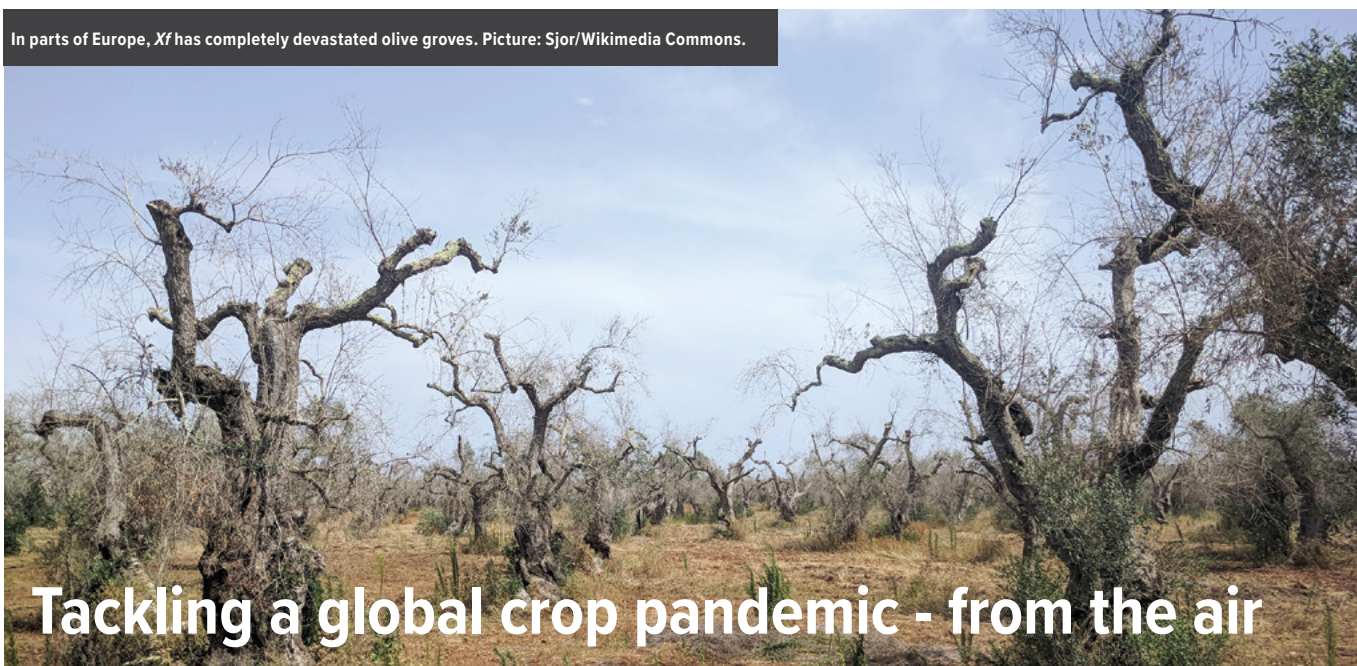




R&D Insights contains the latest levy-funded R&D project updates, research findings and related industry resources, which all happen under the Hort Innovation Olive Fund.

Hort Innovation partners with leading service providers to complete a range of R&D projects to ensure the long-term sustainability and profitability of the olive industry.

In parts of Europe, *Xf* has completely devastated olive groves. Picture: Sjur/Wikimedia Commons.



Tackling a global crop pandemic - from the air

Professor Pablo J. Zarco-Tejada and Dr Tomas Poblete, University of Melbourne

The ongoing **National Xylella Preparedness Program**, a joint initiative of Hort Innovation, Wine Australia and Plant Health Australia, aims to proactively ensure rapid detection and management should an incursion of Australia's number one pest threat, *Xylella fastidiosa*, occur. The program has supported research into innovative detection methods, which allow remote monitoring of tree condition with the ability to separate biotic (living, e.g. disease) and abiotic (non-living, e.g. drought) stresses. The new research complements the work of the tree crop remote sensing project featured in the September edition of *R&D Insights*, and is explained in this overview by the lead researchers.

