



2024 AgriFutures Cultivate Program applications are open.

Roast chooks for all

■ Cultivating the chicken meat workforce

TO meet the needs of a growing population of chicken meat lovers, with the average Australian now consuming 1kg of chicken a week, the new AgriFutures Cultivate Program aims to build the poultry workforce one student at a time.

AgriFutures has partnered with the chicken meat industry to launch the traineeship, which provides an unparalleled opportunity to launch a career in a thriving sector for people in their early profession who are interested in animal welfare, innovation and sustainability.

As well as a Certificate III in Poultry Production, successful participants will be guaranteed a full-time role in the industry, engage in professional development and mentoring and complete the program alongside a passionate network of peers.

Inghams executive general operations manager Susy Klein said Inghams were proud to back the initiative.

“We are delighted to partner with AgriFutures on this program.”

“It is an important collaboration that provides the industry with a new way of growing our workforce capacity,” Ms Klein said.

“There are diverse career options in the chicken meat industry as it has a vastly different structure compared to other agricultural industries.

“Chicken companies directly provide farmers with one-day old chicks, feed, veterinary expertise and farm management support, which creates an industry rich in opportunities to progress.”

AgriFutures Australia managing director John Harvey said the Cultivate Program is a unique pathway into

the agricultural workforce that aims to catch the attention of those who may not have considered a career in the chicken meat industry before.

“With a new focus on strengthening the agricultural workforce, at AgriFutures we recognise that young people have a key part to play as future workers and leaders of the agricultural industry,” Mr Harvey said.

“We need to support them, listen to them and invest in their development.”

Baiada Poultry general manager, technical, nutrition and feed-milling Katherine Balding agreed that the opportunities in the chicken meat industry are little known but plentiful.

“I know a number of professionals in the chicken meat industry who began their career in a hands-on role on-farm and have

PCPP's 2023 Poultry School

THIS month I had the pleasure of being invited as the opening plenary speaker at the Philippine College of Poultry Practitioners' 2023 Poultry School, a conference of over 1500 delegates held in Manila.

I also had the chance to visit Cavite State University and several poultry farms in the Philippines.

I was impressed with the agri tourism on display at Cavite State University and look forward to learning more about it and exploring ways to collaborate in the future.

I would especially like to thank Dr Cynthia Dela Cruz for her hospitality and thought-provoking conversation.

What an amazing experience.

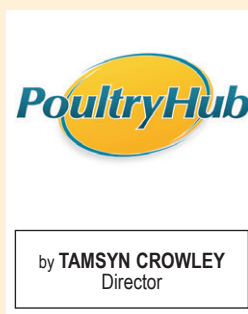
At the PCPP Poultry School I was tasked with exploring the resilience of the Australian poultry sector.

Australia's poultry industry has demonstrated resilience over the years, and there are several key lessons that other countries could benefit from.

Australia places a strong emphasis on biosecurity to prevent the introduction and spread of diseases on poultry farms.

These measures include strict import controls, quarantine protocols and surveillance systems.

The sector has a



emergencies is crucial.

These plans outline steps to take in various scenarios, enabling the sector to respond swiftly and effectively.

Government policies and support play a significant role in ensuring the resilience of the Australian poultry industry.

This includes funding for research, assistance during emergencies and policies that promote sustainable production practices.

Embracing sustainable practices, such as efficient resource

continued P2

well-developed supply chain that can quickly adjust to changes in demand.

Many Australian poultry producers are vertically integrated – meaning they control various stages of the supply chain, from production to process-

ing and distribution.

This integration enhances supply chain resilience and reduces vulnerabilities to disruptions.

Having comprehensive contingency plans in place for disease outbreaks, market disruptions and other



The author and Dr Cynthia Dela Cruz at Cavite State University.



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**Poultry Industry
Calendar of Events**

2023

OCT 17-18 – Poultry Hub Australia Ideas Exchange, Adelaide South Australia, www.poultryhub.org

NOV 6-8 – Poultry Tech Summit 2023, Georgia USA, www.wattglobalmedia.com/poultrytechsummit/

NOV 6-8 – Avicola and Porcinos 2023, Buenos Aires Argentina, www.avicola.com.ar/en/

NOV 23-25 – Poultry India 2023, Hyderabad India, www.poultryindia.com.in

2024

JAN 31 - FEB 4 – International Production and Processing Expo (IPPE) 2024, Georgia USA, www.ippexpo.org

FEB 6-8 – Australian Poultry Science Symposium, Sydney Australia, www.apss2024.com.au

MAR 12-14 – World Agri-Tech Innovation Summit, San Francisco USA, www.worldagritechusa.com/

MAR 12-14 – Meat Pro Asia, Bangkok Thailand, www.meatpro-asia.com

JUN 24-28 – XVIth European Poultry Conference, Valencia Spain, epc2024.com

OCT 28-29 – International Conference on Poultry Science, Lisbon Portugal, waset.org/poultry-science-conference-in-october-2024-in-lisbon

NOV 12-15 – EuroTier 2024, Hanover Germany, www.eurotier.com

How to supply event details:
Send all details to National Poultry Newspaper, PO Box 162, Wynnum Qld 4178, call 07 3286 1833 or email ads@collins.media

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HAVE YOUR SAY!

All producers are encouraged to send in letters to be published in NPN, outlining any concerns or issues they may have with the industry.

This is an open forum where you can cover any topic, whether for or against an issue.

Please send your letters to: editorial@collins.media or PO Box 162, Wynnum Qld 4178



The author was the opening plenary speaker at the Philippine College of Poultry Practitioners' 2023 Poultry School, a conference of over 1500 delegates held in Manila.



Opening speaker at PCPP's 2023 Poultry School

from P1
use and waste management, not only benefits the environment but also improves the sector's long-term viability.

Investing in research and innovation has allowed Australia's poultry industry to enhance its productivity, improve animal welfare and reduce environmental impacts.

Prioritising animal welfare not only aligns with consumer preferences but also contributes to the industry's sustainability long-term.

Investments in better housing, nutrition and health management can lead to healthier animals, higher-quality products and increased revenue.

Australia's poultry

network plays a key role in helping the sector manage challenges.

Collaboration through sharing information, best practices and resources has enhanced the collective ability to respond to disruptions.

Poultry Hub Australia provides training and education packages, resources and events for poultry professionals.

Ensuring a skilled

workforce through training and education programs has contributed to the success of Australia's poultry industry.

By investing in human capital, countries can build a knowledgeable workforce capable of driving growth and innovation.

Australia's poultry sector's resilience can be attributed to its em-

phasis on biosecurity, diversification, innovation, supply chain integration, adaptation, sustainability, collaboration, crisis management, workforce development and transparent communication.

These lessons can be valuable for other countries aiming to enhance their own poultry industry's resilience and success.

Cultivating the future chicken meat industry workforce

from P1
progressed to supervisors and management at some of Australia's largest food production companies," Ms Balding said.

Australian Chicken Meat Federation chief executive officer Dr Mary Wu said, "This is a hugely exciting initiative for the industry and provides an excellent entry platform for people to explore the diverse and rewarding what a winning combination!"

The AgriFutures Cultivate Program aims to shine a spotlight on a livestock industry that holds an enormous amount of potential for young people – applications are now open to people looking for an early career opportunity and no prior experience is required.

For those seeking more information about the AgriFutures Cultivate Program, AgriFutures Australia is hosting a live question and answer session on Monday October 16, 2023.

During this session, attendees will have the opportunity to have their queries addressed and gain deeper in-

sights into various aspects of the traineeship, including eligibility, the application process, program details and the

diverse roles on offer. Head to agrifutures.com.au/cultivate for more information and to apply.



For those seeking more information, AgriFutures Australia is hosting a live question and answer session on Monday October 16, 2023.

QUEP CEO John Coward resigns

QUEENSLAND United Egg Producers recently received the resignation of John Coward as chief executive officer of the organisation due to health reasons.

John has been in the position of CEO for over 12 years and has been the rock of the organisation during this period.

John's ability to li-

aise with producers and government at all levels is unparalleled and will be sorely missed by all.

The egg industry continues to operate in uncertain times with respect to the Australian Animal Welfare Standards and Guidelines for Poultry following a Federal Government announcement endors-

ing the proposal in its entirety.

The regulation and implementation of the guidelines now reverts to the states for determination with QUEP's position firmly centred on the need for national uniformity.

Representations to the state government will continue to impress this point as the process progresses.



John Coward resigns as CEO of QUEP.



