

Flavour does matter

National papaya breeding and evaluation program

DR CHAT KANCHANA-UDOMKAN



The research team Left to Right, Emily Pattison, Dr Jiraporn (Nui) Surachartkumtonkun, Dr Chat Kanchana-udomkan, Ms Ziwei Zhou, Mr Luke Trabucco, Dr Mai Nantawan

he 'National papaya breeding and evaluation program' (PP18000), run by a project team at Griffith University, is working to characterise in-depth the key flavour type preferences within the whole papaya chain and develop a library of chemical fingerprints that will be used as a tool to differentiate flavour types.

The project team selected commercial red RB1 and yellow 1B papaya from Lecker Farming, Mareeba to represent two distinct flavour profiles and compared differential gene expression between these two varieties using RNAsequencing technique.

Project lead, Dr Chat Kanchanaudomkan from Griffith University said that about 180,000 genes were detected in fruit samples of both varieties, and only half of them expressed differently between the two varieties.

"5,000 of the genes showed differential expression at the ripe fruit stage and may relate to the flavour of papaya, so we narrowed the number of genes down to 70 that were related to sugar, (fructose, glucose, and sucrose) and volatile compounds," Dr Kanchana-udomkan said.

"These 70 genes will be investigated further to validate the function of genes on flavour of papaya and can potentially



Claudia and Michael Oldano, and Chat

develop as a tool to predict flavour of papaya to assist papaya breeders."

The research team from Griffith University and Department of Agriculture and Fisheries (DAF) Mareeba also conducted a consumer survey on the current commercial varieties at Mareeba Market on Saturday, 8 May 2021.

This survey aimed to examine consumers' papaya consumption and to assess the consumer acceptance of different types of papaya and received strong engagement with 124 participants.

Dr Kanchana-udomkan said three clusters 'Papaya Lover', 'Red Lover' and 'Not a Papaya Fan' were identified, and the favourite varieties were RB1, Skybury and H13.

"We have now got in-depth data on candidate genes relating to papaya flavour, specific volatile compounds making up a variety, descriptions of papaya flavour from an experienced, trained panel, and consumer preference toward commercial varieties," she said.

"Next steps for the project will be to analyse data to correlate the favourite varieties, characteristics and chemical profiles to candidate gene expression. This will create a reliable and accurate model to predict new emerging varieties."

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The papaya flavour research aligns with the new research project AS19003: Genetics of Fruit Sensory Preferences which is a collaborative project with the University of Queensland and DAF.

For more information, please contact Dr Chat Kanchana-udomkan. c.kanchana-udomkan@griffith.edu.au.

Ziwei Zhou, the PhD student on PP18000 also won the three-minute thesis challenge from School of Science from Griffith University and published a review article on 'Papaya (Carica papaya L.) Flavour Profiling'. This can be accessed at: https://www.mdpi.com/1272018. 0

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Get an update on all new, current and recently completed levy funded activity on the Hort Innovation Papaya Fund page at *www.horticulture.com.au/papaya*.

You can access easy-to-read project updates, a snapshot of the Papaya Fund, research reports and resources, key industry contacts and more. Don't miss the Hort Innovation 'Growers' section to keep informed on your levy investments, upcoming events, scholarship opportunities and other handy info!

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From the Chair: Papaya industry, 'Steady as she goes'

GERARD KATH

irstly, welcome to all who have an interest in our wonderful industry. We are after all a small but vibrant industry in the context



of all fruit and veg within Australia.

We are steadily growing by fruit volume and value, though the number of growers and people in the whole industry are somewhat decreasing. It is a strange world we find ourselves in, particularly the last two years, with no clear outlook on the implications the COVID-19 phenomenon has on shopping habits, labour supply, compliance issues, as well as government decisions and dictatorial rules that are implemented at a drop of a hat. I would suggest that change is the one constant in business and that we are all going to have to deal with it. Good luck.

