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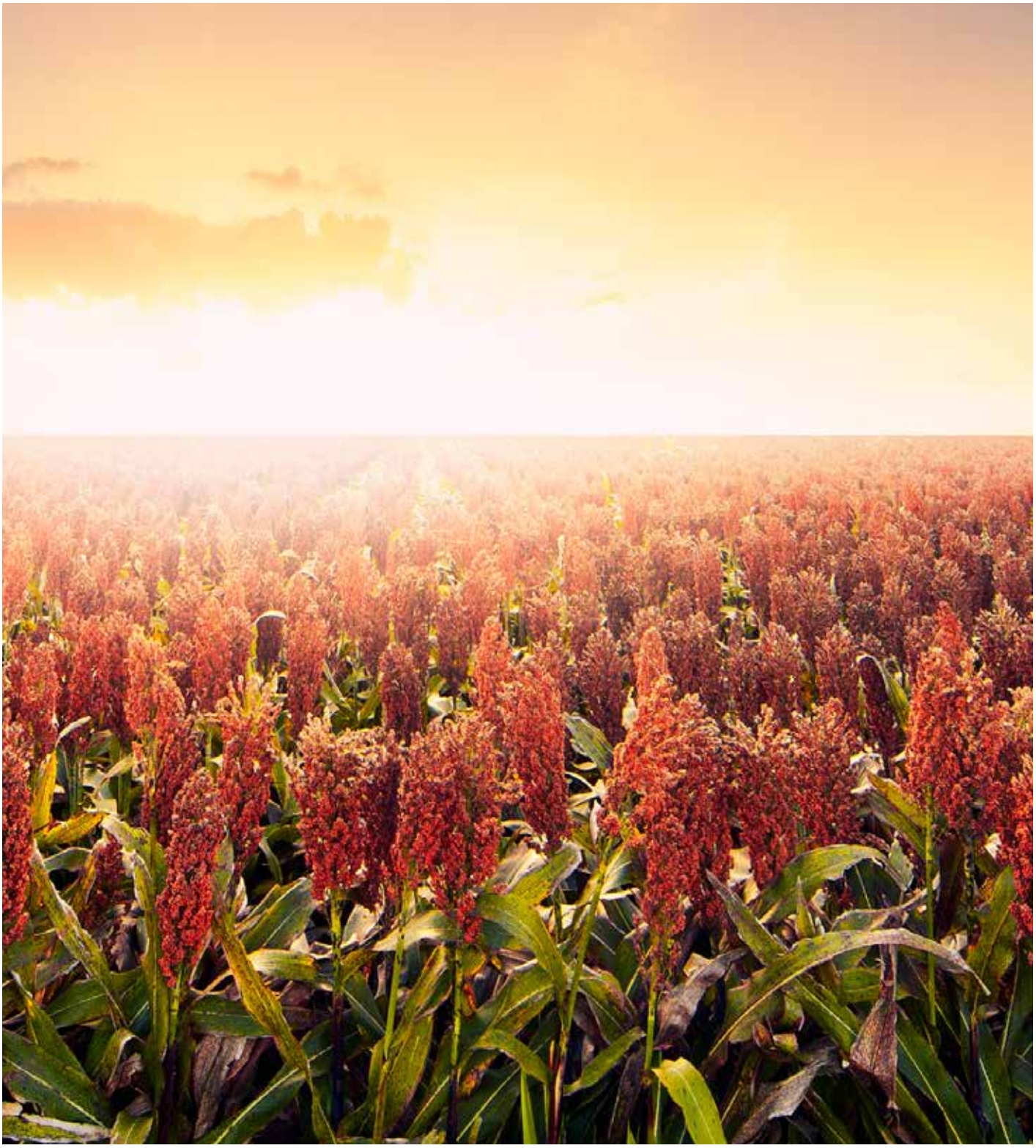

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CONTENTS

CITRUS AUSTRALIA LEADS TRACEABILITY PROJECT FOR HIGH-VALUE EXPORTS

OLD WAYS AND NEW. KEEPING AUSTRALIA'S BEE INDUSTRY STRONG

SEAWEED EXTRACTS COULD REDUCE NITROGEN FERTILISER USE

THE AUSTRALIAN AGRONOMIST

Fortuna Villa, 22 Chum Street, Golden Square VIC 3550 Australia
P: 03 5441 8166 **E:** info@theaustralianagronomist.com **W:** www.theaustralianagronomist.com

Publisher
Paul Banks
Email: paul@regionalreachpublishing.com
Phone: 03 5441 8166

Design & Advertising
Kate Griffiths
Email: info@regionalreachpublishing.com
Phone: 03 5441 8166

Administration & Advertising
Caitlyn Hamilton
Email: caitlyn@regionalreach.com
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N-GAUGE GRAIN LOGISTICS APP

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Next Instruments, trading as CropScanAg, have partnered with CropScanAg Solutions, to develop a mobile App called N-GAUGE, that delivers a suite of services and products to farmers using the CropScan 3300H On Combine Grain Analyser. CropScanAg is the exclusive distributor for the CropScanAg Solutions N-GAUGE services and products.

The first module for the N-GAUGE Mobile App is called N-GAUGE Grain Logistics which provides CropScan 3300H users tools to manage the quality and quantity of grain as it is harvested and then stored in the field and on farm.

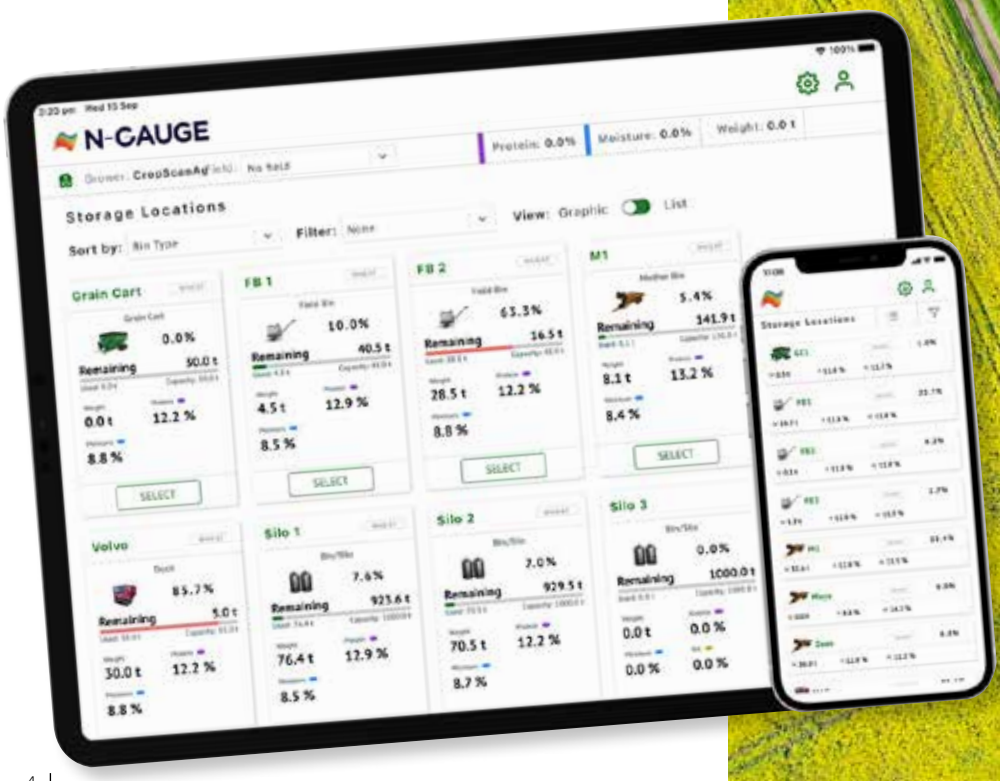
The N-GAUGE Grain Logistics App displays a Virtual Grain Storage System setup for the farm and shows the running average for Protein, Moisture and Oil plus Weight for the grain stored in each storage unit, i.e., grain carts, mother bins, field bins, silos, bags etc.