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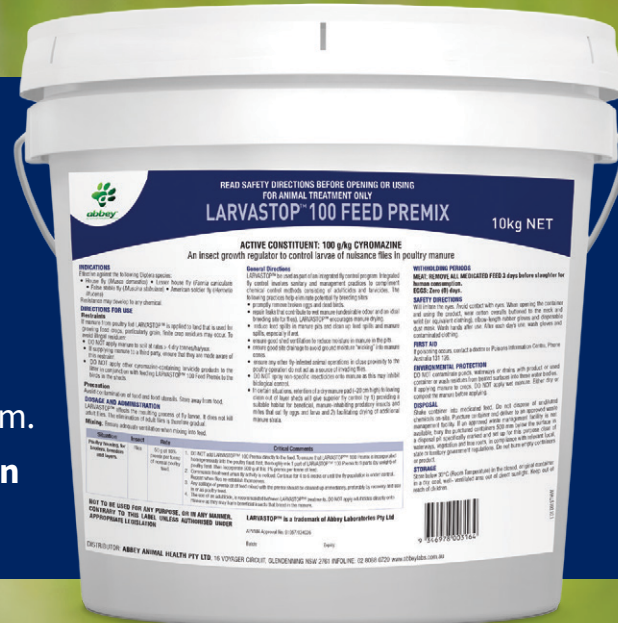
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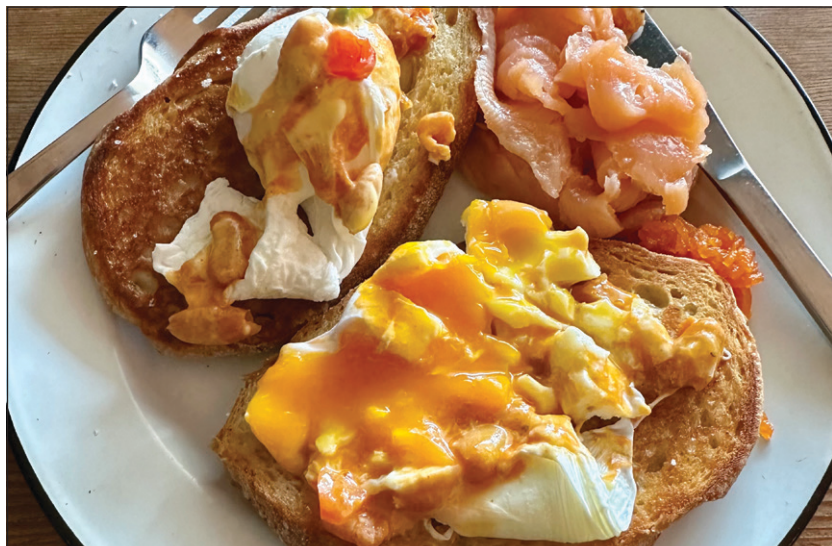
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Brown shells, that's OK – essential are rich coloured yolks.



The author's Pemberton poached eggs were a delight, albeit not smoked.



Competing for shelf space. Where there's smoke, maybe there's fire!

Shelling out for smoked eggs

SMOKED eggs?

How do they work?
And what do they taste like?

Are they barbecued eggs?

Well, I had long wondered, hence I dove in and bought a chilled box of half a dozen when holidaying in Western Australia at picturesque Pemberton recently.

I've since enjoyed them at home, hard boiled and poached and admit I'm a fan – of the flavour at least.

That unique smoky flavour is something different of course, and a modest move on the magical mystery tour that is exploring new foods, new flavours and new cooking methods.

However, the other sales pitch beyond the obvious flavour is their shelf life, spruiked by the producer as an attractive four or five months.

However, I'm not sure this is a significant selling point for me.

I've never had an issue with a limited shelf life of purchased fresh eggs, at least not from my preferred supplier, the Fremantle Egg Company.

Typically, one dozen boxes of their delectable extra-large or mega jumbo eggs have an expiry date of well past a month beyond my purchase day.

The usual two dozen at a time that I buy are always consumed within 30 days, hence all good.

So, aside from the obvious flavour fantasy, what's the allure of buying smoked eggs – which, not surprisingly, are priced at a considerable premium over conventional fresh eggs?

I paid \$7.90 for my half dozen smoked eggs.

In what can be a costly up-front exercise though with a potentially rewarding end point, the Victorian based Smoked Egg Company apparently has the world patent on an advanced smoking technique that stops the ageing process of eggs.

Cant Comment

by BRENDON CANT



I understand laboratory tests have indicated no bacteria at 18 weeks, compared to 'normal eggs' held in the same environment showing plenty.

According to the Smoked Egg Company website – which seems fascinatingly short of detail – the business has perfected the precise equation of time, temperature, humidity and volume of smoke to create a "beautiful aroma" and taste of smoke within the egg shell.

Adding, "The smoky flavour is full bodied, but not overpowering."

"They taste great poached, boiled or fried. "Scotched eggs are fabulous."

Company co-founder Julie Kos – a chef before hatching as an egg farmer – combined her two skills and started smoking eggs for flavour profile alone and it took more than nine

months to perfect the method.

In the end, another aspect of the process became truly groundbreaking.

"Once we got the flavour in there, we wanted to know if the flavour developed over time, which it does", she told Australian Farmers website.

"What we do is we get an egg, we then naturally smoke wood, encapsulate that smoke, we chill that smoke down.

"Cold smoking is usually between 18-35C.

"We go from -4 to 7C."

Julie explained there was no reason the same equation couldn't be used for any food that required refrigeration.

"We don't change the quality of the protein or the structure of the food," she said.

"That's really exciting because we can do meat, flour and rice and prolong the life of any

of those products."

With eggs, the process works by opening the pores of the egg, infusing flavour, but at that temperature, it's still entirely raw.

"The pores won't open unless it's in a chilled environment," Julie said.

"As an egg producer, we grade our eggs and wash them in warm water.

"If we did it in cold water, all the impurities in that water would go straight back into the egg and it would carry bacteria," she explained.

"We're talking with people in the United Kingdom, with the egg board in America and have sold a licence over there and also the Netherlands.

"We're gaining ground, but nobody really understands what it's about because they see the word smoked and think it's cooked, which it's not.

"My ultimate dream for the future is seeing smoked eggs in every shop and supermarket around the world, but it's going to take us a while to get there.

"Being a female founder of this product, I'm very proud of what we've achieved.

"It has been a very hard journey, but I think we're nearly there."



Boiling the smoked eggs made for a good home brekky.

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Making food security an Australian priority

PEOPLE have little time to really look into the background of food production in our country and to acknowledge the proud contribution in both capital and time that farmers make to feeding the nation.

People are quick to point out the rewards or romanticised lifestyle that farmers have but seldom focus on the risk and sacrifice made in this vocation.

Many farmers have worked hard to capture information for those not from farming backgrounds, through video clips and written material, of the cutting-edge technology and skills used on-farm.

And wherever I go,



I quickly strike up a conversation about egg production once people have asked the question, "What do you do?"

Occasionally people are so intently focused on our domestic situation that they miss what is happening globally.

Other times the focus is so concentrated



on following an international trend, people forget about food security here.

I have spoken before about the policy decisions in Europe – to put the vast majority of hens outside – which have resulted in higher risks to flocks.

Now there is chatter abroad about the consideration of the

benefits of hens being housed indoors to reduce risk.

We don't want to put our biosecurity at risk by needing to import table eggs.

There was no clearer example than a recent article that stated the European Union's proposed prohibition of the utilisation of cages in agriculture had been postponed – initially released by the *Financial Times* and featuring in *PoultryMed*.

The industry has always noted that both a reduction in national egg production and price increases would result if there were a phase-out of one system.

We also know there

are those who want to pick and choose trends from overseas – such as adopting European policy on egg production – which would cost our farmers not only millions of dollars but often for reduced animal welfare outcomes.

Those most vocal about cage eggs say very little about the power of importing cage eggs into Australia.

We know there is no level playing field and our domestic industry suffers.

Recently, my friend Andrew Henderson from Agsecure wrote an article entitled 'Food is the fundamental to Australia's security' – see page 12.

This article has certainly started further discussion on our food security and the importance of it.

I cannot agree more that preparedness is the key.

Farmers can only prepare long-term strategies for future farming when government listens and works hand-in-hand with industry, as it is often government dictating the regulations and settings for our industry that egg farmers must work under.

Online registration portal open for APSS 2024

THE Australian Poultry Science Symposium is the premier avian science conference in Australia and attracts delegates from across Australia and around the world.

APSS 2024 will be the thirty-fifth edition of the symposium, which will again be held at the Sheraton Grand Hotel, Sydney Hyde Park from February 19-21, 2024.

This event's over-arching theme will be 'Frontier science – integrating nutrition, gut health and welfare'.

