# MushroomLink

WINTER 2022 ISSUE 1

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2022 CONFERENCE

# AMGA®

Australian Mushroom Growers' Assoc.

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# Highlights






Communications Manager
**Hort Innovation**
Level 7, 141 Walker Street
North Sydney NSW 2060
Australia

Email: communications@horticulture.com.au
Phone: 02 8295 2300



**TECHNICAL CONTENT**

Dr Jenny Ekman
jenny.ekman@ahr.com.au

**EDITOR**

Paulette Baumgartl
paulette.baumgartl@ahr.com.au

**PROJECT COORDINATOR**

Ryan Hall
ryan.hall@ahr.com.au

**DESIGN**

Jihee Park
hello@jiheeparkcreative.com





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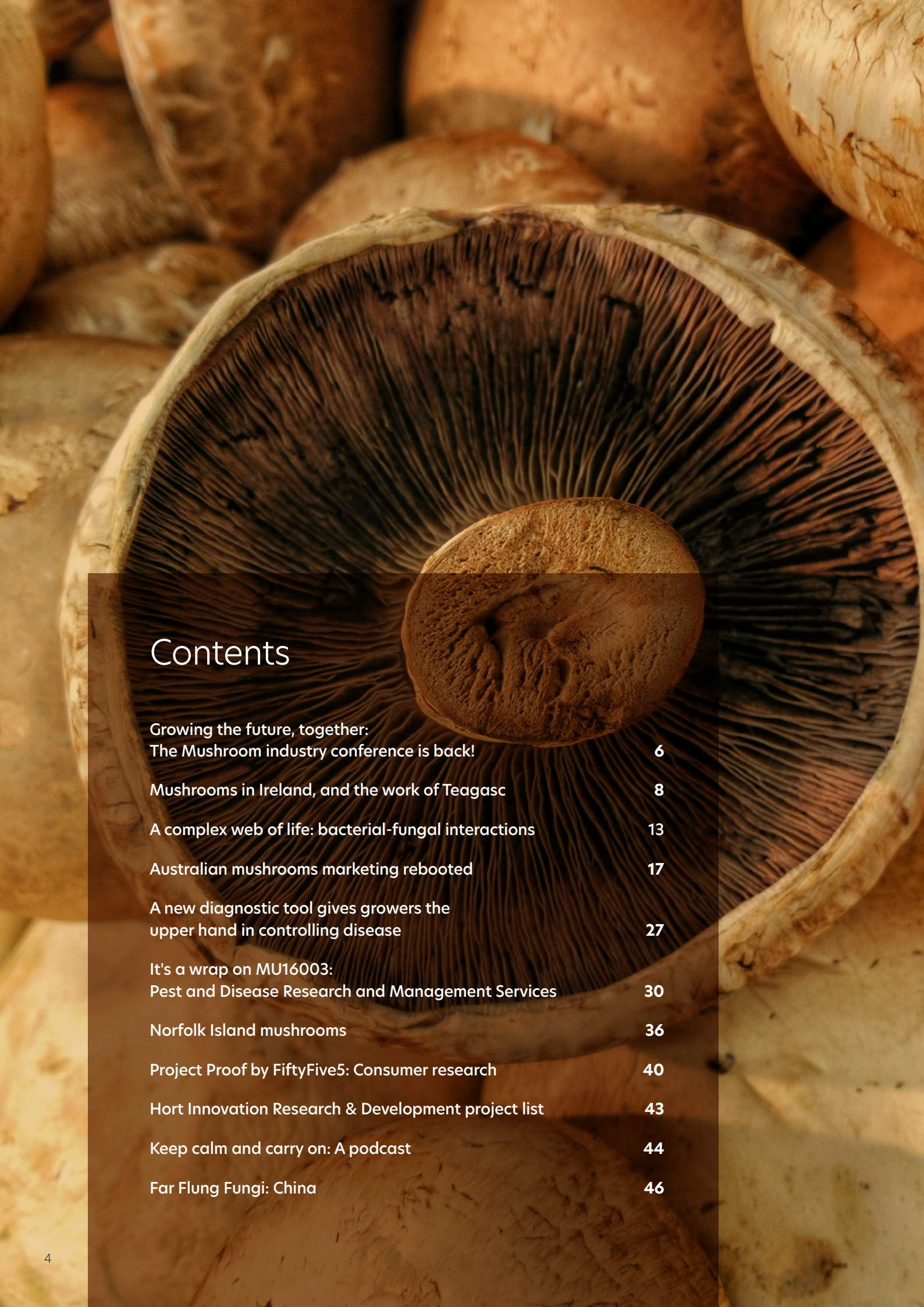

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# WELCOME TO THE FIRST EDITION OF **MUSHROOM LINK MAGAZINE**

The new-look quarterly magazine is an important part of the Australian mushroom industry communications program, supported by the Hort Innovation Mushroom Fund and the Australian Government.

In each issue we will explore the latest in research developments, look at what's happening beyond our shores, and bring you updates on services and issues that are important to our Australian growers.

Our first issue takes readers from the growing rooms of Norfolk Island to research developments on the Emerald Isle. In this issue's *Far Flung Fungi* column, we visit China and showcase the extraordinary numbers of the mushroom industry in the world's most populous country.

We also present the final report of the pest and disease project, with some of the most important tips and tricks for growers summarised in one spot. And although we all know that mushrooms are good for *our* nutrition, have you ever wondered how they nourish themselves? A University of Sydney honours student has explored the fascinating interactions of bacteria and fungi that work to nourish a growing mushroom.

To help growers with their food safety testing, we have also included a MushroomLink pull-out poster. With a step-by-step guide, preparing samples for food safety testing has never been easier.

We hope you enjoy our first issue. We look forward to working with all members of the mushroom supply chain, delivering information the industry wants, the way industry wants it.


**Jenny Ekman**
jenny.ekman@ahr.com.au

**Paulette Baumgartl**
paulette.baumgartl@ahr.com.au

**Ryan Hall**
ryan.hall@ahr.com.au


# GROWING THE FUTURE, TOGETHER

## Following a four-year enforced hiatus, the Mushroom Industry conference is back, bigger than ever from 26-28 October 2022, in Adelaide.

This highly anticipated meeting will facilitate the exchange of ideas among the Australian and international mushroom growing community.

The 2022 event marks the 44th conference managed by the Australian Mushroom Growers Association (AMGA). The highly respected event is part of the industry's history and typically attracts a large delegation of growers, suppliers, consultants, researchers, and other key industry stakeholders. It is anticipated that at least 75% of Australian mushroom growers will attend the 2022 conference.

The conference provides an excellent forum to share the latest developments in mushroom production, sustainability, health benefits, consumer marketing and more with growers, thereby contributing to a stronger, more resilient Australian mushroom industry.

The organising committee has put together a fantastic program with farm tours, international guest speakers, Australian research providers, an exhibition, and two exciting networking events.

Presentations span a cross-section of topics, including Hort Innovation marketing, health and nutrition, production, pest and disease management, and food safety. The mushroom industry conference will facilitate:

- Increased awareness of Hort Innovation's Mushroom Fund R&D investments and related programs by the Australian mushroom industry, as well as greater understanding of the levy system and Hort Innovation membership.
- Knowledge transfer to the mushroom industry value chain on research findings, best practice, emerging risks and opportunities
- Increased on farm adoption of Mushroom Fund R&D to build a stronger, more resilient Australian mushroom industry.
- Enhanced communication and sharing of knowledge and information on technical developments in the mushroom industry, from both Australian and international organisations.

## International Guest Speakers:

- Dr Ralph Noble – Microbiotech – United Kingdom – Alternatives to Casing
- Ger Hendrix – Sylvan – Netherlands - Compost
- Folkert Moll – BVB – Netherlands – Peat
- Brigitte Hendrix – Mushroom Harvesting Consultancy – Netherlands – Harvesting
- Jack Lemmen – GTL – Netherlands – Robotics
- Roland van Doremaele – Christiaens – Netherlands – Robotics
- Anne-Marie Artz – The AgriChain Centre – New Zealand – Sustainability
- Jorge Calvo – Sylvan, Spain – Exotic Mushrooms

## Hort Innovation RD&E and Marketing stakeholders

On day three of the conference, Hort Innovation's Brett Fifield (CEO) and Anthony Kachenko (General Manager, Stakeholder Experience) will provide an overview of mushroom research, development and extension, giving growers an opportunity to discuss how they can adopt these findings on farm.

Also attending are Jane Smith and Kylie Hudson (joint Heads of Marketing) and Emma Day (Australian Mushrooms Marketing Manager) to inform industry of the positive changes in mushroom marketing.

Speakers representing levy-funded R&D projects will discuss new research, technology and techniques. These will include:

- Delivering evidence-based messages and tools on the nutritional benefits of mushrooms to Australian health professionals
- New research at the Marsh Lawson Mushroom Research unit at The University of Sydney
- Outcomes from the long-running pest and diseases program
- A research update on the relationship between compost quality, microorganisms and mushroom nutrient uptake
- An overview of the Australian mushroom communication and extension project

## Hort Innovation Speakers:

- Brett Fifield – CEO Hort Innovation
- Mark Spees – Industry Strategic Partner
- Jane Smith and Kylie Hudson – Heads of Marketing
- Emma Day – Australian Mushrooms Marketing Manager

## Mushroom Fund Levy Researchers:

- Dr. Flavia Fayet-Moore - Nutrition Research Australia
- Dr. Jenny Ekman – Applied Horticultural Research
- Judy Allan and Dr. Warwik Gill - University of Tasmania
- Dr. Michael Kertesz – The University of Sydney

**Speakers are correct at time of printing and are subject to change*

**Good to know**

- **Early bird tickets are on sale now, until 15 August 2022**
- Purchase tickets online at www.amgaconference.com.au
- AMGA Members receive discounted conference tickets
- Limited accommodation is available at the Crowne Plaza at a discounted rate. Visit the conference website for more information.
- Sponsorship and exhibition packages are still available. If you would like to receive a sponsorship proposal, please contact Leah Bramich, AMGA General and Relationship Manager on 0450 504 675 or leah.bramich@amga.asn.au

The AMGA Conference is partially funded by Hort Innovation using the mushroom research and development levy and funds from the Australian Government.

**THE AMGA ORGANISING COMMITTEE**

Nick Femia, AMGA Conference Chair (*SA Mushrooms),* Dr. Geoff Martin (*Dr Mush Advisory*), Michael and Carmine Callisto (*Global Axis Import Solutions*), Brian Backhouse (*Costa*), Leah Bramich (*AMGA*)

# MUSHROOMS IN IRELAND, AND THE WORK OF TEAGASC

**By Dr Jenny Ekman**

**When people think of horticulture in Ireland, they probably think potatoes. However, the largest horticulture sector in Ireland is actually mushrooms. With 40 farms employing more than 3,500 people and a farm gate value over €120 million, mushrooms are a major industry on the Emerald Isle, a country with a population of only 5 million.**

Yet despite gradual growth, the position of the mushroom industry is increasingly under threat. Labour shortages, complications due to Brexit (80% of production is exported to the UK), changes to local regulations, reduced funding for R&D and growing focus on environmental sustainability including carbon footprinting have increased challenges to mushroom growers.


**Figure 1.** Irish mushrooms on retail display in Dublin. Prices are equivalent to A$4.90/kg (white) and A$5.04/kg (brown) respectively. Note the use of perforations in the plastic film to prevent condensation. Photo by Georgia Thomas.

Like Australia, the last few years has seen consolidation of the industry. Small farms have closed or been taken over, while larger operations continued to expand. The average farm size is now 12 grow rooms using 100 tonnes of substrate weekly. This is considered the minimum commercially viable farm size for white mushrooms, although brown mushroom growers can operate at half that size.

All are shelf farms as blocks and bags are no longer produced by composters.

During a recent trip to Ireland, I was lucky enough to spend a day with Dr Helen Grogan at the Teagasc Ashtown Research Centre, as well as meeting the "Beyond Peat" research team.

## Teagasc and Dr Helen Grogan, leaders in mushroom R&D

Teagasc – pronounced "Chaggass", meaning "to teach or teaching" in Gaelic – is the Irish Agriculture and Food Development Authority. They do everything from research and advisory services to providing Agricultural education at degree and certificate level.


**Figure 2.** Dr Helen Grogan with the author, outside the mushroom research unit.


**Figure 3.** Irish mushrooms audited to the Bord Bia quality assurance certification scheme.

They work closely with Bord Bia (The Irish Food Board), which has an audited quality assurance scheme relating to both farming practices and food safety for local products (Figure 3).

Teagasc has been a leader in mushroom research and technology for many years. They run a multi-room mushroom unit at their site just outside Dublin (Figure 4), and provide advisory and training services for the local industry.

The research unit has facilitated much of Dr Helen Grogan's seminal work on mushroom diseases. Helen Grogan will be familiar to many in the Australian industry, having visited here several times and collaborated on a range of pest and disease projects.

A mycologist by trade, Helen has conducted extensive trials on every grower's nightmare – *Trichoderma aggressivum*. In fact, Helen still holds the record for the most webinar registrations (87!) when she presented on this issue for the Australian industry.

## Defying the virus

We all certainly know a lot more about viruses now! Much of Dr Grogan's recent work has been focussed on managing these difficult organisms. Surprisingly, large numbers of different viruses are found in mushrooms. For example, research published in 2017[1] found 18 distinct viruses in *Agaricus bisporus* alone.

As viruses are carried within the mushroom mycelium, they can be transmitted in fragments of compost produced during crop filling or emptying. All compost

**Figure 4.** Inside the Teagasc mushroom research unit.

fragments must therefore be erradicted. The only control method is hygiene, particularly thorough cookout of compost as well as removal of all compost fragments on conveyors and surfaces by washing and disinfection.