There has, however, been a positive COVID effect on demand and price, with an increasing percentage of fruit going to the three main supermarkets in Aldi, Woolworths, and Coles. I know that they are actively looking at the tropical fruit category to drive growth in sales, understanding that papaya is at about 20 per cent market penetration and has massive room for growth. There is a challenge to industry to meet this demand and remain viable and we're also seeing increasing demand for red papaya being driven by consumers who have been happy with the product and knowing the health benefits that exist. Interesting times ahead for the next five years!

Papaya Australia has also been involved with our industry's Biosecurity Plan. Both Joe Zappala and I have been engaging with Trevor Dunmall, Biosecurity Australia to help finetune the Plan. Looking closely at all the different types of pests and diseases that exist in the world, all I can say is that prevention is a long way better than dealing with an incursion.

I know that there is still evidence of papaya sticky disease, yellow crinkle, dieback, blackspot, bacterial leaf diseases, fruit spotting bugs and spider mites, just to name some of the challenges of growing papaya. It doesn't seem to get any easier with time.

I recognise that most papaya operations are all year round, so labour shortages may not be as severe as in the short-term seasonal industries. However, there is an effect still being felt by growers. Backpackers alone has fallen from approximately 160,000 pre-COVID to about 30,000 thousand and dropping by approximately 2,000 a month across Australia. The effects are very real and painful in certain areas and crops, so there is a strong push to fill gaps with the Pacific Island Worker Scheme, but this will take time. Growers may find increasing pressure to retain and find workers in the time ahead.

Now to compliance... this one is getting harder by the year. The latest push to audit Fair Farms and SEDEX leaves me baffled. For SEDEX, a UK based company to convince major chains to enforce their suppliers to a code for industrial relations and have growers pay for this 'privilege' is extremely frustrating. Australia has one of the strictest industrial and workplace laws in the world, so for me, it would make more sense to enforce noncompliance to Australian laws, rather than dream up a new 'voluntary' code to look to be doing the right thing.

I feel that I have vented some frustration, (don't feel that much better) and had better get out there and attend to something more constructive.

Until next issue, Merry Christmas and Happy New Year and happy papaya production for the foreseeable future. Regards,

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Gerard Kath

From the Papaya Australia office: Papaya Australia Ltd financial members will receive a one cent per seed discount on papaya seeds purchased from Papaya Seeds Australia as of Monday, 1 November 2021. If you would like to become a financial member of Papaya Australia Ltd, email **admin@australianpapaya.com.au** and request a membership form.

NEW EXTENSION PROJECT DELIVERS FIRST PAPAYA WORKSHOP

he inaugural workshop under the new three year 'Papaya industry extension and communications program' (PP20000) was held in Innisfail in August 2021.

Led by the Queensland Department of Agriculture and Fisheries (DAF), 34 industry stakeholders attended the workshop which aimed to give industry an introduction to the new levy funded project and provide growers with an opportunity to have input into key research and development priority areas.

The workshop commenced with presentations from local papaya grower, Joe Zappala and Regional Extension Manager for Northern Australia at Hort Innovation, Dr Olive Hood, as well as Cox Inall who will be leading the communications component of PP20000 including the continuation of the now triannual Papaya Press grower magazine. Attendees received updates from project leads on several papaya levy funded projects including the 'Papaya Clean Seed Program' (PP18001), the 'National Papaya Breeding and Evaluation Program' (PP18000), and 'Nutrient **Requirements for Papaya Production** Review' (PP20002).

DAF project coordinator, Emily Pattison said the event was a great way to introduce the new extension and communication project to industry and get their direct insights on key priorities.

"A key part of the workshops was prioritising research under the new project. We conducted two activities to enable participants to share their outlook for the industry and influence key priority areas for the program over the next three years," she said.

"The first activity was a SWOT analysis, with the second a money allocation activity where growers and agronomists were allocated 100 'papaya dollars' which they had to allocate wholly or in parts to the research areas they wanted to see prioritised. This activity was then shared online so growers who couldn't attend could have their say.