“We need to be able to detect where *Xf* is present and where it isn't, while reducing false positives, where an algorithm incorrectly indicates *Xf* due to other factors”

The spread of the *Xylella fastidiosa* (*Xf*) bacteria is a huge threat to global agriculture, but research is enhancing our capacity to detect it in crops using airborne monitoring.

This so-far incurable bacterial disease causes plants to wither and possibly die, scorching and browning leaves

and reducing the size of fruit in a wide variety of important crops including olive, almond, avocado, coffee, grapevine, citrus, along with many herbaceous and forest species. It could also infect native Australian and ornamental plants.

Overseas, *Xf* is arguably the greatest disease threat to food security and agricultural productivity worldwide.

In Apulia, Italy, *Xf* has left devastating scenes of dead and dying olive trees in its wake and it could cost \$US22 billion to control the outbreak there over the next 50 years. If it spreads through Europe the losses in just the olive industry alone are projected to reach up to €5.2 billion per year.

Already widely distributed in the Americas, it has now been identified in Spain, France, Israel, Iran and Taiwan, raising international alarms about the potential for a global *Xf* epidemic.

Find it early

The key to containing *Xf* is early detection, which isn't easy given that some infections don't cause visual symptoms for 8-10 months. And during this period, the asymptomatic plants continue to be infectious.

But our new research takes us a step closer to developing a rapid and more accurate large-scale screening process of at-risk crop species by enhancing the effectiveness of airborne scanning using hyperspectral imaging.

Hyperspectral images allow us to "see" in more fine-grained wavelengths, and our previous research has already demonstrated that we can use it to detect *Xf* in olive trees before symptoms were visible.

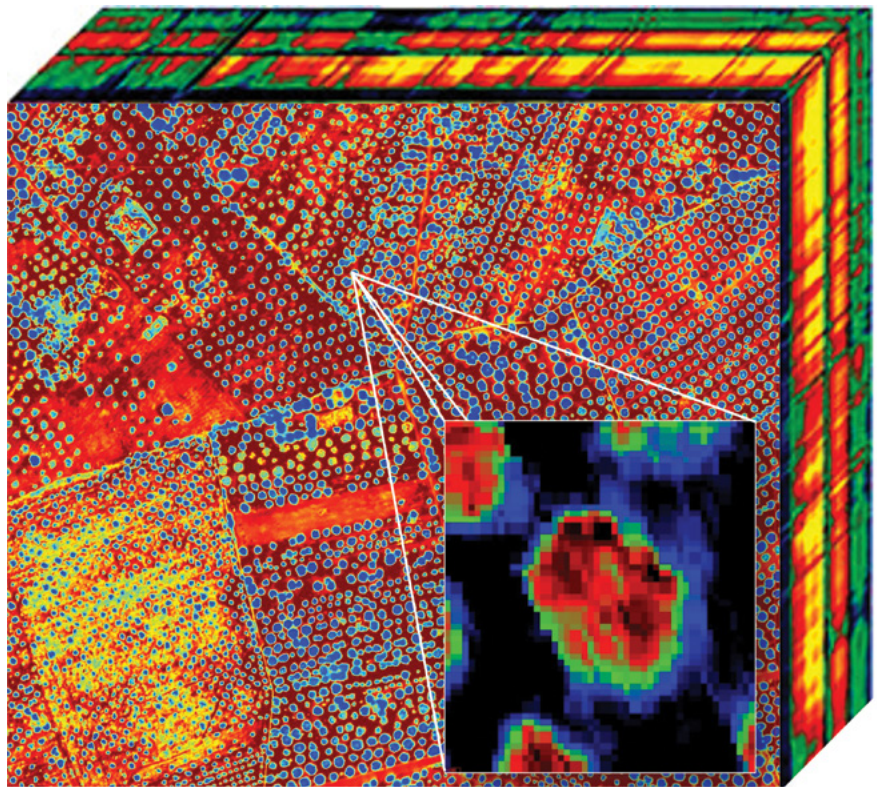
Identifying stressors

But a common problem is that the remote sensing algorithms that scan the hyperspectral images can't always distinguish the symptoms of *Xf* from the symptoms of other pathogens or environmental stress like lack of water or nutrients.