Most viruses cause no symptoms. However, a few can have serious impacts on quality and yield. For example, the La France virus, first identified in 1962, can cause gradual loss of vigour and the appearance of bare patches. These are surrounded by mushrooms with brown and elongated stipes, small caps and waterlogged tissues.

Currently, the most important virus worldwide is AbV16 – one of the mushroom virus X (MVX) complex. In Ireland, MVX-AbV16 mainly causes brown or off-white mushroom caps. Although MVX viruses were recently identified in Australia, they do not appear to be causing major yield losses – yet.

Dr Grogan was previously involved in developing a rapid RT-PCR test for presence of MVX, as well as examining the effects on yield and quality[2]. According to Dr Grogan "Low rates of virus had little or no effect on yield. However, when there was a large amount of virus introduced at spawning, yield could be reduced by up to two thirds. Interestingly, in these trials, the effects on browning were most obvious for the first flush, being much less pronounced by the second." Unfortunately, lack of funding has now ended research in this important area.

In contrast, the Australian mushroom industry SIAP recently supported a recommendation for a funded PhD in mushroom virology specifically focussed on strains of Virus X. While the student would be based in Australia, it provides an opportunity for Dr Grogan to co-supervise, lending her expertise to building technical capacity in Australia. "I would be really pleased to be involved in a project of this kind," Helen says, "I'm looking forward to coming out to Australia in the near future, and this would potentially give me an opportunity to work with a new student on this challenging, but fascinating, topic."

## Biological control of Bubble

One project in progress at Teagasc is comparing *Bacillus* based products with chemical control products like prochloraz for control of dry bubble disease. "The Bacillus struggles to control the disease if there is a heavy inoculum load, which is used to test chemical products," comments Helen. "However, we are investigating if they are more effective under lower disease pressure, which is probably more representative of the situation on mushroom farms.

"Biological control may be more effective if a number of products are combined, an aspect we are interested in working on. We are also interested in demonstrating just how effective the technique of 'salting' is at controlling the spread of disease. When done well, it can dramatically reduce disease levels".

## Turning lignin into mushroom lunch

"One fascinating project we are working on is characterising the efficiency of lignin degradation by different *Agaricus bisporus* isolates. The aim is to find genes involved in the lignocellulose degradation pathway that are more or less effective in breaking down the substrate. This will shed light on the process and potentially identify factors that influence how *Agaricus* can access more of the nutrients available in the substrate."


**Figure 5.** Dr Helen Grogan checks progress of a trial examining efficiency of lignin degradation by different *Agaricus* isolates

**Figure 6.** Gathering data on the forces required to harvest a mushroom (top) and prototype of a soft gripper for harvesting mushrooms robotically (bottom). *- Photos by H. Grogan*

The team is generating variants, growing them through the compost, then examining yield, substrate use, enzyme activity and gene expression. "Finding mushrooms that can degrade lignin more efficiently could potentially increase yield. At least, that is the long-term objective," explains Helen.

## Robotic pickers

Finally, crops are in place to test a new robotic harvesting process. This is part of an EU-funded project 'SoftGrip' with six partners spread across the European Union. As both the cost and availability of labour is an issue – as it is here – the push is on to find better ways to automate mushroom production as well.

It is still early days, but the focus of the team is to develop a 3-pronged soft gripper using new, flexible materials. To test the machine, the mushrooms are being grown in 1 $m^2$ containers that fit the full width of the shelving, replicating commercial practice as closely as possible.

## Beyond Peat

But the biggest mushroom related project underway at Teagasc is 'Beyond Peat', a five year project funded by the Irish Department of Agriculture, Food and the Marine (DAFM). Commercial harvesting of peat has been banned in Ireland since 2019. Although arguments are being formulated to facilitate a gradual transition away from peat use for horticulture, casing producers must seek out peat alternatives.

If suitable alternatives can be identified, peat will be phased out of all horticultural use by 2030. However, new regulations mean that all peat use will end by 2035 regardless – a deadline which is driving the concerted effort to find alternatives.

Of course, peat is not just used for mushroom casing. In fact, only 4% of Irish peat was used in horticulture, with the vast majority burned as fuel*. Peat is also used as a substrate for growing soft fruit and ornamentals, and within potting mixes.

According to project leader Dr Michael Gaffney "The key to finding a replacement for peat as casing is identifying a consistent supply of sustainable materials, and standardising the production method."

"We would prefer to use products that don't have other uses. For example, wood chips and forestry waste have potential, but are also used to generate energy, potentially making supply problematic. On the other hand, bi-products of industrial processes, such as biochar**, could work. However, the characteristics of biochar vary according to the feedstock used, so we really need to understand the critical factors that will give it the characteristics we need."

Other options include spent rockwool, hydrochar (produced from pig slurry) and even mixtures of plastics and organics. Coconut coir is not being considered, as it must be transported half-way around the world, making it less attractive as a sustainable alternative.

"Once we have identified some promising materials, we are aiming to conduct up to 15 commercial trials across a range of crops," comments Michael. "The aim is to have replacements for various purposes close to commercial production by 2025."

**Figure 7.** Initial casing trials at the Teagasc research facility

Between reduced or closed supply of peat from some countries, shipping disruptions, and now changes to inspection which slow entry processes, Australia could find itself with a similar problem with regards peat.

One of the ten new projects recently supported for funding by the SIAP through the mushroom industry levy (see mushroomlink.com.au – News) focusses on exactly this issue; developing a sustainable transition to alternate casing materials.

If approved, collaborating with our Irish colleagues would have many benefits. Even if we use different raw materials, using similar methods for assessing material characteristics, and finding the right combination, could lead to a peat replacement – or partial replacement – a lot faster. Essentially, a whole that is greater than the sum of its parts.

And I for one am happy to re-visit Ireland anytime!

* The cost of energy in Ireland has nearly doubled due to the war in Ukraine, and there are now calls for the ban on peat extraction to be at least temporarily removed.

** Biochar is produced through pyrolysis: slow burning of organic material in the absence of oxygen.

[1] Deakin G., et al. 2017. Multiple viral infections in Agaricus bisporus – Characterisation of 18 unique RNA viruses and 8 ORFans identified by deep sequencing. Scientific Reports. 7:2469.

[2] Fleming-Archibald C, Ruggiero A, Grogan HM. 2015. Brown mushroom symptom expression following infection of an Agaricus bisporus crop with MVX associated dsRNAs. Fungal Biology. 199:1237-1245.

# A COMPLEX WEB OF LIFE: BACTERIAL-FUNGAL INTERACTIONS

**In his book Entangled Life, Merlin Sheldrake imagines the soil as a "horizonless external gut - digestion and salvage everywhere, with flocks of bacteria surfing waves of electrical charge... like the Wild West with all those bandits, brigands, loners, crap shooters... and the seething intimate contact on all sides by fungal hyphae."**

Getting up close and personal to the community of biota within compost reveals a hustle and bustle that could rival Tokyo central station at peak hour. Mushroom compost thrums with life and activity.

The fermented and pasteurised substrates that support mushrooms are home to countless microorganisms, interacting with each other in a series of physiological and biochemical reactions to create ideal growing conditions for the *Agaricus* mycelia.

Understanding these bacterial interactions in mushroom compost will likely underpin future developments in the industry as it searches for more sustainable sources of substrates.

University of Sydney honours student Shivagami Shamugam has been investigating the status of current research, and opportunities to exploit bacterial interactions, as part of a levy-supported research project with Dr Michael Kertesz. Her review has been accepted (with minor changes) for publication in the Journal of Applied Microbiology - a significant achievement for an honours student. The following attempts to summarise this review.

## Bacterial succession planning

Optimising the composting process is a key challenge for the Australian mushroom industry. Microbiological research helps us understand bacterial interactions, the role of bacteria at each phase of composting, and bacterial responses to different materials.

Much like forested landscapes recovering after a bushfire, there is bacterial and fungal species succession that occurs within mushroom substrates as compost develops and the conditions change (Figure 1).


**Figure 1.** University of Sydney honours student Shivagami Shamugam has been studying bacterial - fungal interactions

Regular readers of the *Australian Mushroom Journal* would have seen Professor Micahel Kertesz' previous results demonstrating how populations of different microbial species change during maturation of Australian compost. For example, this research has identified over 30,000 different microbes at the end of Phase 1, all interacting with each other, the mushroom mycelia, and other fungi.

The processes in Phase I composting are biochemically complex, but relatively well understood. As compost temperature rises, heat-loving bacteria are favoured, resulting in high populations of *Firmicutes*, *Proteobacteria*, and other species.

During Phase II, temperatures transition from 58-60°C, to 48-51°C and finally around 25°C before introduction of mushroom spawn. This is when the heat-loving fungus *Mycothermus thermophilus* (previously *Scytalidium thermophilum*), comes into its own, combining with several bacterial species to break down cellulose and hemicellulose in the compost and absorb the excess ammonia otherwise toxic to *Agaricus* mycelium.

By the end of Phase III, *Agaricus* is the dominant species, having absorbed most of the *M. thermophilus*, as well as its bacterial companions.

## Nomad Pseudomonads

As *Agaricus* continues to develop, various bacteria attach to the growing mycelia. Perhaps most important are the 'good' bacteria *Pseudomonas putida* – which helps initiate mushroom formation – and the 'bad' bacteria *Pseudomonas tolaasii* – cause of brown blotch.

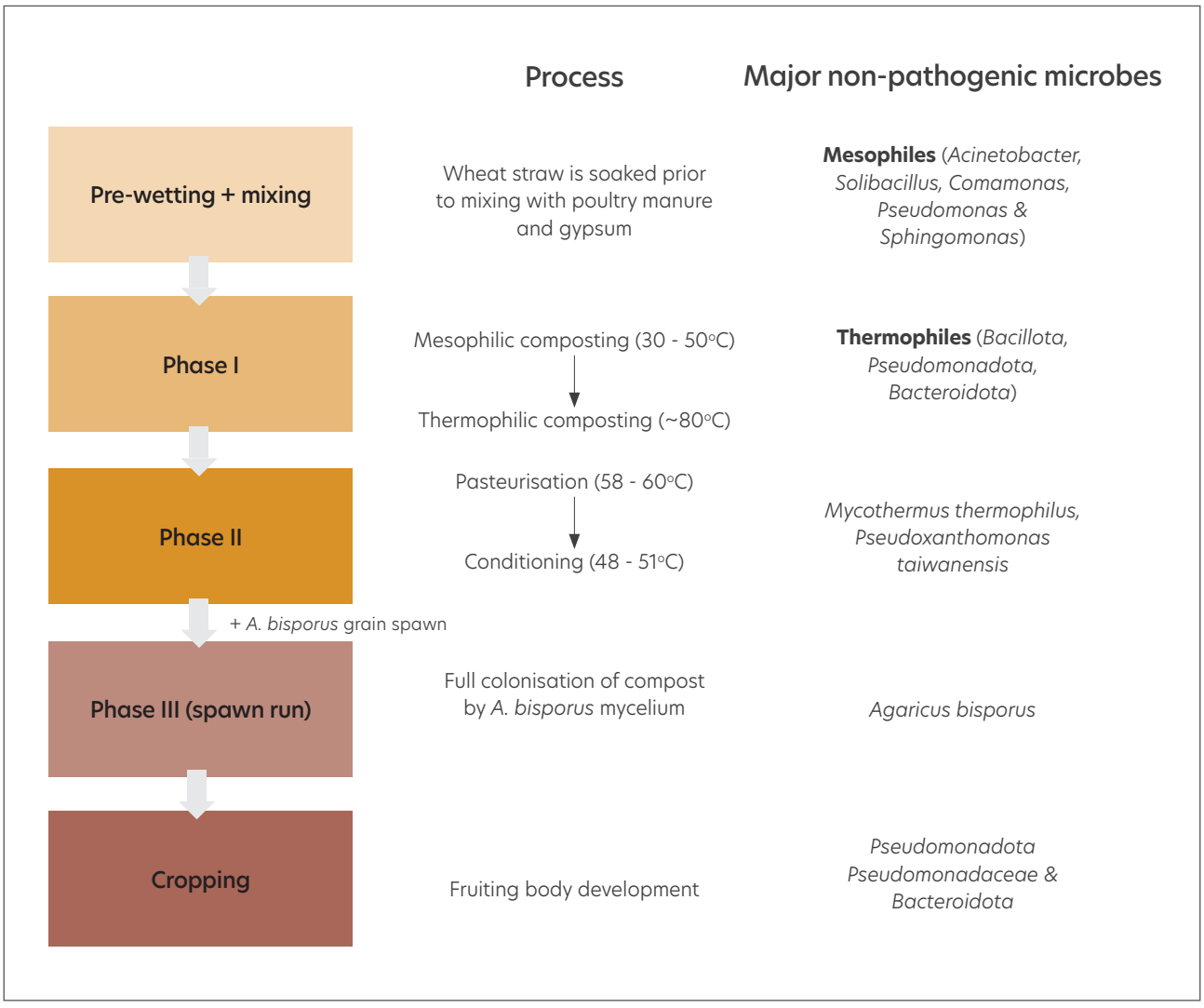



**Figure 1.** Shamugam and Kertesz

Nutrient-poor conditions, such as occur in the casing, stimulate *Pseudomonas putida* to respond more quickly to attractants produced by the *Agaricus* mycelia. There it 'feeds' on ethylene as well as various 8-carbon compounds (VOCs), particularly the inhibitor 1-octen-3-ol. Removing these 'blockers' is what allows the mycelia to pin and form mushrooms.

