



the Propagator

International Plant Propagators' Society <http://aus.ipps.org/>
Australian Region - Newsletter Winter 2024 - No: 79

A Breath of Fresh Air

Returning home from an IPPS Australia conference always brings with it an appreciation of 'seeking and sharing'. As professional propagators, the open exchange of information offers a chance to significantly advance both individual practices, and the industry as a whole. Indulge me, if you will, some of my take-aways from the conference...

We saw from Daniel Parsons of Transplant Systems the requirements for automating nursery processes. It's a complicated matrix of considerations, and while these complications might be unique to the different specialties that make up our industry, by openly sharing his experiences, Daniel has accelerated the rate of effective uptake of innovation. For instance, the examples of challenges in vision-based robotics he showed us, and the ways they are being worked around can form a basis for automation in new crops to be refined more quickly. His 'sharing' of this information could lead to us identifying best practices and new technologies that might not emerge in isolated settings.

TAFE NSW teacher Robert Davis had some encouraging information on the opportunities for education, particularly for young people coming in to the industry. The items he discussed such as workshops, seminars, and forums where experts present their findings, enable us to stay updated on the latest research and techniques. This ongoing education, an essential requirement in a dynamic field like horticulture, helps us adapt to evolving standards and technologies, improving skills and enhancing operational efficiency. And

new entrants into the field benefit from the accumulated wisdom of more seasoned professionals, potentially reducing their learning curve and improving their chances of success. It was fantastic to hear from Robert, as well as Jane Edmanson and Zoe Williams, on the Global Footprints Scholarship opportunities. As well as the South African exchanges and the success they had in seeing a very different part of the world.

One of the most critical areas where information sharing proves invaluable is in our management of diseases and pests. Early detection and intervention are key to mitigating the impact of these issues, and John McDonald from Greenlife Industry Australia, gave us a heads-up on fire ants, and the potential impact on nurseries. By pooling information about pest outbreaks or disease patterns, we can develop more effective control strategies and prevent the spread of these issues. Collaborative databases allow for the rapid dissemination of treatment protocols and preventive measures, thereby safeguarding plant health across diverse regions.

And not to be understated is the benefit that information sharing fosters a sense of community and collaboration within the horticulture industry. Networking opportunities through our conferences build professional relationships and create a support system for individuals facing challenges. This sense of community can lead to partnerships and mentorship opportunities, which contribute to the growth and development of the industry.

THIS EDITION

Wrap-up of the 2024 Conference, Ballina NSW
2024 IPPS Australia Awards
Information on the 2025 Conference in Cairns
Tissue Culture Technologies and Their Applications

Reports:
President's Report
International Directors report
Executive Officer's Report

Presidents Report



Mid-winter and it is a cold one in the south-eastern states with a tight economy and the nursery industry is struggling with low sales. August brings in the Olympics and this too will slow down sales as Australians are a sport mad nation under normal times but when we have multiple national teams and athletes competing on the world stage they are fixated. This will keep people in front of the television and out of the garden.

The Ballina conference seems like last week not two months ago. It was a great conference and like the weather, reminiscent of past conferences. We had a good turnout of attendees across a wide range of ages and regions. The speakers were both interesting and significantly varied in their topics. Trade Displays were excellent and gave plenty of opportunity for discussion on allied suppliers.

There was a great atmosphere that was both positive and inquisitive which is perfect for rebuilding IPPS after the 'Covid Years'. Everyone I spoke to was enjoying the presentations (as usual) but were finding the networking with such a range of growers even more beneficial. So many were inspired to return to their daily lives of producing plants with a new energy.

We have a strong board with several new members bringing a varied set of skills and experiences. I hate the constant media use of the 'diversity' term but I feel we have that on our board. We have members from all states, all industry sectors, a wide age range, male and females plus a wide spread of industry involvement. We are all passionate plant growers with a strong desire to build IPPS into a strong and stable, professional association.

You are all members because you understand the value of the 'Seek and Share' philosophy. You know that the more you share your knowledge the more you gain. As our industry ages we are losing a mountain of knowledge and IPPS is a key to storing that information. We do it through our membership and through our proceedings. You too can assist in keeping this knowledge alive and contemporary. All you need to do is encourage others to join. Every single member has something to give and they can also take away history from other members.

This year David Hancock has a great program of regional meetings. If there is one near you, please attend and bring along a friend. Keep an eye on the website, the Newsletter and your emails for details. Zoe

Williams is actively building our Facebook and Instagram presence. Please follow and add posts and reels when you can. Next conference is in May 2025 in Cairns. Please put the dates aside.

Thanks for being a member of our society and please be an active sharer of plant knowledge while it is still there.

Clive Larkman
President of IPPS Australian Region

International Directors Report



The international board is progressing through several issues at the moment, a strategic plan review, reviewing standard operating procedures, changing the society's name, and the ongoing web page saga.

So, on the good news front membership worldwide has increased by 200 up to 1345, which is positive, and gives encouragement that we are not necessarily being left behind with new technology. As a society we need to embrace the opportunities, but the face-to-face meetings is still the strength and core of our networking. It is interesting to read other regions reports and see how we stack up, and most of the annual meetings held in other region have a participation rate very similar to our own around the 120 attendees, so our Australian region is well and truly holding our own.

Back to the strategic plan, it is progressing slowly, and hopefully by the end of the year most issues will be agreed upon. Reviewing the operating procedures is pretty well done, and really effects the delegates attending international meets.

Over the next few months, we should get more about the name change from "International Plant Propagators Society" to 'International Plant Producers Society', still holding the same initials but a slightly wider descriptive field.

Our international Secretary Katie is working on getting estimates for a new up dated web page and design, this is estimated at the moment to be a very substantial investment, which hopefully will push us into the 22nd century, time will tell.

The next international tour is New Zealand, across the ditch from the 28th of April to 11th of May 2025, based on the north island only. Always a well worth tax deduction.

Tony Vander Staay
International Delegate of Australian Region

Executive Officers Report



What an awesome conference and 52nd celebration in Ballina, NSW. 'Thank you' to our supporting sponsors this year. A big 'Thank You' to those Members who were able to attend. I hope you enjoyed the conference venue and the 'face to face networking' with fellow Members.

Contact Detail Changes

To ensure Office records are kept '*up to date*' I would appreciate it if Members could please notify me of any changed contact details. In particular, if you have changed telephone provider recently, please advise me of your new email address at pam@ipps.org.au

It is important that the Australian & International database records are kept '*up to date*', otherwise you could be missing out on receiving information.