This aspect is particularly relevant for pathogens like *Xf* that invade a plant's vascular (circulatory) system because the bacteria eventually block the water flow, causing similar symptoms that can be wrongly attributed to lack of water.

Just as visibility and rapid testing were essential to managing COVID-19 in humans before the deployment of vaccines, we need to be able to see where *Xf* is present and where it isn't, while reducing false positives, where an algorithm incorrectly indicates *Xf* due to other factors.

Published recently in *Nature Communications*, our research with international partners from the EU, UK and US demonstrates that hyperspectral imaging and a novel algorithm can distinguish the disease from water-induced stress. It can also increase *Xf* detection to as high as 92% accuracy, while reducing uncertainty to below 6% across



Hyperspectral image data gathered on flights are analysed for traits linked to plant health at resolutions that allow assessment for each tree.

different hosts, including almond and olive, and across other vascular pathogens.

The technology

The research is based on scanning one million infected and healthy trees in seven regions in Europe.

The technology used in this study is available in Australia as part of our Airborne Remote Sensing Facility - HyperSens Lab, established across the Faculties of Veterinary and Agricultural Sciences (FVAS) and Engineering and Information Technology (FEIT) at the University of Melbourne.

“(This method) can increase *Xf* detection to as high as 92% accuracy, while reducing uncertainty to below 6%”

With two hyperspectral imagers and one thermal camera, the facility can scan thousands of hectares in the visible, near-infrared and thermal spectral regions of light, generating images where every single tree

or vegetation pixel is acquired with hundreds of narrow spectral wavebands.

By using algorithms based on physical models and machine learning, we can retrieve spectral plant traits directly linked with the physiological condition and stress levels of each tree, generating a pool of spectral screening indicators related to subtle changes occurring to infected vegetation.

In a trial in Victoria last year, funded by the Department of Agriculture, Water and Environment (DAWE) as part of the Plant Biosecurity and Response Reform (PBRR), we were able to scan several thousand hectares of healthy almond, citrus and olive trees with varying water and nutrient status levels as baselines, to better adapt the *Xf* detection models developed in Europe for the particular varieties and management practices in Australian agriculture.

These methods enable the collection and delivery to the grower of water stress and nutrient maps for each tree in an orchard within 24 hours. These are innovative precision agriculture technologies to support the efficient use of resources and



Remote monitoring of tree condition can provide rapid detection of pest and diseases, drastically reducing the risk of our growers ever having to do this. Image: James Hook©, Getty Images.

“Rapid detection through airborne and drone-based hyperspectral imaging is our best hope for protecting Australia’s \$A15 billion horticulture industry and preventing Xf’s spread around the world”

optimizing yields while protecting the environment.

Biosecurity and food security

And in the context of biosecurity, if an Xf outbreak occurs in Australia or elsewhere, our methods could potentially be used to rapidly detect and prevent the spread of the disease.

Global warming and international trade are causing unprecedented risks to agriculture, particularly with emerging and re-emerging pathogens that cause yield losses exceeding 30% in food-deficit regions with fast-growing populations.

At the same time, we need to increase global food production by 50% in the next 30 years to achieve food security.

Where to from here?

These facts underscore the importance of developing global plant disease and precision agriculture monitoring methods that use advanced technologies. But the answer isn’t only to be found in technological advances, but also in collaborative research across disciplines.

The future requires joint efforts between agricultural and engineering disciplines to create networks of hyperspectral sensors mounted on drones, as well as high-altitude drones and satellites that can concurrently screen for disease outbreaks and assess water and nutrient limitations at a global scale.

Until we get there, the rapid detection through airborne and drone-based hyperspectral imaging is our best hope for protecting Australia’s \$A15 billion horticulture industry and preventing Xf’s spread around the world.

Source: [www.nature.com](https://doi.org/10.1038/s41467-021-26335-3) - Zarco-Tejada, P.J., Poblete, T., Camino, C. et al. Divergent abiotic spectral pathways unravel pathogen stress signals across species. *Nat Commun* 12, 6088 (2021). <https://doi.org/10.1038/s41467-021-26335-3>.

Found something scary in your grove? Or just not sure?