Many strains of *P. putida* also secrete organic acids, increasing availability of microelements for *Agaricus*. Some also secrete cellulase; although *Agaricus* can degrade celluloses itself, it seems possible that this makes it easier for the hyphae to absorb carbon from these materials.

However, the situation is clearly complex, as *P. putida* cannot **always** be detected in either compost or casing, and inoculating additional *P. putida* has not been demonstrated to increase yield. Nevertheless, identifying *P. putida* strains which respond more quickly to nutrient gradients and VOCs could potentially increase the efficiency of this bacteria's important effects.

## Bacteria, nutrient uptake, and the promotion of growth

How fungi take up nutrients and use bacteria as a nutrient source is as complex as it is ingenious. Mushrooms are opportunists, developing a number of mechanisms to take advantage of the carbon and nitrogen available in their vast bacterial pantry.

Three such interactions are illustrated in Figure 2.

**System A**, known as bacteriolytic enzyme activity, works a little like our own digestion, in that the mycelia produce and releases enzymes (key enzymes are muramidase and NAG) to break down bacteria in the compost into components that are readily absorbed by the fungal hyphae.

In **System B**, simple sugars and other compounds produced by the mycelia attract bacteria to the environment around the mushroom mycelium, where they attach directly onto the hyphal surface. Some may then be broken down as food, whereas others (e.g. *P. putida*) provide benefits such as absorbing VOCs.

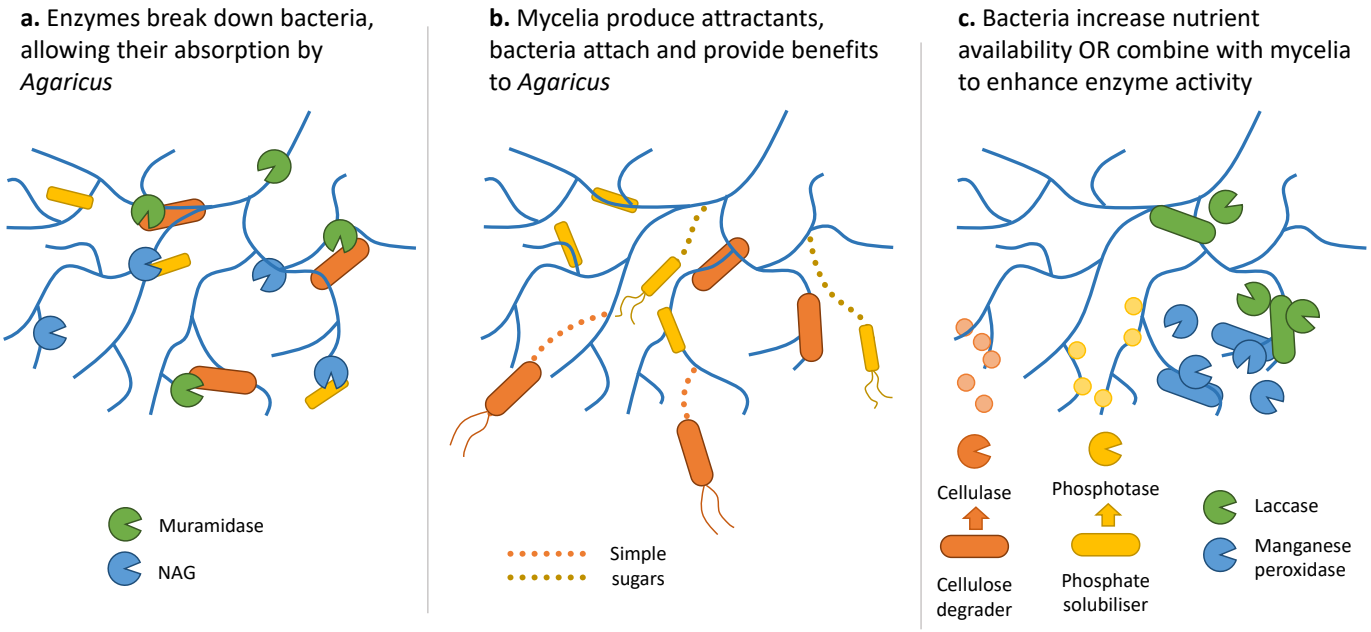



**Figure 2.** Three systems of interaction between bacteria and Agaricus mycelium. A. Bacteriolytic enzyme production (muramidase and NAG) breaks down bacteria into forms that can be absorbed directly B. Bacteria are attracted by hyphal exudates and attach, where they may provide benefits such as breakdown of ethylene and C8 compounds C. Bacteria produce enzymes that break down cellulose or phosphates into forms readily absorbed by the mycelia OR combine with the mycelia to enhance enzyme activity, increasing absorption from the substrate.

In **System C**, bacteria work for the mushroom! Bacteria release enzymes such as cellulase and phosphatase, which break down nutrients in the substrate (cellolose, hemicellulose, phosphate) into forms readily absorbed by the hyphae. Alternatively, attached bacteria combine with the mushroom mycelia, enhancing production of enzymes such as manganese peroxidase and laccase, thereby improving uptake from the substrate.

For those looking for further reading, a review that includes the role of bacteria in compost production is available on the MushroomLink website https://www.mushroomlink.com.au/resources-1/review-pre-and-postharvest-management-of-mushrooms.

Deep dive: Like Dr Michael Mosley selecting from a buffet, mushrooms release different enzymes to break down bacteria according to need.

- Researchers believe that *Agaricus bisporus* can sense differences in substrate and secrete different concentrations of extracellular enzymes to balance its carbon and nitrogen requirements
- Bacterial biomass represents a major nutrient source for mycelial growth of *Agaricus*
- *A. bisporus* can degrade both living and dead bacteria cells by secreting enzymes that degrade the bacterial cell walls, releasing essential nutrients. This may be why *A. bisporus* can outcompete other fungi, which rely on the availability of free nutrients within the compost
- Carbon and nitrogen can be absorbed very efficiently from bacteria by the Agaricus mycelium due to two key enzymes: β-N-acetylmuramidase (muramidase) and *N*-acetyl-β-D-glucosaminidase (NAG)
- The presence of bacteria stimulates production of muramidase, especially if carbon sources such as glucose and fructose are not available
- Modifying the substrate to increase the biomass of bacteria readily degraded by *Agaricus* could potentially increase growth, especially during spawn run
- However, interactions in compost are complex, and the mechanisms by which *A. bisporus* breaks down some bacterial taxa more than others are uncertain

Bacterial interactions with the mycelium of the cultivated edible mushrooms Agaricus bisporus and Pleurotus ostreatus. Shivagami Shamugam and Michael A. Kertesz*The University of Sydney, School of Life and Environmental Sciences, Faculty of Science, Sydney, NSW 2006, Australia

Pre and post harvest management of mushrooms Jenny Ekman, Applied Horticultural Research.

Hort Innovation Strategic levy investment | MUSHROOM FUND

This project has been funded by Hort Innovation using the mushroom research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

# AUSTRALIAN MUSHROOMS MARKETING REBOOTED

**The marketing team at Hort Innovation has developed a new approach to the Marketing Planning Process through close collaboration with industry. This fresh approach for the FY23, presented in September 2021 by Hort Innovation General Managers of Marketing Jane Smith and Kylie Hudson, laid out a commitment to foster better working relationships with growers and peak industry bodies.**

A shift to a taking a collaborative approach to co-designing marketing strategies, as well as diagnosing current market challenges, will deliver better communication, better consultation, and more transparency for industry marketing levy funds.

The AMGA, along with other peak industry bodies, were asked to identify three to four industry representatives to form a marketing co-design advisory panel.

**The Mushroom Marketing Advisory Panel for the Australian Mushroom industry is:**

- Leah Bramich — AMGA General & Relationship Manager
- Elisa Siliato — Costa Group (Mushroom category Marketing Manager)
- Tim Archibald — White Prince CEO
- Georgia Beattie — Bulla Park CEO
- Kyle Davies — Marland Mushrooms General Manager

The first and most important step towards marketing co-design was the decision for Hort Innovation and the newly formed mushroom marketing advisory panel to subscribe to one evidence-based marketing approach, which would underpin the industry strategic marketing plan moving forward. To do this, joint marketing training was identified as a key pillar to achieve effective co-design.

## Ehrenberg Bass Institute - Laws of Growth Marketing Training

In May this year, the entire marketing department at Hort Innovation and the newly formed industry Marketing Advisory Panel embarked on joint marketing training with the world-renowned Ehrenberg Bass Institute, an independent not-for-profit marketing research institute at the University of South Australia.

The purpose of the training was to align Hort Innovation and the industry panel members to a common understanding of the principles and practices of Ehrenberg Bass. These principles will be used during future collaborative planning sessions.

**Mushroom Marketing Collaborative Planning Workshops with Hort Innovation and the Marketing Advisory Panel were held in Sydney on the 2 - 3 August 2022.**

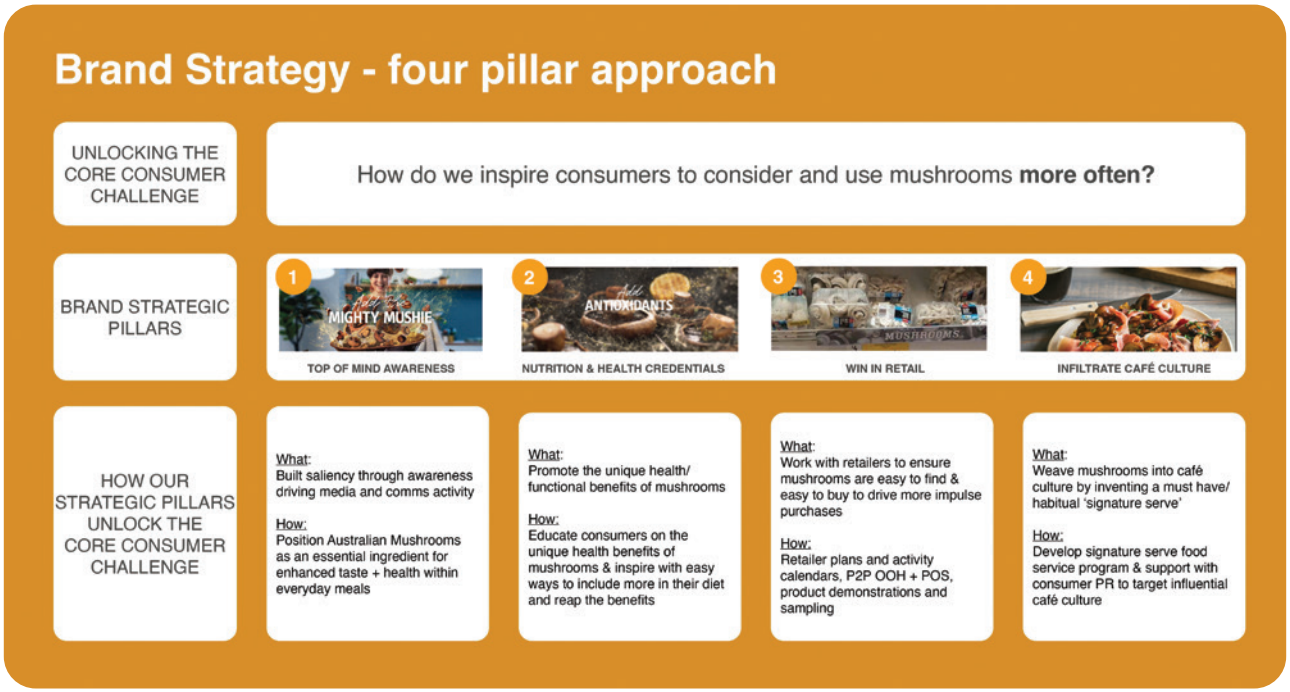
The workshops will culminate in the development of Annual Investment Plans that are built from robust diagnosis, contain actions that clearly link to demand creation and facilitate transparent measurement and evaluation of actions and impact.

**Look for further updates on the FY23-26 co-designed marketing plan in the next edition of Mushroom Link.**

### About Ehrenberg Bass

The Ehrenberg Bass Institute is an independent not-for-profit research institute at the University of South Australia, uniquely focused on discovering and disseminating robust evidence about how brands grow and how marketing interventions work. It is the world's largest centre for research into marketing with a team of 60+ marketing scientists dedicated to advancing marketing knowledge and identifying growth levers that can be readily applied to any product or category, thereby reducing risk and improving results (returns). The institute's expertise and capability has been recognised by the world's leading marketing organisations. Their client base is global and diverse, including packaged goods companies, financial institutions, food and beverage, tourism organisations, media companies, government, and non-profit organisations.

# Four-pillar approach to encourage mushroom consumption




Through leveraging current diet trends, there are ample opportunities for mushrooms in the vegan, vegetarian, flexitarian, meat-reducing, plant-forward, superfood and sustainability spaces.

Riding on new consumer data that Australian eating habits post-COVID are leaning towards more home cooking, consuming less meat and a greater focus on nutrition, the FY22 brand strategy is focused on pitching mushrooms as an everyday, for everyone, essential ingredient.

The core challenge for the FY22 plan: **How do we inspire consumers to consider and use mushrooms more often?**

Guiding the brand strategy for Australian Mushrooms is a four-pillar approach:

## Top of mind awareness

Increasing the prominence of mushrooms through media and communication activities ensures top of mind awareness for consumers. In practice, this means positioning Australian mushrooms as an essential ingredient in everyday meals to improve taste and nutrition.

Top of mind awareness (or 'saliency' in marketing terms) is achieved through consistent frequency of message across multiple media channels. The current Australian Mushrooms brand strategy uses a mix of social media


and traditional media, such as (catch-up) TV, broadcast radio and Out of Home (OoH) billboard ads.