There will again be an array of outstanding local and international invited speakers, and as always, APSS will be inviting researchers far and wide to submit and present a large range of scientific papers, loaded with industry-relevant content and cutting-edge research.

The social program will also provide everyone with plenty of networking opportunities over the three-day event.

Online registrations officially opened for APSS 2024 on Monday October 2, 2023.

Invited speakers include:

- Dr Mary-Frances Copley
- Prof Peter Ferket
- Prof Mike Gidley
- Prof Brian Fairchild
- Prof Filip van Immerseel
- Prof Kapil Chousalkar
- Dr Dana Campbell
- Dr David Cadogan
- Prof Rami Dalloul
- Prof Ruth Zadoks
- Prof Sam Abrahams
- Prof Andrew Holmes

For more information, contact benjamin.geist@sydney.edu.au or visit the website at apss2024.com.au



Those most vocal about cage eggs say very little about the power of importing cage eggs into Australia, and the biosecurity risks by needing to import table eggs.

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Professor Mingan Choct of the University of Sydney.

Challenges for Australia's poultry industry coming

THE poultry industry is the number one supplier of quality animal protein sources for human consumption.

It does not matter whether you focus on the ethics of food production or the essence of food production, from a global food security and sustainability point of view, it is essential have a prosperous and advanced poultry industry.

Recently, the Poul-

try Research Foundation of the University of Sydney – supported by AgriFutures Australia and BEC Feed Solutions – organised a poultry industry think-tank meeting to discuss the key challenges that will shape the poultry industry over the next 20 years.

It was well attended by leaders of industry and academia in Australia.

The three key challenges identified were people, collaboration and communication.

Here I will discuss the first challenge – people.

The other challenges will be covered in subsequent issues.

The 'people' challenge has been looming for quite some time.

First, finding people to do the day-to-day operation in the industry is difficult because most young people think the poultry industry is not sexy, so shy away from entering the sector.

The situation is not

likely to improve greatly in the future.

Thus, the onus is on the industry to plan for its workforce, taking into account technological advancement.

That is, how many jobs will be replaced by artificial intelligence and how can the industry prepare for it in terms of the way a poultry farm operates, what the migration intake of the country looks like and the types of skills required to run a future poultry farm?

Second, finding, attracting and retaining scientific and industry leaders in the sector has become hard because the training and research providers are struggling to offer courses and conduct research due to lack of funding.

This is related to two main developments over the years.

Universities

Australian universities have been increasingly corporatised.

Meaning they support courses that attract a

large number of students – in particular, international students – and research groups that bring in big grants.

Along the way, the 'national interest' criterion no longer plays a role in our higher education system.

If it did, it would think about supporting an area such as poultry research and training because the sector is a key pillar of Australia's food security system.

The consequences of this are a major decline in postgraduate students interested in poultry research and undergraduate students specialising in poultry science.

This has led universities to put massive pressure on poultry science-heavy courses to rationalise due to low enrolment numbers.

Though, I'm afraid, perhaps this is not unique to the Australian higher education system?

Funding

The pool of industry funding of poultry

research through the Australian Government's research and development levy system is limited, with little increase over the years.

There is also a view by some – rather similar to that on climate change – that as a small country, Australia accounts for a very small proportion of the world population and hence, we do not need to fund research as a priority.

Indeed, one of the key reasons for the Australian national productivity slow-down has been identified as a slowed rate of innovation and technology adoption by companies.

This challenge is the priority for everyone involved in the poultry industry – be it research, education or production – and cannot be left in no-man's land.

It is a priority that all tiers of our government should take notice of and bring it to our national agenda.

Mingan Choct
University of Sydney



Finding people to do the day-to-day operation in the poultry industry is difficult.



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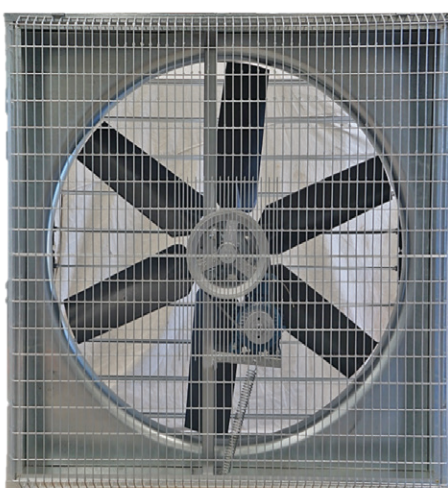


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The consortium team is motivated and committed to working with the chicken meat industry and research community both within Australia and globally.

Inaugural Chicken Meat Consortium

OUR Consortium Inaugural Showcase held on September 5, 2023 was an inspiring and productive day, with more than 70 honourable guests, passionate steering committee members, enthusiastic industry partners, talented students and dedicated consortium members gathering at Customs House in Brisbane City Queensland to celebrate Australia's first chicken meat research consortium.

It was highly appreciated having Queensland Alliance for Agriculture and Food Innovation institute director Professor Matthew Morell, AgriFutures Australia general manager levied and emerging industries John Smith and our consortium director Professor Eugeni Roura delivering the

opening speeches and introducing our consortium team to all guests.

Sincere gratitude also goes to Katherine Balding and Dr Sheridan Alfirevich for joining the panel with the three speakers, providing in-depth and insightful discussion about the challenges and opportunities faced by the chicken meat industry and the research community.

We would also like to thank Department of Agriculture and Fisheries Queensland principal extension officer poultry Rachele Osmond for chairing a great showcase, together with the staff at Customs House and all the members involved in preparing the event and working behind the scenes to make the showcase a reality.

Your efforts to the success of the con-

sortium showcase is truly acknowledged.

It is encouraging to envisage how our multi-institute and cross-disciplinary consortium team can collaborate with the wider community to address the challenges and opportunities, train the next generation of chicken meat experts and feed the growing population while improving sustainability, animal welfare and public health.

Our amazing consortium team is motivated and committed to working with the chicken meat industry and research community both within Australia and globally for a better and sustainable future of the chicken meat production ecosystem through innovation and collaboration.

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ACMF has a new website.

New look website for Australian Chicken Meat Federation

THE Australian Chicken Meat Federation, the national voice for Australia's chicken meat industry, has a new website.

Representing all elements of the industry, including chicken growers and processors at a national level, the new website offers a member section.

This area provides

comprehensive information on what ACMF is doing for its members, with an example being the work undertaken on an industry workforce strategy and sustainability roadmap.

The ACMF Strategy and Operating Plan highlights how the federation is advocating for the chicken meat industry on be-

half of its members.

The member section also contains valuable resources such as research and development outcomes and reference materials, including a recent factsheet to help members understand the organisations and bodies involved in an emergency animal disease response. Together with the

above, the site provides robust and educative information for consumers and the general public, as ACMF represents also a range of suppliers, providers of services and customers to the industry, all of whom are involved in the production and distribution of chicken meat in Australia. As such, the public-

facing content of the website was written to address the most commonly asked Google-search questions and demonstrates how the Australian chicken meat industry delivers our favourite meat to the dinner table.

For more information, to become a member and industry related resources, visit chicken.org.au