EXOTIC PLANT PEST HOTLINE
1800 084 881



Above and right: Field days, webinars and updates of industry R&D reports are just some of the outputs of the olive industry communications and extension project.

Communications and extension project extended

The ongoing stream of industry information and learning is set to continue, with an extension to the olive levy project *Australian olive industry communications and extension program* (OL18000).

Run by the Australian Olive Association (AOA), over the past three years the project has provided outstanding knowledge transfer opportunities across a wide range of timely and relevant industry topics. The initial project period was set to end in September this year, however it has now been extended to June 2022 to ensure continuity of information dissemination around a number of ongoing projects and events.

What it does

Utilising the AOA's industry-owned communications platform and network of national and international

industry experts, the project promotes world's-best practice and the results of R&D in grove management and olive oil production to the Australian olive industry.

Project outputs

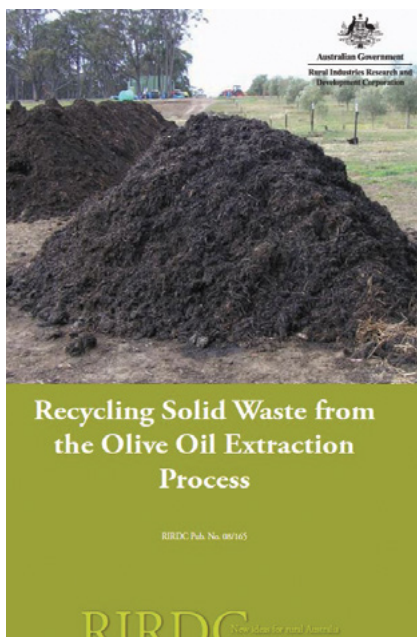
The outputs are broad in both content and dissemination format, aiming to reach and inform as much of the industry as possible, and include:

- events including best practice workshops and field days, held across all producing states and supported by information on the industry OliveBiz website;
- recordings of and/or from these events for ongoing reference;
- other video content covering best practice management topics;
- webinars covering topical issues and practices;

- related fact sheets and reference material;
- expert updates of existing industry RIRDC resources;
- monthly *Grove Innovation* e-newsletters, emailed to levy payers and also available on the *OliveBiz* website;
- quarterly *R&D Insights* lift-outs, published in the *Australian & New Zealand Olivegrower & Processor* industry journal and also available on the *OliveBiz* website.

AOA CEO Michael Southan said the extension provides the opportunity to complete several activities curtailed by COVID restrictions over the past 18 months, and to ensure the flow of information on new R&D and projects currently underway.

"The communications and extension project has been an incredible success across all aspects," he said.



Recycling Solid Waste from the Olive Oil Extraction Process

RIRDC Pub. No. 00/165

RIRDC
Rural Industries Research and Development Corporation

“Grower feedback throughout the project period is that the information provided has been relevant, practical and highly useful. In particular, the project has provided invaluable solutions to issues being experienced

in their groves and businesses, along with new techniques and methodologies to improve their management practices. All of that is translating into a continuing increase in product quality and viability across Australian olive businesses.

“We now hope to secure a further three to five-year extension of the project so we can continue to drive increased industry knowledge, best practice management and capability.”

Access resources online

The communications and extension program has generated a wealth of resources over the past three years, all of which are available to access, view and/or download 24/7 from the *OliveBiz* website.

Go to www.olivebiz.com.au and you'll find them in the various dropdown tabs – Publications, Projects/Comms Project, R&D Reports and *R&D Insights*.