Membership Subscription Renewal 2024

Membership Renewals for 2024 are now OVERDUE.

If you have not received your Membership Renewal Notice, please contact me...pam@ipps.org.au

If you are having difficulty in paying your subscription please contact me so that we can look at the various options available for split payments.



BANK DETAILS: Bendigo Bank BSB: 633-000 Account No: 140185737

If paying by EFT PLEASE PUT INVOICE NO. OR NAME IN THE PAYMENT BOX SO I CAN IDENTIFY WHO PAYMENT IS FROM. THANK YOU

Australian Region Board 2024/25

President:	Clive Larkman	clive@larkmannurseries.com.au
1st Vice President:	Puthiyarambil Josekutty	josekutty964@gmail.com
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Membership Committee Chair:	David Hancock	david@naturalarea.com.au
Executive Officer:	Pam Berryman (07) 38299767	pam@ipps.org.au

2024 Australian Region Conference - "A Breath of Fresh Air"

Couldn't Make it to Ballina this year? Here are some of the highlights you missed out on:

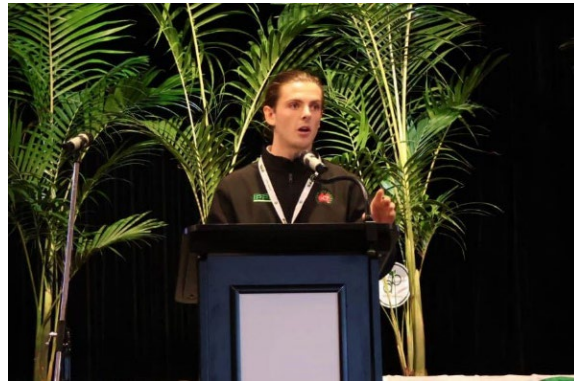


The conference kicked off with a couple of 'keynote' speakers sharing their journeys through the world of plants. We were fortunate to hear from Sam Birkwood about her life going from various corporate roles in locations around the world, before taking on a bamboo nursery on the North Coast. Growing this business alongside a young family, Sam shared insights into implementing innovation, change and technology. Along with ideals based around sustainability, environmental stewardship, and community engagement. Breathing a 'breath of fresh air' into the business and ensuring a sound future for her family.



Another North Coast local, Des Boorman is well known to us in the IPPS. He has been a long-time contributor to the society. And we heard a fascinating story of his horticultural path to propagating and breeding plants, especially Brachychitons. Later in the program Des delved deeper into this subject, sharing some amazing specimens that are the result of his life's passion. He has developed some truly stunning forms of Brachychitons!

The South African Exchange program has been hotly contested in recent years, and hearing from this year's exchanges, it's easy to see why. Nosipho Ndlovu and Josh Taylor were the respective exchanges this year. They each presented their experiences traveling to a country with very different approaches to growing plants, but with equally passionate growers.



Dr Carl Barry is founder of Growth Technology Pty Ltd, the company that gave us Clonex Gel. He gave us a back-to-basics overview of plant growth, with a slide show that explained how the simplest of primordia develop into a myriad of specialised organs. It was a fresh way of looking at the phenomenon we deal with every day that is that is 'plant growth'



Lisa Wightwick was the recipient of this year's Rod Tallis Award. She presented her work on a novel use of fungicide to improve results of tissue culture propagation with a particularly challenging variety of Grevillea. The success she has had through this work is exactly the kind of information that is valuable to us as propagators. Her presentation was awarded the 'Anita Boucher' award for best presentation at this year's conference.

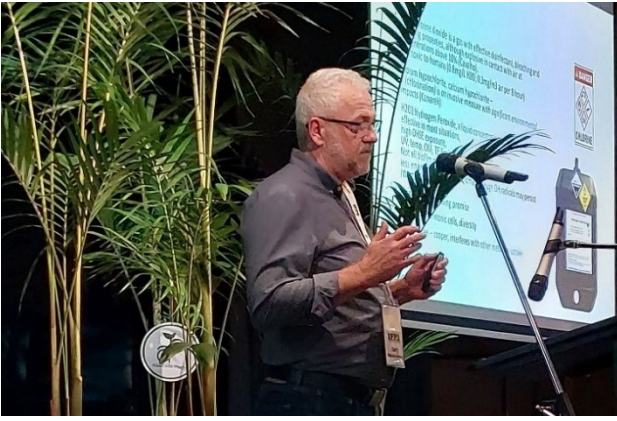
Tissue culture work featured strongly this year. Along with Lisa we had Ranjith Pathirana give a comprehensive overview of how tissue culture techniques can be used beyond just multiplying plants. We heard about virus eradication, invitro hybridization and genetic modification, and biopharming and plant conservation. Jose Puthiyaparambil gave us an in depth look at a more specific application – Invitro propagation of grape vines. And Jayni Hiti-Bandaralage likewise shared her experience in propagating Red bayberry, a new and emerging crop with potential for the future.



A fresh idea in Ballina was the introduction of a 'Q&A' segment. Renowned horticulturist Jane Edmanson interviewed Zoe Williams, a young propagator with a bright future ahead of her. Jane and Zoe discussed how young people can be involved in the industry, as well as Zoes recent Global Footprints Scholarship, which saw her travel to the UK and Germany. There she was involved in working with various nurseries, gaining experience, and a valuable insight into the wider world of horticulture.



Daniel Parsons from Transplant Systems spoke about automating nursery processes. He highlighted what's needed in terms of trays and plugs to suit an automated system, as well as the need for accuracy to ensure efficiency, quality improvement, and cost savings. With the cost of labour rising, it was good to hear about what options we have to automate now, and into the future.



Gary Murdoch-Brown discussed cleaning irrigation systems, and preventing blockages from coming back. It's a problem I think we are all familiar with. The problems they cause can result in significant production losses. In particular, Gary highlighted biofilms. What they are, why they develop, and the options we have for addressing them. He covered preventative measures, and both chemical and 'greener' options for control.



Luke Weisenberger from KW Automation also talked about how automation can help create a successful business. He discussed its use in the nursery beyond propagation, in areas like soil mixing, pot and tray filling and washing and watering processes. He stressed the need for fine tuning the automation process to the specific needs of the individual business. And that no one solution would necessarily work in different production scenarios.