Every load of grain that is out loaded from the combine, is tracked from the field to the farmer's site storage locations or shipped off to the grain buyers or elevators. N-GAUGE Grain Logistics App also allows the farmer, their field manager and workers to direct the flow of grain from the combine to the site storage locations using their Smart Phone, iPad or Android tablet. Tools allow the N-GAUGE users to blend, split and transfer grain.

The N-GAUGE Blending Estimator tool allows the user to blend grain from two or three storage locations into a truck or field bin to achieve a specific Protein or Oil grade, thereby optimizing crop payments or to ensure the correct moisture content.

Other N-GAUGE modules are being developed to provide a complete on-farm solution to measuring, managing and growing grains and oilseeds. These modules will provide management tools for optimizing Yield in the Field through simple yet accurate variable rate fertilization applications, in season nutrient management, soil carbon sequestration and greenhouse gas emission management.

For more information, visit the web site: www.cropscanag.com or call 02 9771 5444.



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A TRIP INTO THE THERAPEUTIC POTENTIAL OF AUSTRALIA'S NATIVE MAGIC MUSHROOMS

Psilocybe cubensis – "golden top" magic mushroom grows wild throughout Australia. Image: © Paul Vallier.

Australia's first legal, living collection of native magic mushrooms is being studied by scientists in a Brisbane laboratory to help identify characteristics that might be useful for medical research into psychedelic treatments.

University of Queensland mycologist and evolutionary biologist Dr Alistair McTaggart said Australian magic mushrooms were unique from international species, but scientists had little understanding of them.

"In Australia, it is estimated there are up to 20 species of magic mushrooms, some of which are native, while others have been introduced," said Dr McTaggart.

"They grow in dung or leaf litter on damp forest floors. We are not certain of magic mushroom biodiversity in Australia, and we do not know how many species produce psilocybin – a psychoactive compound with effects similar to LSD."

More than 200 species of mushrooms worldwide are known to produce psilocybin.

In a new research project underway at UQ's Queensland Alliance for Agriculture and Food Innovation, Dr McTaggart will investigate the diversity of native magic mushrooms in Australia, following State Government approval for UQ to use psilocybin for research, analysis and teaching.

He said there was renewed global interest in the psychoactive properties of magic mushrooms for treating depression and post-traumatic stress disorder.

Dr McTaggart believes the current global research interest in magic mushrooms is similar to where the medicinal cannabis industry was 15 years ago.

"Similar to the cannabis industry, mushrooms will need selection of genetic traits to upscale production or tailor different strains for different experiences," he said.

"Australian native magic mushrooms may have evolved different methods for psilocybin production and offer adaptations that are preferential for use in clinical treatments.

"Our new project will determine whether one species which is believed to be native, Psilocybe subaeruginosa, has spread globally. This species, or a close relative, is now the foundation of patents and research in Europe and the United States."

Approval under the Health (Drugs and Poisons) Regulation 1996 (Qld) allows Dr McTaggart to possess, use and dispose of limited quantities of psilocybin, for the specific purpose of research, analysis and teaching.

Without this approval, the possession and use of psilocybin is prohibited in Queensland – including for native psilocybin-producing mushrooms.

"Consuming magic mushrooms can be dangerous – they can be mistaken for toxic mushrooms," Dr McTaggart said.

In another project in development, Dr McTaggart plans to use genomic sequencing to determine which species of native mushrooms in Australia (not magic mushrooms) are edible, poisonous or adaptable for medicinal use.

This work is funded through UQ's Research Support Program.

Psilocybe subaeruginosa, photographed in Tasmania, is thought to be a magic mushroom that is native to Australia. Image: © Caine Barlow.

Dr Alistair McTaggart holding a sample of Psilocybe Cubensis. Image: © Megan Pope, UQ.

THE MICROBIAL MOLECULE THAT TURNS PLANTS INTO 'ZOMBIES'

A newly discovered manipulation mechanism used by parasitic bacteria to slow down plant aging, may offer new ways to protect disease-threatened food crops.

Parasites manipulate the organisms they live off to suit their needs, sometimes in drastic ways. When under the spell of a parasite, some plants undergo such extensive changes that they are described as "zombies." They stop reproducing and serve only as a habitat and host for the parasitic pathogens.

Until now, there's been little understanding of how this happens on a molecular and mechanistic level.

Research from the Hogenhout group at the John Innes Centre and collaborators published in Cell, has identified a manipulation molecule produced by Phytoplasma bacteria to hijack plant development. When inside a plant, this protein causes key growth regulators to be broken down, triggering abnormal growth.

Phytoplasma bacteria belong to a group of microbes that are notorious for their ability to reprogramme the development of their host plants. This group of bacteria are often responsible for the 'witches' brooms' seen in trees, where an excessive number of branches grow close together.

These bushy outgrowths are the result of the plant being stuck in a vegetative "zombie" state, unable to reproduce and therefore progress to a 'forever young' status.

Phytoplasma bacteria can also cause devastating crop disease, such as Aster Yellows which causes significant yield losses in both grain and leaf crops like lettuce, carrots, and cereals.

Professor Saskia Hogenhout, corresponding author of the study said: "Phytoplasmas are a spectacular example of how the reach of genes can extend beyond the organisms to impact surrounding environments.

"Our findings cast new light on a molecular mechanism behind this extended phenotype in a way that could help solve a major problem for food production. We highlight a promising strategy for engineering plants to achieve a level of durable resistance of crops to phytoplasmas."

The new findings show how the bacterial protein known as SAP05 manipulates plants by taking advantage of some of the host's own molecular machinery.

This machinery, called the proteasome, usually breaks down proteins that are no longer needed inside plant cells. SAP05 hijacks this process, causing plant proteins that are important in regulating growth and development, to effectively be thrown in a molecular recycling centre.

Without these proteins, the plant's development is reprogrammed to favour the bacteria, triggering the growth of multiple vegetative shoots and tissues and putting the pause on the plant ageing.

Through genetic and biochemical experiments on the model plant Arabidopsis thaliana, the team uncovered in detail the role of SAP05.

Interestingly, SAP05 binds directly to both the plant developmental proteins and the proteasome. The direct binding is a newly discovered way to degrade proteins. Usually, proteins that are degraded by the proteasome are tagged with a molecule called ubiquitin beforehand, but this is not the case here.

The plant developmental proteins that are targeted by SAP05 are similar to proteins also found in animals. The team were curious to see if SAP05 therefore also affects the insects that carry the bacteria plant to plant. They found that the structure of these host proteins in animals differ enough that they do not interact with SAP05, and so it does not affect the insects.

However, this investigation allowed the team to pinpoint just two amino acids in the proteasome unit that are needed to interact with SAP05. Their research showed that if the plant proteins are switched to have the two amino acids found in the insect protein instead, they are no longer degraded by SAP05, preventing the 'witches' broom' abnormal growth.

This finding offers the possibility of tweaking just these two amino acids in crops, for example using gene-editing technologies, to provide durable resilience to phytoplasmas and the effects of SAP05.

Journal Reference:

Weijie Huang, Allyson M. MacLean, Akiko Sugio, Abbas Maqbool, Marco Busscher, Shu-Ting Cho, Sophien Kamoun, Chih-Horng Kuo, Richard G.H. Immink, Saskia A. Hogenhout. Parasitic modulation of host development by ubiquitin-independent protein degradation. Cell, 2021; DOI: 10.1016/j.cell.2021.08.029

SUSTAINABLE AGRICULTURE

THE PATH TO A BETTER FUTURE

Sustainable agriculture: what do we mean?

By sustainable agriculture, we mean a type of agriculture that prioritises respect for natural resources alongside human and economic resources.

According to the definition of Agricultural Sustainability Institute, sustainable agriculture can ensure the well-being of the world's population and its need for food and textiles without harming the future generations that will inherit the world we live in.

What are the aims of sustainable agriculture?

Sustainable agriculture is based on an ethical economic model that is binding on all stakeholders and whose principles are to;

- improve working and living conditions for producers. This supports the most disadvantaged through greater development opportunities
- raise consumer awareness of the mechanisms used for exploitation of land resources

It was the FAO – Food and Agriculture Organisation of the United Nations – that defined the 5 principles of sustainable agriculture that can help us understand the importance of this change within our society.