ROLES AND RESPONSIBILITIES IN AN EAD RESPONSE	
Chicken Industry Peak Bodies and Associations	Government Agencies
<ul style="list-style-type: none"> Australian Chicken Meat Federation (ACMF) <ul style="list-style-type: none"> Processor, grower and government preparedness, coordination and liaison Disburse approved Jurisdictional communications. Develop and supply internal communications (EAD Preparedness) Nominate representative for NMG, CCEAD and LLI Nominate a representative to review Initial Response Plan. Circulate communications provided by ACMF and/or the Jurisdiction. Australian Chicken Growers Council (ACGC) <ul style="list-style-type: none"> Provide growers' commentary in relation to disease effects on farm Represent growers in EAD preparedness and responses Circulate communications provided by ACMF and/or the Jurisdiction. State Farming Organisations (SFOs) <ul style="list-style-type: none"> Represent growers in EAD preparedness and responses Circulate communications provided by ACMF and/or the Jurisdiction. 	<ul style="list-style-type: none"> EAD Hotline / Government Vet <ul style="list-style-type: none"> Respond to calls surrounding EAD. Connect the caller to the relevant part of the State Jurisdiction. Australian Centre for Disease Preparedness (ACDP) / State Laboratory <ul style="list-style-type: none"> National reference laboratory for AI confirmatory testing. Notify State Jurisdiction and CCEAD of test results. Continue to process samples throughout an EAD as directed by the Jurisdiction. Responsible for developing and implementing state response (Ideally consistent with the AI AUSVETPLAN) Coordinate industry LLI's Develop and supply industry communications. Engage with media where required. Conduct testing programs where required. Chair the CCEAD. Chair the NMG. Oversee and implement cost sharing agreement (and pay back arrangements) Engage WOAAH and markets where required. State Jurisdiction <ul style="list-style-type: none"> DAFF to notify WOAAH of confirmed notifiable diseases. DAFF to manage certification of exported product and re-negotiate trading arrangements where required.
Chicken Industry Participants	EAD Response Agencies
<ul style="list-style-type: none"> Affected Integrator <ul style="list-style-type: none"> Notify Jurisdiction of suspected EAD (through the EAD Hotline). Notify ACMF of suspected and/or confirmed EADs. Respond to the incident as directed by the Jurisdiction. Continue to implement preparedness activities across the business. Affected Farm <ul style="list-style-type: none"> Notify affected integrator of suspected EADs. Respond to the EAD as directed by the State Jurisdiction Other farms (Other Producers) <ul style="list-style-type: none"> Implement EAD Preparedness activities. Respond to the EAD as directed by the State Jurisdiction. 	<ul style="list-style-type: none"> Refine where necessary and approve the EAD Response Plan. Provide technical advice to the EAD Response. Make recommendations to NMG on capacity to eradicate EAD and recommend agreement on the cost and Response Plan to the NMG. Approve budget and Response Plan as provided by CCEAD. Oversee the implementation of the Response Plan.
Cross Government/Industry	Media
<ul style="list-style-type: none"> Animal Health Australia (AHA) <ul style="list-style-type: none"> Maintain up-to-date preparedness documents. Provide guidance on operation of AUSVETPLAN and EADRA NMG (National Management Group) <ul style="list-style-type: none"> Peak bodies take direction from the State Jurisdiction's Public Information (PI) function, and co-ordinate the flow of information to and from media. 	<ul style="list-style-type: none"> Refer all incoming enquiries to Outbreak.com.au and/or nominated call centre number unless you have been advised otherwise by your Peak Industry Council (PIC) or State Jurisdiction. Individual processors and growers should not engage with the media.

A factsheet to help members in an emergency animal disease response features in the member section of the new website.

Animal Welfare	Animal Health	Workforce	Food Safety
<ul style="list-style-type: none"> Protect Promote Deliver 	<ul style="list-style-type: none"> Prepare Respond Represent 	<ul style="list-style-type: none"> Attract Retain Train 	<ul style="list-style-type: none"> Standardise Apply Evolve
Sustainability	Trade	R&D	Governance
<ul style="list-style-type: none"> Benchmark Promote Evaluate 	<ul style="list-style-type: none"> Protect Expand Unlock 	<ul style="list-style-type: none"> Guide Adapt Innovate 	<ul style="list-style-type: none"> People Process Business

The ACMF Strategy and Operating Plan highlights how the federation is advocating for the chicken meat industry on behalf of its members.

Ragazzini peristaltic hose pump for sludge and slurry situations

OVER the past number of years Hydro Innovations has delivered a number of Ragazzini peristaltic pumps into extremely tough working environments, including piggeries, abattoirs and water filtration plants, as well as in food manufacturing and processing applications.

One of the toughest projects has been the search for a pump that could draw animal waste – broken-down manure – in the form of sludge from the bottom of covered anaerobic lagoons.

CALs are often used in piggeries, abattoirs and rendering plants, from which methane gas can be produced and recovered to generate electricity.

A CAL is a man-made lagoon covered with a membrane to create an anaerobic digestion environment and to contain the build-up of methane gas produced.

The methane gas is then drawn off to fuel generators to produce power.

The broken-down organic waste collecting in the bottom of the CAL then needs to be removed – pumped out – so that new 'fresh' material can flow into the lagoon, continuing the process.

Hydro Innovations were approached to identify a pump that could handle this very tough environment, stand up to the material being

pumped, be reliable and easy to maintain, as well as have the ability to operate without constantly being observed.

The Ragazzini peristaltic hose pump was selected due to its inherent features, including:

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- No lubricating fluid required therefore simplified and cheaper hose change over

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No contamination of product, for example in the case of food products.

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Ragazzini peristaltic pumps for extremely tough working environments.

Page 8 – National Poultry Newspaper, October 2023

www.poultrynews.com.au

Looking at nutrient digestibility beyond traditional view

ANY gain in nutrient digestibility in animals can result in big gain in feed efficiency.

Feed efficiency gain is a big win for sustainability because there will be less extra ending up in the environment and less land used to grow crops.

Indeed, a reduction of feed conversion ratio by three points – that is, from 1.53 down to 1.50 at market weight – would save the Australian chicken meat industry approximately 56,000 tonnes of feed per year, the monetary value of this alone is staggering even for a small country such as Australia.

But the advent in animal nutrition science means that a substantial increase in nutrient digestibility will be difficult using the traditional methods of nutrition research, such as using feed additives or processing technologies and measuring nutrient disappearance at a specific part of the gut.

This is where digestive dynamics come in. Digestive dynamics refers to the way different nutrients interact with one another during digestion along the lumen and transition across the gut mucosa into the portal circulation.

How do feeding practices, feeding behaviour, ingredient composition of feed, nutrient constituents of diet and feed processing affect the way feed is digested and nutrients absorbed?

These are the questions that Dr Shemil Macelline at Poultry Research Foundation is exploring under the auspices of Associate Professor Sonia Liu.

Dr Macelline is a

young scientist with global experience.

He completed his bachelor's degree at the Uva Wellassa University of Sri Lanka, his masters at Chungnam National University in South Korea and his PhD at the University of Sydney with Drs Liu and Selle in 2022, with the science faculty's 'Outstanding Academic Achievement Award'.

The central tenet of Dr Macelline's work is to examine why there is an inflection point for performance and carcass fat when the protein content in broiler chicken diets is reduced to a certain level, despite balancing essential as well as conditional essential amino acids.

In order to find an answer, Dr Macelline is exploring amino acid catabolism and anabolism in various tissues and cells, such as enterocytes, liver and skeletal muscle, as well as exploring post-enteral amino acid antagonisms, deamination and uric acid synthesis.

Furthermore, Dr Macelline is examining whether a correct blend of protein-bound and non-bound – free, synthetic, crystalline – amino acids would optimise broiler performance.

Dr Macelline is a high performing scientist who thinks innovatively and works extremely hard.

To date, he has 49 peer-reviewed full papers under his belt and presented at 13 national and international conferences.

Poultry research at the University of Sydney is in good hands.

Benjamin Geist
University of Sydney



Dr Shemil Macelline is a high performing scientist who thinks innovatively and works extremely hard.

www.poultrynews.com.au

Friday 13 October will be lucky for egg industry

FRIDAY the thirteenth is the stuff of myth and legend and is seen in many parts of the world as a day of bad luck.

However, the opposite will be true on Friday

October 13, as it will be World Egg Day.

The event was first held in 1996 and since has spread to over 100 countries.

This year's theme is 'Eggs for a healthy future', with a focus on the

highly nutritious and versatile value of eggs.

The International Egg Commission said the initiative shines a spotlight on the vast range of unique benefits that eggs can bring to human and planetary

health, contributing to a healthier future to all.

The IEC continued that eggs combat common nutrient deficiencies that often go unaddressed but are critical for optimal health and performance.

Beyond their nutritional powers, eggs are also one of the most environmentally sustainable animal-source proteins.

To support egg businesses in their celebrations, the IEC has created an industry toolkit that includes themes and key messages, ready-made social media graphics and inspiration for 2023's activities.

This year, for the first time, the IEC has also created a children's activity pack, to spread the message of egg nutrition to the younger generation.

Mark Clements
WattPoultry



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¹Data on file, Study report No. 04-16-7ADMI

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Get home safe with free Aussie online training course

AUSTRALIA'S leading designer and manufacturer of high-pressure water blaster equipment has launched an updated version of its free online safety training course, Aussie Pumps Safe Operator.

Aussie Pumps has designed the course for operators of high-pressure water blasters of all types and brands. Popularity of pressure cleaners for farm applications has skyrocketed in recent years, but so too has the potential for injury.

Aussie Pumps' designers and engineers work in consultation with farmers to continually improve product safety.

The Aussie range of pressure cleaners – sold not only in Australia now but globally – has set new standards in safe design of high-pressure cleaning devices up to 500 bar, or 7300psi.

As Aussie's product range expanded, the company realised that safety in the use of the equipment is an essential part of the package.

Aussie Pumps' chief engineer John Hales said, "We listened to feedback from farmers and realised there were some extraordinary risks being taken by

untrained operators." "For example, using a pressure cleaner from a ladder is risky!"