Steve Hart from Garden City Plastics introduced the 2024 'GCP Six-Pack'. The six-pack program is now well established across most of the regions of IPPS around the world. It gives six young propagators at the start of their horticulture careers the opportunity to attend an IPPS conference. They assist with the running of the conference, and get to experience the benefits of seeking and sharing first hand. Steve gave a history of the program, which started in Australia in 2003. He is well qualified to discuss it, as he, alongside Greg McPhee, was one of the instigators of the program, which is now in its 22nd year. This year's six pack was made up of Nicoletta Centofanti from Royal Botanic Gardens Melbourne; Emily Smith from Royal Botanic Gardens Cranbourne; Willow Sawyer from Glasshouse Tubestock; Nosipho Ndlovu from South Africa; Gabriella Lee from Westlands Nurseries and Indie Keenan from Ellenby Tree Farm.



2024 IPPS Australian Region Awards

The annual awards night is always a highlight of our conferences. This year was no different, with a host of wonderful propagators and plant people being given recognition for their contributions to the mission of 'Seeking & Sharing'.

Ed and Mary Bunker Award

The 'Edward and Mary Bunker award' is a relatively new award recognising excellence through someone who has made a significant contribution to horticulture, with the person not necessarily being a member of IPPS. Previous recipients of the award have been John MacDonald in 2019 at Twin Waters, Gabe Mostafa in 2022 at Leura, and Jane Edmondson at Geelong in 2023.

The focus of the 'Edward and Mary Bunker Award' is to recognise an outstanding contribution from someone who has demonstrated the IPPS motto 'To Seek and To Share' for the betterment of the industry at large. This year's winner was Karen Smith. She has lived and breathed horticulture for most of her life in garden design, nursery and the media.

Based in Sydney, Karen has worked in the horticultural industry for over 30 years as an employee and business owner, and is the editor of the National horticultural industry magazine "Hort Journal". She is a recognised Horticultural Trainer, Presenter, Master of Ceremonies, Writer and Podcaster.

She is widely recognised as being skilled and experienced, in both practical and theoretical horticulture. She has a significant knowledge of plant species and their application in landscape design. As well as a passion for gardening and collecting unusual plant species she is a keen Scuba diver.

Karen is active in the industry and has served on many committees including the Hort-Media Association and the Interior Plantscape Association and is also a member of various horticultural organisations including IPPS. She currently is an Executive Board Member of the Interior Plantscape Association

In November 2017 she was awarded the 'Allan Seale Award' by Nursery Garden Industry NSW & ACT.

In 2020 the Australian Institute of Horticulture awarded with the 2020 'Golden Wattle Award' for her work in the media, and for her raising the awareness of the importance of horticulture in today's world.



Above: Karen Smith receiving the 'Edward & Mary Bunker Award' from Ed & Marys son John Bunker.

Steve Vallance Pewter Tankard Award

In 1979 the Great Britain & Ireland Region of IPPS, presented a pewter tankard to our region, to be used as an annual award to recognise the contributions of one of our members to the society.

It was regularly awarded up until 1991. After that time, it went into hiatus, until 2010. In that year, at the Freemantle conference, it was awarded to Steve Vallance. Steve really embodied the ideals of the award, contributing without fanfare, but with commitment. And in honour of Steve, and the way he went about his 'seeking & sharing', in 2017 the award was renamed the *Steve Vallance Tankard*.

This year's recipient was Dermot Molly. Dermot obtained a Diploma of Horticulture in 2006 from Oakleigh College of Horticulture, and has been involved in horticulture his whole working life. Prior to employment with the Royal Botanic Gardens Victoria, he worked in a nursery, owned a garden design business and was head gardener at the historic Invergowrie property in Hawthorn. His membership of IPPS started in 2005 and has been a board member since 2018. He has travelled widely promoting the values of IPPS and spoken at our conferences.

His propagation and growing experience include *Cycads, Clivia, Agathis and Araucaria* as well as native and exotic species from all over the world. He has collected seed from all over Victoria as well as cuttings from around Australia and the world.

He says he "enjoys mixing horticulture and travel to discover the world's plants and people". His professional role outside his activities supporting IPPS is as the Senior Curator of Horticulture at the Royal Botanic

Gardens of Victoria, where he has worked for over 22 years.

The Royal Botanic Gardens Board Victoria have awarded him the Guilfoyle Award for excellence in team achievement in July 2010 and for excellence of Individual achievement in August 2011.



Above: Dermot Molloy receives the 'Steve Vallance Tankard' from Natalie Vallance

IPPS Australian Region Award of Honour

The Australian region has been awarding individuals who have made a significant contribution to the society for many years, and the 'Award of Honour' is the highest accolade bestowed on a member by the society. The winner receives a unique trophy made from an individually selected, free form piece of rare Australian native timber.

This year we honoured David Hancock, a man who has made an exceptional contribution to our society and horticulture in general. David's background was outside of horticulture. He has accounting and economics qualifications and spent 22 years of his working life in finance and banking at general management level. However, his love for native plants and restoration of mine-sites and other disturbed areas fostered a change in career to horticulture, founding Natural Area Holdings in 2001. He is currently a major shareholder and contributing consultant to the business with a nursery, contracting and environmental consulting divisions. The workforce varies from 115 to 150 staff based upon seasonal demand, and services government at all levels, property developers, mining companies and private landowners for their ecological requirements. As we heard in the technical sessions, the nursery is based on propagation from collected seed, with his family involved in the business. And David is proud to have been involved in the development and support of many new nursery industry people in both personal and business skills while encouraging a

willingness to research and experiment in plant development. His restoration focus has been on recalcitrant species propagation and developing methods to overcome seed dormancy. Working with researchers and practitioners in hot spot locations has been an abiding interest.

He has been a long serving member of the IPPS Australian region board, having convened a conference in Perth in 2017, as well as regional meetings in Western Australia and more recently at Boomeroo nursery in Queensland. He readily has admitted that through seeking and sharing he has benefitted from the valuable experience of many growers that he would otherwise have not known of or had access to. He also serves on the management committees for the Revegetation Industry Association of WA (RIAWA), The Society for Ecological Restoration Australasia (SERA) and Australian Institute of Horticulture. As part of the additional community support provided by the business, he is active in the operations of the Dieback Working Group (DWG), the Association of Mining & Exploration Companies (AMEC) and the Australian Network for Plant Conservation (ANPC). He is recognised for the Plant Breeders Rights filing in 2014 for *Hibbertia spicata* 'Ocean Reef'. In 2002 the City of Joondalup recognised him as 'Citizen of the Year' and he received the 'Premiers Award' for the state of Western Australia and 'Volunteer of the Year' by Department of Environment & Conservation in the same year.

