australian avocado production practices. Key learnings from WAC and Chile were discussed among the small group of Australian growers and industry stakeholders in Chile.

Liz presented research on *Phellinus noxius*, from AV10001 and rootstock evaluation from AV08000 and AV13018. Louisa presented results from her PhD study on black root rot pathogens of avocado which is supported by AV14012.

## Methodology

The 8<sup>th</sup> WAC commenced with a Welcome Reception on 13<sup>th</sup> September 2015. There were several plenary presentations, and three concurrent sessions running through 14<sup>th</sup>, 15<sup>th</sup>, 17<sup>th</sup> and 18<sup>th</sup> September. The sessions that Liz and Louisa attended were focused on Genetic Resources/Nursery Management (included presentations on breeding and selection of rootstocks and varieties), Pests and Diseases, and various presentations in the Cultural Management session (eg. presentations on alternate bearing and growth regulators). Liz and Louisa travelled with other conference delegates by bus to two avocado orchards near Lima on 16<sup>th</sup> September. One orchard was well managed and trees were planted at 6 x 2m spacing. There was a high density of polliniser planted, and attempts to graft polliniser *in situ*

(eg. on Hass branches) had also been made, however, many of the grafts had died. The second orchard visited was certified as an organic orchard, and trees were of varying heights and not particularly healthy, with most trees exhibiting salt burn. Unfortunately, the field day component was not very well organised and we had no effective translation from Spanish, so it was difficult to obtain information about orchard practices from the owners/managers etc.

The Study Tour group (14 people) travelled to Santiago on 19<sup>th</sup> September 2015. Dr Francisco Mena (agronomist and Partner of Gama, a Chilean horticultural consultancy) hosted the first day's visit (21<sup>st</sup> September 2015), to orchards in the Llay Llay region approximately 100km north of Santiago. The Desarrollo Agrario orchard has about 240Ha of Hass (with Edranol pollinisers), at row and tree spacings of medium 6x4m to high density 3x3m. The Las Palmas orchard is a new development with 400 Ha planted with plans to expand to 1,200 Ha. This orchard has very high density row/tree spacing 2.5x2.5m down to 1.25x1.25m, with maximum tree height of 2m. Plant growth regulators are applied by helicopter sprays or through fertigation, and the pruning regime has been optimised to keep trees small but productive. This orchard has its own outdoor nursery, which will turn out 1.7 million trees this year to satisfy expansion plans. All trees are seedling propagated with Hass grafted to Mexicola rootstock. The operation was extremely impressive, and average yields of 19 T/Ha are achieved for medium density orchards, and over 24 T/Ha for the high and very high density blocks.

The second day's visit to a more conventional family-run orchard was hosted by Mr Alejandro Palma, Senior Agricultural Manager, AgroVision Corp (horticultural consultants). The orchard is located 75km south of Santiago, and has a total of 250 Ha avocados, mostly Hass, but also Fuerte and other varieties. Spacings ranged from very low density (12x12m) to medium density 6x2m, and large fans with gas heaters have been installed in some sections as the area is vulnerable to damaging frosts. Yields are approximately 6-10 T/Ha, due to tall trees and overcrowding. A block of Hass on Mexicola had been yielding only 2 T/Ha in the last 4 years, and was topped to about 2-3m. Some of the Australian growers commended the family/manager on the substantial (and courageous) canopy management, but encouraged even more severe stumping to 1-2m.

## Outputs

### *1. Delivery of three presentations from projects funded through HIA.*

Two presentations were given by Liz Dann "Multi-location rootstock evaluation in Australia", "Brown root rot of avocado in Australia", and one presentation by Louisa Parkinson "Soilborne Nectriaceae fungi impacting young avocado tree establishment in Australia". There was considerable interest in all presentations and several questions asked. The presentations and dialogue generated an international awareness of brown and black root rot and our capacity for high-quality disease and rootstock evaluation studies.

### *2. Dissemination of new information, post-conference.*

A short presentation (Appendix 1) was given to the Horticultural Pathology team at DAF, and aspects of the conference and study tour were also discussed with Drs John Wilkie and Helen Hofman, during a visit by Liz Dann to Bundaberg Research Station on 29<sup>th</sup> October 2015. The pruning and plant growth regulator regimes utilised in high-density production systems in Chile, have direct relevance and

potential for adoption in the Small Tree High Productivity Initiative (HIA project AI13004 "Transforming subtropical/tropical tree crop productivity").