Research recap

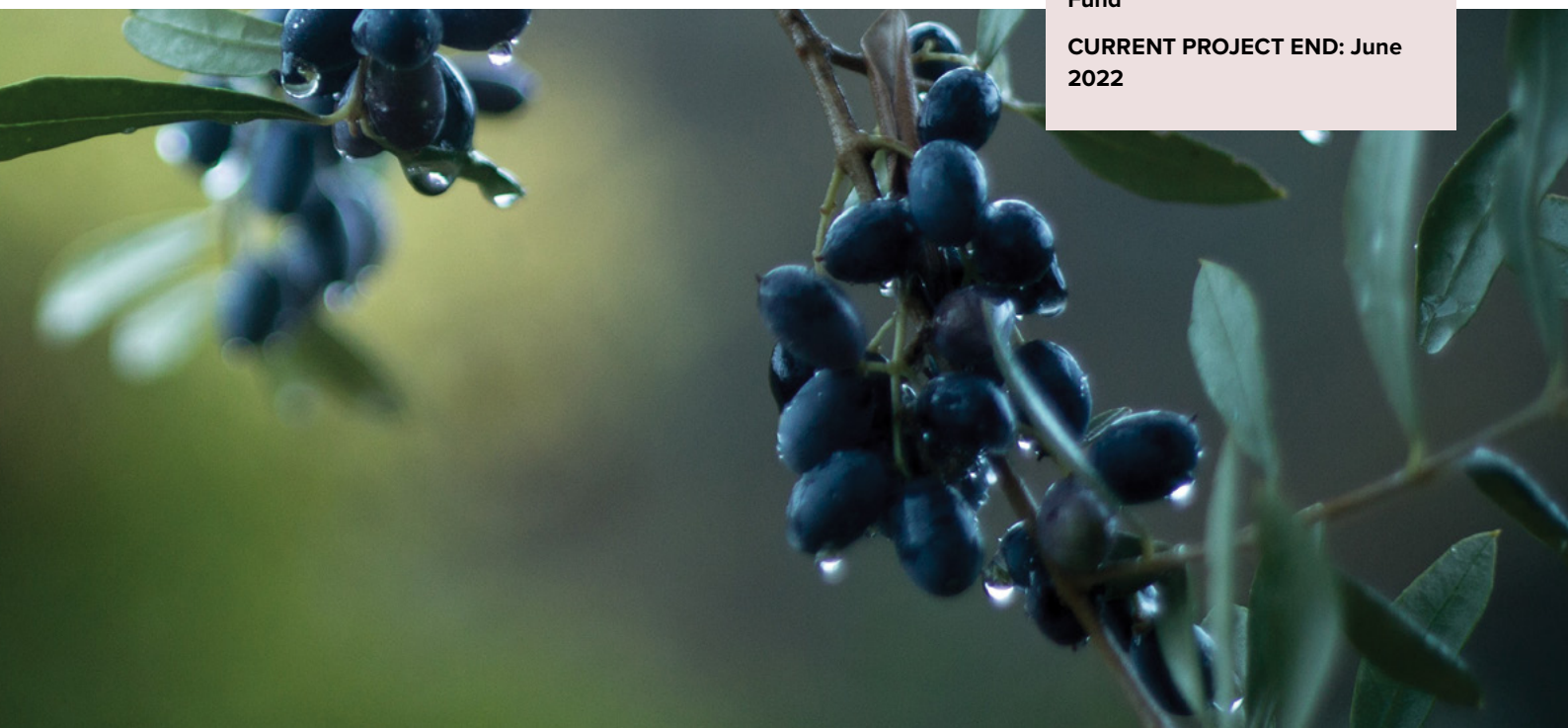
PROJECT NAME: *Australian olive industry communications and extension program (OL18000)*

PROJECT AIM: Continuing to build greater skills, capacity and knowledge in the Australian olive industry by promotion and dissemination of world-best practice and the results of R&D in grove management and olive oil production

PROJECT PARTNER: Australian Olive Association

FUNDING: Hort Innovation Olive Fund

CURRENT PROJECT END: June 2022



OWI puts cooking with EVOO on the front burner



**Olive Wellness
INSTITUTE™**

There's no stopping the team from the Olive Wellness Institute on their mission to educate health and food service professionals on the health benefits and culinary versatility of EVOO and olive products.

In the three months since we last updated on their work there's been a bunch of new activities undertaken, and new resources produced. Let's take a look at what they've been up to.

Food service webinar

It was virtual 'standing room only' on 26 October when 270 chefs and food service professionals joined the OWI for a webinar run by chef Emma Rosen and Cobram Estate Olives Joint CEO Leandro Ravetti.