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"Recognising current industry priorities is vitally important to set the themes for the delivery of the next three years of activities through PP20000. This project has a target of 6 trials/demonstrations over the project and topic selection will be based on the identified priorities.

"Thank you to everyone who presented, attended the workshop and participated in the research prioritisation activities. We look forward to running more of these sessions over the next three years."

Stakeholder communications throughout the project will be conducted via 6 workshops and the 9 triannual Papaya Press publications over the 3 years. The workshops will include updates on project activities including trials, information resources and industry R&D updates, as well as provide growers the opportunity to network with other growers and industry stakeholders.

For more information, please contact *Emily.pattison@daf.qld.gov.au*.

RESULTS FROM RESEARCH PRIORITY ACTIVITY

27 agronomists and papaya growers allocated their 2,700 papaya dollars across the below priority areas:

Integrated Pest and Disease Management: received \$1,486 total allocation across Phytophthora (\$511), Phytoplasmas (\$442), Spray Efficiency (\$131), Black Spot/Brown Spot (\$131), Two Spotted Mites (\$72), Fruit Spotting Bug (\$62), Pythium (\$40), Sticky Disease (\$30), African Spider Mites (\$27), Powdery Mildew (\$22), Oriental Scale (\$16), Nematodes (\$1), and Fruit Piercing Moth (\$1).

Agronomic Practices: received \$686 total allocation across whole papaya plant nutrition (\$206), soil health (\$121), seedling issues (\$101), nursery issues (\$94), fruit consistency (\$80), irrigation efficiency (\$62), phosphorus efficiency (\$16), and nitrogen efficiency (\$6).

Post-Harvest and Supply Chain: received \$528 total allocation across Phytophthora (\$337), Anthracnose (\$111), break-down (\$54), ripeness/ flavour (\$20), supply chain issues (\$5), and Phomopsis (\$1).

The 'Papaya industry extension and communications program' (PP20000) project is funded by Hort Innovation using papaya industry levies and funds from the Australian Government.

Hort PAPAYA FUND rategic levy investment

New biosecurity plan safeguards papaya industry

PLANT HEALTH AUSTRALIA

Plant Health Australia (PHA) has been working with Papaya Australia to develop a new industry Biosecurity Plan, a timely refresh that builds on the previous Plan developed in 2011.

Developed by PHA in collaboration with Papaya Australia, Hort Innovation, state and territory governments and leading technical experts through the 'Biosecurity plan for the lychee, papaya and passionfruit industries' (MT18006) project, the Plan is in the final stages of development and is expected to be published later this year.

Australia has an estimated 130 commercial papaya growers in Queensland (QLD), Western Australia (WA) and the Northern Territory (NT) who produced over 19,000 tonnes of papaya in 2020, valued at more than \$30 million.

After the previous plan was developed in 2011, exotic papaya sticky disease was detected. Since detection, the QLD Department of Agriculture & Fisheries (QDAF) has been working with industry on new testing methods to detect all the four known viruses that cause the disease, as well as improved management programs, including clean seed protocols.

"The occurrence of papaya sticky disease highlighted the need for growers to remain vigilant as new pests and diseases can impact production as well as market access and trade," said Papaya Australia Chairman, Gerard Kath.

"There are a range of direct and indirect effects that new pests and diseases have such as loss of production, increased management costs and potential trade restrictions that all impact the bottom line for growers."

Industry, government, and technical experts from QDAF, NT Department of Industry, Tourism and Trade (DITT) and



WA Department of Primary Industries and Regional Development (DPIRD) have provided invaluable input in the development of the biosecurity plan.

"A refreshed biosecurity plan for the Australian papaya industry is important as it provides an opportunity to revisit the future outlook and adjust industry strategies to better prepare for and to minimise the threat posed by exotic pests and diseases," said Trevor Dunmall, PHA's Biosecurity Planning Manager.