His enthusiasm to travel has been broadened by the IPPS network of friends and professional contacts throughout Australia, New Zealand, the USA, South Africa, New Caledonia, Oman, China & Europe. Like our motto of "seek and share" is the common saying of "you get out of life what you put into it". David truly lives up to both with his energetic approach to life.



Above: David Hancock receiving the Australian Region 'Award of Honour' from Bruce Higgs

Honorary Life Membership

Honorary members are those members of our society who have made outstanding contributions to the field of plant propagation.

To be granted honorary membership a member must have been a part of the IPPS for a minimum period of 10 years, though this period may be reduced if the executive feels the nominee's contribution is of sufficient merit, and they must have made a significant contribution to the field of plant propagation. This maybe in any field, including but not limited to; education, research, promotion, industry etc.

Importantly, an honorary member must have a demonstrated history of sharing their knowledge and belief in the principles of the Society.

This year the Australian Region was proud to present Michael Gleeson with the status of honorary member. Michael is recognised as a person who has more than lived up to these attributes. For many of us he was the face of IPPS. Ever present at our conferences, and always recognisable by his raucous laugh and infectious enthusiasm for 'seeking and sharing'.



Above: Michael Gleeson accepting the 'IPPS Honorary Life Membership' award at his home, from outgoing president Bruce Higgs.

Rod Tallis Award & Anita Boucher Award

The IPPS Australian Region recognises outstanding achievement by the younger section of our industry through the 'Rod Tallis Award', which is presented annually to a commendable achievement by a person over 18 years of age who is working or studying in horticulture.

The award is named after one of the Society's most respected members, Rod Tallis. Rod was an avid nurseryman with a passion for plant propagating, for the IPPS and for the next generation of our industry. He was a mainstay in many of the early conferences and made significant contributions to Plant propagation in Australia before his sudden death in 1981.

It is awarded to someone who has exhibited merit in completing a research project, writing an article or series of articles, or developing a new process or product. The outcomes of their work are presented at our annual conference. Many of the previous winners have gone on to successful careers in the society, and in the wider industry.

This year, the prize went to Lisa Wightwick for her work with improving propagation outcomes in a challenging Grevillea variety. Such was the merit of her paper, that she also received the 'Anita Boucher Award' for best presentation of the conference. Anita was editor of "Australian Horticulture" magazine, the predecessor of "Hort Journal". She was also a passionate believer in sharing knowledge for the benefit of the industry. At each of our conferences the papers that have been presented are assessed and ranked by the IPPS and "Hort Journal" editorial teams for the quality of the presentation, the material presented and potential impact to horticulture. The 'Anita Boucher Award' has been sponsored by Hort Journal each year in memory of Anita.

Lisa's passion for plants, and sharing with the IPPS really showed through in her presentation. A fantastic achievement by Lisa, and the first time a 'Rod Tallis Award' presentation has also been awarded the 'Anita Boucher' award.



Above: Lisa Wightwick receives the 'Rod Tallis Award' from awards committee chair, and past 'Rod Tallis Award' winner David Daley.

Propagation for Conservation



53rd Conference CAIRNS 2025

IPPS



Venue

CRYSTAL BROOKE
RILEY

PRE CONFERENCE TOUR

25TH 27TH MAY

CONFERENCE

MAY 28 -31ST

International Plant Propagators Society (IPPS)

 ipps.org



FIRST ANNOUNCEMENT: 53rd IPPS Australian Region CONFERENCE, 28-31st MAY 2025

Welcome to 'Gimuy' (Cairns) – home of the Golden Penda

The Convenor and the Organising Committee are delighted to announce the 53rd IPPS Australian region conference in Cairns. With exciting pre- and post-conference tours and a line-up of expert speakers, this is an opportunity not to be missed.

A post-conference tour from Cairns to Cape York, about 1000 km of real outback, tropical QLD trip is being considered.

Pre-conference tour and traditional golf competition are already on the agenda. Please register your interest in the pre-conference tour, the golf day, or the post-conference tour as soon as possible with Pam or Clive.

Convenor: Dr Puthiyaparambil Josekutty, Research Manager, Skybury farms, QLD 4880

Organising Committee: Dr Puthiyaparambil Josekutty (Chair), Mr Clive Larkman (President, IPPS-AU), & Mrs. Pam Berryman (Secretary, IPPS -AU), Dr Ranjith Pathirana (IPPS Proceedings Editor), Ms Zoe Williams (IPPS-AU, social media), Prof. Darren Crayn, Director, Australian Tropical Herbarium, Mr Mark MacLaughlin, Manager, Skybury Farms, Mrs Elaine Duncan, Director, Flourish Plants, and Mr Yan Diczbalis, DAFF, QLD.

Proposed Speakers and Topics*

List subject to final confirmation

- Dr N. Anilkumar, MS Swaminathan Research Foundation, Chennai, India: A Conservation Story from a Global Plant Biodiversity Hotspot
- Prof. Darren Crayn, Director, Australian Tropical Herbarium, James Cook University: Conservation of Some Australian Mountain Flora
- Prof. Nitin Mantri, RMIT, Melbourne, Victoria: The Future of Plant Pathogen Diagnostics in Nursery Production Systems
- Prof. Prakash Kumar, National University, Singapore: Omics and Plant Biodiversity Conservation
- Prof. Rakhi Chaturvedi, Indian Institute of Technology, Guwahati, India (IPPS India): Cellular Totipotency and Crop Improvement Utilizing Plant Tissue Culture Techniques
- Dr Ranjith Pathirana, University of Adelaide (Editor, IPPS Australia): Cryotechnology for Crop Germplasm Conservation
- Prof. Sanjay Deshmukh, Mumbai University, India: Seeds of Sustainability: Preserving Mangrove Genetic Diversity Through Propagation
- Mr Yan Diczbalis, DAFF QLD: Can I Eat my Palm?
- Prof. David Leung, University of Canterbury, Christchurch, New Zealand: Over Three Decades of Training Advanced Plant Propagators in New Zealand
- Ms Candy MacLaughlin, General Manager, Skybury farms, QLD: Farming with Climate Change: Recovering from the Impacts of Cyclone Jasper
- Mr Des Boorman, Nursery Consultant, Byamiti FBB, NSW: Grafting: Tips, Tricks and Tools of the Trade
- Mrs Elaine Duncan, Director, Flourish Nursery, Mareeba, QLD: Growing in the Wet and Dry Tropics
- Mr Andrew Weinert, Geographe Community Landcare Nursery, Amber gate, WA: Symbionts of Legumes in the Southwest of Western Australia
- Dr Ross Bicknell, Plant and Food Research Ltd, Lincoln, New Zealand: Novel Methods for Breeding Orchids
- Mr Angus Stewart, Tasmania: Propagating Australian Plant Biodiversity for the Establishment of a Private Arboretum in Tasmania