"Our aim is to prevent injuries by training operators to identify hazards and in understanding how the equipment works," Mr Hales said.

The training course explains how the product functions, with particular attention being paid to the relationship between pressure and flow of the pump.

It covers basic maintenance checks to identify and minimise hazards.

Scan the QR code or visit aussiepumps.com.au to view the Aussie Pumps Safe Operator course online.

Aussie Pumps invites

all users of pressure cleaners – irrespective of brand – to complete the course.

If you have any questions, contact Aussie Pumps' marketing department – the team is happy to help.

Further information on Aussie's Pumps complete range of high-pressure cleaners in both hot and cold versions is available by either calling +61 2 8865 3500 or visiting aussiepumps.com.au



The online Aussie Pumps Safe Operator training course.



McDonald's work with their chicken suppliers to make sure their farms and abattoirs meet the RSPCA's detailed animal welfare standards.

Golden arches inspiring better chicken welfare

MCDONALD'S Australia had been engaging with RSPCA Australia for over a decade to improve animal welfare in their supply chains and, in 2021, they finished their move to sourcing 100 percent RSPCA Approved chicken throughout their Australian locations.

It's a huge accomplishment – and one that contributes to many millions of meat chickens now and in the future having a better quality of life.

To achieve this, McDonald's worked with their three existing chicken suppliers – Ingham's, Turosi and Baiada – who committed to participating in regular assessments to make sure their farms and abattoirs meet the RSPCA's detailed animal welfare standards.

Rigorous assessments are completed two to four times a year on farm, and annually at abattoirs by specially trained RSPCA assessors.

Once assessments are completed, assessors send their reports to be reviewed and evaluated by the certification team to check

for conformance and work through any potential issues before granting certification.

This multi-layer approach to certification reflects the world's best practice.

Prior to making the switch to RSPCA Approved chicken, in 2017, McDonald's transitioned to sourcing 100 percent of its whole eggs from cage-free farms.

In 2022, they served up around 81 million eggs annually, meaning millions of hens have lived better lives, with more space to flap their wings and lay their eggs in secluded nest boxes.

To date, over 4.4 billion animals have benefitted from being reared to the RSPCA's detailed animal welfare standards by producers with RSPCA Approved certification.

Brands such as McDonald's are listening to their customers and demonstrating a commitment to making higher welfare food options more accessible to Australian consumers.

We look forward to seeing what they do next to further improve the lives of farm animals.

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AgriFutures Australia Rural Women's Award

WHAT an incredible night at AgriFutures Australia Rural Women's Award 2023.

It was such an inspiring experience to hear the stories of the seven amazing finalists, who are truly making a difference on the ground in rural and regional Australia.

Their grit and resilience are remarkable. I'm grateful to have been a part of such an empowering event.

Congratulations to Nikki Davey of Grown Not Flown, which connects local producers and positively contributes to enhancing sustainability and provenance.

Applications are now open for the 2024 AgriFutures Rural Women's Award – agrifutures.com.au/opportunities/rural-womens-award

Mary Wu
Australian Chicken Meat Federation



The author at the AgriFutures Australia Rural Women's Award 2023.

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Food is fundamental to Australia's security

RESILIENCE, the economy and national security are a live discussion across Australia.

People can feel change in their bones, from the climate to mortgage repayments – even Australia's place in the world.

These discussions are happening on milk crates at smokos and at home around dinner tables because big topics have a habit of raising themselves when people gather around a meal.

Food brings us together, but it also goes far beyond the simple fellowship of breaking bread.

Food is central to Australia's stability and security, yet it's too often neglected in favour of seemingly higher priorities.

The release of Australia's defence strategic review in April was a defining moment.

Rarely has a public document talked so openly about Australia's challenging strategic environment.

The review tells us that the threat of conflict in the Indo-Pacific is the highest level of strategic risk we have faced in 80 years, and that leaders need to return to fundamentals.

It offers a new vision of defending Australia – one that goes beyond the military and in which we all have a role to play.

It also brings to the

fore the fatigued concept of resilience and calls our national preparedness into question.

But for a document that points squarely at the need for every part of Australia to pitch in, it was disappointing that the unclassified version didn't mention food or agriculture.

With work on a national defence strategy underway, now is the perfect time to reflect on why food should be more highly prioritised.

Agriculture and food production will play a central role in the defence strategic review's 'whole-of-government' and 'whole-of-nation' approach to security, and not only for enabling defence but for 'whole-of-society' resilience.

Agriculture and food production are much more valuable than their 2 percent contribution to gross domestic product or employment of 1.6 million people.

After all, what's more fundamental than food?

Our ability to produce it, process it and export it shouldn't be taken for granted, nor should our ability to get what we want, when we want from a supermarket shelf.

Without any one of these capabilities, Australia would find itself suddenly facing complex problems directly linked to our ability to defend ourselves and the region.

Hungry populations are discontent, and discontent breeds instability.

The basic capacity to feed and clothe the population – and to export that prosperity – is fundamental to the stability of our society.

Agriculture is a microcosm of Australia's strategic vulnerabilities.

It's heavily trade exposed, vulnerable to supply chain shocks and contends with the daily threat of devastating climate and biosecurity risks.

It offers key lessons on preparedness and resilience for the rest of the nation.

Australia's agricultural sector exports about 70 percent of what it produces every year.

Just like the broader economy, it's so trade exposed that if farmers can't export their surplus produce, most will go broke.

Two-way trade makes up more than 40 percent of Australia's overall GDP.

Stuff coming in and stuff going back out profitably is key to Australia's solvency.

Profitable trade is becoming more challenging as the lines between trade and security increasingly blur and trade becomes weaponised.

Our trading environment is rapidly changing as challenges to the rules-based world order grow stronger.

If the commitment to economic liberalism continues to erode, the terms of trade may not be as favourable to us as they have been in the past.

Australia has long enjoyed the luxury of focusing on securing favourable terms for decades, as the recent European Union trade negotiations highlight, but the ability to get our products out to market at all is often overlooked.

The state of Ukrainian wheat exports is an extreme example of what this could look like.

That raises the issue of supply chains – the indispensable veins and arteries that keep the sector and the economy alive.

Curtin University associate professor of supply-chain management and logistics Elizabeth Jackson has highlighted that, "Australia is one of the most logistically isolated major economies on earth."

We felt this reality in both world wars, when our access to world markets effectively vanished overnight and entire export industries were lost.

Soberingly, a 2003 navy report noted that Australia is still reliant on non-Australian ships for trade.

The situation hasn't improved, and Australia's merchant fleet has continued to shrink, sharpening the focus on the government's plan to establish a maritime strategic fleet.

For agriculture, the ability to import key inputs such as labour, liquid fuels, animal medicine, chemicals, ferti-

liser and spare parts is just as important as being able to export the final product.

In a potential future conflict, our solvency would depend on it.

Finally, Australian agriculture faces ever-present climate volatility and biosecurity risks.

These range from mild inconveniences to crippling foot-and-mouth disease outbreaks and increasingly frequent extreme climate events that could decimate industries.

Compared with some sectors though, honest and open conversations about these risks have led to a relatively sophisticated understanding of the importance of preparedness.

Governments and industry have worked together to combat established pests and diseases and to prevent incursions of new ones.

Together, they operate a biosecurity system that generates an estimated 30:1 return on every dollar invested into it.

The Federal Government appears to have recognised this in its proposed sustainable funding model for biosecurity, which defrays funding increases across the economy.

While it's contested, it should be recognised as an example of taking a whole-of-nation approach to security.

Understanding these vulnerabilities and the role of food and agriculture in Australia's stability and security is crucial if we are to return our focus to fundamentals.

The lesson this offers for the authors of the 2024 national defence strategy is simple – investing in preparedness pays off.

The sooner an honest and open conversation starts with the community about risks, the more prepared they can be.

Andrew Henderson
Agsecure



The author, with his best friend, asks what's more fundamental than food?



Food is central to Australia's stability and security, yet it's too often neglected in favour of seemingly higher priorities.

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Andrew Henderson is the principal of Agsecure, the independent chair of the Safemeat Advisory Group and a former adviser to the federal government on biosecurity and the red meat and livestock sector.

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Human gene stops us from catching avian flu

SCIENTISTS have identified a gene in human airways that stops us from being infected with avian influenza – but it has its limits.

While you may never have heard of the gene *BTN3A3* before, be glad you have it, particularly if you work in the poultry industry.

BTN3A3 is the gene that gives us protection from strains of avian influenza and is commonly expressed in our airways, where it blocks the disease from replicating in cells.