Increase productivity, employment and added value in food systems with the aim of fostering a change in agricultural practices and processes to ensure global food supplies and reduce water and energy consumption.

Protect and enhance natural resources by promoting environmental conservation and reducing pollution of water sources and destruction of ecosystems.

Improve livelihood and promote inclusive economic growth.

Improve the resilience of people, communities and ecosystems with a view to minimising the impact of weather events due to climate change or market price variability.

Adapt governance to new challenges to ensure fairness and transparency at all levels (public and private).

In 2018, a document was published titled TRANSFORMING FOOD AND AGRICULTURE TO ACHIEVE THE SDGs which sets out the 20 actions needed in the field of agriculture to achieve the 17 sustainable development goals of the United Nations. These actions concern the practice of recycling and reuse, increasing the resilience of people and ecosystems against extreme climate events, protecting biodiversity as well as safeguarding farmers from an integrated perspective.

Techniques and models of sustainable agriculture

There are various agricultural models and techniques that can be applied in a sustainable way, but we must not fall into the trap of thinking that sustainable agriculture can be totally overlapped or identified with a specific model.

By sustainable agriculture we mean agriculture that is conservative and can make integrated use of the knowledge developed by each of these models.

1. Organic farming model

This is a production model that only allows the use of natural substances, avoiding over-exploitation of resources such as water, soil and air, in compliance with European Regulation EEC 2092/91.

Certified organic farms do not use synthetic chemicals (fertilisers, herbicides, fungicides, insecticides, pesticides), but use natural fertilisers and more traditional techniques such as crop rotation.

2. Biodynamic farming model

It was created with the aim of enriching the environment and improving food quality by preserving plant biodiversity.

Biodynamics is based on respect for the earth's ecosystem, taking into account the lunar phases and the activation of life in the soil. It does not use chemical fertilisers or pesticides, but instead uses homeopathic doses of natural preparations to promote soil fertility and plant growth.

3. Solidarity-based farming model

Solidarity-based agriculture is a type of agriculture that respects people and the environment and is based on direct relationships of trust, reducing the distance between consumer and producer.

4. Permaculture

The term refers not only to a set of agricultural practices oriented towards the natural maintenance of soil fertility, but also to a design system that intertwines issues from architecture, economics, ecology, anthropology and legal systems.

The aim is to optimally and ethically design and manage landscapes to meet people's needs in harmony with natural systems.

5. Ecovillages

These are communities whose ultimate goal is environmental sustainability and to achieve it they choose lifestyles that are different from those currently imposed by our socio-economic system.

Participation is voluntary and includes the design of housing units to minimise environmental impact, the use of renewable energy sources, food self-sufficiency based on permaculture or organic farming.

New technologies as a driving force for change

The digital technologies at our disposal are an indispensable factor on the road to a sustainable agricultural model. This is because today's technological innovation is able to meet the need to collect and organise the data necessary to support analysis and decisions for the future of the sector.

Digitisation makes it possible to achieve maximum precision during processing with less waste and higher yields, through:

- calculation of resources to be dedicated to a specific crop and soil against water wastage
- forecasting risks related to certain crops to combat diseases, protect crops and moderate the use of fertilisers and herbicides
- traceability of the supply chain to monitor each step of the production process and ensure product quality.

Producing more with fewer resources whilst maintaining superior quality standards: this is the ultimate goal of precision farming.

This type of approach generates a two-fold advantage:

- for farming enterprises, which can optimise efforts and resources, reduce consumption and waste, and boost land productivity. The work becomes more profitable for farmers and contractors as the processes are managed more quickly and effectively leading to a drop in hourly costs.
- for the environment, given that there is a reduction in waste of fertilisers and herbicides, emissions and soil compaction thanks to a more rational use of resources.

Find out why it is important to invest in precision farming at https://www.mccormick.it/us/precision-farming.

PESTICIDES ESSENTIAL TO CELEBRATE INTERNATIONAL COFFEE DAY

The first of October was International Coffee Day, an occasion to promote and celebrate one of the world's most loved beverages.

Chief Executive Officer of CropLife Australia, the national peak industry organisation for the plant science sector, Mr Matthew Cossey said, "The world consumes around 500 billion cups of coffee each year. While it is not a major crop in Australia, as a commodity, coffee is worth over $100 billion globally.

"Coffee is one of the most widely traded commodities in international markets and is an agricultural crop of global economic importance. Coffee is grown in 80 countries around the world with 70 per cent being produced by smallholder farmers.

"However, the large-scale production of coffee beans would not be possible without farmer's ready access to crop protection products.

"Without pesticides, coffee crops would suffer yield losses of up to 40 per cent due to devastating diseases such as coffee leaf rust and pests like root nematodes and the coffee borer beetle.

"It's the judicious application of crop protection products that assist farmers to successfully produce healthy crops and remain profitable."

"Farmers around the world are having to adapt to farming in even more challenging climatic conditions. They are constantly faced with pests, weeds and diseases which damage and consume their crops. This means they need access to all farming tools and agricultural innovations to assist them.

"In addition to continual advances in crop protection products, scientists are using biotechnology innovations to breed new varieties that are resistant to environmental threats, changing weather patterns, increased temperatures, disease and insects."

There are more than 100 coffee species in the world but only two are currently commercially viable. Arabica coffee contributes almost 75 per cent of production with the remaining 25 per cent coming from the Robusta species. Of these two species, Arabica coffee is considered a superior beverage but is highly sensitive to pests like fungi, nematodes and insects. Robusta coffee, while lower in quality, is more resistant to pests. It would be desirable to combine these genetic traits, however, to date, traditional plant breeding techniques have been largely unsuccessful.

Mr Cossey continued, "Agricultural biotechnology research and innovations hold great promise in meeting the types of challenges we see in crops like coffee – and thankfully chemistry is protecting it in the meantime."

Mr Cossey concluded, "The plant science industry is committed to improving farming practice so that farmers and farms benefit environmentally, agronomically and economically.

"As you enjoy a coffee today, take a moment to recognise all of the hard work and inputs that take coffee from crop to cup."

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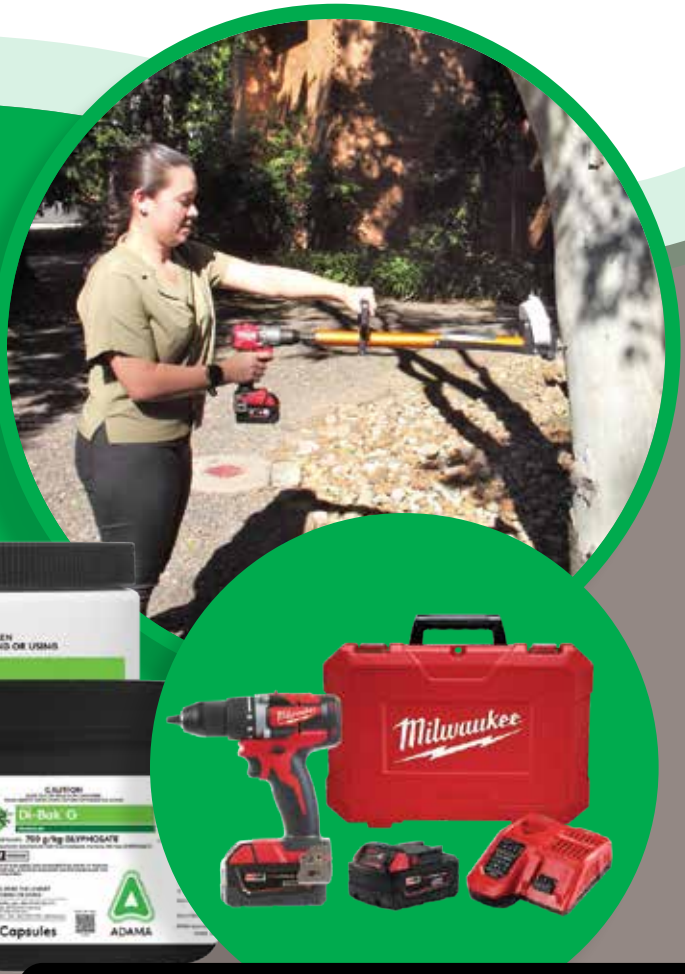

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CITRUS AUSTRALIA LEADS INNOVATIVE TRACEABILITY PROJECT FOR HIGH-VALUE EXPORTS

Agriculture Victoria is funding an innovative $770,000 traceability pilot for high-value exports, which will be led by peak industry body Citrus Australia.