Call for Papers:

If you wish to showcase your work in an oral or poster presentation, please send a 250-300 words abstract to the Convenor, Dr Josekutty (josekutty964@gmail.com) or the Editor, Dr Pathirana (Ranjith.pathirana@adelaide.edu.au) as soon as possible. The speaking slots are limited and will be allocated in the order of receipt. All speakers are expected to submit a paper for publishing in the IPPS Combined Proceedings and must have necessary clearance to publish.

Registration Costs for the 2025 Conference are now available!

Registration	Early bird: Up to 30 th Dec. 2024	Full registration From 1st Jan. 2025
Member	\$700	\$750
Non-Member	\$750	\$800

Register Early and SAVE!:

ATTENTION ALL WESTERN AUSTRALIAN BASED MEMBERS!

The organising committee of the 2027 IPPS International Tour in Western Australia is seeking the addition of another WA based member to join the existing group of 4.


An excellent opportunity presents for a member to contribute to the development of this major event.


Initial planning is well under way and the planning load will be well shared.

For further information on how you can join the organising team, please email David Hancock at david@natalarea.com.au


Boost plant health and yield quality with

GROW LIGHTS






SCAN FOR MORE INFO




BLUE LIGHT 400-500nm



Suitable for Seedlings, Cuttings and Micro-greens.

For these early and delicate stages, opt for lights with a higher proportion of blue light as it supports strong root development. Micro-greens also thrive under blue light, as it promotes dense and healthy foliage. Great for vegetable growth, blue light promotes strong root development and dense foliage.


GREEN LIGHT 500-600nm



Suitable for small or young Vegetable plants.

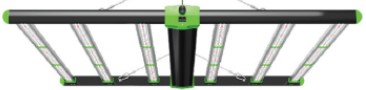
Green light may better penetrate a canopy than other colours on the visible spectrum. This allows lush growth on lower leaves, possibly leading to a better yield overall. Although less efficiently absorbed by chlorophyll, green light penetrates deeper into the plant canopy, supporting overall growth.

RED LIGHT 600-700nm




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Lights with more red wavelengths are ideal for flowering and fruiting stages. Red light stimulates blooming and fruit production, ensuring your plants can produce healthy and abundant flowers and fruits. Red light encourages blooming and fruit protection, vital for the later stages of plant development.




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µmol/s



WATTS
650w LED
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ENERGY
Energy
efficient light




DURABLE
Water-proof,
dust-proof

500W LED GROW LIGHTS







OUTPUT
Up to 1549
µmol/s



WATTS
500w LED
grow light



ENERGY
Energy
efficient light



COOLING
Passive
cooling



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TISSUE CULTURE TECHNOLOGIES AND THEIR APPLICATIONS: PART 2 HIGH-HEALTH PLANTS

Dr Ranjith Pathirana (Editor, IPPS Proceedings)

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Introduction

In the Autumn 2024 issue of this newsletter, I gave a short introduction to plant tissue culture (PTC) including why plant cells are amenable to tissue culture, structural organization during propagation, and different approaches to micropropagation such as organogenesis, somatic embryo production and microtuber production. In this issue, another application of PTC – development and deployment of disease-free high-health plants is discussed. Often, we deal with clonally propagated crops and most of these are perennials. The vegetative propagation and exchange of budwood among regions and countries contribute to the spread of pathogens. This is true not only for fruit crops but also for root and tuber crops such as potato, cassava, yam and sweetpotato and for many ornamental crops such as orchids, anthuriums as well. The practice of vegetative propagation contributes to the spread of pathogens. Plant pathogens cause significant economic losses, for example in grapevine, fanleaf disease caused by a nepovirus (*Grapevine fanleaf virus* - GVFLV) causes economic losses amounting to US\$ 16,600 per ha, and in France where about 2/3rd of the vineyards is affected, it has an economic impact of at least US \$1.5 billion per year. Another main viral disease affecting vineyards around the world is *Grapevine leafroll-associated virus 3* (GLRaV 3) causing leafroll disease. It is estimated to cause losses from US \$25,000 to US \$ 226,000 per ha over a 25-year vineyard lifespan depending on the location and cultivar [1].

In Australia, there are many virus diseases causing millions of dollar losses to the respective industries such as *Banana bunchy top virus* in banana – its exclusion will avoid AUD 15.9-27.0 million in annual losses for the banana industry [2], leafroll disease in grapevine – even more than 50% yield loss including reduced quality [3], *Potato virus Y* in potato, *Strawberry mild yellow edge virus* in strawberry, *Cassava mosaic virus* in cassava, sweet potato virus disease in sweet potato, *Blueberry scorch virus* in blueberry etc. In addition to transmission by the vectors, these diseases are transmitted through infected planting materials and cuttings. Furthermore, several undetected viruses and viroids keep reducing yield and quality of our crops such as *Potato virus X* over successive years thought to be due to ‘degeneration’ of cultivars. Therefore, establishment of orchards of horticultural crops and seed production of potato free of damaging diseases is a key control measure. Towards this many countries have sanitary selection programmes and certification of clonal stock. In Australia, grapevine clonal stock needs to be certified free from several viruses and potato seed is certified free from *Potato virus Y* by the Australian Seed Potato Certification Authority. However, once the stock is infected, it is important to have robust methods to eliminate the infecting viruses.

Traditional practices used for pathogen eradication from planting material

In general, the term eradication is used to describe the process of destroying all infected plant material after an incursion of a new disease. An excellent example comes from Australia in eradicating citrus canker, a disease caused by *Xanthomonas* bacteria. There have been several outbreaks; 1912, 1991, 1993 (in NT), 2018 (NT + WA), 1984 and 2004 (QLD) that were successfully eradicated. While strict quarantine, sourcing plant material from disease-free fields/orchards, inspection etc. are important, often we encounter situations where the need for eradicating infecting microorganisms from planting stock for reuse arises.