PHA develops crop-specific biosecurity plans for plant production industries in collaboration with industry and government. Biosecurity plans undergo regular reviews to ensure they remain up to date, along with an annual review by biosecurity reference panels to help monitor and drive implementation.

KEY BIOSECURITY THREATS

The biosecurity plan identifies key biosecurity threats to the industry, outlines risk mitigation activities and focuses on five key areas:

- high priority exotic pests and established pests of biosecurity significance
- threat identification and risk assessment
- risk mitigation and preparedness
- response management
- biosecurity plan implementation

Biosecurity planning provides a mechanism for the papaya industry, government and other stakeholders to assess current biosecurity practices and future biosecurity needs.

"The papaya industry relies on sound production practices, and good on-farm biosecurity is already an essential part of the production process," said Mr Kath.

Early detection and reporting of exotic pests or pathogens provides the best opportunity for containment and eradication. Growers are encouraged to report any suspicious symptoms to the Exotic Plant Pest Hotline on 1800 084 881.

For more information on papaya biosecurity, visit the PHA at: www.planthealthaustralia.com.au/ industries/papaya

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The 'Biosecurity plan for the lychee, papaya and passionfruit industries' (MT18006) project is funded by Hort Innovation using lychee, papaya and passionfruit industry levies and funds from the Australian Government.



REGIONAL **ROUND-UP**

TABLELANDS, QLD - Gerard Kath

Large yields have again been majorly produced by the larger three to four growers, with a significant increase in production on the Tablelands.

The last 12 months have again been dominated by large production volumes of mostly good quality fruit. This fruit has sold well, with prices being very reasonable with good grower viability.

It wasn't a cold winter, so the weather conditions have been quite favourable on the Tablelands, and the fruit is coming on nicely as a result.

Seed production wise, growers haven't planted as much this year, which is part of the reason why we're seeing a lesser crop compared to the last year or two.

There are no significant disease problems impacting growers at the moment, with issues remaining pretty steady and consistent.

TULLY, QUEENSLAND- Nicholas Mackay

Winter this year was mostly absent on the coast, which meant fruit volumes have been consistent with only a minor decrease through the winter months.

Coming into the warmer months, we are expecting a minor increase in production volumes which usually coincides with an increase in fruit sugar content (Brix) making for a better eating product.

Planting for the 2021 season has brought many challenges with wet weather limiting and delaying plans. The planting season for the coast will wrap up soon before temperatures get too high, and the wet season begins. 🙆

CARNARVON, WESTERN AUSTRALIA -**Caranarvon Growers Association**

The Carnarvon region experienced flooding earlier in the year which continued into heavy rainfall but are now heading into warmer weather.

The market looks good for papayas and pawpaws in comparison with market numbers from last year and we are hopeful for another successful year.

WANT TO SUBMIT AN UPDATE FROM YOUR GROWING REGION?

Email Meg Pearce, Cox Inall dentsu: meg.pearce@coxinalldentsu.com.au

GET CONNECTED

eet Emily Pattison, the project lead for the new Papaya Industry Extension and Communications Project (PP20000). Emily grew up in Innisfail with involvement in the banana industry and has a great interest in agricultural science, having attended the University of Queensland, Gatton to study a

Bachelor of Agricultural Science. After working in various research roles across the vegetable, banana, cotton industries and as junior agronomist, Emily eventually followed her passion for tropical horticulture and began work as a consulting agronomist for Total Grower Services

in Tully in papaya and bananas. After a year, she was transferred to the Mareeba Branch and began consulting on citrus, mango, avocado, papaya and other niche crops in the area.

Emily joined the Queensland Department of Agriculture and Fisheries in April 2021 as a Horticulturist.

"I'm particularly interested in agronomy and looking at farming systems holistically, covering nutrition, irrigation and their effect of pest and disease management. So, I'm excited to be leading this project, particularly given the project's breadth and the prospect of being able to look at the whole papaya growing system," said Emily. Connect with Emily at:

emily.pattison@daf.qld.gov.au.