Two ideas for articles or fact sheets arose from discussions with Australian growers and nursery operators. a) A summary of agrochemicals registered for use in avocados will be prepared, and b) Guidelines for preparing land and planting avocados (to be prepared by Liz Dann and Simon Newett). These will be disseminated to Industry via links from the electronic newsletter, "Guacamole" to the Avocados Australia Ltd Best Practice Resource, and/or published in "Talking Avocados", as appropriate.

## Outcomes

1. *Enhanced knowledge and capacity for long term leadership within the Australian avocado industry.* Key international linkages were initiated and existing ones strengthened. Enhanced the quality of the PhD student's candidature, through networking and communication opportunities, and providing a global perspective of avocado production.

2. *Generated significant interest in the Australian rootstock evaluation program.* There was particular interest in SHSR-04, the Australian rootstock identified as highly tolerant to Phytophthora root rot, and potential commercialisation partners were identified. This outcome will be of short term value as the industry progresses with commercialisation of SHSR-04.

3. *Enhanced productivity and fruit quality via adoption and incorporation of some key learnings.* Several interesting talks at the conference were of direct relevance to our research and provided some ideas for incorporation into Industry operations or future research projects. These will be discussed in more detail in the Recommendations section.

Some outcomes are of immediate benefit, eg. 1. above, while others will be realised over the medium (eg. 2.) and long term (eg. Outcome 3.).

## Evaluation and Discussion

This short term conference/study tour project was extremely successful. It enabled sharing and dissemination of research and knowledge generated in HIA projects to the international avocado community. Several useful presentations and discussions improved our knowledge and stimulated thoughts and ideas for incorporation into future research projects. Significantly, participation in the conference and study tour ensures that avocado research in Australia remains relevant and up-to-date and reinforces the research leadership within the Australian industry.

# Recommendations

## 1. Articles to be prepared in the next 2-3 months

Three ideas for articles or fact sheets arose from discussions with Australian growers and nursery operators. a) A summary of agrochemicals registered for use in avocados will be prepared, and b) Guidelines for preparing land and planting avocados (to be prepared by Liz Dann and Simon Newett). c) Recommendations for management of the polyphagous shot hole borer/*Fusarium* dieback currently a problem on the Atherton Tablelands. These will be disseminated to Industry via links from the electronic newsletter, "Guacamole" to the Avocados Australia Ltd Best Practice Resource, and/or published in "Talking Avocados", as appropriate.

## 2. Adopting key learnings

a) There were separate presentations on using calcium (John Bower) and PCR-based technologies (Kerry Everett) to predict fruit quality at harvest. It should be possible to combine both Ca, levels of infection by fungal pathogens (eg. *Colletotrichum*), and maybe other parameters, eg. NIR or fluorescence imaging, into one model to determine fruit quality or robustness and thus drive decisions on postharvest handling and/or market destination. Liz will discuss with Peter Hofman and/or Daryl Joyce, as this could be a component of a supply chain/quality project.

b) Of potential biosecurity significance is the discovery in San Diego of *Kuroshio* shot hole borer associated with *Fusarium* dieback (presentation by Akif Eskalen, and follow up discussion). The beetle vector and fungi associated with the dieback are reported to be different, but more severe, than the isolates associated with *Fusarium* dieback in Los Angeles. *Fusarium* dieback has been characterised in Australia and is causing branch dieback in several orchards on the Atherton Tablelands. Some management options identified from a presentation by Jonathon Crane on laurel wilt (which we don't have in Australia, but is caused by an analogous beetle/fungus system) could be incorporated into management practices now, (early detection of infected trees by frequent scouting of orchards, sampling suspect trees for the pathogen, tree uprooting, chipping of all wood possible and burning wood too large to chip and treatment of wood chips with insecticide. Additional recommendations could be made after further investigation of their efficacy in Australia eg. prophylactic infusion of propiconazole into avocado trees adjacent to infected trees or all trees in the orchard and periodic ground-based aerial insecticide applications to avocado trees adjacent to *Fusarium* dieback affected trees to reduce beetle populations.

c) Following Liz's talk on *Phellinus*, which showed that *Trichoderma* sp. reduced viability of the fungus in root debris, a suggestion was made to trial tree injections with *Trichoderma*.

d) There is a test commercially available from Agdia for detection of avocado sunblotch viroid. It is a nucleic acid based membrane hybridization test, and is quick and simple, and is an alternative to the laboratory based PCR test. This could be useful for the Australian industry.