Heat therapy is a traditional method often used for this and is successful in eradicating some pathogens from planting material. It consists of keeping plants, or a part of them, at temperatures between 35°C and 54°C, within the physiological tolerance limits of each plant species, for a predetermined period. The selected temperature should represent the best compromise between virus degradation and plant survival. Advantage is that the threshold of thermal

sensitivity of some viruses is lower than that of plant cells and that the damage caused to plant tissues by the thermal stress can more easily be reversed than viral damage. Some examples of heat therapy for disease eradication from planting material include mint (*Mentha* sp.) rhizomes infected with mint rust (*Puccinia menthae*). The fungus can be eradicated by immersing in water at 44°C for 10 minutes and then transferring to cold water. This is effective for mint rust existing in the form of urediniospores. Hot water treatment (50°C for 2 h) is also used to control ratoon stunt bacterium (*Leifsonia xyli* subsp. *xyli*) in sugar cane planting material (setts) as well as to control nematode infections in bulb crops. Some seed borne diseases can also be controlled by hot water treatment (e.g. some fungal pathogens in wheat seeds and leaf spot of brassicas caused by *Alternaria brassicae* and black spot caused by *A. brassicicola*). Traditionally heat therapy has been used to reduce the viral load, but some viruses are heat stable. Although heat therapy is useful in reducing the incidence of virus diseases, when used alone it is often not useful for clean stock certification programs.

Tissue culture-based methods for eradicating diseases infecting vegetative plant material

PTC plays a significant role in eradication of microbial infections in clonal crops as different therapies can be applied alone or in combination when a single therapy is not effective. Also, the methods can be applied anytime of the year and under highly controlled laboratory conditions, making them easily reproducible once protocols are established.

Meristem culture

The simplest method is to use meristem tip culture because if extracted accurately, meristem is devoid of vascular tissue and consists only of actively dividing meristematic cells. Therefore, plants can be regenerated from the meristems without phloem limited bacteria and viruses such as Ampeloviruses causing leafroll disease in grapevine. The meristem is microscopic and is often less than 0.5 mm in most species. Shoot apical meristem (SAM) consists of an apical dome and one or two leaf primordia (Fig. 1). Often meristem culture alone does not eradicate even phloem limited viruses. Moreover, there are many pathogens that are not limited to vascular tissue such as Nepoviruses (e.g. GFLV in grapevine), infecting the meristem and then therapies need to be combined to successfully eradicate the pathogens.

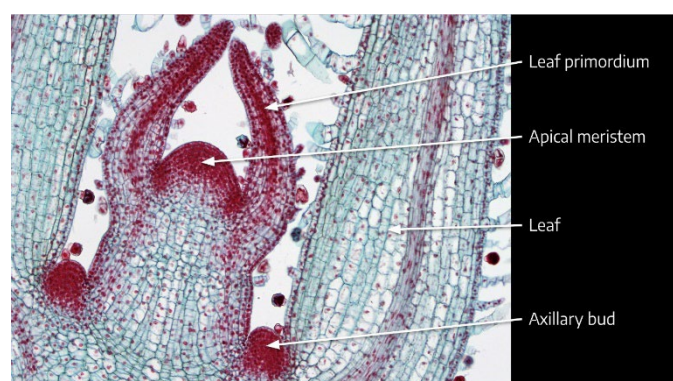


Figure 1. Microscopic (10X) view of a *Coleus* stem tip showing the structure of the apical meristem (Credit: <https://open.lib.umn.edu/horticulture/>)

Combining thermotherapy with meristem culture

Thermotherapy when combined with meristem culture is much more effective compared to application of the two methods alone. Thermotherapy, as discussed above, either completely deactivates or partially kills the infecting virus. Thus, the chances of regenerating infection-free plantlets through meristem culture are greater when combined with thermotherapy. There are many such examples such as eradicating GLRaV 1, 3 from infected 'Chancellor' grapevine by applying thermotherapy to in vitro plants followed by meristem culture [4], applying thermotherapy (37–40 °C for 4 weeks under hot air treatment) to shoots harvested from field-grown 'Oregon Spur-II' apple infected with *Apple mosaic virus*, *Apple chlorotic leaf spot virus* (ACLSV), *Apple stem grooving virus*, *Apple stem pitting virus* and *Prunus necrotic ringspot virus* followed by in vitro establishment and meristem culture (0.3 – 0.5 mm meristems effective for all viruses and 0.5- 0.6 mm effective for all except ACLSV – only 50% success for ACLSV) [5] and applying thermotherapy (35 °C for 3 weeks) to potted nectarine (*Prunus persica* var *nectarina* Max) 'Arm King' infected with *Plum pox virus* (PPV) and PNRSV followed by meristem (1.3 – 2 mm) culture [6]. As thermotherapy inactivates the virus, longer shoot tips that better survive in vitro culture can be used for culture initiation. Thermotherapy (4 weeks with day/night conditions of 16/8 h and 40/36°C) of two-week-old cassava plants infected with *African cassava mosaic virus* and *East African cassava mosaic Cameroon virus* were used by Yéo, *et al.* [7] to establish tissue cultures from which meristems

were isolated and cultured. They reported 88 % of the regenerated plants free from both viruses. Combining thermo-therapy with meristem culture for improved eradication of *Onion yellow dwarf virus* and *Shallot latent virus* from co-infected in vitro-cultured shallot shoots [8] and *Bean yellow mosaic virus* from infected gladiolus [9] are among many other reports of successful use of this combined therapy.

Chemotherapy

Since the first antiviral drug in humans was registered in the 1960s, many antiviral drugs have been developed. Anti-viral agents targeting plant viruses are mainly derived from natural products and many products with varied control mechanisms have been developed. However, demonstration of the antiviral activity of a guanosine analogue agent, ribavirin (originally used as a drug for human hepatitis C virus) in tobacco cells infected with *Tomato spotted wilt virus* made this compound the most popular for virus eradication programs in tissue cultured plants. Its broad spectrum of activity against replication of both RNA and DNA viruses makes it the first choice in many virus eradication programs and is often combined with other therapies. Usually, the viricide is added in concentrations of 10 – 100 mg/L in media for growing infected plants and maintained for 2 – 6 weeks during which time thermo-therapy regimes can also be applied. It is also used in combination with cryotherapy for viruses that are difficult to eradicate using a single therapy. Therefore, some examples of this method are discussed below under cryotherapy.