The funding is part of the Victorian Government's Food to Market program, announced by Minister for Agriculture Mary-Anne Thomas.

"The Food to Market program is an excellent example of how we are providing timely support to agribusinesses impacted by the pandemic, while capitalising on opportunities to expand into new markets over the longer term," the Minister said.

The Citrus Australia project will utilise leading tracing technology, isotope testing, cool-chain tracking and orchard mapping to enhance traceability.

Citrus Australia CEO Nathan Hancock said the aim is to safeguard the industry from fraudulent activity and ensure the integrity of high-end citrus exports is protected.

Australia exports more than $500 million of citrus each year to over fifty countries.

"By participating in this pilot, we have the opportunity to work through the real world application of emerging technology on farm and through the supply chain," Mr Hancock said.

"We hope to further progress the integration of traceability into the everyday operations of citrus businesses in the future, whether they be farm to customer marketing, proof of origin or tracing a biosecurity outbreak."

The pilot project comprises three components, one of which will build on the successful traceability project led by Citrus Australia last year.

That pilot traced fruit from Nu Leaf I.P. orchards in Mildura, through the Mildura Fruit Company (MFC) packhouse, and on to international consumers.

Mr Hancock said the new project would further integrate traceability technology at MFC, utilising additional automation to reduce human data entry. Unique serialised GS1 Digital Link-enabled QR code labels will be added to both bags and cartons of fruit making them traceable by sales unit from end to end.

MFC General Manager Perry Hill said MFC was committed to protecting both the fruit its growers produce and the brands it exports from counterfeiters in overseas markets.

"We see the introduction of unique labelling to our cartons and bags as a critical step forward in our overall protection efforts," Mr Hill said.

"The acceptance of QR Codes around the globe through the pandemic, provides a unique opportunity for marketers to enhance the customer experiences across all products and markets, and fresh citrus is no exception.

"The adoption of this technology by MFC and the wider citrus industry, provides opportunities for direct and targeted marketing, to show our customers the conditions under which the fruit is grown, and locations where the product they are buying is sourced.

"Tracing the product back to its source provides the customer with knowledge and comfort, to make informed buying decisions about the authenticity and provenance of the product."

GS1 Australia will incorporate its traceability standards into the project, enhancing the international compatibility of these supply chains for global exports.

"GS1 standards enable organisations to identify, capture and share information smoothly, creating a common language that underpins systems and processes all over the world," GS1 Australia Chief Customer Officer, Marcel Sieira, said.

There is also an additional emphasis on increasing the scan rate by overseas consumers. A marketing campaign for premium fruit brands and varieties will be utilised to raise customer awareness.

"In a way the pandemic has assisted our cause here in that people are far more familiar with using QR type codes to access information, so we hope to see a significant increase in scan rates across the supply chain," Mr Hancock said.

In addition to protecting Australian export brands through the innovative labelling of boxes and bags, the pilot project will include isotope testing of Australian fruit.

"What isotope testing will enable is the ability to differentiate place of origin of Australian citrus fruit using science to prove provenance down to the individual farm and region," Mr Hancock said.

"It not only protects them from deliberate food fraud, but can provide evidence in disputes from export partners on MRLs, and domestic and international claims of food borne illness."

The isotope testing component will be conducted by New Zealand isotope science specialists, GNS Science.

GNS Science Senior Environmental Scientist, Dr Karyne Rogers, uses stable isotopes and elemental analyses to understand the transfer of atoms from soil, water and air.

"Navel orange traceability technology compares the different soil and nutrient derived elements from each farm that are infused into the orange flesh during its growth," Dr Rogers said.

"The project will undertake origin traceability analysis of Australia's navel oranges from different growing regions and compare results with navel oranges from other countries.

"The goal is to determine country and regional specific attributes which can distinguish the origin of navel oranges and develop protocols to identify intentionally mislabelled Australian fruit domestically and internationally."

The third component of the project is the further development of a national online crop mapping platform, which will improve both the accuracy of Citrus Australia's national crop figures, and traceability.

Citrus Australia will work with the University of New England (UNE) to enhance the citrus component of the Australian Tree Crop Map Dashboard, which was recently awarded first place at the global Esri User Conference, the world's largest event dedicated to geographic information system (GIS) technology.

Craig Shephard, Senior Researcher at UNE's Applied Agricultural Remote Sensing Centre, said traceability requires farm-level information.

"We are supporting Citrus Australia to build an 'industry specific' map which value-adds the essential information, including block ID, variety, age, etc. to support traceability across the supply chain," Mr Shephard said.

"Importantly, all information populated in the map by Citrus Australia will be secure under strict sign-in access."

Mr Hancock said: "Digitising the mapping will help improve the traceability to farm for biosecurity and food fraud related issues and is a step in understanding the flow of citrus from farm to packhouse to market.

"This sets us up well to track and trace issues across the supply chain and is a good model for other industry interactions such as nursery, food waste and transport and logistics when associated with our industry."

CSIRO MISSIONS TO HELP TRANSFORM AUSTRALIA'S AGRICULTURE SECTOR

The Morrison Government is supporting efforts by the CSIRO – Australia's national science agency – to help grow the agriculture sector and secure the long-term economic prosperity of our regional communities.

CSIRO has today launched three new "missions" that will see more than $150 million invested in key research and development collaborations that will tackle Australia's biggest agriculture and food challenges.

The three missions and their respective goals are:

Drought Resilience Mission, to reduce the impact of Australian droughts by 30 per cent by 2030. The Mission is vital to protect jobs and agricultural profitability, strengthen the economic resilience and water security of regional communities, and improve environmental outcomes.

Trusted Agrifood Exports, to increase the value of Australian food exports by $10 billion by 2030. The mission will improve access to high-value markets, verify the authenticity of Australian products through new methods of demonstrating food origin, and improve supply chain efficiency through automated export compliance.

Future Protein, to grow Australia's protein industry and produce an additional $10 billion of new products by 2030. The mission, which is backed by Meat and Livestock Australia and GrainCorp among others, will support existing livestock and aquaculture industries to transform no or low-value waste streams into high value food products. The Mission will also focus on developing new protein-based industries and products along the full value chain to enable grain growers to capitalise on emerging consumer trends.

Minister for Industry, Science and Technology Christian Porter said the CSIRO missions will ensure Australia can continue to be the envy of the world in agricultural innovation.

"The CSIRO's missions program is about using innovative science and technology to reach beyond what is possible today to solve Australia's greatest challenges, and this is certainly the aim of these three missions," Minister Porter said.

"CSIRO will play a crucial role in fostering collaboration with government, industry and the research sector to drive innovation and deliver strong outcomes for the whole Australian agriculture sector, leading to economic growth and job creation, particularly in our regions."

Minister for Agriculture and Northern Australia, David Littleproud said the missions will help make Australian farmers and communities more resilient to droughts, increase the value of Australian food exports and help to secure the future of our regional communities.

"The missions will also help the agriculture industry achieve its ambitious target to increase the value of the nation's agrifood exports to $100 billion in the next decade," Minister Littleproud said.

"Transforming Australia's agriculture sector requires a large, focused research effort between industry, government and research organisations, and the Australian Government is committed to supporting these monumental efforts.

Key to each mission's success will be a growing list of partners in industry, government and the research sector. Those include GrainCorp, Bureau of Meteorology, Meat and Livestock Australia, Department of Agriculture, Water and the Environment, Department of Industry, Science, Energy and Resources, Austrade, state governments and leading universities from around the country.

The three Missions are supported by $79 million from CSIRO, with combined contributions of $71 million from industry and government.

In 2020, CSIRO identified a portfolio of initial missions in development to solve Australia's greatest challenges through innovative science and technology. CSIRO will continue to launch future missions over the next 12 months.

More information on CSIRO Missions are available at: www.csiro.au/en/about/challenges-missions/

AUSTRALIA AND VIETNAM ACCELERATE AGTECH OPPORTUNITIES

New Report by Asialink Business and Beanstalk explores how 'smart' agricultural technologies are unlocking sustainable growth.