## Scientific Refereed Publications

None to report

## Intellectual Property/Commercialisation

No commercial IP generated

## References

1. Australian Avocado Industry Strategic Plan, (2011-2016).  
<http://industry.avocado.org.au/AboutUs/documents/AvocadosStrategicPlan2011-16.pdf>

## Acknowledgements

## Appendices

Appendix 1. Louisamarie Parkinson's Congress/Study tour report.

Appendix 2. Powerpoint presentation summarizing key learnings and highlights from the Conference and Study Tour. This was delivered in October to Horticultural Pathology team, and emailed to John Chapman and Vicki Lane (DAF). NB. This presentation also includes a summary and photos of an international symposium on Phytophthora attended by Liz Dann in Bangalore, India, prior to the WAC. While the Indian conference was very relevant to avocado work (*Phytophthora cinnamomi* is the primary disease affecting avocados globally), no portion of the funds from AV15702 were expended attending the Indian meeting.

**Report on the 8<sup>th</sup> World Avocado Congress, Lima, Peru, (13-18 September, 2015) and Avocados Australia study tour, Chile (19-23 September 2015)**

**by Louisamarie Parkinson**

**What have you learnt from attending the 8<sup>th</sup> World Avocado Congress (WAC) in Peru and the avocado study tour in Chile and how valuable was it to you?**

Attending the WAC and avocado study tour in Chile was extremely beneficial to my PhD studies. The opportunities to learn about the global avocado industry; how avocados are grown; the production and management practices in different countries; and the constraints different countries face due to disease and different climates and environments have given me a broader perspective on the plant I am studying. It has given me an appreciation of where my research fits within the global industry and the contribution the research would make to the industry.

The opportunity to interact with growers, researchers and members of the avocado industry at an international conference has taught me a valuable lesson in science communication, in understanding the scope of my research and in demonstrating the impact and application of my research to a diverse scientific and general audience – how the research contributes to science and knowledge, how the research is applicable to industry and how the research is relevant to the grower. I can apply these communication skills throughout my career.

**Information gained from the WAC and Chile study tour**

***Market knowledge***

Learning about the different avocado races, Mexican, Guatemalan, Antillean and Cost Rican race gave me an appreciation for the origins of the crop. I also learnt about the various avocado varieties grown and sold across the globe. I gained valuable knowledge in how the target market perceives a crop variety and this has an impact on the success of the crop in the market. For example, *Maluma* is a Hass-like variety that is generally well-received by customers as it looks like Hass and has similar handling requirements. However *Maluma* is generally more frost tolerant, ripens uniformly, the fruit is larger, maintains firmness and has low wastage. Prior to the conference I had little knowledge of the differences between the avocado varieties and didn't understand consumer interests – I thought consumers would eat any avocado, but marketing plays a huge part in the success of a fruit variety. This information was valuable to my career in horticulture. I now know to take into consideration the customers' wants and needs when introducing fruit varieties into the market.

I learnt about the health benefits of eating avocados – new research suggests that simply adding an avocado to your diet per day increases cardiovascular health and cognitive function, lowers HDL cholesterol and boosts nutrient absorption acquired from the other fruits and vegetables in your diet. This is knowledge we could incorporate into Australian avocado marketing to encourage more consumption of avocados.

### ***Orchard and production practices***

An innovative way to harvest fruit, which reduces the need for tractors and transporting harvesting bins, was introduced from Chile – this is via an “Agricable™” which works similarly to a ski chair lift. There are buckets along the cable which gets filled with fruit by the pickers and the buckets are transported down to the end of the line to be emptied where the bins are located. The Agricable™ is portable and can be moved between locations and reassembled quickly. It also eliminates the risks of injury from using tractors on a sloping orchard. This harvesting technique may be useful to the Australian horticultural industry.