Cryotherapy

Cryotherapy involves treating the shoot tips of infected plants at ultra-low temperature, often in liquid nitrogen (LN) at -196 °C. The development of novel vitrification-based protocols has enabled cryotherapy to be applied once a protocol is developed. Unlike cryopreservation for conservation purposes, the recovery percentage of treated shoot tips need not be high for virus eradication. In fact, when optimized protocols are applied with high survival percentages, more cells of the meristem survive the treatment reducing the chances of virus eradication. For example, we used droplet vitrification to test the suitability of cryotherapy for virus eradication of leafroll disease in grapevine. ‘Chardonnay’ and ‘Lakemont Seedless’ were infected with GLRaV-3, ‘Pinot gris’ and ‘Sauvignon blanc 316’ infected with GLRaV-2, and another clone of ‘Sauvignon blanc’ infected with both GLRaV-1 and GLRaV-3. All the plants regenerated after cryo-treatment (one hour in LN) tested negative for the viruses after six months in the greenhouse. The regeneration percentages were from 13 % (‘Chardonnay’) to 30 % (‘Sauvignon blanc’) [10].

In New Zealand the potato germplasm collection of about 950 genotypes was maintained in the field until we could introduce cryopreservation. At the time, these had many virus infections. Before cryopreserving the germplasm, it is important to clean up the collection. Virus eradication efficiency in potato infected with *Potato virus S*, *Potato virus A* and *Potato virus M* is variable (20 – 100%) when chemotherapy (2 weeks in 100 mg/L ribavirin) is used alone, whereas combining it with cryotherapy was more effective (80 – 100% efficiency). Cryotherapy and thermo-therapy applied alone was also not effective [11] (Fig. 2). Now this method is routinely used to eradicate viruses for cryo-preserving the potato germplasm for long-term conservation.

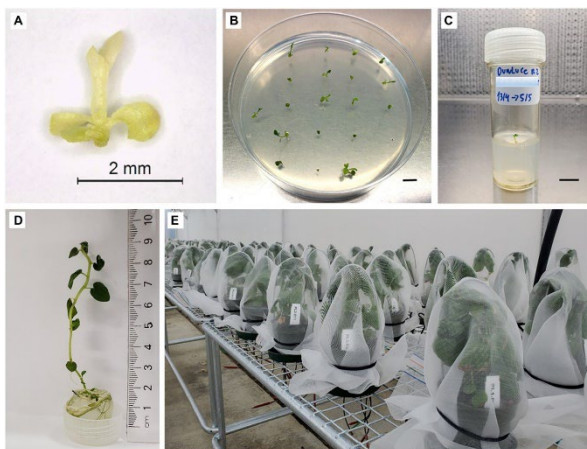


Figure 2. Shoot tip recovery process in potato “Dunluce” infected with *Potato virus S* following a combined chemotherapy + cryotherapy treatment. (A) Shoot tip 1 week after combined chemotherapy + cryotherapy and (B) 3 weeks recovery from cryoexposure. (C) Shoot transferred to vial and (D) grown for 3 months. (E) Plants after 3 months of growth in the greenhouse. Bars = B 0.6 cm, C 0.7 cm. Reproduced from Bettoni et al. [11].

Raspberry bushy dwarf virus (RBDV – a member of the species *Idaeovirus rubi* of the genus *Idaeovirus* in the family *Mayoviridae*) is one of just 17 horizontally transmitted viruses among over 1000 known plant viruses. Horizontally transmitted viruses are pollen-borne and after pollination and fertilization, get into the maternal tissue through the fertilized ovary. Thus, RBDV can spread rapidly within one flowering season and is most damaging and occurs in all

raspberry growing regions in the world. Meristem culture, cryotherapy or thermotherapy alone are not effective on their own as it is aggressive and infects parts of the growing meristem as well. Therefore, we tested several combinations of chemotherapy, thermotherapy and cryotherapy. Chemotherapy (30 mg/L ribavirin) combined with thermotherapy (24°C for 8 h in dark and 39 °C for 16 h with light) for two weeks followed by cryotherapy was the most effective with 80 – 100% of plants testing virus-free in the greenhouse [12]. This work was conducted in New Zealand, and we cleaned up many clones of raspberry in our collection, so that the breeders can now use these genotypes as pollen or female parents in their breeding program without risking virus transmission (Fig. 3).



Figure 3. Different stages of thermotherapy + chemotherapy followed by cryotherapy of raspberry tissue cultures infected with RBDV. a) Cultured meristems on regeneration media after combined therapies, b) Regenerating plantlets after 4 weeks in culture, c) Shoot transferred to individual tub after 4 weeks, d) Plants acclimatizing in the greenhouse after 6 weeks of exflasking, e) Plants in the greenhouse after 1 year from exflasking

I will describe cryopreservation techniques in more detail in a later article of this series under conservation. Often, cryotherapy is combined with other therapies for more aggressive viruses as already described for the eradication of three viruses in potato [11] and for RBDV in raspberry [12]. As only the meristematic cells with no vacuoles survive and the more differentiated cells with vacuoles get destroyed due to ice crystallization, cryotherapy can be regarded as a very precise meristem culture (Fig. 4).

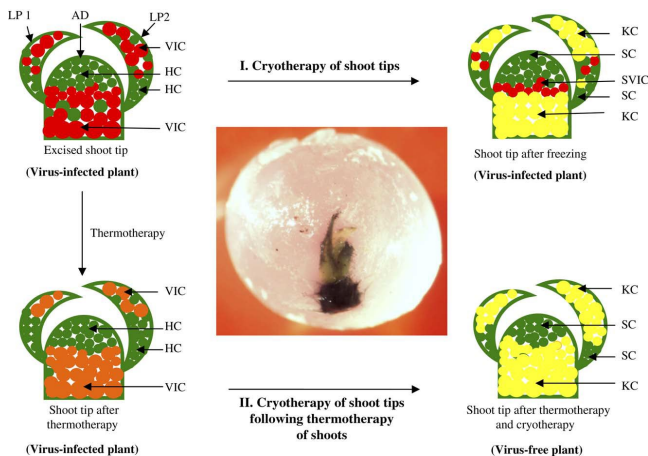


Figure 4. Combination of thermotherapy and cryotherapy for enhanced elimination of viruses that can invade the meristematic cells efficiently. I: Most of the differentiated older infected cells are lethally injured whereas the youngest cells in the meristem survive the cryo-treatment. If the virus was not able to enter the meristem, the treatment would result in virus-free plants. However, in cases like here where the virus invades the meristem, shoots regenerated after cryo-treatment will remain infected. II: Additional suppression of virus and increased propensity of infected cells to be injured by cryo-treatment can be achieved by subjecting shoots to thermotherapy before excising shoot tips for treatment in liquid nitrogen. Thermotherapy causes stress and reduces survival of the cells and also accelerates degradation of viral RNA. An encapsulated raspberry shoot tip (1.5mm) is illustrated in the middle. AD, apical dome; HC, healthy cells; KC, killed cells; LP1, leaf primordium 1; LP2, leaf primordium 2; SC, surviving cells; SVIC, surviving, virus-infected cells; VIC, virus-infected cells. Reproduced from Wang et al. [13]