The top of mind strategy also uses PR executions, such as the highly successful campaign with celebrity Chef Adam Liaw appearing on Weekend Sunrise from the 'Mushroom Meatery', which achieved substantial reach both via TV audiences and other online media who picked up the story, resulting in an audience reach of over 49.2m across multiple news outlets.

Below the line promotional type activities can also be used for products to stay top of mind. In FY22, the levy funded, AMGA-run *Grassroots Product Demonstrations and Events Program* was activated in both metro and regional areas, to create 'hyper local' product demonstration events that build lasting connections with consumers. You can read more about this program on page 22 .

## Nutrition and Health Credentials

Promoting the nutrition and unique health benefits of mushrooms through education and inspiring consumers to incorporate mushrooms in home cooking forms pillar two. The consumer claims research run by Fiftyfive5 (outlined on page 40) is a great example of this initiative in action. Consumers were asked to rank a variety of mushroom health claims against criteria of appeal, credibility and uniqueness.

A new fact sheet about the health benefits of the nutrients found in mushrooms is now available. From immune system health to glowing skin, the ready-to-use statements are a more consumer-friendly version of permitted nutrition and health claims under the Australia New Zealand Food Standards Code.

A second fact sheet explains how growers can use this information to make health claims on packaging. This includes a 'NIP' (Nutrition information panel) that may be used for mushrooms.

Both of these resources can be accessed on the MushroomLink website (mushroomlink.com.au). Look for "Factsheets" under the RESOURCES tab.



## Winning in Retail

The basis of pillar three is to increase the visibility of mushrooms in retail settings, capitalising on impulse buying. Winning in Retail aims to inspire shoppers to purchase mushrooms via in-store promotion.

This includes retailer in-store advertising, online shopping advertising and out of home (OoH) advertising panels on the path to purchase - close to, or inside of, retail stores.

Impulse buying can also be achieved with in-store sampling. Australian Mushrooms have a nationwide retail sampling activation scheduled for late August to the end of October 2022. This was scheduled for delivery in late FY22, however was delayed at the industry's request due to current supply issues.

## Infiltrating Café Culture

Weaving mushrooms into café culture, and Australia's beloved brunch, is an exciting project and the fourth pillar of the brand strategy. Mushrooms are in a position to follow in the wake of smashed avocado on toast and become a must-have menu item. The AMGA-run #MyMushroomToast project is designed to infiltrate café culture with a food service program developed to promote mushrooms on toast as an alternative to the avo on toast café phenomenon. The program was to be executed in FY22, however it has been put on hold until late August due to industry supply issues. You can read more about this program on page 25 .

This FY22 brand strategy has been extended into September this year, to allow time for the Marketing co-design between Hort Innovation and the newly formed Mushroom Marketing Advisory Panel. **Look for further updates on the FY23-26 co-designed marketing plan in the next edition of Mushroom Link.**

# Grassroots Product Sampling and Events

**By Leah Bramich, AMGA**

TO CONTINUE TO DRIVE TOP OF MIND AWARENESS, A LEVY-FUNDED, AMGA-RUN GRASSROOTS PRODUCT DEMONSTRATION AND EVENTS PROGRAM IS UNDERWAY TO SUPPORT LOCAL GROWERS BY DRIVING DEMAND WITHIN COMMUNITIES IN WHICH THEY LIVE AND WORK.


The program has developed 'hyper local' product sampling events to drive the uptake of mushrooms in both regional and metro markets, providing delicious product samples and promoting "Add the Mighty Mushie" to position mushrooms as an essential ingredient for enhanced taste and health.

The AMGA has selected Melbourne, Adelaide, Sydney, Perth and the Gold Coast for activations, along with 15 regional areas which align with grower locations. A total of 23 product sampling events are being activated around the nation.

To efficiently roll out the product demonstration and sampling events remotely, local radio stations were engaged to design their version of a 'Hyper local event' with preference given to local foodie festivals, farmers' markets, restaurants, or independent green

grocers, with mushroom samples cooked by professional chefs. In Ballarat, a former MasterChef contestant will cook 'Mushroom toasties', in Adelaide, Callum Hann (MasterChef) will cook live on stage at the Adelaide Markets, and in Perth, seaside café Odyssea will include a mushroom on toast item on their menu for the week, inviting radio listeners to try it.

Each regional event is accompanied by a live broadcast or street team event, and a hefty radio campaign to support it, with reach amplified via the station's social media channels. Taking simple product sampling to the next level, all events include both a product sampling element and mushroom giveaways, and the opportunity for mushroom growers to be personally involved in the grassroots promotion.

Metro events have been selected in premium markets with high traffic. The 3-day Melbourne event at Queen Victoria Market reported 1760 mushrooms on toast samples provided, with 2250 interactions. A huge impact!

### Local Grower Involvement

Local growers will be invited to take part in their region's event, as many have a long history of being active in their local community, active with local media and have long-standing relationships with local businesses.

In regions where there are multiple growers, AMGA will need to manage relationships carefully to ensure each grower is represented equally, and no preferences are shown.

### Managed by the AMGA, Local Growers will be invited to:

- Be interviewed on-air about the mushroom growing process
- Provide free mushrooms for product sampling and giveaways
- Provide a display, showing the mushroom growing process
- Facilitate open days/farm tours

While local growers are invited to take part, all messaging will remain with the "Australian Mushrooms" brand and all promotional efforts will link back to Australian Mushrooms channels.

Cambridge Markets - Sydney

While all activations were booked to deliver in FY22 (and some have indeed have been deployed), Hort Innovation and the AMGA made the decision to put the program on hold due to the supply shortage. The program is now booked for late July and August.

Hort Innovation Strategic levy investment | MUSHROOM FUND

This project has been funded by Hort Innovation using the mushroom research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

## REGIONAL RADIO EVENTS

| OUTPUT | DESCRIPTION |
|---|---|
| **QLD: Townsville** | Star 106.3 – 4hr street team event 0730-1130 from Willows Sunday Markets. Chef cooking elevated mushrooms on toast. Inc. Advertising schedule |
| **QLD: Toowoomba** | Hit 100.7 – Toowoomba Farmers' Market, 3hr outside broadcast. Chef cooking mushrooms on toast. Inc. Advertising schedule |
| **QLD: Sunshine Coast** | Mix FM 97.3 – Erbachers independent greengrocer (46yrs), 3hr outside broadcast 1500-1800. Chef cooking mushrooms on toast. Inc. Advertising schedule |
| **QLD: Gold Coast** | Hot Tomato – HOTA Farmers' Markets, 3hr outside broadcast 0800-1100. Chef cooking mushrooms on toast. Inc. Advertising schedule |
| **VIC: Ballarat** | 3BA – Tim Bones (Masterchef) at Ballarat Markets cooking mushroom toasties, 2hr outside broadcast 1000-1200. Inc. Advertising schedule |
| **VIC: Bendigo** | Hit 91.9 – Heathcote on Show, 3hr outside broadcast 0900-1200. Chef cooking Mushroom Bruschetta. Inc. Advertising schedule |
| **VIC: Wangaratta** | Edge FM – 4hr live broadcast 0900-1300 from Fruits n Fare independent grocer. Chef cooked mushrooms on toast Inc. Advertising schedule |
| **NSW: Albury** | Hit 104.9 – Albury Wodonga Farmers' Markets. 4hr street team with live crosses 0800-1200 – Chef from Smart Hospitality Inc. Advertising schedule |
| **NSW: Gosford** | Hit 101.3 – Terrigal Beach Markets. 2hr pop up event with live crosses. Chef to cook mushrooms on toast. Inc. Advertising schedule |
| **NSW: Newcastle** | Hit 106.9 – Newcastle Food and Flower Markets, Sandgate. 2hr outside broadcast 1000-1200 and chef. Inc. Advertising schedule |
| **ACT: Canberra** | Mix FM – 2hr roadside activation 1000-1200. Location TBC Inc. Advertising schedule |
| **NSW: Nowra** | Power 94.9 – Easts and Eats Event. 2hr pop up event, late afternoon. Chef cooking mushrooms on toast. Inc. Advertising schedule |
| **SA: Adelaide** | Nova – Callum Hann (Masterchef) 2hr cooking demonstration. Location TBC, likely the new food hall. Inc. Advertising schedule |
| **WA: Perth** | Nova – Odyssea restaurant featuring mushroom bruschetta on menu for a week. 2hr live cross event with chefs providing mushroom samples. Inc. Advertising schedule |

## METRO PRODUCT SAMPLING EVENTS

| OUTPUT | DESCRIPTION |
|---|---|
| **Adelaide** | Sampling events held at the Adelaide Central Markets for 3 consecutive Thursdays:<br>• 26 May 2022<br>• 2 June 2022<br>• 11 June 2022 |
| **Melbourne** | Sampling events held at the Queen Victoria Markets for 3 consecutive days. Each event is 9hrs.<br>• Thurs 30 June 2022<br>• Fri 1 July 2022<br>• Sat 2 July 2022 |
| **Sydney** | Two Sampling events held by Cambridge Markets events. Each event is 6hrs<br>• 12 June 2022<br>• 28 August 2022 "Christmas in July" (Postponed event) |

# Mushrooms on Toast set to Infiltrate Café Culture

**By Leah Bramich, AMGA**

AN EXCELLENT OPPORTUNITY EXISTS FOR MUSHROOMS TO LEVERAGE CURRENT VEGAN, VEGETARIAN, FLEXITARIAN, MEAT-REDUCING, PLANT-FORWARD, SUPERFOOD AND SUSTAINABILITY DIET TRENDS, AND TO BECOME THE NEXT HERO INGREDIENT ON BREAKFAST, BRUNCH, AND LUNCH CAFÉ MENUS.

It's safe to say that you can walk into any almost any café in Australia and order smashed avocado on toast. Smashed avo's rise to fame is tied to the wellness movement. This global sensation began more than two decades ago and was driven by consumer demand for less processed foods, and more fresh, healthy, and plant-forward meals; reasons which are still relevant today.

**The AMGA is leading a new Foodservice Program to "infiltrate café culture" to influence cafés to replace smashed avo on their menu - with *Mushrooms on Toast*.**

Mushrooms on Toast is similar to the smashed avo in its simplicity, while allowing cafes to get creative. It's a quick and easy meat-free menu option for diners, with great 'value add' options for cafés to increase their profit margins.

While smashed avo is served raw, mushrooms require cooking; typically in one of two ways - either sautéed or roasted.

A successful and desirable mushroom dish depends on **how well the mushrooms are cared for during the cooking processes.** Mushrooms have a high-water content, which can easily become 'mooshie' - therefore it's imperative that café kitchen staff learn how to cook the mighty mushroom properly.

A key element in the Australian Mushrooms Café Culture Foodservice program is the educational tool kit. We are on a mission to 'ban the mooshie mushie' by teaching café kitchen staff mushroom 101 – how to choose, prep, store and cook a great mushroom dish, while enticing café owners and staff to add mushrooms to menus with a huge prize incentive.

**Through this Foodservice Program, the AMGA will influence café culture by:**

- **Scope the Foodservice industry –** Food Industry Foresight has been engaged to offer detailed insight into the café sector through hard data and qualitative and quantitative industry surveys. These reports are invaluable to understanding the sector, how to educate, and how to influence menus.
- **Engage industry to co-design and collaborate –** A Project Reference Group of café owners and food industry experts was engaged to ensure the program and educational materials have relevance.
- **Cooking Education –** Educational videos, a 'My Mushroom Toast' educational booklet and café recipes with detailed profit projections were produced. These resources are housed on the new food service section of the Australian Mushrooms website and will be used in remarketing to teach and inspire cafés.
- **Health Education –** Educating café staff of the unique health benefits of mushrooms, and to instill mushrooms as the hero ingredient for meat-free/vegan/vegetarian/flexitarian/plant-forward menu options.
- **Inspire menu change** – Directly engage cafés through a social media competition, open to both

consumers and café owners. The café major prize incentive is $10,000 for Australia's best Mushrooms on Toast. The competition is designed to build hype as well as creating a community for mushroom menu inspiration.

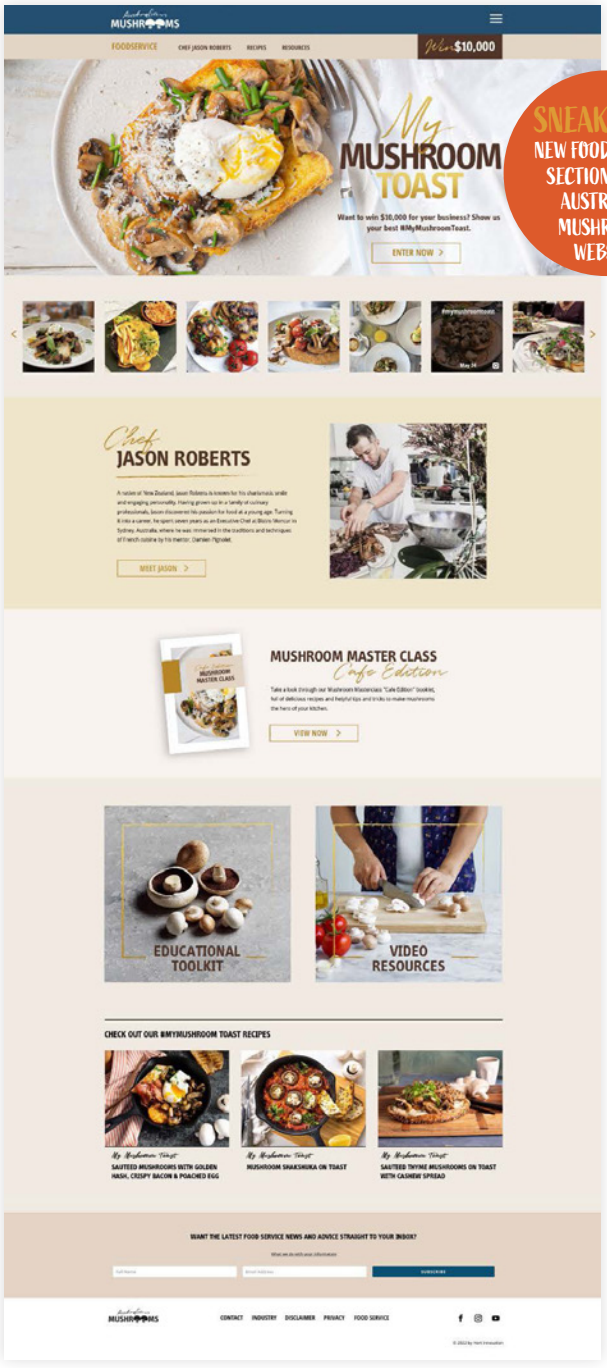
- **Make mushrooms famous –** Through a media launch and hefty PR campaign, to garner both paid and earned media to increase reach.
- **Monitor and evaluate** – Survey the industry pre and post program, to show the effectiveness of the campaign.