There were reported benefits of using shade net in orchards on improving avocado fruit production in South Africa. Hail damage, sunburn, hot, dry and windy conditions are some environmental constraints in some growing regions in South Africa. They reported that using shade nets improved shoot growth, fruit growth and reduced damaged caused by these elements.

In Chile, we visited an orchard that practices high-density tree planting where trees are spaced as little as 1.5m x 1.5m between each other. Due to high density spacing, the trees are trimmed down to 2m in height, however fruit production is still significantly high (approximately 30 tonnes per hectare per year) and this has reduced the risks of injury by pickers as they no longer have to climb the tree or use cherry pickers. They also practice treatment spraying by helicopter which significantly reduces the time to spray an entire orchard. The orchard visit in Chile gave me a perspective on the size of the Australian avocado industry in the global scale. The orchard in Chile is approximately 400 hectares (with plans to expand to 1200 hectares) and also has an open air nursery which contains 1.7 million avocado seedlings growing on 45° hillside slopes. Collectively Australia has approximately 1 million avocado trees planted in the ground. Australia’s entire avocado tree population was sitting in a single nursery in Chile! In Australia Phytophthora rot is a significant problem. In Chile, although there was evidence of Phytophthora rot in the roots of some trees, loss due to poor irrigation practice is a larger problem in Chile.

### ***Rootstocks***

Learning about the phylogeny of avocados had direct relevance to my PhD. One of my thesis chapters is on the taxonomy and phylogeny of *Nectriaceae* fungi. A common theme between the phylogeny of avocados and the phylogeny of the fungi from my studies was the separation of currently known genera or into new genera.

Avocados are part of the genus, *Persea*, which is separated into the sub-genera, *Persea* and *Eriodaphne*. *Persea parvifolia* was recently separated into its own genus and was found to be compatible with *Persea americana* (avocado). *P. parvifolia* is a small bush and has potential to be used as a source for dwarfing rootstocks. It may also be a source for Phytophthora resistance.

I learnt about various tolerant rootstocks: SHSR04 and Dusa in Australia are highly tolerant varieties to Phytophthora and Velvick is moderately tolerant; Bounty and Dusa in New Zealand are tolerant to other environmental constraints and results in generally healthier trees in the orchard; and Dusa in the US is salt tolerant. This gave me an insight into the varieties I could potentially test on resistance to black root rot in my PhD research.

### **Disease**

I learnt about the global impact of laurel wilt, which Australia has reported a similar problem. Laurel wilt caused by *Fusarium* spp. is a disease which attacks the vascular tissue of the avocado tree, causing tree wilt and death. The fungal pathogen is introduced to the tree by Ambrosia beetle vectors. The beetles bore holes into the tree and transfer the fungi onto the vascular tissue for larvae to feed on. Laurel Wilt is a threatening problem in America. We have had reports of a similar disease in Australia by different beetle vectors. Learning about problems faced by other countries gave me an insight into the epidemiology of the disease and the recommendations for disease management. That is, disease is spread by importing infected trees and wood (eg. as fire wood) and recommendations include identifying native hosts of laurel wilt, developing a monitoring program, training diagnostic clinics to identify insect-vector disease, research into finding tolerant germplasm and developing an eradication or containment method.

### **Dealing with environmental constraints**

I learnt that climate affects avocado reproduction, which in turn has an effect on the size of the fruit, impacting production. There were various seminars on the effects of climate on avocado production. These seminars were highly valuable for my future career in science as climate change will have an impact on global food production.

### **Outputs**

1. Improved avocado industry knowledge from attending the 8<sup>th</sup> World Avocado Congress (WAC), which can be accessible to growers and researchers through workshops, seminars, conferences and publications.
2. Findings of the PhD students' research on avocado black root disease were presented at the WAC which generated an international awareness of the impact of black root rot in Australia.

3. Dr Liz Dann's presentation on avocado rootstock trials generated an international interest in commercial use of the avocado rootstock variety, SHSRO4, for improved disease resistance.
4. Acquired knowledge on avocado orchard management practices from the Chile study tour applicable to the Australian avocado industry.
5. Training of a PhD student and development of additional skills in scientific communication to a broad scientific and general audience.
6. The opportunity to interact with industry professionals has improved the students' networking skills in promoting research linkages, with HIA for example, in her career post-candidature.