An emerging problem: African Spider Mite

frican Spider Mite (Eutetranychus africanus) has been detected on papaya farms in the Innisfail, Tully, and Mareeba districts at increasing levels, raising concerns for Australia's papaya growers.

An exotic mite species, African Spider Mite is believed to have been present in Australia for at least 10 years, possibly more. This mite has several distinct differences from the well-known Two Spotted Mite which impacts management practices for this emerging pest.

Emily Pattison Queensland Department of Agriculture and Fisheries (DAF) project coordinator for the 'Papaya industry extension and communications program' (PP20000), said African Spider Mite reproduction is very temperature dependent and under warm north Queensland conditions, populations can boom.

A laboratory study in Taiwan has found eggs will not hatch under 12°C and that their reproduction was greatest at 27°C. At higher temperatures the life cycle progresses faster, but the longevity of the mite reduces. At 32°C the African Spider Mite will go from a newly hatched egg to an adult in nine days.

"On top of that, rapid life cycles increase the risk of chemical resistance in the population, so chemical management and rotation are critical.

"Papaya and citrus farms in Taiwan



and Japan suffer from this pest, and it's unknown how long this mite has been present in north Queensland's papaya growing areas," she said.

Ms Pattison said Integrated Pest Management principles for controlling African Spider Mite are similar to those recommended for the Two Spotted Mite.

"If you are having issues with African Spider Mite or Two Spotted Mite, it's important to consider your chemical, cultural and biological management responses," she said.

"For example, be sure to rotate chemicals to avoid resistance and always use registered pesticides and follow the label, make sprays fit into the life cycle of the pest, and choose chemicals that fit the problem.

"With cultural strategies - rigorous monitoring programs helps increase the chance of early detection, make sure papaya plants don't experience water stress, and remember that nitrogen is a major contributor to mite populations in other crops so consider reducing nitrogen fertiliser application.

"Finally, lady beetles are important mite predators in papaya so monitor populations and reduce the use of broad-spectrum chemicals to conserve these beneficial populations. Beneficial mites may also be effective against the African Spider Mite so allowing groundcover to come up underneath papaya plants will help predatory mites persist in orchards as they use pollen as an alternative food source." For more information, please contact

Emily.pattison@daf.qld.gov.au. 1

The 'Papaya industry extension and communications program' (PP20000) project is funded by Hort Innovation using papaya industry levies and funds from the Australian Government.

This project has been funded by Hort Innovation

using the papaya research and development levy and funds from the Australian Government. For more

information on the fund and strategic levy investment

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visit horticulture.com.au

SPOT THE DIFFERENCE: AFRICAN SPIDER MITE AND TWO SPOTTED MITE

- The African Spider Mite lives on the upper surface of the leaf, in contrast to the Two Spotted Mite, which lives on the underside.
- Damage will look different. African Spider Mites leave small grey dots on the top of the leaf where they have fed. Eventually these grey marks will join to give the 'washed out' look and will continue to cause the leaf tissue to die, giving the leaf a 'tattered' look.
- African Spider Mite do not create webbing like the Two Spotted Mite.

Papaya clean seed project delivers 10 clean parental lines

he 'Papaya clean seed program' (PP18001) has officially ended after three successful years of research conducted by the Department of Agriculture and Fisheries Queensland (QDAF) in collaboration with Griffith University.

Working to better protect the papaya industry from papaya sticky disease by delivering a clean seed protocol, the project set about providing clean parental lines to produce virus-free hybrid seed, as well as some basic knowledge development in relation to the virus involved in the disease.

Dr Paul Campbell, project lead at QDAF said the project was successful in generating ten parental lines through embryo rescue free from the virus that causes papaya sticky disease.