The free event, *Extra Virgin Olive Oil: Can I cook with that?*, was presented in conjunction with Nutrition Australia with support from the Australian Culinary Federation. It looked at both culinary and technical aspects, covering how EVOO is made and the science behind cooking with EVOO, along with the health benefits of consuming EVOO.

It then got practical with a live demonstration by Emma of three EVOO-based recipes – focaccia, crispy skinned salmon and tomato salad - providing the opportunity to both showcase EVOOs versatility as an ingredient and dispel the myth about cooking with EVOO at high temperatures.

The OWI's Sarah Haworth said the session was a huge success, particularly in terms of increasing the chefs' technical knowledge about EVOO.

"We surveyed the participants at the start and end of the session, asking them to rank their knowledge on each topic from poor, fair or good to excellent," she said.

"There was an increase of 50% in 'knowledge of processing and production of EVOO' and an



increase of 48% in 'knowledge of smoke point and stability of EVOO'.

"That's a great result, and means that at least 135 chefs and food service professionals now have a better understanding of the benefits of using EVOO in their dishes. If each of them works in a kitchen with a group of other professionals, that's a substantial wave of influence for a change to EVOO," she said.

Blog posts and recipes

Recent months have also seen new blog posts on the OWI website, written by nutritionist and TV chef Zoe Bingley-Pullin. A passionate advocate for proactive health through functional foods, Zoe's blogs provide practical information about the active health components of EVOO. Her first two blogs, *The Misconceptions Around Cooking with Extra Virgin Olive Oil* and *Enhancing your diet with Extra Virgin Olive Oil*, also offer more myth-busting about EVOO and heat, and promote the use of fresh, local EVOO.

Each also has accompanying recipes, giving readers a delicious introduction to the benefits of swapping to EVOO for cooking.

HEIA National Conference

In late September the OWI also virtually attended the Home Economics Institute of Australia (HEIA) National Conference, 'meeting' delegates in the virtual trade hall to share the benefits of cooking with EVOO.



"It was a great opportunity to reach a large cohort of professionals on the front line of food preparation education, in the context of community wellbeing," Haworth said.

"We were also able to provide them with resources on the health benefits of cooking with EVOO and introduce them to our website for a wider range of resources."

Access resources

The recipes demonstrated during the October webinar and referenced in the new blogs are available on the Olive Wellness Institute website - www.olivewellnessinstitute.org - along with a wealth of additional resources. Use and share them to keep spreading the word about the myriad benefits of cooking with healthy, Australian EVOO!

Olive Fund Annual Report 2020/21 released

As a levy payer, the Hort Innovation Olive Fund is your R&D fund, invested along with Australian Government contributions into initiatives to help growers be as productive and profitable as possible.

It's important that all stakeholders know what their levy dollars are being used for – and just as importantly, what they're achieving for the industry. To that end, Hort Innovation produces annual reports for each of the 37 industries it handles levies for: the latest were released in late October, covering the 2020/21 financial year.

The reports provide key project information from the year, including grower case studies of how levy investments have made an impact on the ground.

Report overview

Not everyone has time to read the fine print, so here's an overview of the Olive Fund Annual Report 2020/21.

Fund highlights

Among the major projects delivered during the 2020/21 year were:

- the industry *Communications and Extension Program*, delivering *Grove Innovation* newsletters, editions of *R&D Insights*, best practice workshops and more;
- educational resources via the Olive Wellness Institute, providing evidence-based health information about olive products to health professionals, and the olive industry;
- preparation support for pest incursions, including emergency minor use permits and longer-term investments to bolster the horticulture sector's response;
- a range of pest and biosecurity investments to ensure the olive industry is equipped to manage present and future threats;
- investments in the Hort Frontiers strategic partnership initiative to address longer-term and complex

issues and opportunities critical to the future of Australian horticulture*

- projects supported by grants secured by Hort Innovation, ranging from cross-sector Rural R&D for Profit initiatives to horticulture-specific work to aid in access to crop protection products.*

*These initiatives were delivered outside of the Hort Innovation Olive Fund and, in most instances, did not involve the industry levy.

Strategic Investment Plan (SIP) alignment

Investments specific to the Olive Fund are guided by the olive Strategic Investment Plan (SIP). The SIP features priority outcome areas that have been identified and agreed upon by the industry, and Hort Innovation works to invest in R&D initiatives that are aligned to these.