## **Outcomes**

Enhanced quality of the PhD students' candidature by:

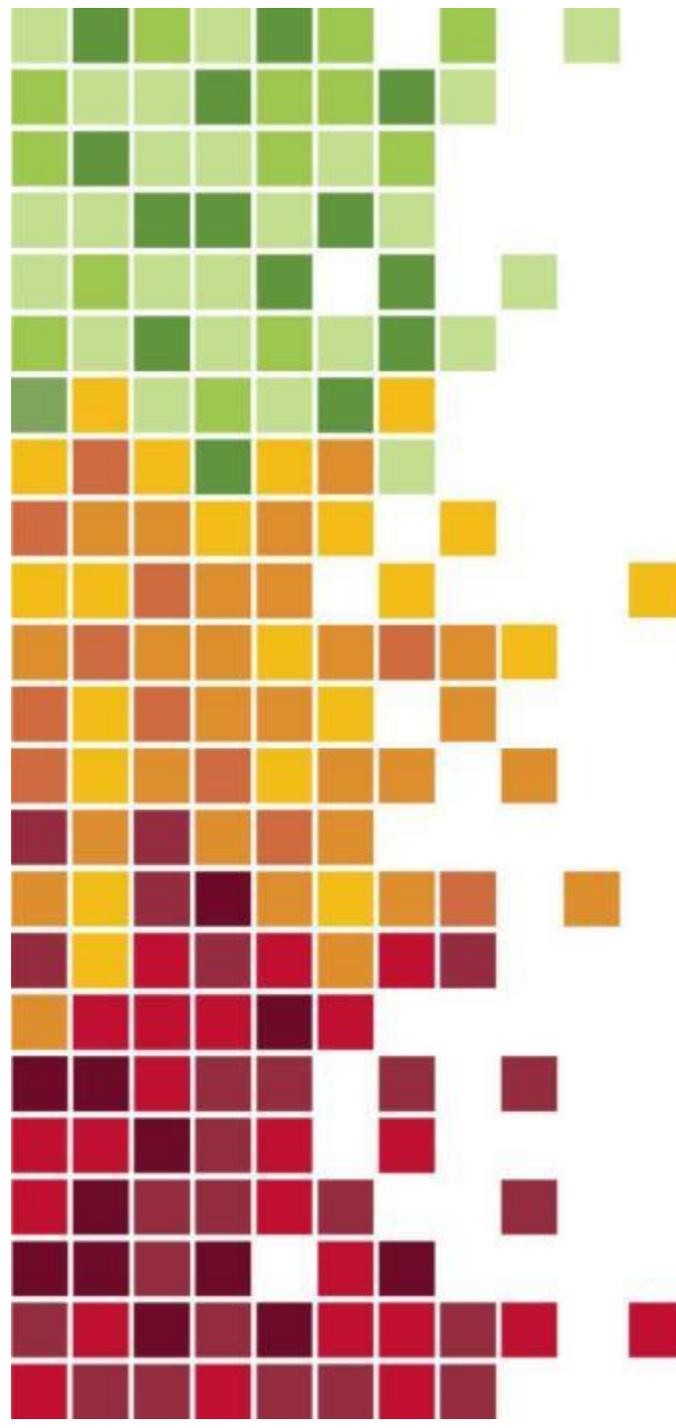
1. Providing an opportunity to meet key Australian industry members that will positively impact on her continuing research
2. Broadening the students' general avocado knowledge – eg. how it is grown; the constraints encountered in various growing regions.
3. Providing a global appreciation of the crop
4. Learning about scientific techniques and methods applicable to her PhD research
5. Discussing key learnings from the WAC and Chile study tour with members of the Australian avocado industry.

Stronger research linkages between UQ and key partners:

1. Attending the WAC and study tour has enabled a UQ research higher degree student and supervisor to communicate and discuss new information and key knowledge with Australian avocado industry members including researchers, growers and stakeholders of Avocados Australia Ltd and Horticulture Innovation Australia (HIA).
2. Presenting researching findings at the WAC has promoted HIA-funded Australian research
3. Attendance by the next generation of avocado research leaders will contribute to stronger research linkages between UQ, HIA and Avocados Australia Ltd.