Its importance came to light as part of a study headed by the MRC-University of Glasgow Centre for Virus Research.

Part of a much broader project to look at avian influenza's pandemic potential, the study has looked at hundreds of genes normally expressed by human cells during a viral infection with either human seasonal viruses or AI viruses.

BTN3A3 is not always successful in blocking AI replication however, and some strains can evade it.

As an example, it did not work against the virus strain – thought now to have been an AI strain – that caused the 1918 Spanish flu pandemic, which resulted in 25 million deaths.

So why are some strains able to evade this useful gene?

To answer this, the Glasgow team looked at the N7N9 virus strain in more

detail – which since 2013 has infected more than 1500 individuals, with a 40 percent case mortality rate.

They found that N7N9 and some others have a genetic mutation that allows them to escape the blocking effects of *BTN3A3*.

While studying the evolution of AI virus strains, the researchers also found that where there had been spill-over events into humans, there was an increase in the number of *BTN3A3*-resistant virus strains circulating.

While *BTN3A3* may offer protection against most avian influenza strains, it's not going to protect us against all of them, but knowing this does allow the development of new strategies to protect human health.

Identifying *BTN3A3* resistant variants when they first emerge in birds would allow greater measures to be taken to prevent human infection.

Control measures against emerging AI viruses could be tailored specifically against those that are resistant, in addition to other genetic traits known to be important for zoonotic transmission.

Thankfully, *BTN3A3* is going to protect us against most AI virus strains and where it can't, at least we now have the knowledge to step in where the gene can't help out.



Scientists have identified a gene in human airways that stops us from being infected with avian influenza. Photo: Artem Podrez

Utilising food waste as animal feed

THERE is renewed interest in utilising food waste as animal feed due to its potential benefits in reducing feed cost and environmental impact while improving global food security.

The study 'Feeding recycled food waste improved feed efficiency in laying hens from 24 to 43 weeks of age' was conducted by researchers from the University of New England to examine the efficacy of recycled food waste-based feed for laying hen performance, egg quality and nutrient digestibility.

Following are excerpts taken from the research, which has been published on *Scientific Reports* and can be viewed in full at nature.com/articles/s41598-023-34878-2

Introduction

It is estimated that about one-third of all food produced globally is lost as waste, causing a loss of \$A1.48 trillion annually.

In Australia, approximately 7.3 million tonnes of food is disposed in landfill per year, which costs more than \$20.67 billion to the Australian economy.

This waste also contributes to more than 5 percent of Australia's greenhouse gas emissions, leading to substantial environmental and economic losses.

As food is wasted, the costs associated with the production, processing, delivery and selling of that food are also lost.

Moreover, the global warming potential caused by 1 tonne of food waste in landfill is more than five times higher than that of recycling food waste into dry animal feed.

Simultaneously, poultry feed occupies a major cost to producers and its price has increased due to rising prices of raw materials.

Previous studies have illustrated the possibility of producing feed from food waste that meets nutritional requirements for poultry, as well as hygiene and chemical safety standards.

A comprehensive review concluded that food waste can be effectively and safely utilised in commercial production systems.

Some processed food waste streams such as spent brewers grain, fish offal and spent brewers grain blend, and meat and bone meal may replace costly grains, oil and protein meals in poultry diets, thus reducing feed cost significantly.

Creating poultry feed from food waste is also expected to lower carbon and greenhouse gas emissions in the production of chicken meat by 35 and 25 percent respectively, and in eggs by 75 and 76 percent respectively.

Similarly, recycling food waste into pig feed may lead to better public health and environmental effects compared to other processing methods, such as anaerobic digestion and composting.

Therefore, there is great economic and environmental opportunity in the creation of poultry feed from food waste.

While this concept is new to many countries, using food waste-based feed has been an ongoing practice for many years and is supported by local governments in Japan and South Korea.

It is estimated that approximately 40 and 46 percent of mixed food waste are recycled as livestock and poultry feed respectively in these countries.

Others including Taiwan and the US have already used processed food waste as animal feed.

This study aimed to investigate the efficacy of recycled food waste-based feed on laying performance, egg quality and nutrient digestibility of laying hens by comparing a commercial diet with a food waste diet and a 50:50 blend of the two.

It was hypothesised that laying hens would perform up to the breeder specifications when fed diets containing 100 percent food waste.

Experimental design and diets
The study was implemented at the University of New England Laureldale cage layer facility in Armidale NSW.

One hundred and fifty Hy-Line Brown pullets were purchased from a commercial laying hen farm in Tamworth NSW at 15 weeks of age.

Birds were fed a pre-lay diet (2800kcal ME/kg, 16.7 percent crude protein, 2.6 percent calcium, 0.48 percent available phosphorus) from 15 to 19 weeks of age and a commercial layer diet from 19 to 22 weeks of age (2750kcal ME/kg, 16.5 percent crude protein, 3.6 percent calcium, 0.4 percent available phosphorus – Barastoc Premium Top Layer Mash, Ridley Corporation Ltd).

At 23 weeks of age, birds were weighed and randomly allocated to three dietary treatments:

- Standard control feed based on wheat, sorghum and soybean meal
- Recycled food waste-based feed
- A 50:50 blend of control and food waste-based feed.

There were 50 replicate hens per treatment, housed individually.

The average starting hen weights were not different between the dietary treatments ($P>0.05$).

Experimental diets were gradually increased during a 10-day adaptation period and were then fed to birds from week 24.

Feed intake from 15 to 22 weeks of age was employed to formulate the experimental diets according to Hy-Line Brown nutritional requirements.

The study was implemented over a 20-week period until the hens were at 43 weeks of age.

Birds were housed individually in cages (30cm wide x 50cm deep x 45cm high) in a curtain-sided house.

There were two nipple drinkers and one feeder per bird.

Birds had free access to feed and water.

A lighting program of 16 hours light and 8 hours dark was maintained throughout the study.

Temperature and relative humidity in the hen shed were recorded daily throughout the study but were not controlled.

The average hen house temperature and relative humidity by weeks are shown in Figure 1.

All diets met the minimum nutrient requirements of Hy-Line Brown hens (2700kcal ME/kg, 14 percent crude protein, 4 percent calcium, 0.4 percent available phosphorus) according to Hy-Line Brown nutritional recommendations for the laying period.

Diets were offered as mash and contained two feeding periods – 24 to 37 weeks and 38 to 43 weeks.

Feedstuffs were analysed for particle size distribution and nutrient content including dry matter, gross energy, crude protein, amino acids, crude fat, crude fibre and mineral composition using standard procedures prior to diet formulation.

The particle size distribution of the diets was measured by dried sieving using a shaker provided with eight sieves.

Metabolisable energy and total and digestible AA levels of wheat, sorghum, soybean meal, canola meal and meat and bone meal used in

the control diet were obtained from near-infrared reflectance spectroscopy and standardised with Evonik Aminonir Advanced calibration.

The metabolisable energy and digestible AA levels of the food waste materials were estimated at 65 percent based on previous reports.

Dry matter, GE, CP, AA, crude fat, crude fibre, ash content and mineral composition of mixed control and food waste-based diets were analysed by standard methods to confirm the accuracy of the dietary composition.

Food waste materials were collected from breweries, hospitals, nursing homes, bakeries, pubs and restaurants, abattoirs, fish processing facilities and vegetable and fruit markets.

After removing foreign objects, collected food waste was separated into general classifications including spent brewers grain, fish offal and spent brewers grain blend, hospital and nursing home meal, pub and restaurant meal, vegetable and fruit meal, meat and bone meal, bakery meal and oyster shell meal.

Each food-waste stream was processed by Food Recycle Limited using their patented production process to create a granular powder, which was then in a suitable form to feed to poultry.

Then, waste streams were blended into a complete mash feed.

Steam heating to exceed 100C for 30 minutes was used during the food waste processing to ensure the inactivation of pathogenic and spoilage organisms.

Minors such as crystalline AA, xylanase, phytase, red and yellow pigments, antioxidant and layer vitamin-mineral premix were added to all diets.

The analysed nutrient content of the dietary treatments showed that the mixed diets met the minimum nutrient requirements of Hy-Line Brown hens according to the breed recommendation.

Thus, the main feed formulation objective of this study was achieved.

However, the nutrient composition of the control and recycled food waste-based diets were different.

Of concern was the high sodium, phosphorus and fat levels in the food waste-based diets. These nutrients were reduced as much as possible during feed formulation.

However, it was not possible to produce 100 percent food waste-based diets with the same nutrients as the control diets.

The objective of the study was to determine how laying hens would perform on 100 percent food waste-based diets.