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Somatic embryogenesis

SE is a process by which plants can produce bipolar structures from a single somatic (i.e. non-reproductive) cell without meiosis and fertilization, therefore the new plant derived from a SE is genetically identical to the mother plant. This complex process can follow two paths: direct (from a single somatic cell) and indirect (from undifferentiated cells - callus) embryogenesis. I will discuss the details of this process in a separate article of this series.

Somatic embryogenesis has many applications in agriculture and plant biotechnology, and one is producing high-health plants from infected material. It has proven to be highly effective in eliminating some viruses, either alone or in combination with thermotherapy. Boamama-Gzara et al. [14] reported 100% elimination of GLRaV 3, *Grapevine*

stem pitting-associated virus and Grapevine virus A from the Tunisian cultivar 'Hencha' through somatic embryogenesis. The stages of development of SEs are shown in Fig 5.

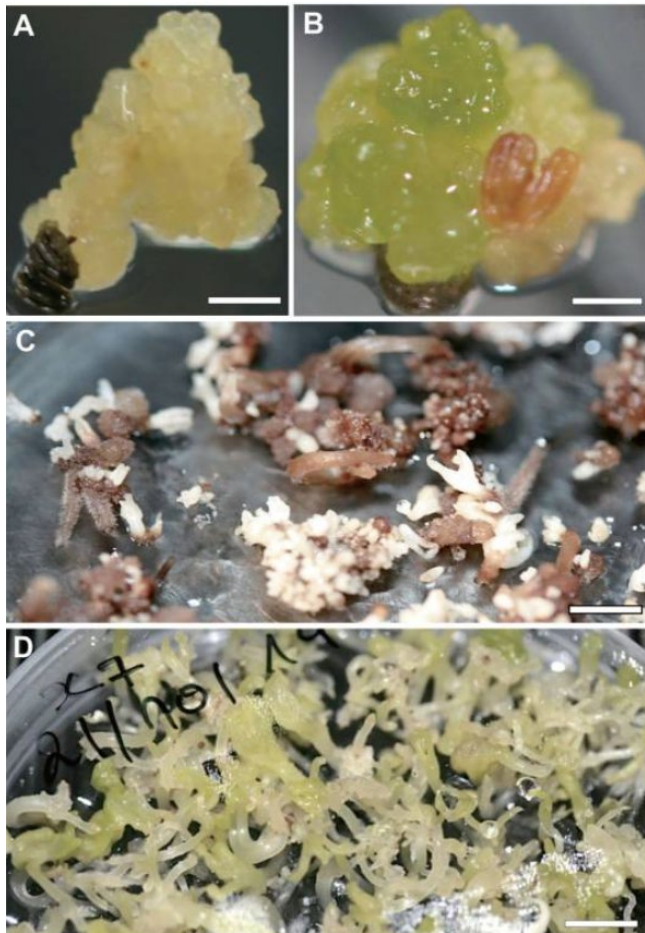


Figure 5. The stages of somatic embryo (SE) production in grapevine 'Hencha'. A) Early-stage SEs derived from the cut end of anther filament, B) Globular and heart stages, C) Cotyledonary stage SEs maturing on media and D) Germinating SEs in growth regulator-free medium. Bars A & B – 1 mm; C & D – 2 mm. Reproduced from Boamama-Gzara et al. [14]

Conclusions

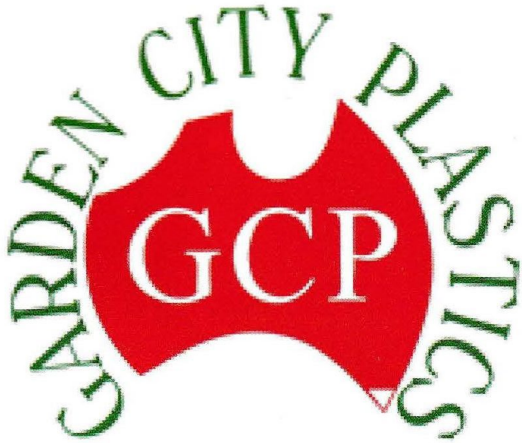
PTC is critical in producing high-health planting materials in vegetatively propagated crop, ornamental, forestry and medicinal species. Use of healthy planting material can reduce farm losses. While meristem culture and heat therapy have often been used to eradicate infecting microorganisms from planting material, their combination with chemotherapy and cryotherapy ensures eradication of more aggressive viruses that invade the meristem.

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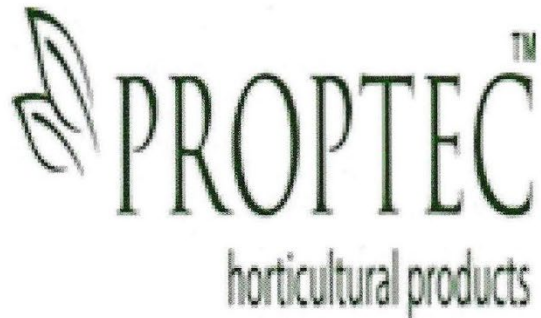
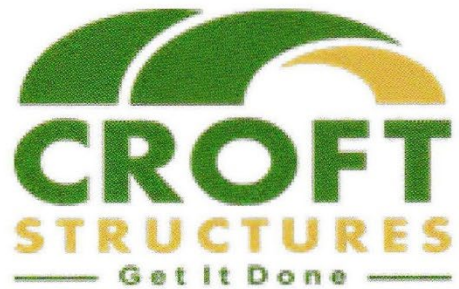




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