## **Evaluation and Discussion**

The WAC and Chile study tour has provided an opportunity for researchers to interact and collaborate with international industry members, and gain new knowledge of the latest research findings, production practices and technologies applicable to the Australian avocado and horticultural industry.



# Highlights from India, Peru, Chile travel, September 2015

Liz Dann

**INDIA**

CH-4  
g/tree/year  
y bean  
ONES



CC-1  
tree/year  
bean



**Vermicompost & Vermiwash**  
Eudrilus sp. earthworm for quick conversion of lignin rich coconut leaf to compost  
**GREEN TECHNOLOGIES**  
Coconut Leaf Vermicompost adds:  
→ 17-20% organic carbon  
→ Major nutrients, plant growth hormones  
→ Thousands of plant-beneficial bacteria

One ha coconut garden can provide 3-4 tonnes of vermicompost/year  
Extract vermiwash to use as a liquid organic fertilizer  
Vermicompost and vermiwash can be used for all types of crops



**ProBio**  
ProBio  
AM  
Microbial agents for natural & cost-effective GREEN TECHNOLOGIES for healthy and robust seedling  
Yard Green Promoting Fungicide (YGP)  
Biocontrol Microorganism Fungus (BMF) for  
PP Coconuts  
antiseptic and disinfectant  
Disease suppressant and drought stress



Microbial agents for natural & cost-effective GREEN TECHNOLOGIES for healthy and robust seedling

Yard Green Promoting Fungicide (YGP)  
Biocontrol Microorganism Fungus (BMF) for  
PP Coconuts  
antiseptic and disinfectant  
Disease suppressant and drought stress



**Trichoderma**  
Trichoderma  
Green Technology  
Best efficient biocontrol agent for  
Disease suppressant and drought stress  
Place two cubes in the soil  
Best control disease of roots  
Remove soil from the soil and place the cube in the soil  
Can also be used for the control of nematode



**CENTRAL PLANTATION CROPS RESEARCH INSTITUTE**  
POST HARVEST TECHNOLOGY  
Image of a person working with a machine, likely a post-harvest technology.



# ICAR - CENTRAL PLANTATION CROPS RESEARCH INSTITUTE KASARAGOD 671 124, KERALA, INDIA



### COCONUT VARIETIES

ICAR-Central Plantation Crops Research Institute  
Kasaragod 671 124, Kerala, India

- Chandana Kadam
- Kappa Kadam

### TENDER COCONUT VARIETIES

ICAR-Central Plantation Crops Research Institute  
Kasaragod 671 124, Kerala, India

- Chandana Kadam
- Kappa Kadam
- Kappa Kadam

### COCONUT HYBRID VARIETIES

ICAR-Central Plantation Crops Research Institute  
Kasaragod 671 124, Kerala, India

- Chandana Kadam
- Kappa Kadam
- Kappa Kadam

### ARECANUT VARIETIES

ICAR-Central Plantation Crops Research Institute  
Kasaragod 671 124, Kerala, India

- Chandana Kadam
- Kappa Kadam
- Kappa Kadam

### COCOA HYBRIDS

ICAR-Central Plantation Crops Research Institute  
Kasaragod 671 124, Kerala, India

- VTLC-1
- VTLC-2
- VTLC-3
- VTLC-4

### COCOA SELECTIONS

- VTLC-1
- VTLC-2

### COCOA CLONES

- VTLC-1
- VTLC-2

### ICAR-Central Plantation Crops Research Institute

ICAR-Central Plantation Crops Research Institute  
Kasaragod 671 124, Kerala, India

Uses  
Fertilizer up-  
take  
for  
quick conversion of  
nitrogen rich coconut leaf to  
compost  
Coconut Leaf Vermicompost







# Phytophthora meeting

- Focus on *P. infestans* of potato and tomato
- Good talks/research on establishing lineages, useful databases, diagnostics, targets for control
- Many new compounds for oomycetes (eg. Zorvec (a.i. oxathiapiprolin from Dupont)
- Suggestion to set up Wikipedia page on Ashburner system
- Phellinus on rubber – propiconazole collar drench



## Sophien Kumoun, UK

- CRISPR-Cas9 system for genome editing (2012)
  - ie. targeted mutation
- RXLR effectors are virulence proteins (but some are Avr) allow disease.
- Effector targets (eg. plant proteins) act as S factors.
- Target plant S factors, then effector has no target → **RESISTANCE!**
- Supercede GMO ?