At a farm in Da Lat, Vietnam, a woman gently picks plump red strawberries from rows of carefully staked, vertical farming pods. Designed by Australian agribusiness, Orlar, using cutting edge innovation and technology, the vertical farms emit zero greenhouse gases, are 100 per cent water efficient and use significantly less energy than traditional hydroponics. They use an organic Australian rock to grow strawberries and other pollutant-free fruit and vegetables, destined for Vietnam's grocers and premium restaurants.

This story is just one example of the way agricultural technology or AgTech is poised to reshape Vietnam's agricultural sector, creating exciting commercial opportunities for Australian agricultural innovators that can do their research, adapt and invest in cultivating local relationships.

It features as a case study in *Accelerating AgTech: Australia's opportunity in Vietnam*, launched by Asialink Business and Beanstalk AgTech. This timely report analyses the latest trends and identifies opportunities for Australian and Vietnamese AgTech innovators to share expertise, tackle common challenges, and boost quality, sustainability and productivity.

"Vietnam's agriculture sector is rapidly transforming and poised for further growth. Agriculture already employs 1 in 3 people in Vietnam, generating over $56 billion per year in exports like rice, coffee and seafood," says Robert Law, Director of Advisory and Insights at Asialink Business.

"But the sector also faces many shared challenges with Australia, such as balancing costs and output with environmental impacts. In both countries, 'smart agriculture' technologies can offer alternatives to traditional labour and water intensive production methods. With a strong track record of collaboration already in place, Australia and Vietnam are natural partners to share expertise and boost AgTech opportunities," Law says.

The study finds that to remain competitive, Vietnam's agriculture sector needs to invest in more efficient, high-quality and sustainable production. With agriculture already a cornerstone of the Australia-Vietnam relationship, the study highlights the strong foundations for collaboration to drive innovation, address shared challenges, support rural economies and enhance competitiveness.

"The Australian AgTech industry has come into its own in recent years, and is starting to make waves on the global stage. Through our own efforts working alongside many of Vietnam's agrifood industry leaders, what we see is a market that is hungry for transformative solutions. Australia and Vietnam have built a strong foundation for innovation-centred collaboration based on shared values, common challenges, and complementary capabilities.

With the right blend of focus, support, and adaptability, Vietnam should represent an attractive growth opportunity for Australia's AgTech innovators," says Justin Ahmed, a Director at Beanstalk and Global Program Lead for GRAFT Challenge Vietnam 2021.

The report identifies 4 key areas where Australian innovators can adapt AgTech solutions to the challenges facing Vietnam's agriculture sector:

1. Sustainability

Demand will grow in Vietnam for technology innovations to minimise waste and mitigate environmental impacts, such as sensors coupled with data analytics that can help decision-making.

2. Climate resilience

Both countries are grappling with the impacts of climate change, creating opportunities in areas such as water management and weather-related risk assessment.

3. Productivity

As Vietnam is export-oriented, there are opportunities for technologies that will boost productivity and drive competitiveness in the face of seasonal variations, such as robotics, automation and drones.

4. Food quality and safety

Growing concern among Vietnamese consumers about food safety is creating opportunities in blockchain, QR codes, DNA tracing and automated reporting for certification bringing greater visibility through the food supply chains.

Funded by the Department of Foreign Affairs and Trade's Australia-Vietnam Enhanced Economic Engagement Grant pilot, the report sets out a practical roadmap to help position Australian AgTech businesses for success in Vietnam.

"We have a window of opportunity, but Australian businesses will need to invest time and resources to develop better market understanding and practices. They will need to adapt to local requirements, identify appropriate entry points, and engage partners who can support them in-market," Law says.

The time to act is now: If both Governments and the private sector act quickly, they can capitalise on pressing opportunities, accelerate growth and realise the potential of Australia and Vietnam's AgTech sectors.

DISCOVERY BOOSTS SORGHUM POTENTIAL

Researchers at The University of Queensland are optimistic the value and versatility of one of the world's top crops will be improved following the discovery of genes which could increase the grain size of sorghum.

Use of the drought-resilient summer crop has been constrained by the small size of sorghum grains, but Professor David Jordan from the Queensland Alliance for Agriculture and Food Innovation said that could be about to change.

"Sorghum is Australia's third-largest grain crop, providing vital feed to animals, but it is increasingly being used in cereals and other foods for human consumption".

"Sorghum has been an important dietary source of starch in Africa for thousands of years, but it is increasingly valued in Western diets as a low-GI, gluten-free and nutritious grain.

"Larger grains make it more digestible for both people and animals and improves processing efficiency."

Sorghum is popular among Australian growers, particularly in Queensland and New South Wales, and the research will help breeders to expand the crop's potential.

The project began six years ago, involving UQ and the Queensland Department of Agriculture and Fisheries.

QAAFI Research Fellow Dr Yongfu Tao initially mapped the sorghum genome to help identify which genes were associated with grain size, narrowing the search with existing genetic information for rice and maize.

"New variants have been identified that are capable of doubling grain weight," Dr Tao said. "These traits are strongly inherited, with genes accounting for as much as 80 per cent of the grain size characteristics.

Dr Tao said 125 regions in the sorghum genome had now been identified where variation in the DNA sequence was associated with grain size and response to environmental conditions.

Dr Yongfu Tao displays size variations in sorghum. Credit: Megan Pope.

The analyses included wild relatives of domesticated sorghum and Australian native sorghum.

"We demonstrated that genetic diversity exists in the sorghum gene pool for grain size," he said.

"Genetic makeup largely determined an individual sorghum plant's grain size, however environmental conditions also had an effect.

"This allows us to identify the genetic control of grain size with minimal change to environmental resources, such as water or nitrogen."

The project also delivered additional information and tools to help plant breeders improve sorghum cultivars.

The research is published in The Plant Journal and was funded by the Australian Research Council, with additional support from the Queensland Department of Agriculture and Fisheries, the Grains Research and Development Corporation and UQ.

BIOSECURITY COLLABORATION WITH NORTHERN NEIGHBOURS

A collaborative plant health survey being undertaken in Papua New Guinea (PNG) will help support biosecurity surveillance in PNG as well as Australia's preparedness for potential pest and disease risks.

Australia's Chief Plant Protection Officer Gabrielle Vivian-Smith said the survey was being undertaken on the island of New Britain.

"Over two weeks, scientists from Papua New Guinea's National Agriculture and Quarantine Inspection Authority (NAQIA) will be surveying, sampling and testing plants and insects in the East and West provinces of the island," Dr Vivian-Smith said.

"They will be surveying the plant health and presence of plant pests, which will improve our knowledge of what potential disease or pest risks we need to be alert to.

"Because of COVID-19 travel restrictions, we've had to develop a remote system of real-time support. The Department's Northern Australia Quarantine Strategy (NAQS) scientists will provide real time support whilst NAQIA is in the field using platforms like WhatsApp to send messages and share images.

"We'll be on the lookout for species on the priority lists of both NAQIA and DAWE. This includes coconut rhinoceros beetle, mango pulp weevil, Xylella and Siam weed.

"Any species that cannot be identified by NAQIA will be sent to Australia for diagnosis by NAQS.

"Not only will this survey help NAQIA better understand what plant and insect pests they're dealing with, but it will enable us at DAWE to have early warning and intelligence of priority plant pests in Australia's near neighbours.

"Given Australia's proximity to Papua New Guinea, and the vital trade links between Papua and the Torres Strait, it's important that we are armed with knowledge of what's affecting our neighbours.

"We're not stopping here either – a second survey will be undertaken in the Vanimo region. This survey will focus on Asian citrus psyllid, a small sap-sucking insect which can carry disease and kill off citrus trees.

"We're proud to be working alongside our neighbours in Papua New Guinea to safeguard the biosecurity of both nations."

LEADERSHIP FOR CROPLIFE ANNOUNCED FOR 2021-22

The National peak industry organisation for Australia's plant science sector, CropLife Australia, today announced its leadership team for 2021-22 following its Annual General Meeting. Country Head and Managing Director, ANZ, for Syngenta, Mr Paul Luxton will continue as President of the organisation.