Project expenditure in the Olive Fund during 2020/21 was aligned to the SIP, with each project allocated to a SIP outcome based on its primary objective:



Outcome 1: Supply - improved on-farm productivity, sustainability and product quality saw investment of \$154,320 on seven projects, including:

- An integrated pest and disease management extension program for the olive industry (OL17001)
- Extending OliveCare® to foster excellence in production of Australian olives (OL17006)
- Olive industry minor use program (OL16000)
- International Olive Council Committee (OL15002)
- Improving preparedness of the Australian horticultural sector to

Olive Fund snapshot 2020/21


\$392,322
 invested in R&D


12
 active R&D investments


\$130,809
 in levies collected
 by the Government and passed on to
 Hort Innovation for investment

the threat potentially posed by *Xylella fastidiosa* (MT17006)

- Generation of data for pesticide applications in horticulture crops 2019/20 (MT18018)
- Strategic Agrichemical Review Process (SARP) Updates (MT19008)

Outcome 2: Demand - Increased demand for Australian olive products within Australia and in key overseas markets saw investment of \$124,000 on two projects:

- Horticulture trade data (MT19005)
- Educating health professionals about Australian olive products (OL19001)

Outcome 3: Capacity - Greater skills, capacity and knowledge in the industry saw investment of \$110,00 in one project:

- Australian olive industry communications and extension program (OL18000)

Other content

The report also includes the 2020/21 Financial operating statement, a list of new and current chemical minor use permits for olives, and a case study focusing on the approach, use and impact of The Australian Olive Industry Code of Practice (OliveCare®) program.

Future investment

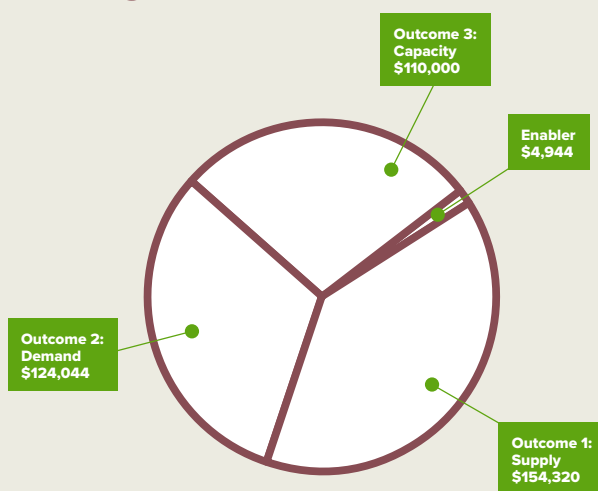
The report lists the four productivity and profitability outcome areas identified in the olive SIP for future investment as:

- industry supply, productivity and sustainability

Current Olive Fund investment activity

Currently underway:	2+ R&D investments
Ready to use:	10+ resources and reports
Levy collected in 2020/21:	\$130,809
Invested in R&D in 2020/21:	\$392,322
Potential impact of industry SIP:	\$25 million

Here's what your fund invested in over the year



- demand creation
- extension and capacity
- business insights.

The focus for the next five years will be detailed in the olive Strategic Investment Plan 2022/2026, and the olive Annual Investment Plan (AIP) 2021/22 will detail how levy funds will be spent over the 12-month period.

Both documents are currently being finalised. We'll let you know when they're released, and they'll be available to view on the Olive Fund Management page.

Want more detail, or resources?

The full Olive Fund Annual Report for 2020/21 is available to download from the Hort Innovation website, along with the previous annual reports for the 2017/18, 2018/19 and 2019/20 financial years. Go to www.horticulture.com.au and search for 'Fund Annual Reports'.

And if you want to know more about the Olive Fund, there's an overview of how it works and how it's managed in the *Growers* section of the Hort Innovation website: navigate to the *Olive Fund* page and you'll find the *Fund Management* dropdown in the top menu.

You can also access research reports, publications, fact sheets and more relating to *Olive Fund* R&D activity from the *Olive Fund* page: just look for the *Research reports and more* dropdown.