The protein, fat, sodium and phosphorus levels of various food waste streams such as pub and restaurant meal, hospital and nursing home meal, fish offal meal and meat and bone meal were high.

Due to the nature of the food-waste streams, previous studies might not attempt to make food waste-based diets isonitrogenous or isocaloric compared to the control diets.

Similar to this study, the protein and fat content in the food waste-based diet reported by Garnida et al were also higher than the control diet.

Data collection
Egg weight, hen day egg production and egg mass were recorded daily.

Feed consumption was recorded weekly.

The feed conversion ratio was calculated by dividing feed intake by egg mass.

Mortality rate was recorded daily throughout the study.

Individual hen weight was recorded every fifth week beginning on week 24.

At weeks 34 and 43, fresh, clean and normal-shaped eggs from all hens were collected for egg quality measurements.

At week 43, 10 hens per treatment with body weights close to the average body weight of the treatment were chosen for measurements of DM, GE, CP, crude fat digestibility, apparent metabolisable energy, apparent metabolisable to gross energy ratio and N-corrected AME using the total excreta collection method according to Dao et al.

Egg quality measurement
Eggshell reflectivity was measured by the TSS QCE-QCM equipment.

Egg length and width were measured by a digital caliper.

The egg shape index was calculated as a ratio of egg width to egg length.

Eggshell breaking strength, shell thickness, albumen height, Haugh unit, yolk colour, yolk height, yolk diameter and yolk index were measured by a digital egg tester.

The egg yolk was

• continued P16

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Study to utilise human food waste as animal feed



One of the lead researchers, Dr Amy Moss from the University of New England.

from P14 collected on filter paper and weighed.

Eggshell was rinsed, dried thoroughly and weighed.

The albumen weight was calculated by subtracting the weights of egg yolk and eggshell from the total egg weight.

Then egg proportion was calculated by dividing the weight of each egg component by the intact egg weight.

Nutrient digestibility

Excreta samples collected at 43 weeks of age were freeze-dried and milled to pass through a 0.5mm screen.

Gross energy and protein content of the feed and excreta was determined using a Parr adi-

abatic oxygen bomb calorimeter and a nitrogen analyser respectively.

Crude fat of the feed and excreta was measured using Soxhlet method adapted as outlined by Holman et al.

Apparent DM, GE, CP and crude fat digestibility were calculated following equations described by Dao et al.

Apparent metabolisable energy, AME:GE and AMEn were calculated following equations described by Moss et al.

All data were calculated on a DM basis.

Results

Environmental condition, analysed dietary nutrient composition and mortality rate

The temperature and relative humidity inside the hen shed during the study are shown in Fig. 1.

The average indoor temperature was 15.2°C, ranging from 10 to 19.7°C, while the average relative humidity was 63.4 percent, ranging from 49.4 to 76.1 percent, during the experimental period.

The maximum daily temperature ranged from 13 to 29°C, average 20.4°C, while the minimum daily temperature ranged from 4 to 14°C, average 10.4°C.

The fish offal and spent brewers grain blend, pub and restaurant meal, and meat and bone meal waste contained high levels of CP, crude fat and total phosphorus.

The sodium content of the pub and restaurant meal was 2.29 percent, being high relative to the requirement.

Whereas, spent brewers grain and vegetable and fruit waste contained high fibre levels – 17.3 and 14.8 percent respectively.

The final diets formulated with waste streams

met the formulation objectives in terms of meeting the nutritional requirements of Hy-Line Brown laying hens.

The analysed nutrients of the control diet were similar to the calculated values.

In the food waste diets, the analysed CP, crude fat, calcium and sodium levels were lower, while crude fibre level was higher than the calculated values.

Nevertheless, it was notable that when formulated to meet the minimum nutrient requirements of the breed, food waste-based diets contained higher concentrations of CP, crude fat, crude fibre, total phosphorus and sodium compared to the control diet.

Additionally, the analysed free sugars were lower and total non-starch polysaccharide was higher in the food-waste diets compared to the control diets.

As the study progressed and new batches of food waste were utilised, closer nutritional levels between the control and food-waste diets were observed in the second period of the study from weeks 38 to 43, compared to the initial period weeks 24 to 37.

The particle size distribution test showed that certain amounts of over-size particles ($\geq 4\text{mm}$) were still observed in bakery meal, recycled meat and bone meal, pub and restaurant meal, fish offal and spent brewers grain blend, hospital and nursing home meal and oyster shell meal.

Whereas, high percentages of fine particles ($\leq 0.5\text{mm}$) were detected in spent brewers grain (72.8 percent) and vegetable and fruit meal (72.3 percent).

Over the entire study, birds in all dietary treatments were visibly healthy.

The mortality rates of the control, food waste and 50:50 blend treatments from 24 to 43 weeks of age were 0, 0 and 2 percent respectively.

There was only one mortality recorded in the 50:50 blend treatment and the mortality was not related to dietary treatment.

Hen weight and laying performance

Lower body weight was observed in hens offered the food waste-based diets compared to those offered the control diets at weeks 29 and 39 ($P < 0.05$).

Hen weight in the 50:50 blend treatment was intermediate between the control and food waste treatment.

Hens offered the food waste-based diets had lower weight gain compared to those fed the 50:50 blend diets over the entire study ($P < 0.01$) and specifically from weeks 24 to 29 ($P < 0.001$) and 34 to 39 ($P < 0.05$).

Also, lower weight gains were observed in hens offered the food waste based-diets compared to those fed the control diets from weeks 24 to 29 ($P < 0.001$) and 39 to 43 ($P < 0.001$).

The laying performance of dietary treatments from weeks 24 to 43 is given in Figure 2 and Table 8.

Hens offered the food waste-based diets had similar egg weight, hen day egg production and egg mass but lower feed intake ($P < 0.001$), resulting in a lower FCR ($P < 0.001$) compared to those fed the control diets from 24 to 43 weeks of age.

Specifically, hens fed the food-waste diets had approximately 15 points lower FCR compared to those fed the control diets from 24 to 43 weeks of age.

The 50:50 blend treatment had an intermediary response over weeks 24 to 43.

Similar findings were observed in laying performance from weeks 24 to 33 and 34 to 43.

Egg quality

Hens offered the food waste-based diets exhibited lower shell breaking strength ($P < 0.001$), shell thickness ($P < 0.001$), shell weight ($P < 0.001$) and shell proportion ($P < 0.001$) compared to the control and 50:50 blend treatments at week 34.

However, all other egg quality parameters were not significantly different between the dietary treatments at week 34.

At week 43, higher yolk colour score was observed in hens offered the food waste-based diets compared to those fed the control and 50:50 blend diets ($P < 0.001$), but all other parameters, including shell measurements, were not significantly different between the dietary treatments.

Excreta moisture and nutrient digestibility

Hens offered the food waste-based diets had higher excreta moisture than hens offered the control diets ($P < 0.01$).

Hens offered the food waste-based diets had a lower retained DM ($P < 0.01$) and digestibility ($P < 0.05$) compared to those fed the control diets at week 43.

Hens fed the 50:50 blend diets exhibited a lower DM intake ($P < 0.05$) and retained

DM ($P < 0.01$), but similar DM digestibility compared to those fed the control diets at week 43.

Hens offered the food waste-based diets tended to have a higher energy consumption ($P = 0.056$) but lower energy digestibility ($P = 0.056$), and thus had a higher energy excretion ($P < 0.01$) compared to those fed the control and 50:50 blend treatments.

Higher AME and AMEn were observed in hens fed the food-waste diets compared to the control diets ($P < 0.001$).

Hens offered the food waste-based diets had a higher protein intake ($P < 0.05$) and tended to have higher retained protein ($P = 0.066$) compared to those fed the 50:50 blend diets.

Noticeably, hens offered the food waste-based diets had a higher fat intake, retention and digestibility compared to those offered the control diets ($P < 0.001$).

Hens fed the 50:50 blend diets showed an intermediary response ($P < 0.001$).

Conclusion

Laying hen diets that sustained production were successfully formulated from food-waste materials.

Furthermore, hens fed the recycled food waste-based diet had higher feed efficiency compared to those fed the commercial control diet.

The current study demonstrated that food waste not only has great potential as an alternative feed ingredient within poultry feed but can meet the nutrient requirements of laying hens.

Further study to determine the nutrient digestibility, calcium and phosphate availability, and optimal particle size of the food waste streams and the economic efficiency – cost-benefit analysis – of feeding food waste-based diets is necessary to facilitate a precise feed formation and optimise the food waste-based diets for practical commercial use.