Mr Luxton's sixth term as President will see him joined on CropLife's Executive by fellow industry leaders with an extensive range of expertise and vast wealth of knowledge:

- Mr Damien Ryan, Managing Director, Sipcam Pacific Australia as Vice President (Crop Protection and Stewardship)
- Mr Joerg Ellmanns, Managing Director, Bayer Crop Science as Vice President (Crop Biotechnology)
- Mr Gavin Jackson, Head of Agricultural Solutions (Australia and New Zealand), BASF Australia as Chair of the Corporate Governance Committee

In addition to the Executive, the following will serve as Directors on the CropLife Australia Board for 2021-22:

- Ms Kristina Hermanson, Managing Director ANZ and ASEAN, FMC Australasia Pty Ltd
- Mr Darrin Hines, Chief Executive Officer, ADAMA Australia
- Mr Rob Kaan, Managing Director Australia/NZ/Japan/Korea, Corteva Agriscience
- Mr Peter O'Keeffe, Commercial General Manager, Nufarm Australia Limited
- Mr Brett Ryan, Managing Director, Sumitomo Chemical Australia Pty Limited

The Executive and Board provide important strategic guidance for CropLife Australia, whose management team is led by Chief Executive Officer, Matthew Cossey.

Mr Cossey said, "CropLife is fortunate to represent the best of the plant science industry and all of our members are incredibly proud to be part of what is a vibrant and innovative agricultural sector.

"Our members have shown great commitment throughout the pandemic to ensure Australian farmers have access to the latest products and innovations of the plant science industry. The obvious passion for agriculture of CropLife members has been unwavering and they have been dedicated to maintaining and improving Australian farming's productivity, profitability and sustainability.

"The extensive industry experience of these individuals, supported by all our member company leads, continues to be invaluable in guiding CropLife through its busy operations and significant strategic goals," Mr Cossey concluded.

SIVANTO® PRIME IS TOUGH ON KEY HORTICULTURAL PESTS, WITH SAFETY FOR BENEFICIAL SPECIES

The Australian fruit and vegetable industry is set to benefit from stronger and more sustainable pest control, with the launch of Sivanto® prime, a new insecticide from Bayer.

Having been developed globally in a wide variety of fruit and vegetable crops, Sivanto® prime has shown excellent performance on a broad spectrum of damaging sucking pests.

Importantly, the product introduces a new chemical class - butenolide (Group 4D) - into key pest management programs, such as for fruit spotting bug and silverleaf whitefly. Introducing innovative and selective insecticide classes such as this is critical for sustainable pest management.

Sivanto® prime offers advantages over existing management options by offering rapid protection, flexibility for use over flowering and a good level of beneficial species safety.

Bayer Grower Marketing Lead: Horticulture, Anthony De Monte, says it is exciting to be bringing such an innovative insecticide to market, after it has been proven by over a decade of field research in Australia.

“It will be a welcome addition to the crop protection programs for growers needing new options for whitefly and aphid control in a range of vegetable crops,” Anthony says.

“With the registration of Sivanto® prime in avocados, mangoes and papaya for control of fruit spotting bugs and planthoppers, growers will have an innovative and selective insecticide class to support sustainable pest management.”

After being proven through extensive field research in Australia, it has shown excellent performance on a wide spectrum of damaging sucking pests, including; fruit spotting bugs, banana spotting bugs, lace bugs, aphids, whiteflies, planthoppers and for the suppression of scirtothrips.

“The product acts fast and selectively, meeting the needs in most cases of a beneficial species-safe insecticide and diverse environmental safety requirements in a range of crops,” Anthony says.

Business Development Manager for Bayer in Queensland, Tim O’Grady, believes Sivanto® prime is a game-changer in orchard pest management, with its ability to work fast, but in a targeted way, which he agrees is good news for beneficial insects.

“Fruit spotting bugs are controlled quickly by direct contact, however the majority of important beneficial insects like predatory mites, lacewings, hoverflies, parasitoids and lady bird beetles remain untouched,” Tim explains.

“This makes the product ideal for use early in the season, especially given the unique level of safety to European honey bees and Australian native bees. It also helps meet the demand for a quality pack-out, without disrupting the whole orchard system.”

It shows low toxicity to Australian native stingless bees (Tetragonula spp. and Austroplebeia spp.) and European honeybees (Apis mellifera) when used as directed, and can be safely applied during the period of crop flowering. The use of Sivanto® prime may result in transient effects on bee behaviour, but is not expected to affect the performance of bee colonies or solitary bees. However, under good agricultural practice, it is recommended not to apply Sivanto® prime or any other insecticides at times when bees are actively foraging.

The good level of safety for beneficial species it provides is also critical in vegetable production, with the product matching the best standards for residual control of silverleaf whitefly, without being detrimental to the parasitoid wasp, Eretmocerus hayati.

“Trial work at the Queensland Department of Agriculture and Fisheries Bowen Research Station has proven this complementary fit under high pest pressure,” Tim says.

“Using Sivanto® prime early on a building pest population, where younger lifecycle stages are present, can help avoid large population peaks later in the season.

“The product rapidly prevents sap feeding and honeydew secretion for both silverleaf whitefly and aphids, with the cessation of feeding happening within minutes, not hours after application.”

It is expected to be launched into macadamias, and other crop label extensions are expected to follow later in 2022. For more information, head to sivantoprime.com.au for a range of resources, including field guides and experiences from the paddock.

UTILISING THE BEST NOSES IN BIOSECURITY

Australia's biosecurity detector dog unit has evolved over many years, with the dogs now being trained to detect specific cargo pests and taking part in trials to screen passengers for COVID-19. Secretary of the Department of Agriculture, Water and the Environment and Australia's Director of Biosecurity, Mr Andrew Metcalfe AO, said the dogs have continued to be a vital part of Australia's biosecurity frontline.

"There have been significant changes in how the detector dogs are selected, trained and deployed, and this has helped us manage growing biosecurity risks," Mr Metcalfe said.

"Initially, our dogs were selected from pounds and private breeders, and were only deployed at airports to screen passengers.

"We now select dogs from the Australian Border Force (ABF) Detector Dog breeding program, which are bred specifically for detection roles and this has supported us in deploying dogs into airports, mail centres and seaports.

"We have partnered with researchers to ensure we are picking the best dogs for the job, which has improved the success rate for dogs selected for training."

Head of Biosecurity and Compliance at the Department of Agriculture, Water and the Environment, Andrew Tongue, said the dogs are now also being trained to target pests and diseases.

"Our detector dogs are being utilised for new and innovative purposes – which is helping manage growing biosecurity threats posed by specific pests," Mr Tongue said.

"We now have detector dogs screening imported cargo in Brisbane and Perth to detect brown marmorated stink bug (BMSB), which is a huge threat to Australia's horticulture industry.

"There is still some work to do in this space, but the early signs are good, and we will look to expand this to other states in the future.

"More recently, the detector dogs have been part of a COVID-19 Feasibility Study, which is looking at their ability to detect COVID-19 in body odour.

"This project is led by ABF in conjunction with the department, Adelaide University and South Australian Metropolitan Fire Service, with trials underway at Adelaide airport.

"This is all in addition to their regular day job, which sees them intercept tens of thousands of risk items at airports and mail centres each year.

"We are excited to see what is next for our detector dogs and will continue looking at ways to build and utilise their skills to strengthen our frontline defence against biosecurity threats."

The adult brown marmorated stink bug is a little over a half inch in length and about as wide. The shield-shaped back contains various shades of brown. Unique markings for this species include alternating light bands on the antennae.

FUNGICIDE A WELCOME ADDITION TO TASMANIAN APPLE PROGRAM

Talendo® fungicide, from Corteva, has been welcomed as a key addition to the disease protection program used and recommended by Peter Morrison, of Nutrien Agronomic Services, at Huonville, in Tasmania.

Mr Morrison consults to apple growers across Tasmania and said, with annual rainfall of between 650 and 950mm, diseases such as Powdery mildew were a major issue each year.

“La Nina events also put pressure on across the season,” he said. “Predominantly we look at preventative programs, rather than curative, for the control of Powdery mildew and so need a range of products across the season to produce high quality apples. Every application across the orchard has a Powdery mildew product included.”