The program has been researched, designed and is ready to go, however Hort Innovation and the AMGA made the decision to put the program on hold, until the current shortage is resolved. The program aims to deploy in late August through to October 2022.

SNEAK PEEK! CAMPAIGN PROMOTIONAL FLYER


SNEAK PEEK! MY MUSHROOM TOAST – MUSHROOM MASTERS – CAFÉ EDITION BOOKLET


SNEAK PEEK! NEW FOOD SERVICE SECTION OF THE AUSTRALIAN MUSHROOMS WEBSITE



# A NEW DIAGNOSTIC TOOL GIVES GROWERS THE UPPER HAND IN CONTROLLING DISEASE

**By Dr Gordon Rogers**

A mushroom industry-funded project has delivered a commercially available early disease detection service which has revolutionised the way growers manage disease.

Growers can now identify disease early, whether in compost, grow room, or the crop itself, facilitating timely action to manage diseases and minimise losses.

For example, the system can identify *Trichoderma aggressivum,* a species of green mould that is highly damaging to yield but nearly impossible to distinguish visually from other less serious green moulds.

Interestingly, the PCR test used to detect *Trichoderma* uses the same technology as the gold standard PCR test for detecting COVID-19.

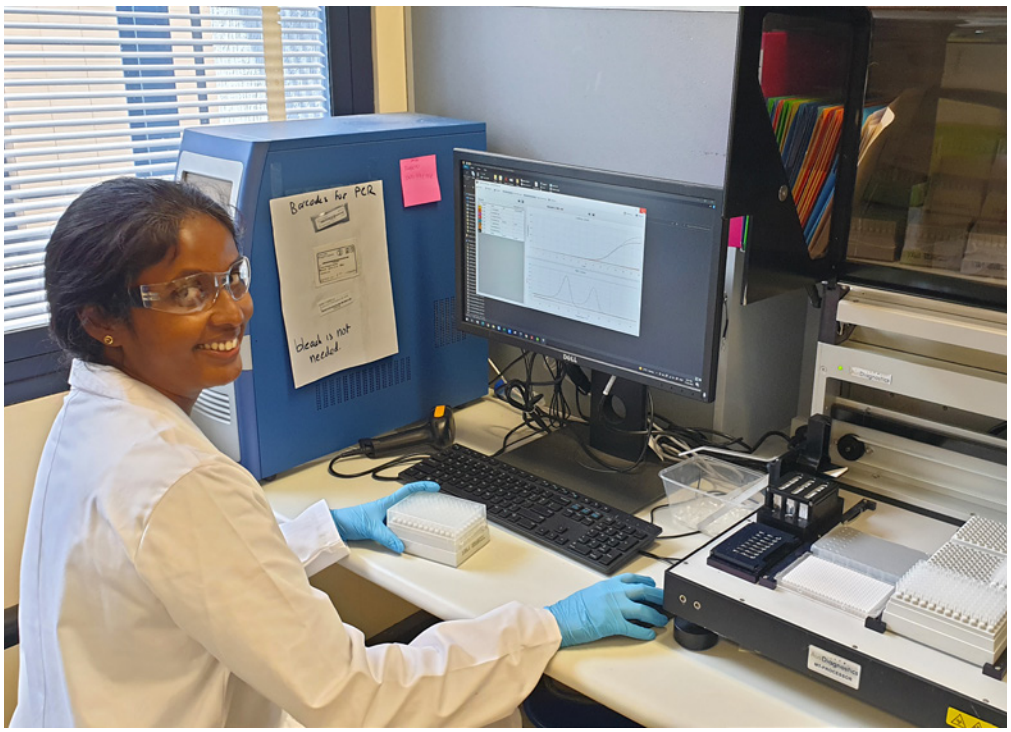
The PCR test can also identify Dry Bubble (*Lecanicillium fungicola*), Cobweb (*Cladobotryum* sp.) and Bacterial Blotch. All four diseases are included in the same testing 'panel', meaning that a single test can detect any of the diseases above in any one sample provided.

The results from a single sample give a positive or negative for a range of species (see Table 1), as well as an indication of how much disease is present.

Quick turnaround of test results, early detection before symptoms are evident, and cost-effectiveness are all major benefits of the new testing service.

The PCR-based testing service was developed by a Hort Innovation project (MU12007) and is now fully operational.

*Trichoderma* (left) and dry bubble (right) are just two of the diseases that can be tested for using the PCR testing service




AHR employee Samali Perera runs mushroom samples through the PCR machine

The development team was led by Associate Professor Michael Kertesz from the University of Sydney. Partners included AusDiagnostics, who provided the PCR delivery platform, and disease experts Judy Allan and Dr Warwick Gill. Trials were carried out by the Marsh Lawson Mushroom Research Unit (MLMRU).

The project was managed by Applied Horticultural Research (AHR) who are now also providing the testing service commercially from their Sydney laboratory.

The table below shows the diseases which can be detected using the PCR testing service developed by Hort Innovation project MU12007.

## Testing and control measures on farm are effective at controlling disease

The mushroom disease testing service has already proved popular, with over 5,000 samples processed since August 2020.

As well as identifying disease, testing after cookout can provide vital information on whether control measures taken at the farm have been effective.

AHR has seen some encouraging trends in the testing results, showing that PCR testing for disease, coupled with corrective action, is effective at controlling disease.

| COMMON NAME OF DISEASE | SCIENTIFIC NAMES |
|---|---|
| **Cobweb** | *Cladobotryum mycophilum (Hypomyces odoratus)* |
| | *Lecanicillium* spp. |
| **Dry bubble** | *Lecanicillium fungicola (Verticillium fungicola)* |
| | *Trichoderma* spp. |
| **Green mould** | *Trichoderma aggressivum* |
| **Bacterial blotch** | *Pseudomonas tolaasii*<br>*Pseudomonas gingeri* |

**Table 1.** The diseases which can be detected using the PCR testing service developed by Hort Innovation project MU12007

AHR principal, Dr Gordon Rogers says "Farms using this service see a steady decline in positives for diseases they are targeting."

"This means the control measures on farms are working, and testing is confirming their effectiveness."

## How to get your samples tested

PCR testing, developed during the Hort Innovation project, is now being offered as a commercial service by AHR, using a methodology commercialised by AusDiagnostics.

The PCR technique is highly sensitive at detecting diseases. A sample containing even the smallest amount of the disease can usually be detected before any symptoms are evident in the crop.

Very importantly, the way the sample is collected is critical.

A video produced by Judy Allan and Warwick Gill demonstrates how to collect samples for disease testing from growing rooms, equipment, work areas, mushroom caps and compost. Click here to view the video or visit the AGORA website for both the video and appropriate control measures.

To test for the presence of Trichoderma, Cobweb, Dry Bubble or Blotch disease, send your samples by express post to the AHR diagnostic laboratory in Sydney to:

**Applied Horticultural Research**
**PO Box 917 Alexandria NSW 1435**

For more information on how to collect and send samples to the laboratory, visit the AHR website https://ahr.com.au/mushroom-disease-diagnosis-service

This project has been funded by Hort Innovation, using the mushroom research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

Samples being prepared for PCR testing

Hort Innovation Strategic levy investment | MUSHROOM FUND

This project has been funded by Hort Innovation using the mushroom research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

# IT'S A WRAP ON MU16003 **PEST AND DISEASE MANAGEMENT AND RESEARCH SERVICES**

**By Dr Jenny Ekman and Paulette Baumgartl**

Like all crops, mushroom yields can be adversely impacted by pests and diseases. However, mushrooms lack protective skins, as well as the defence compounds often produced by parent plants. Moreover, treating disease with fungicide is clearly problematic for a fungus! Added to this is a short cropping cycle, leaving little time to treat diseases mid cycle.

*Prevention is better than cure* very much applies here.

Over the last five years, Warwick Gill from the University of Tasmania and Judy Allan have led the levy funded project MU 16003 *Pest and disease management and research services*, creating an exhaustive and detailed body of knowledge for the Australian mushroom industry.

The team has researched and collated information on current and emerging mushroom pests and pathogens, as well as how to recognise, treat and manage them. They have also focussed strongly on communicating their findings through a variety of engaging formats. The legacy is an impressive and invaluable information resource.

Most of the resources created through the project are available via the AGORA website (agora.australianmushrooms.com.au, note that this is password protected), with a few highlights presented here.

## THE MU16003 CATALOGUE

Information collected via scientific literature, AGORA's own pest and disease library, national and international networks, and the growers themselves, has been disseminated and distributed to growers in a variety of forms, including fact sheets, case studies, articles, and digital resources.

### The catalogue includes

**37** INDUSTRY JOURNAL ARTICLES PUBLISHED IN AMJ

**8** FACT SHEETS

**11** GROWER ALERTS

**2** VOICE OVER POWER POINT PRESENTATIONS

**4** INSTRUCTIONAL VIDEOS

**6** CHEMICAL SUMMARY TABLES

## RESEARCH HIGHLIGHTS

Research projects focussed on critical areas that would have the greatest impact on effective pest and disease management strategies.

### Improving management of foot dips

Once disease is present on a mushroom farm, the grow room floor becomes a significant disease reservoir. Normal farm practices can spread pathogens between grow rooms, potentially contaminating the entire farm. They can also transfer virus contaminated spores and mycelium of *Agaricus* spreading viral disease.

While the usefulness of foot dips is widely known, the factors effecting their efficacy on mushroom farms is less certain.

### Top tips:

1. Replenish the foot dip often and make sure it is CLEAN
    - For example, only 8g of casing soil (approx. a tablespoon) in 100ml of a fresh registered disinfectant solution (mixed according to manufacturer's instructions) severely reduced efficacy of the disinfectant against L. fungicola (Dry Bubble) spores
2. Make sure the person mixing the solutions understands how to mix to the correct concentration
3. Do not simply "top up" partly used solutions, especially if dirty; dispose of the old mix (as much as possible) and replace the solution
4. If a foot dip is not being used, empty it, clean it and put it away.
    - Neglected foot dips pushed into a corner when not needed can become a breeding ground for pests and diseases
    - If the organic material dries out, it can spread around the farm
5. Depending on the amount of dirt or casing build-up in the foot dip, replenishment may be required more than daily.

Make sure footbaths are replenished regularly with fresh disinfectant

### Getting the best from cookout (fact sheet 5)

As mushroom crops mature, so do pests and pathogens within the crop. Effective termination when cropping has finished is the best way to 'start clean' when the new materials are introduced. Steam provides an effective way to heat compost, and is still the best way to prevent cross contamination, killing pests within the compost as well as on the structures and equipment in the growing rooms.

However, cookout clearly requires large amounts of energy. With energy costs rising it is ever more important to maximise effectiveness. This is where it helps to understand what pests or pathogens are present, and the time + temperature combinations needed to kill them.