Sponsored by

- Department of Biotechnology, New Delhi, India
- Department of Science and Technology, New Delhi, India
- Defense Development and Research Organization, New Delhi, India
- National Horticulture Museum, Bengaluru, India
- Directorate of Cashew and Cocoa Development, Cochin, India

# 3<sup>rd</sup> International symposium on Phytophthora: Taxonomy, Genomics, Pathogenicity, Resistance and Disease Management

9-12, September, 2015  
Bengaluru, India

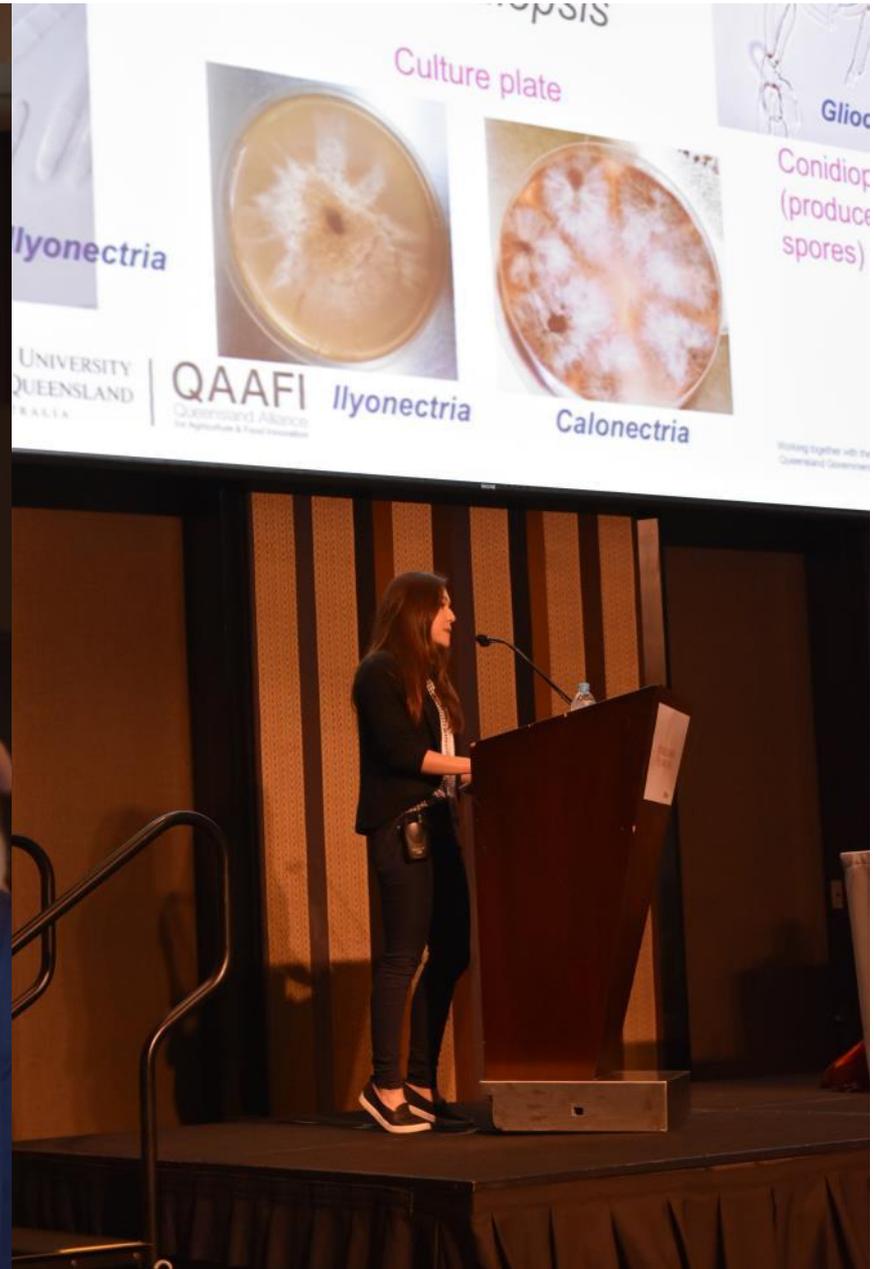
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KAP-Indian Institute of Horticultural Research, Hosuraghatta Lake Post, Bengaluru-560 089, India  
Association for Advancement of Pest Management in Horticultural Ecosystems, Bengaluru-560 089, India