He said it was vitally important to rotate the modes of action to reduce the onset of resistance so the different products could be viable into the future.

“Resistance management is paramount. There wouldn’t be a day go by where I don’t talk about resistance to a grower. Unfortunately, we have a first-hand experience with a disease in cherries at the moment which has developed resistance to certain chemicals.”

Mr Morrison first saw Talendo® fungicide being used in grapes in Victoria and felt it had excellent potential as part of an apple disease management program.

Apple varieties grown in Tasmania include Gala, Pinks, Jazz and Envy with many of the more modern options proving to be quite susceptible to Powdery mildew.

“These newer varieties seem to be Powdery mildew magnets,” Mr Morrison said.

He said the high-pressure period for Powdery mildew was from late November through to mid-to- late December and this was the window where Talendo® was used.

“In that high pressure timing we are finding Talendo® has done an excellent job.”

A typical program recommended by Mr Morrison includes sulfur for the first three sprays, followed by Topaz and three Flint applications over flowering. Three applications of Fontelis® and Talendo® are used and Delan, Nimrod and Topaz might finish off the season.

“I use Fontelis® and Talendo® at the pressure times of the year,” Mr Morrison said.

Talendo® works on three important stages of the disease life cycle by making exposed spores unviable, inhibited spore germination and preventing Powdery mildew from reproducing. This ensures a cleaner orchard into the future.

The program recommended by Mr Morrison rotates through the different modes of action to help reduce the incidence of resistance. It is designed for a fungicide application once every ten days but can come under pressure in bad Powdery mildew years where the interval is reduced to seven days.

“There are good options but due to the fact that we need to have a Powdery mildew spray in every tank you can run out,” Mr Morrison said.

If an orchard succumbs to Powdery mildew it can turn white and cause issues that season and also into the future. Mr Morrison said many growers in Tasmania were focused on Integrated Pest Management (IPM) programs to help control insect pests and preserve beneficial insects through the orchards.

He said Talendo® had fitted well into the program as it was IPM compatible and mixed well with a range of other products used by growers. It is also a product with low toxicity, with minimal impact on the environment and excellent operator safety.

Mr Morrison said the programs implemented throughout the season help farmers grow excellent apples that are exported to the mainland and across the world. “I think we do a very good job producing high quality apples here in Tasmania,” he said.

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GRAPEVINE PHYLLOXERA:

OUR KNOWLEDGE IS EVOLVING

An Agriculture Victoria research project studying phylloxera has revealed new ways to improve detection and management of the destructive grapevine pest. Over the past three years, a $1.5 million project co-funded with Wine Australia has delivered a new portable technology for rapid identification of phylloxera in the field, new knowledge in assisting screening of rootstock resistance, and new disinfestation practices to help prevent the pest from spreading.

"Phylloxera are tiny insects about a millimetre long and are extremely difficult to identify even with the trained eye of an expert," Agriculture Victoria's lead insect diagnostician Dr Mark Blacket said.

"We've developed a portable assay that gives rapid and accurate molecular identification of a suspect phylloxera in less than an hour – before now the process of identification could take up to a week."

The assay is called LAMP (loop-mediated isothermal amplification) and can be carried out under field conditions using a portable device (a LAMP machine) that is about the size of a laptop.

"LAMP provides a simple method to confirm the identity of the pest in a vineyard and will save valuable time in decision making for biosecurity officers," Dr Blacket said. "We've shown it works with insects removed directly from roots, and on phylloxera obtained from traps placed underneath the vines."

In addition to developing the new LAMP tool for DNA identification of phylloxera, the project team has also made a new discovery about the genetic diversity of the insects in Australia.

Grape phylloxera (Phylloxera vastatrix) is a pest of commercial grapevines worldwide.

Their study collected phylloxera from across the King Valley wine region in Victoria, where the genetic diversity of the pest was first studied in early 2000. Having carried out genetic studies, the team compared findings with a former study conducted 30 years ago. The new study identified 32 new strains of phylloxera.

"Genetic differences among phylloxera underlies the ability of certain strains to overcome resistance in rootstock cultivars," Agriculture Victoria phylloxera research lead Dr Catherine Clarke said.

"By knowing more about these genetically different strains and how they spread, we can provide better advice to growers about which rootstocks might be most suitable against phylloxera in their locality."

Wine Australia General Manager Research, Development and Adoption Dr Liz Waters said the King Valley study indicates that changes in genetic variability of phylloxera could threaten the long-term stability of rootstock tolerance to the pest.

"The identification of new strains presents a number of challenges as each strain of phylloxera has the possibility of a different impact, particularly on tolerant and resistant rootstocks," Dr Waters said.

"Due to the critical need for accurate rootstock data, the project also expanded the rootstock testing program which delivered new information on the resistance status of particular rootstocks to certain phylloxera strains.

"The rootstock 5C Teleki was screened against a panel of phylloxera strains, and a range of rootstocks were tested for resistance to the virulent strain G38, in the field and under controlled conditions." Dr Waters said. "This new information will be fed into the Grapevine Rootstock Selector tool for easy referral."

For producers within phylloxera-infested zones, farmgate hygiene and disinfestation are vitally important in stopping the spread and inadvertently introducing a new strain to vineyards.

In studying disinfestation practices to limit the spread of phylloxera, the project has identified a product available from supermarkets that is effective for disinfestation of footwear and hand-held tools.

"Preventative biosecurity practices are the best form of defence," Dr Clarke said. "Current best practice suggests bleach is optimal for disinfestation of footwear and hand tools, to prevent phylloxera from travelling within and outside quarantine zones.

However, it is not favoured by growers due to the hazards posed by chlorine odours and residues, and the damage it causes to footwear and tools," she said.

"We found that Dettol, a readily available disinfectant, is a suitable substitute for bleach. It's adding to the arsenal of tools that growers can use at the farm gate."

Phylloxera is a hardy insect pest, but the research found Australian strains in general are sensitive to temperatures above 30°C and below 18°C. It was also found that fermentation for 48 hours is sufficient to kill phylloxera in ferments with commercial yeast added, but not necessarily for 'wild' ferments.

Further research will firm up these results and determine how fermentation can be applied to disinfest grape products during winemaking.

A new research project co-funded by Agriculture Victoria and Wine Australia will build on the project's findings to further improve the nation's strategy to control phylloxera through more effective disinfestation procedures, validating the LAMP DNA surveillance tool for use in field detection, improving selection of resistant grapevine rootstocks, and looking at native biological control options, such as Australian plants and native insects.

"Phylloxera remains a challenge for the Australian wine sector," Dr Clarke said. "But it's a challenge that we're continuing to build solutions to address and provide support to ensure the sector can manage."

The final report for the project Integrated management of established grapevine phylloxera is available on Wine Australia's website.

Phylloxera facts

(pronounced fi-locks-erra)

Grape phylloxera (Daktulosphaira vitifoliae) is a tiny insect pest, akin to aphids, that destroys grapevines by feeding on their roots and/or leaves. There are now 115 genotypes of phylloxera present in Australia and impacts are dependent on the strain and vine host. Vitis vinifera cultivars, commonly known as 'own roots', die within six years once vines are infested and effects on yields are felt much sooner. Once infested, the only solution is to replant on resistant rootstocks, selected based on site conditions and the individual phylloxera genetic strain.

Phylloxera's arrival in Europe from North America in the 1850s wiped out millions of hectares of vineyards within years. The pest is found in eight quarantine zones in Australia, but good fortune and strict quarantine regulations have limited further spread. However, Australia's wine sector remains vulnerable to phylloxera because the susceptible, own-rooted vines make up the majority of the nation's vineyards – including some of the oldest vines in the world. This means the stakes are extreme should phylloxera spread outside the current phylloxera-infested zones.

OLD WAYS AND NEW

KEEPING AUSTRALIA'S BEE INDUSTRY STRONG

Third-generation beekeeper Tim Alt has a passion for beekeeping, honey production and the Australian bee industry.

His respect for passed down knowledge, combined with the latest education, products and support from Elders make his family's operation a leader in honey production. He insists a balance of both are crucial for a sustainable industry and bee population.