Fact sheet 5 includes a quick reference table showing the time and temperature combinations needed to kill a number of pests and pathogens, summarised in Table 1. However, it is important to understand that these are based on laboratory trials. Moreover, times to kill dry spores can be much longer than those needed to kill fresh material – another reason to cook out promptly once the crop is finished. Cookout times will also be affected by:

- Rate and uniformity of heat penetration
- Compost and casing structure, density and moisture content
- Production system (trays or shelves)
- Age and integrity of the grow rooms

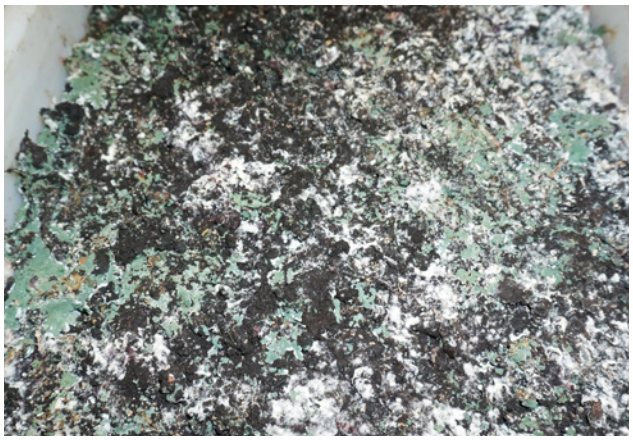
For a routine cookout, holding compost at 65 to 70°C for 9 hours is generally sufficient for a shelf farm, increasing to 70°C for 12 hours or more in an older farm using timber trays.

| | TEMPERATURE | | | | | | TIME (Hours) |
|---|---|---|---|---|---|---|---|
| | 46°C | 50°C | 55°C | 60°C | 65°C | 70°C | |
| ***Agaricus* spores** | | | | | X | | 72 |
| | | | | | | X | 3 |
| **Bacterial blotch** | | X | | | | | 0.15 |
| **Brown plaster mould** | | | | X | | | 4 |
| **Cecid adults and larvae** | X | | | | | | 1 |
| **Cobweb** | | X | | | | | 4 |
| | | | | X | | | 2 |
| **Dry bubble** | | | X | | | | 4 |
| | | | | X | | | 2 |
| **False truffle** | | | | X | | | >3 |
| **Lipstick mould** | | X | | | | | 16 |
| | | | | X | | | 6 |
| **Mat disease** | | | | X | | | 2 |
| | | X | | | | | 16 |
| **Mites** | | | X | | | | 5 |
| **Nematodes** | | | X | | | | 5 |
| **Olive green mould** | | | | X | | | 6 |
| **Phorid adults and larvae** | | | X | | | | 5 |
| **Sciarid adults and larvae** | | | X | | | | 5 |
| **Wet bubble** | | X | | | | | 4 |
| | | | | X | | | 2 |

**Table 1.** Time and temperature combinations needed to kill mushroom pests and diseases. From Overstijns, 1998.

A notable absentee from Table 1 is the green mould fungus *Trichoderma* spp., particularly *Trichoderma aggressivum*. Depending on the strain, *Trichoderma* is exceptionally hard to kill. For example, it has been shown to survive nearly 30 hours at 74°C. The fungus can penetrate and survive in timber trays, especially if heated while containing compost.

If *Trichoderma* is a problem it may be necessary to cook twice – both before and after the room is emptied – as well as extend heating times considerably.



Severe Trichoderma (green mould) in a mushroom crop.
*- Photo by R. Hall*

### Top tips for successful room sanitation:

- Don't cut cookout short, especially if using timber trays
- Make sure floor cracks and joins are sealed, as these can act as havens for disease, and often remain cooler than compost
- Empty grow rooms downwind from new rooms, and never empty old rooms while new rooms are being filled or cased
- Remove spent mushroom compost from the farm as soon as possible
- Follow cookout with;
    - Gross cleaning to remove soil and debris
    - Pre-rinsing with low pressure water
    - Mechanical washing using a detergent (e.g. broom, brush)
    - Post rinsing to remove detergent
    - Disinfection using a sanitiser
    - Final rinse then drying

After the room is emptied, the next step is gross cleaning to remove soil and debris; start at the top and move down.

## NEW AND EMERGING THREATS TO THE MUSHROOM INDUSTRY

This comprehensive review identified three fungi, five bacteria and one virus complex as new, emerging and re-emerging (in more virulent form) diseases in the Australian mushroom industry.

Of these, six had not been recorded in Australia previously, one had been isolated previously in Australia but had not caused a disease issue on-farm, and two were known pathogens that have caused greater problems overseas that in Australia.

Fact sheets on the more concerning diseases were sent to all members.

### Mushroom Virus X Syndrome - Patch Disease and Brown Cap Mushroom Disease (fact sheet 8)

Mushroom Virus X syndrome (MVX) describes a range of symptoms including delayed opening, reduced yields, distorted mushrooms, and cap browning. Initially a bit of a puzzle, researchers now know that it is a combination of two separate virus diseases – Patch Disease and

After the room is emptied, the next step is gross cleaning to remove soil and debris; start at the top and move down.

Symptoms of MVX, with bare patches 'spiralling' along an affected bed. Photo supplied by farm

Brown Cap Mushroom Disease. The two diseases can occur together, with variable and complex expression of symptoms.

Farm operations where compost is exposed, especially during Phase II, Phase III and casing are particularly vulnerable to infection.

### Top tips:

- Don't ignore sporadic 'off white' or 'brown' mushrooms appearing – it might be an early warning that virus is replicating on your farm
- MVX syndrome symptoms may appear similar to symptoms expressed by other diseases
- If you suspect a virus infection, send samples for PCR testing immediately
- MVX syndrome viruses can be spread by mushroom spores and mycelium
- Consider reducing the proportion of open mushrooms grown to reduce the number of mushroom spores moving around the farm
- Reduce dust levels around the farm
- Protect vulnerable operations – Phase II, Phase III and casing – from dust
- Stringent hygiene based on efficient cook out and effective cleaning is the most successful management tool

Yellowing troll doll mycelium colonising a portobello mushroom.
*- Photo Kerry O'Donnell*

## Syzygites megalocarpus – Troll Doll (fact sheet 1)

Troll doll is caused by a common mould (*Syzygites megalocarpus*) that colonises a diverse variety of dead or ailing mushrooms.

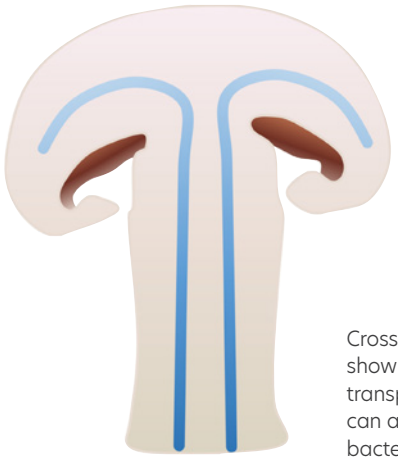
First thought to be confined to late flushes of brown portobello strains of *Agaricus bisporus, Syzygites* has since been observed on earlier flushes and on both brown and white strains of *A. bisporus*. Due to the mould's tolerance to low temperatures, it can also develop postharvest in packaged product, with the mould appearing while on the retail shelf.

### Top tips:

- Symptoms may occur postharvest
- Treat infection as for cobweb – cover with moist paper town, salt edges then the middle
- Do not water areas of infection
- Avoid disturbing the area to prevent the spread of airborne spores
- Sanitisers are effective against Syzygites spores and mycelium, as is an effective cookout
- Hygiene is key – keep beds and floors clear of dead tissue, stumps and knock downs

## Internal Stipe Necrosis (fact sheet 7)

Internal Stipe Necrosis has been observed sporadically on Australian mushroom farms over the past 10 years. It tends to be associated with use of wetter and heavier black peat as a significant component of mushroom casing.



Cross section of mushroom showing the key water transport vessels, which can also transport bacteria

Internal stipe necrosis, showing typically variable symptoms.
*- Photo Judy Allan*

As the name implies, symptoms are largely confined to the stipe. As the bacteria is carried within the water conductive tissues of the mushroom, it mainly affects the ring of tissue surrounding the inner soft central column of the stipe. This becomes brown and necrotic, with dying areas sometimes extending towards the outer edge of the stipe. Affected tissue dries and completely collapses, leaving a column of dead, corky tissue attached to the base of the mushroom cap.

There is no outward symptomology, however some affected mushrooms may appear wet during early development.

## Top tips:

- Internal Stipe Necrosis is characterised by browning and necrosis of affected stipe tissue.
- The disease is associated with the bacterium *Ewingella americana* and can affect a large range of mushroom species, not just *Agaricus*.
- Symptoms are more pronounced when there is an imbalance in water relations, particularly if casing remains wet.
- The impact of Internal Stipe Necrosis can be reduced by managing the room environment; ensure compost temperatures are regulated and there is sufficient evaporation to avoid water pooling.
- Ensure irrigation water is clean.

Hort Innovation Strategic levy investment | MUSHROOM FUND

This project has been funded by Hort Innovation using the mushroom research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

## GROWER ENGAGEMENT

The team actively engaged with growers and took considerable effort to encourage uptake of the resources and expertise that was being made available.

Despite COVID-19 disruptions, ten face-to-face workshops were delivered over five states, attracting attendees from nearly 50% of levy-paying farms. There were also numerous "phone a friend" online consultations.

Workshop topics included mushroom pathology 101, dry bubble biology and management, vectors, spot treatment training, cobweb biology and management, and on farm sampling.

Four on-farm visits allowed the team to examine vulnerabilities of different farms to pests and diseases, as well as undertake some strategic sampling from sites identified during project MU12007 – *development of a pilot mushroom farm disease monitoring scheme*. These visits highlighted disease hotspots, and assisted farms to develop better management strategies.

Over 120 delegates, speakers and exhibitors attended the 43rd Biannual AMGA conference in 2018, 'a Bridge to Success'. The team delivered a presentation entitled *Pest and disease management – it's a numbers game* describing some of the numbers involved in mushroom growing and how they relate to pest and disease management.

## AGORA

One of the key activities of the project team has been to maintain and update the AGORA website, making it the central library of mushroom pest, disease and hygiene information. Hundreds of resources are available, including both locally produced fact sheets and articles and publications from around the world. There are also videos demonstrating sampling methods, spot treatments and pest and disease identification.

The information on AGORA provides an invaluable industry asset for understanding and managing not just pest and diseases, but the important roles of compost quality, farm hygiene and other factors.

Having such information available through AGORA has helped numerous farms manage their way through serious diseases.

**For more information contact:**

**Judy Allan at judyallan@bigpond.com or**
**Tel: (02) 6767 1057**
**Warwick Gill at warwick.gill@utas.edu.au or**
**Tel: 0417 766 588**

Information for this article has been sourced from articles and fact sheets published through the AMGA by Judy Allan and Warwick Gill, and the MU16003 final report.

# NORFOLK ISLAND **MUSHROOMS**

**When people talk about Australia's most easterly point, they are usually talking about Cape Byron. But, an outpost 1,400 km further east - Norfolk Island - is producing its own mushrooms, writes Dr Jenny Ekman.**

Only 35km$^2$ in area and home to around 1,700 inhabitants, Norfolk seems a very long way indeed from mainland Australia.

Norfolk Island was settled by Europeans in 1788, only five weeks after the first fleet arrived in Sydney. Convict labour was used to establish a small farming community. This served as a food bowl, sending crops and produce back to the Australian colony. The rich volcanic soil proved highly productive, and Norfolk helped keep the fledgling Sydney colony alive with supplies of salt meat and vegetables.

Unfortunately, concern about French incursions led to the colony's abandonment in 1814. A second penal settlement (1825-1855) was followed by a final, third settlement by Pitcairn Islanders. Many of these descendants of mutineers from the HMS Bounty and Tahitians still live on the island, maintaining their unique culture and language.

In such an isolated and remote environment, self-reliance and self-sufficiency are crucial. While some fresh produce is imported (following changes to Federal Biosecurity legislation), inconsistent supply and high

cost make local production essential for both locals and tourists.

Pitcairn descendent Darren Nicolai has lived on Norfolk island most of his life. Everybody on Norfolk seems to have multiple occupations. In Darren's case he is a licensed and qualified contractor and vegetable farmer. But in 2002 Darren and wife Anita had another idea – to add mushrooms to their farm offerings, rather than duplicating the many other vegetables already commercially harvested. But how?

I was lucky enough to spend some time with Darren and Anita on a recent trip, and was able to ask them all about it.

**JE: How did you start learning how to grow mushrooms?**

DN: It started with an intense amount of self-research, reading any and all available resources accessible on mushroom cultivation, composting and organic farming. Of course, the internet wasn't as evolved as it is today, so it was books that gave me the fundamentals.

We also visited mushroom farms in Hamilton and Christchurch in New Zealand – that were absolutely fantastic. They were generous in sharing their knowledge, experience and trade information as well as helping troubleshoot our farm plans, which were based on Paul Stamets references. With revised plans we then went about sourcing the entire infrastructure from multiple suppliers throughout NZ.

Bondor (manufacturer of insulated panels), fabricated the shed from insulated panels suited to the environmental conditions required for mushroom cultivation. Tyco supplied the air handling units. The whole lot was shipped across to Norfolk and within 3 months of our NZ visit we had installed our own small commercial mushroom farm, fully equipped with five growing rooms, a cool room and spawn run room: Avoca Mushrooms was born!

Admittedly we had some significant engineering challenges in the early days. It took a good two years before the faults were corrected and I could really get everything to work efficiently.

Norfolk Island mushroom farmer Darren Nicolai with the grasses he is growing to make mushroom compost.

## The compost conundrum

Norfolk Island mushroom farmer Darren Nicolai with the grasses he is growing to make mushroom compost.

**JE: What about compost? Clearly there's no wheat industry on Norfolk, and the cost and paperwork to ship bales or compost blocks would be crazy.**

DN: I tried a few things. Early on I trialled elephant grass and Bana grass. They are tall and grow well but the compost lacked structure. Now I have settled on a mixture of Rhodes, Gatton grass and broad leaf paspalum. I grow these together as a pasture mix. To harvest, I simply chop the green grass into a cage on the back of the tractor. After drying for a couple of days I mix the grass with chook manure, gypsum and some organic fertiliser with 14%N.

**JE: So that's stage 1, what about stage 2?**

DN: When I started, I was doing the whole thing manually. I'd get in there with a pitchfork and shift the entire 5 tonnes by hand. It would take me 2-3 days and I was fitter than I'd ever been in my life. Now, thank

*When I started, I was doing the whole thing manually. I'd get in there with a pitchfork and shift the entire 5 tonnes by hand. It would take me 2-3 days and I was fitter than I'd ever been in my life.*

goodness, we have a fully automated phase 2 bunker with temperature and airflow monitoring. There was a lot of mucking about getting the aeration right – initially I just couldn't figure out why we were getting so many problems during cropping. It turned out the fan wasn't up to the job. We replaced that and suddenly everything came together.