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  - Bionivid Technology Pvt Ltd, Bengaluru, India





PERU



## WAC Peru highlights

- *P. parvifolia* is a small bush graft-compatible with *P. americana*, testing for dwarfing rootstock, (? R to Pc)
- PRR trial at UC Riverside now salinity trial
- Moshe Goren (Volcani) - Ashdot not dwarfing, but tolerant of salt and calcareous soils
- Allesbeste well represented, interested in SHSR-04
- John Bower – high demand for Ca at flowering and major cell division after fruit set. Control vegetative vigour (N) after fruit set (so don't get Ca going to shoot). Exporters using Ca as indicator of quality and decision tool.

## WAC Peru highlights

- Alternate bearing – Ok if yields in “off year” still acceptable
- Laurel wilt (Jonathon Crane) – found on avo in Myanmar, California laurel a potential host, camphor laurel a host, *Raffaelea* now found in 7 other *Xyleborus* spp. and 2 of these can transmit to avo, some R in red bay (2% of trees didn't die), lures, Beauvaria
- Fusarium dieback (Akif Eskalen) - 2 introductions in CA @ LA and San Diego, different shot hole borers and fungi, SD more severe, isolates more pathogenic.
- Agdia have a quick test for ASBVd
- 9<sup>th</sup> WAC in Colombia

**CHILE**







## High density

- 85km N of Santiago
- 6x4m spacing down to 1.25x1.25m (6,400 trees/Ha)
- Hass on Mexicola
- Moderate climate, 200-400 mm rainfall
- 5-11% Edranol pollinisers
- 1.7 million trees in their own nursery
- 45° slopes!











## Pc problem?

- Not much
- ? Less vigorous isolates
- ? High copper in soils
- Stumping, spray and paint with phosphonate
- More problems with poor irrigation





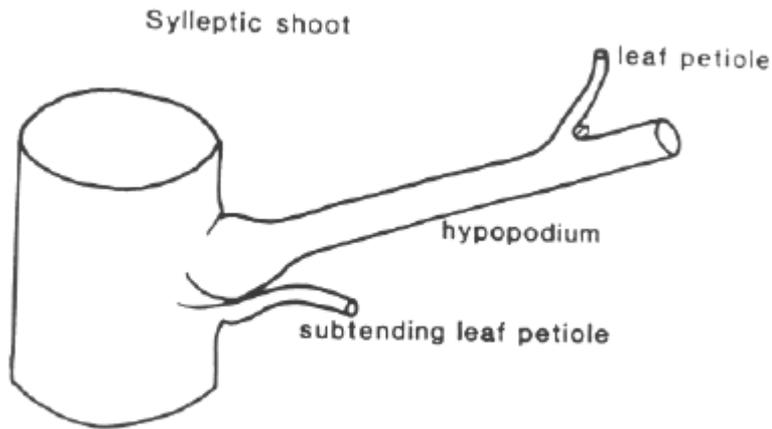


## High Density cont.

- Use nutrition (N) to grow trees quickly then PGR
- Foliar (helicopter) and soil applied uniconazole
- 2x pruning per year, select sylleptic shoots, remove proleptic, keep at 2m tall
- Yields av. 19T/Ha (6x6m, over 11yrs), 24 T/Ha (3x3m over 9 yrs). Expect 30 T/Ha from 1.25x1.25m in 2<sup>nd</sup> year.



- Sylleptic – multi-branched shoots, develop from axillary buds while main shoot is still growing, no dormancy, do not have pre-formed nodes and can continue to grow



- Proleptic – unbranched shoots, develop from dormant terminal or axillary buds once parent shoot has stopped growing, growth is fixed and nodes are pre-formed, can be vegetative or reproductive