"From over 500 plants generated through embryo rescue, only six infected plants were identified, and at least six representatives of each of the clean parental lines were able to be entered into tissue culture to safeguard industry investment," Dr Campbell said.

Through the project, a small-scale field trial with over eighty plants from six parental lines were planted in the field at both the Tablelands and on the coast.

"Plants were regularly sampled and tested for papaya meleira virus (PMeV-Aus), to evaluate virus movement in the field," Dr Campbell said.

"Within three months of planting there was approximately 30 per cent infection with PMeV-Aus.

"The rapid re-infection of the virus demonstrates that careful management of the parental lines is required to produce virus-free seed. But the benefits of growing clean seed will not be fully realised without proper management plans until localised virus pressures drop."

The 'Papaya clean seed program' found that the characterisation of



Papaya sticky disease

PMeV2-Aus, the causal agent of sticky disease, found significant differences to the situation reported overseas.

"It seems to be a double-stranded RNA virus, not a single stranded RNA virus, and a second virus reported to be contributing to virus replication overseas is not found in Australian plants," he said.

"Although virus particles are easily found, there does not seem to be recognisable coat protein in the virus genome sequence. This is very unusual for plant viruses and the method by which the virus obtains the proteins to form a particle is currently still unknown.

"Now that there is a supply of healthy plant material, many questions about the epidemiology of PMeV2-Aus that can impact management decisions can be answered, including what is spreading the virus, how soon after infection can the virus be detected, and how soon after infection can the virus be transmitted to other plants?"

To find out more on the project and read previous project updates, please head to: www.horticulture.com.au/ growers/help-your-business-grow/ research-reports-publications-factsheets-and-more/pp18001/

The 'Papaya clean seed program' (PP18001) is funded by Hort Innovation using papaya industry levies and funds from the Australian Government.



MARKETING AND SOCIAL MEDIA UPDATE

hrough marketing activity, Papaya Australia has continued to support the consumption of Australian grown papayas and increase purchase consideration by promoting the positive health benefits of the fruit.

HEALTH REPORT AND CONTENT CREATION

The 2018 Papaya Health Report was updated with input from Dietician, Caitlin Reid APD, identifying compelling health messages and contributing upto-date research.

Original recipes were developed to create engaging content for a public relations media campaign, including an immuneboosting papaya and chicken salad and a mood-boosting papaya and lime cake.

The report highlighted the myriad of health benefits in papaya which were shared via social media and earned public relations media, inspiring and educating consumers to include papaya in their diet.

Access a copy of the Papaya Health Report, at: australianpapaya.com.au/website/ wp-content/uploads/2020/11/Papaya_ Health_report_2020_SinglePages.pdf





PUBLIC RELATIONS

The marketing team developed three media bursts of activity to increase consideration of purchase for papaya during the spring and autumn flushes.

Using the recipe assets, health messaging and media releases, coverage was secured in several top-tier media titles. Key highlights from the public relations activities include:

- 47 pieces of coverage across traditional and social media
- 9.7 million total opportunities to see our papaya message (versus KPI 6.9 million)
- 100% of coverage contains at least one key message
- 60% of coverage contains two or more key messages

Media coverage was secured in titles including the Sunday Telegraph, Woman's Day, Westfield, MiNDFOOD, Woolworths, Australian Women's Weekly and Healthy Food Guide.

SOCIAL MEDIA

Papaya Australia social media activity continues to attract and engage consumers with regular postings across Facebook (*facebook.com/ papayaaustralia/*) and Instagram (*instagram.com/papayaaustralia*).

For the 2021 campaign, the papaya social media channels were updated twice per week under one of three content pillars: Eat Me; Love Me; and Know Me.

Having a strong media presence combined with social advertising has helped to optimise the reach and engagement of posts to drive awareness and consideration. Key social media highlights include:

- Over 4.4 million impressions across Facebook and Instagram during the campaign
- Over 128,600 engagements across Facebook and 128,600 across Instagram, demonstrating that key messages are resonating with the audience.