**JE: That must have been a major relief.**

DN: Absolutely. We were nearly wiped out financially when two crops in a row failed because of red mites in the chicken manure. It would all be looking good, then suddenly all these mite eggs would appear on the casing surface. Now that we're getting the right temperature and time combination throughout the pile that hasn't happened again.

**JE: It sounds like you've learned an incredible amount simply through trial and error.**

DN: Yes, there's nothing like things going wrong to really help you know your operation inside out! We were hit and miss for four years, then in 2007 I was awarded a Churchill fellowship. This allowed me to visit farms in Europe and do compost and farm management courses through Venray in the Netherlands. I came back with lots of new ideas and a much better understanding of *Agaricus*.

**JE: Having figured out all the parts of the process, how do you bring it all together?**


Darren with his hand-turned compost pile


DN: We grow brown portobellos in 12kg bags. I import the spawn from Sylvan, and can run 150 bags at a time, which is enough to fill one grow room. They are cased using TopTerra black peat. From time to time I've run out of bags, peat, all sorts and had to... improvise. We usually get three to four flushes and the quality's good.

**JE: Has it worked out financially? Costs must be much higher than here on the mainland.**

DN: The logistics of getting anything to the island always results in higher costs. It's particularly volatile at

the moment with all that is going on in the world, which of course makes it even harder to operate a business on a remote and isolated island.

Costs are several times higher. For example, a box of spawn is $100, but adding the freight costs means it's $250 by the time it is transported to the island. Power on the island is generated by diesel and in the last few years prices have more than doubled to 72c/kWh *(N.B. local Australian farms usually pay less than 10c/kWh)*. We got a couple of quotes for solar panels and it came in at over $70,000. Even things like concrete – we want to fully seal the driveway, but with concrete costing $3,000/$m^3$ it's a big investment.

The other challenge is that although we have an ABN and pay Australian taxes we are not part of any state and outside the GST system. This means we are ineligible for the grants and assistance available to other primary producers.

On the other hand, when we've got mushrooms available, we practically get mobbed (which we are always grateful for). We charge $12.50/500g packet and sell them as fast as we can pick. We also sell the used compost. That sells out within a day too, and helps to cover some of the farm operational costs.

**JE: Right now a lot of the supermarket shelves are empty, you could probably charge even more.**

DN: Yes but unfortunately we're not growing at the moment. I need to replace the A/C units as they use an outdated refrigerant. What's more, shipping and biosecurity issues are making it hard to get some of the raw materials we need for production.

**JE: So, what's the plan for the future?**

DN: Once we get the units installed, finish the all-weather farm access, and can hopefully get some more renewable (and cost effective) energy solutions, we are planning to open for farm tours. Many people are interested in looking at small scale farming operations, as well as getting an appreciation of primary production at the grassroots level.

In addition to the mushrooms, we have a large variety of produce and animals here on the farm and plans for some value-added goods. We are also fully organic, so that adds extra interest.

**JE: I call that paradise!**

DN: Perhaps, but not for the faint hearted!!

# PROJECT PROOF
# BY FIFTYFIVE5

## Consumer research funded through the Mushroom Industry Marketing levy

In realigning their approach to mushroom marketing, Hort Innovation has committed to strong collaboration with the Mushroom Industry Strategic Investment Advisory Panel (SIAP). This will ensure that any decisions regarding mushroom messaging are data-driven, rather than being based on opinion or hearsay. The objective is to drive demand for mushrooms through increasing consumer knowledge, attitudes and purchase intent.

Following extensive consultation with the SIAP, and their desire to learn more about the interest consumers had in the health benefits of mushrooms, Hort Innovation engaged consumer research specialist agency fiftyfive5 to investigate the consumer decisions behind purchasing mushrooms.

Specifically, the research by fiftyfive5 sought to tease out the reasons consumers purchase or don't purchase mushrooms, the importance of health in those purchase decisions, and what health claims are most likely to resonate and lead to increased purchase.

Surveys were conducted online during November 2021, with a nationally representative sample of Australians.

Two different surveys were conducted: A "Market Sizing" sample, with 796 participants, and a "Deep Dive" sample representative of those who had purchased mushrooms within the previous six months.

### Key results included:

- Two thirds of Australians bought mushrooms within the last six months; more than half of the remainder had never purchased mushrooms.
- Taste and texture were key barriers for those who had either never purchased mushrooms or stopped purchasing them.
- Price, awareness and 'the kids don't like them' were also key barriers to purchase.
- People who do buy mushrooms generally plan to get them each week.
- Taste, habit, and value are key reasons to buy mushrooms; only 24% of people nominated health reasons as a driver for purchase.
- Even though health is a secondary reason, nearly all purchasers already know that mushrooms are good for them.

**MUSHROOMS L6M PURCHASERS**

**69%**

**MUSHROOMS LAPSED PURCHASERS**

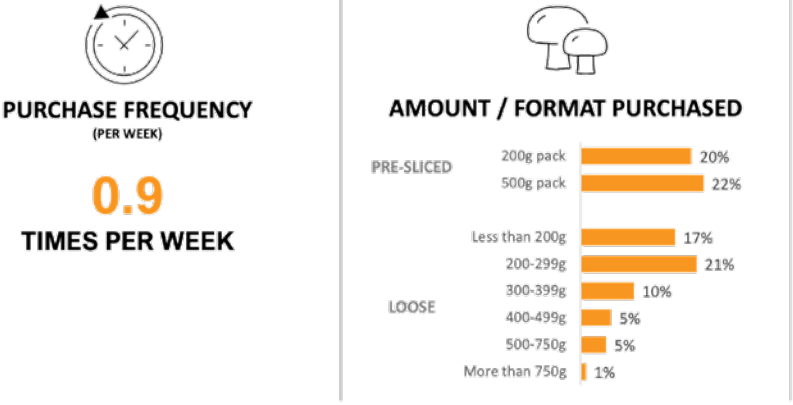
**11%**

**NEVER PURCHASED MUSHROOMS**

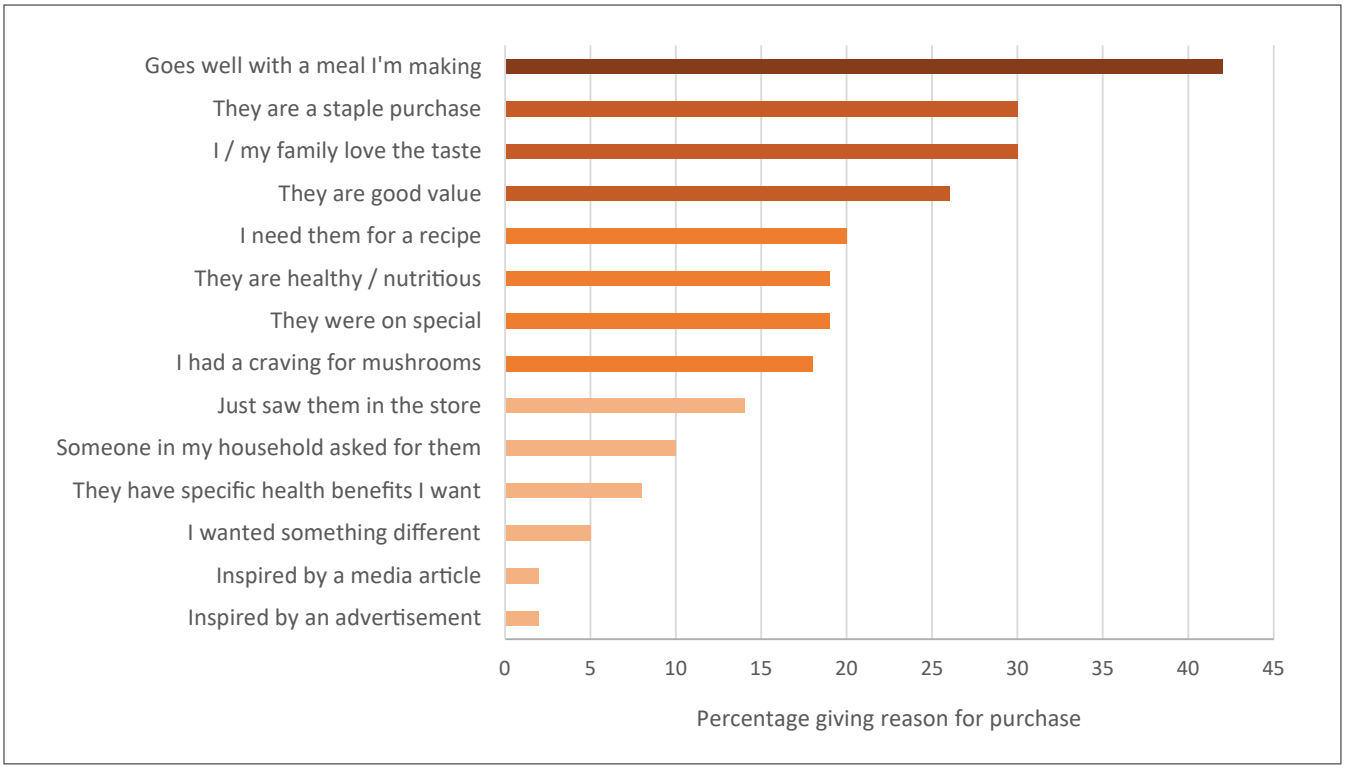
**19%**

## AMONG THOSE WHO DO PURCHASE MUSHROOMS, THEY GENERALLY PLAN TO GET THEM ONCE PER WEEK – AND A MIX OF FORMATS AND AMOUNTS ARE PURCHASED

MUSHROOMS PURCHASE BEHAVIOUR – MUSHROOMS PURCHASERS




On average how often do you buy mushrooms? How much would you typically buy, and what proportion of purchases are planned or impulsive?




Reasons given by consumers for purchasing mushrooms

To further examine the relative importance of health claims, participants were asked to choose the best and worst item/factor in given lists. Repeating this several times allows discrimination between different factors – rather than people just saying **everything** is important.

Claims were then assessed against the criteria of appeal, credibility and uniqueness.

The standout result from this was claims that relate to healthy immune systems (perhaps unsurprising in COVID-19 times!) are most likely to encourage purchase.

*This claim ranked significantly higher than all other claims for all three criteria*

However, some other claims were not far behind. For example, claims relating to fibre for a healthy gut, reduced risk of prostate/ovarian cancer, Vitamin D plus phosphorous for healthy teeth and bones and reducing inflammation, all scored well.

Claims around Vitamin D and fibre were also considered 'credible' by participants. They were less likely to believe claims relating to putting mushrooms in the sun to generate Vitamin D, or that including mushrooms reduced the Glycaemic Index (GI) of a meal.

In summary, the claims that were considered to be appealing, credible and unique were:

1. *"Contains antioxidants and Vitamin D for a healthy immune system"*
2. *"Contains Vitamin D, which is essential for calcium absorption"*

These claims are most likely to influence purchase, likely because they are simple, easy to understand and linked to a tangible health benefit.

Claiming a link between mushrooms and reduced risk of prostate/ovarian cancer was appealing and unique but was less believable. However, if this could be definitively substantiated through research it could be a compelling driver for purchase.

Unsurprisingly, health claims resonated most with older consumers, while younger mushroom buyers were less concerned about health issues. Despite these age trends, it was clear that health was neither a barrier to mushroom consumption, nor was it something new or unknown.

The key barriers to purchasing mushrooms centre around taste, texture, price and awareness. While promotion of health benefits may help to drive awareness, the researchers concluded that health messaging will have limited impact in driving category penetration or frequency.

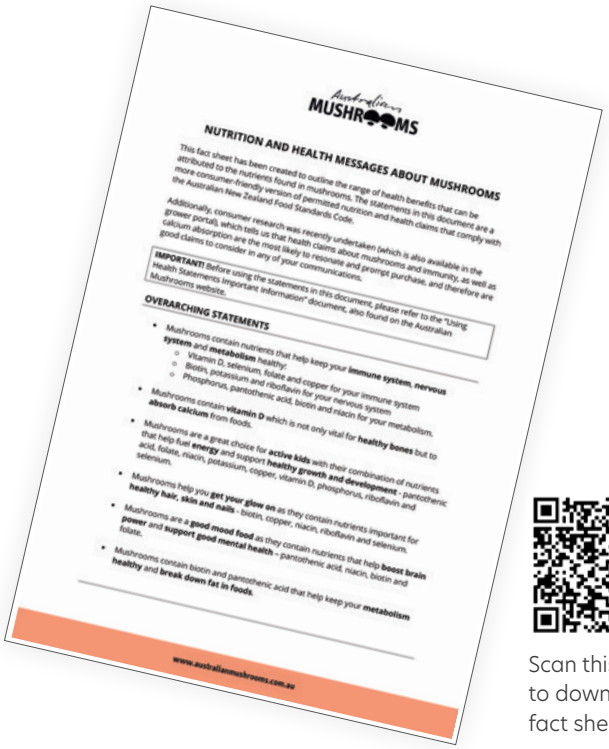
To leverage this research for most impact, the results have been shared with the Hort Innovation R&D team and communication agencies, including advertising, media, PR and social media. Health-focussed messages should be tailored using the strongest and clearest claims to have a greater chance of driving consumer behaviour to increase demand for mushrooms.

## Using this information

A fact sheet outlining the range of health benefits that can be attributed to Australian mushrooms is now available online (http://bitly.ws/taZe) or scan the QR code below.

The statements are written in consumer-friendly language, with clear advice on how to use the claims to ensure they are compliant with the Australian New Zealand Food Standards Code (FSANZ).

The claims relate to benefits to the immune system, metabolism, antioxidants, heart health and gut health.