Additionally, examining the effects of feeding food waste-based diets on the organoleptic properties of poultry products is crucial to facilitate the adoption of the poultry industry on the food waste-based feed.

All experimental procedures were approved by the University of New England Animal Ethics Committee and the study was performed in accordance and full compliance with the approved guidelines and regulations.

Hen age, week	Variable	Control	Food waste	50:50 blend	SEM	P value
24 to 33	Egg weight, g	61.2	60.0	61.1	0.30	0.172
	Hen day egg production, %	97.9	97.4	97.9	0.29	0.193
	Egg mass, g/day	60.0	58.4	59.8	0.34	0.133
	Feed intake, g/day	136 ^b	129 ^a	133 ^{ab}	0.80	0.003
	FCR, kg feed/kg egg	2.284	2.205	2.229	0.015	0.082
34 to 43	Egg weight, g	62.6	62.3	62.6	0.29	0.902
	Hen day egg production, %	96.9	96.6	97.2	0.37	0.235
	Egg mass, g/day	60.7	60.2	60.9	0.38	0.748
	Feed intake, g/day	130 ^c	116 ^a	123 ^b	0.94	< 0.001
	FCR, kg feed/kg egg	2.149 ^c	1.931 ^a	2.028 ^b	0.017	< 0.001
24 to 43	Egg weight, g	61.9	61.2	61.9	0.29	0.468
	Hen day egg production, %	97.4	97.0	97.6	0.30	0.110
	Egg mass, g/day	60.3	59.3	60.4	0.35	0.313
	Feed intake, g/day	133 ^c	122 ^a	128 ^b	0.81	< 0.001
	FCR, kg feed/kg egg	2.216 ^b	2.068 ^a	2.127 ^a	0.015	< 0.001

Table 8: Laying performance of hens fed dietary treatments from weeks 24 to 43. a-c Means within rows not sharing a common suffix are significantly different at the 5 percent level of probability.

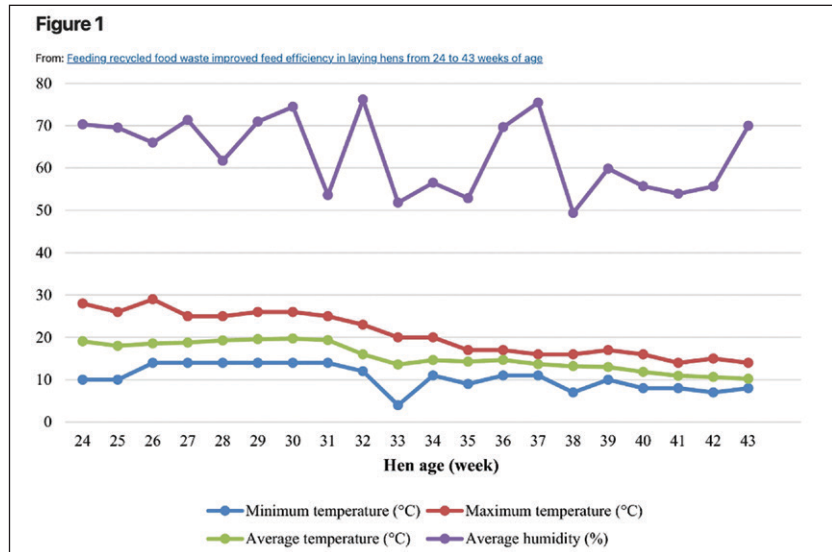


Figure 1: Temperature and relative humidity of the hen house from 24 to 43 weeks of age.

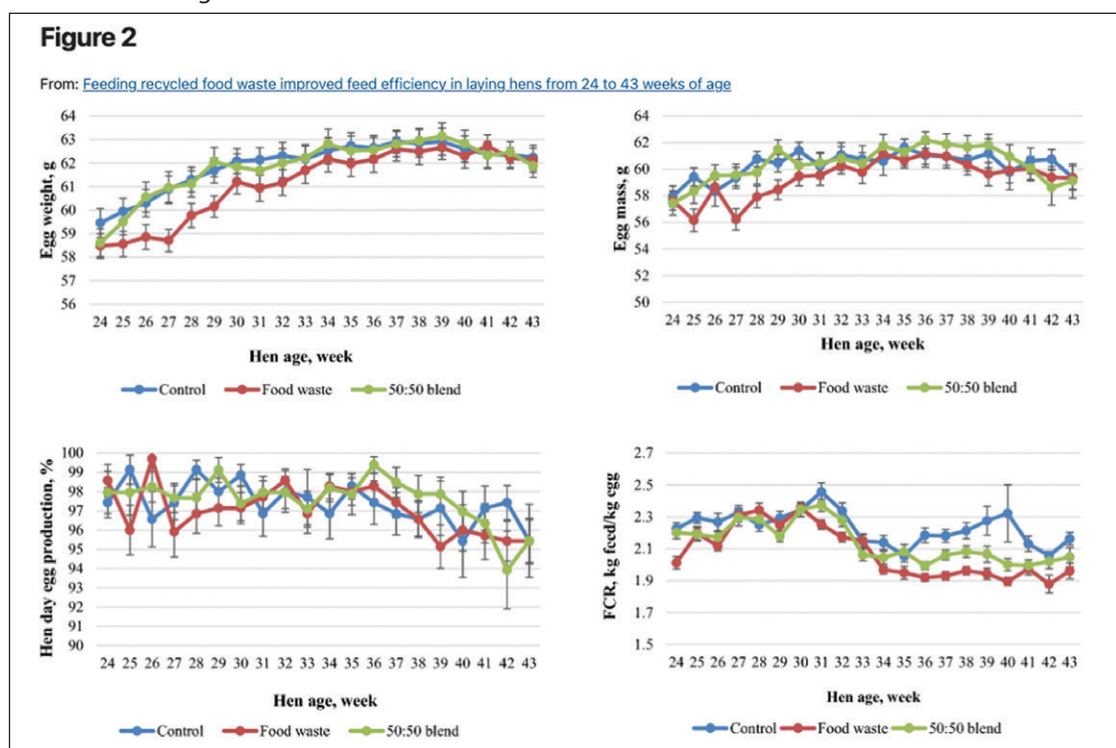


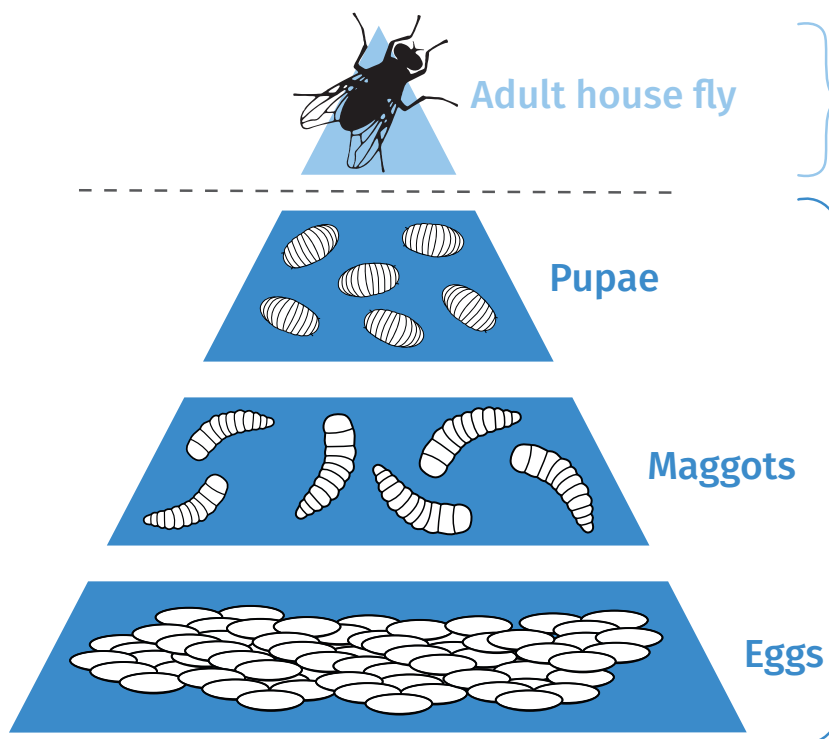
Figure 2: Egg weight, egg mass, hen day egg production and feed to gain ratio of hens fed the dietary treatments from 24 to 43 weeks of age. The dot points represent means and error bars present standard errors of the means.

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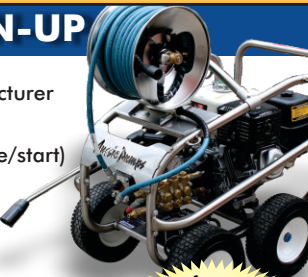
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