Australian MUSHROOMS

NUTRITION AND HEALTH MESSAGES ABOUT MUSHROOMS

This fact sheet has been created to outline the range of health benefits that can be attributed to the nutrients found in mushrooms. The statements in this document are a more consumer-friendly version of permitted nutrition and health claims that comply with the Australian New Zealand Food Standards Code.

Additionally, consumer research was recently undertaken (which is also available in the grower portal), which tells us that health claims about mushrooms and immunity, as well as calcium absorption are the most likely to resonate and prompt purchase, and therefore are good claims to consider in any of your communications.

**IMPORTANT!** Before using the statements in this document, please refer to the "Using Health Statements Important Information" document, also found on the Australian Mushrooms website.

**OVERARCHING STATEMENTS**

- Mushrooms contain nutrients that help keep your **immune system, nervous system** and **metabolism** healthy:
  - Vitamin D, selenium, folate and copper for your immune system
  - Biotin, potassium and riboflavin for your nervous system
  - Phosphorus, pantothenic acid, biotin and niacin for your metabolism.
- Mushrooms contain **vitamin D** which is not only vital for **healthy bones** but to **absorb calcium** from foods.
- Mushrooms are a great choice for **active kids** with their combination of nutrients that help fuel **energy** and support **healthy growth and development** - pantothenic acid, folate, niacin, potassium, copper, vitamin D, phosphorus, riboflavin and selenium.
- Mushrooms help you **get your glow on** as they contain nutrients important for **healthy hair, skin and nails** - biotin, copper, niacin, riboflavin and selenium.
- Mushrooms are a **good mood food** as they contain nutrients that help **boost brain power** and **support good mental health** - pantothenic acid, niacin, biotin and folate.
- Mushrooms contain biotin and pantothenic acid that help keep your **metabolism healthy** and **break down fat in foods**.

www.australianmushrooms.com.au

Scan this QR code to download the fact sheet

Hort Innovation Strategic levy investment | MUSHROOM FUND

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# CURRENT HORT INNOVATION MUSHROOM FUND R&D PROJECTS

Scan this QR code to read more about these projects on the Hort Innovation website

| PROJECT NAME | PROJECT CODE | ORGANISATION | PROJECT DESCRIPTION |
|---|---|---|---|
| Generation of data for pesticide permit applications in horticulture crops 2019/20 | MT18018 | Hort Innovation Communications Team | Pesticide residue, efficacy and crop safety data to support label registration and minor use permit applications and renewals. |
| Regulatory support and response coordination (pesticides) | MT20007 | Hort Innovation Communications Team | Chemicals and strategy planning for future pest management options; regulatory risk assessments. |
| Consumer demand spaces for horticulture | MT21003 | Kantar Insights | Engage consumers and build demand across the domestic market for fruits, nuts and vegetables; inform industry on product development and marketing campaigns. |
| Consumer behavioural data program | MT21004 | Nielsen | Consumer behaviour data and insight reporting to assist growers and supply chain partners; support strategic activities. |
| Strategic Agrichemical Review Process (SARP) - Updates | MT21005 | Hort Innovation Communications Team | Pest, disease and weed control. |
| Economic contribution of Australian horticulture | MT21010 | Centre for International Economics | The horticulture industry's contribution to the Australian economy. |
| Foodservice foundational market insights | MT21011 | KPMG | Insights into the food service sector; engage with food service providers and expand the most profitable market segments. |
| Consumer usage, attitude and brand tracking (pilot program) | MT21201 | Fifty-Five Five | Category tracking for understanding consumer usage and attitudes and the effectiveness of marketing campaigns. |
| Mushroom industry minor use program | MU16002 | Hort Innovation Communications Team | Submit renewals and applications for new minor use permits for the mushroom industry. |
| Marsh Lawson Mushroom Research Centre (MLMRC) | MU16004 | University of Sydney | The Marsh Lawson Mushroom Research Centre (MLMRC) at the University of Sydney. |
| Optimising nitrogen transformations in mushroom production | MU17004 | University of Sydney | Nitrogen used in mushroom production and composting; understanding the microorganisms involved. Maximise nitrogen use efficiency and retention. |
| Developing a database of biomarkers for compost quality control to maximise mushroom production yield | MU17006 | University of Sydney | How microbial populations within compost can be used to manipulate compost quality; how microbial successions align with other compost quality indicators and correlate with mushroom crop yield and quality. |
| Development of a biosecurity plan for Australian mushrooms | MU18006 | Plant Health Australia | Identify endemic and exotic pests and diseases, and develop mitigation, surveillance and diagnostic activities |
| Extension and Adoption for Food Safety, Quality and Risk Management | MU20000 | AMGA | Deliver targeted information on food safety, quality and risk management to the mushroom industry, provide support and training and deliver microbial and chemical residue testing services. |
| Mushrooms and their potential health benefits of lowering blood cholesterol | MU20001 | CSIRO | Examine whether the β-glucan in mushrooms has the same direct impact on lowering cholesterol as β-glucan from oats or barley. |
| Educating the food industry about Australian Mushrooms | MU20003 | AMGA | The nutrition and health benefits of mushrooms for health professionals. Recommending mushrooms, and mushrooms in menus. |
| Mushroom industry crisis and reputation risk management | MU20006 | AMGA | Crisis and reputation risk management for the Australian mushroom industry; tools for response. |
| Digitisation of mushroom industry archive | MU21000 | AMGA | Digitise past industry journals, research reports, books, posters for the Australian Mushroom Growers' Association website. |
| Desktop review of pathway risks for the mushroom industry - Agaricus mushrooms and growth substrate imports | MU21002 | AHR | Identify exotic mushroom pests and diseases and investigate the potential ways that they could enter Australia, such as through imported mushrooms, substrates or inoculum. |
| Mushroom industry communications program | MU21003 | AHR | Deliver communications to Australian mushroom growers and other industry stakeholders; latest mushroom R&D and marketing investments, developments and outcomes. |
| Mushroom price elasticity of demand | MU21005 | Natural Capital Economics | Investigate how price changes for mushrooms and substitute/ complementary products affect the industry's market share and overall revenue; determine the optimal value/volume mix for the supply chain. |

# KEEP CALM & CARRY ON A PODCAST

IN A COMPLICATED AND DIVERSE MEDIA LANDSCAPE HOW CAN YOU KEEP CONTROL OF A NEGATIVE STORY? HOW CAN WE MANAGE RISK AND WHAT SYSTEMS ARE IN PLACE TO ASSIST GROWERS WHEN AN ISSUE ARISES?

EXPLORE THESE QUESTIONS PLUS THE INSIDE STORY ON THE 2018 STRAWBERRY CRISIS IN THE NEW 3-PART PODCAST SERIES ***KEEP CALM AND CARRY ON***.

Reputational damage caused by a food safety crisis exploded into full national view in early Spring 2018, when a Facebook user posted a warning about a needle in a strawberry.

Within less than 24 hours, the strawberry needle story become a saga, and was the main news item across all media. Police, government departments and large retailers all took control of the narrative and soon the season that typically celebrates strawberries had a very different flavour.

Delightful images of strawberries and cream, Victoria sponges, and berry crowned pavlovas were displaced by strawberry 'mug' shots, police, suspects, and masses of dumped and destroyed strawberries.

The podcast series, a collaboration between the AMGA and Porter Novelli, examines the role of risk management in protecting growers with the important lessons for the mushroom industry.

Episode 3 of *Keep calm and carry on* includes a first-hand account of how this unfolded for the strawberry industry, what went wrong, and the valuable lessons learned for the horticultural industry, with expert discussion.

Key points:

- Risk can be predicted and to some extent mitigated. Unforeseen issues sometimes arise that require immediate crisis management.
- News spreads fast. Through social media channels, damaging images and videos can be broadcast and shared by anyone, anywhere.
- The mushroom industry has systems in place to assist growers should an issue arise.
- Don't let an issue become a crisis. Call AMSAFE 24 hrs a day, seven days a week to chat to someone about anything concerning. Hotline 0457 440 298

The strawberry tampering crisis led to the dumping of hundreds, possibly thousands, of tonnes of perfectly good fruit

**In a complicated and diverse media landscape how can you keep control of a negative story? How we manage reputation and the systems in place to assist growers are discussed in this three-part series. All three episodes of the *Keep calm and carry on* are now available**

**SCAN THE QR CODE TO ACCESS PODCAST**

In episode one, reputation and communication expert Patrick McClelland of Porter Novelli Australia and fresh produce industry expert Clare Hamilton-Bate of Mallsgate Pty Ltd elaborate on how reputation management plans work, why they are important, and what growers can do to if they see or hear something that doesn't seem quite right.

In episode 2, Patrick and Clare cite examples of types of issues specific to the mushroom industry, including product related risks (that can impact food safety) and people related risks (e.g., seasonal work force related issues, industry 'cowboys' or disgruntled employees).

Patrick McClelland is a stakeholder engagement specialist with Porter Novelli, while Clare Hamilton-Bate is a food safety expert with a background in postharvest management

The strawberry case study, with special guest Rachel Mackenzie (now executive director of Berries Australia, formerly of Growcom) rounds out the series.

Rachel Mackenzie believes the strawberry incident exemplifies how quickly an issue can escalate if not properly managed.

"Although the needle in the berry was a genuine incident, it was how it manifested throughout the media that took the incident to a crisis." Ms Mackenzie said.

"What began as a few isolated incidents spread to copycats and hoaxes in the days that followed".

Patrick McClelland hopes the podcast series gives growers a greater understanding of the topic, and the people and systems in place to help and support them.

"We want all growers to be more involved and to report issues earlier so we can manage risks as they arise," Mr McClelland said.

"An issue won't develop into a crisis if reported early to the right people."

Hort Innovation Strategic levy investment | MUSHROOM FUND

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## ABOUT THE HOSTS

### Patrick McClelland

Patrick is a stakeholder engagement specialist with 15 years of consulting experience across the agribusiness, health, government, environment, and energy sectors. A media and politics devotee, Patrick has a knack for connecting the dots between stories and stakeholders, creating meaningful relationships for his clients.

### Clare Hamilton-Bate

Clare Hamilton-Bate has worked with the Australian mushroom industry for over 25 years. One of her first industry projects after arriving in Australia was working with the AMGA on quality guidelines and product handling training for retailers. Clare has managed industry support projects on food safety and risk management since 2010.

### Rachel Mackenzie

Rachel Mackenzie is executive director of Berries Australia. She previously worked at Growcom, where she was instrumental in establishing Growcom's Fair Farms Initiative, as well as implementing Best Management Practices regarding water quality. Rachel was a tireless advocate for the strawberry industry during its challenges of the 2018 winter season

3

**Black wood ear**

*Auricularia heimuer*

4

**Button**

*Agaricus bisporus*

2

**Oyster**

*Pleurotus* spp.

5

**Enoki**

*Flammulina filiformis*

# FAR FLUNG Fungi

1

**Shitake**

*Lentinula edodes*

6

**King Oyster**

*Pleurotus eryngii*

## Mushroom research from around the world

## EDIBLE MUSHROOM INDUSTRY IN CHINA: current state and perspectives

Li C., Xu S. 2022. Appl. Microbiol Biotech. 106:3949-3955. https://doi.org/10.1007/s00253-022-11985-0

Mushrooms have been grown in China since the Tang Dynasty (618 to 907 AD). The earliest methods simply involved cutting openings in logs to allow natural growth of fungi. However, shiitake are known to have been grown through inoculation into logs for at least 800 years.

China is now one of the largest producers of mushrooms worldwide. Cultivated mushroom production ranks fifth after grain, vegetables, fruit and oilseeds. Large scale, industrial operations are now overtaking small traditional farms, greatly increasing yields as well as the variety of species commercially available.

Total production has quadrupled in only the last ten years. As a result, mushrooms that were once an expensive delicacy are now an everyday food.

In China, *Agaricus* ranks a distant fourth behind more popular mushroom species:

A number of relatively rare species are cultivated, including morels (*Morchella* spp.), elm ear (*Gloeostereum incarnatum*) and cauliflower mushroom (*Sparassis latifolia*).

Other mushrooms are grown for use as medicines. The fungus *Ophiocordyceps sinensis*, which parasitises and grows inside a caterpillar host, is now in large-scale production. Other examples include glossy ganoderma (*Ganoderma Sichuanese*) and tuckahoe (*Wolfiporia cocos*).

There are also numerous intensive breeding programmes. Some are aimed at domesticating wild species, others at improving those that are already cultivated. For example, more than 40 new varieties have been developed from wild strains in Jilin Province, northern China.

The paper reveals that mushroom production in China has increased phenomenally in only a few short years. It is also evident that there is major investment into R&D in all aspects of mushroom production in China. For example, a 2020 review of research reports found that approximately 25% of all published papers on *Agaricus bisporus* had Chinese authors. Clearly Chinese mushroom research is an area to watch.

The *Ophiocordyceps sinensis* fungus grows through the body of the host caterpillar, eventually producing an elongated "mushroom" from its head.

## CHINESE MUSHROOMS BY NUMBERS

**240**
NUMBER OF DIFFERENT SPECIES SOLD

**>60**
NUMBER OF SPECIES COMMERCIALLY CULTIVATED

**40,610** (2021)
NUMBER OF LARGE-SCALE COMMERCIAL FARMS

**40** million tonnes
TOTAL ANNUAL MUSHROOM PRODUCTION

**64** kg (up from 0.5kg in 2005)
ANNUAL CONSUMPTION PER CAPITA

**73,000** tonnes worth
US$ **5.7** billion (2019)
TOTAL EXPORTS

Hort Innovation
Strategic levy investment

MUSHROOM FUND

MushroomLink