Based in northern New South Wales, Tim works in partnership with his brother, Peter, managing around 1,000 hives to produce honey for Capilano.

"I've got some pretty good memories from growing up in a beekeeping family," he said. "I used to have my head in a hive fairly often, learning how to do it all and watching over Dad's shoulder."

His father, Jack, still helps in the business and his wisdom and sharp eye for finding the queen are always welcome. "The older generation's knowledge is absolutely irreplaceable," he said. "There are a lot of new initiatives coming into the industry too, but you've still got to know the old ways."

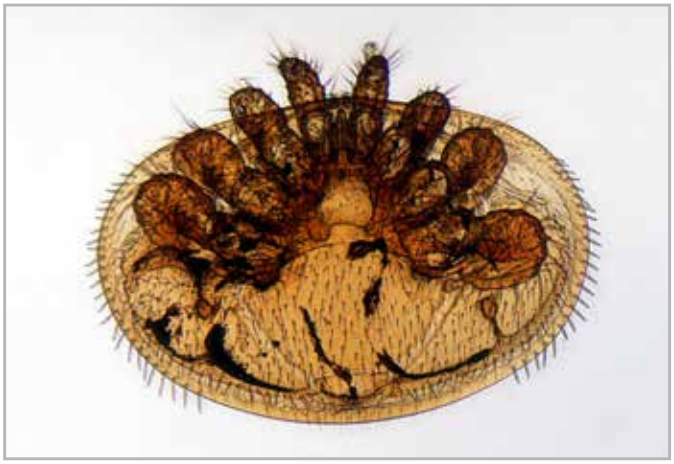
He believes the future for the bee industry in Australia is looking bright, thanks to our pristine environment and quality honey, continuing strong prices and an absence of the industry's most feared pest, the Varroa mite.

"If we can keep that out, we've got a very, very healthy industry to look forward to," he said. "I think there's got to be a very strong push for the education of people managing bees," Tim said.

Despite his years of experience, he thought it was worthwhile to complete a Certificate III course in beekeeping at Tocal College, and believes these types of courses can be valuable for both commercial and hobby beekeepers.

Tim also regularly attends the annual bee conferences held by the NSW Apiarists' Association to keep up to date with the latest insights and innovation and is looking forward to the Australian Bee Congress in Sydney in 2022. He says it has been great to see Elders supporting beekeepers in his region.

A number of Elders branches are now supplying Ecrotek hives, beekeeping supplies, pollination supplements and attractants, along with advice. Jason Traplin and the team at Elders Stanthorpe have been hosting information days for apiarists in their local region.



One of the biggest problems to honeybee population is the varroa mite. These little mites kill thousands of hives every year by weakening individual bees during the winter.

"I had worked with Jason a little bit when he was beekeeping with Granite Belt Honey, so it's fantastic to see what he's doing now to run information days for Elders and provide support to people starting up," he said.

Tim has also tried the new Ecrotek hives, available from Elders, finding them well put together. "You need new boxes and frames all the time, although we've also got some boxes that could be anywhere up to 60 years old," he said.

Tim said that it was important to find a balance between keeping up with new products and new initiatives and learning from the old ways.

"For example, you don't turn around half way down a forest track when you're scouting for new country for your bees, you've got to go right to the end because it might only be one more kilometre down the track where you find trees that are absolutely fantastic and in bud," he said.

"When looking for winter sites, you've got to find a site where the hive is going to get the first sun on the entrance to the hive and sun on the front of the hive until the middle of the afternoon, so it's nice and warm and dry and the bees can get out every day. That way, they maintain a nice, healthy hive."

The Alt family move their bees throughout northern New South Wales and southern Queensland to find flower sources, sometimes pollinating macadamia or canola crops, or just setting up in bushland.

"Beekeeping is a bit of an art form, I suppose, we love it," he said. "It's a pretty important creature, the old bee. If bees go, we go."

SUPPORTING AUSTRALIAN FARMERS TO BE THE WORLD'S BEST THROUGH INDUSTRY STEWARDSHIP & BEST PRACTICE

CropLife Australia, the national peak industry organisation for Australia's plant science sector, has launched a revamped website to better support Australian farmers to be the world's best.

The 'StewardshipFirst' website brings together all of CropLife Australia's world leading crop protection and crop biotechnology stewardship programs and best practice guidelines in one easy to access location.

Chief Executive Officer, Matthew Cossey, said, "CropLife's members are global leaders in their whole-of-life-cycle and best practice approach to industry stewardship, contributing millions each year to activities to ensure the safe and sustainable use of their products. Our members are continuously adopting and promoting ethical and responsible practices right from discovery and development of crop protection and crop biotechnology products through to their use and the final disposal of associated waste."

The updated website pulls together CropLife's stewardship initiatives and programs – the StewardshipFirst suite – making it easier for farmers, agronomists, environmental land managers, local councils and other pesticide users to navigate. The website also provides further information to guide better understanding of StewardshipFirst and pesticides.

Mr Cossey continued, "Through StewardshipFirst, CropLife and our members are providing a suite of world-leading stewardship initiatives, programs and resources that support the plant science industry's commitment to the careful and responsible use of plant science products and innovations. StewardshipFirst enables farmers to better use crop protection solutions to improve their agricultural practices through practicing pollinator protection and managing spray drift."

The updated website further demonstrates commitment to whole-of-life cycle stewardship and product best practice and comes after the appointment of a dedicated Director of Stewardship and Sustainability Policy for CropLife Australia earlier this year.

Mr Cossey concluded, "Stewardship has always been a pillar of CropLife's advocacy work, but this dedicated position puts a spotlight on the motivation of CropLife member companies to be more forward-looking and future-ready in the context of stewardship. We will be expanding our stewardship offering in the coming year to continue better supporting farmers, environmental land managers and other pesticide users.

"At its core, StewardshipFirst is about our role in supporting the users of plant science industry products and innovations, ensuring sustainability and protecting the environment."

FUTURE-DRIVEN POLICY IS NEEDED TO TACKLE THE LABOUR CRISIS IN THE AGRICULTURAL INDUSTRY

The agricultural industry, stimulated by improved seasonal conditions, has remained the second fastest-growing sector, contributing 2.3% to Australia's GDP (or $63 billion) and is set to reach $100 billion in output by 2030. Scalability, however, is heavily dependent on addressing the labour crisis. The farming sector provides over 1.6 million jobs, but for sustained growth more needs to be done to give farmers confidence in their ability to recruit and maintain a labour-force.

The labour crisis is not a new problem. From 2018 as many as 60% of growers in the fruit and vegetable sector reported experiencing difficulty securing workers. This has subsequently led to significant amounts of produce loss and wastage. Labour shortfalls in the dairy industry result in $364 million dollar losses annually.

These labour struggles have resulted in farming businesses relying heavily on working migrants to fill seasonal roles. The onset of COVID-19 eradicated this source of labour, having a devastating effect on farming business's ability to harvest their produce. Persistent international border restrictions have immobilised the migrant workforce resulting in an additional shortfall of 26,000 workers. With international travel bans in place for the foreseeable future, there is an urgent need to address labour shortfalls and begin to implement policy that fosters agricultural employment now and well into the future.

With 80% of farmers reporting difficulty with recruiting workers, the consequences are far-reaching affecting all Australians with restricted food supplies and increased food prices. To provide relief to farming businesses, innovative thinking is needed to safeguard our agricultural industry and pave the way to economic recovery and renewed prosperity.

In response to COVID-19, temporary changes to visa arrangements for the Seasonal Worker Programme (SWP) were announced. These have:

- Allowed Pacific workers under the SWP and the Pacific Labour Scheme to continue working in the agriculture sector until the crisis has passed.
- Let workers with new visas remain in Australia and continue working for up to 12 months.
- Continued the sponsorship arrangements between Pacific workers and their employers.

While these measures have been warmly welcomed by the agricultural community, they only provide temporary relief for farming businesses. Instead of reactionary policies, the Federal Government must consider long-lasting initiatives that nurture sustained agricultural employment pathways.

Plunged into a recession in 2020, Australia's economic forecast for 2021 was a lot better than initially predicted, largely thanks to the agricultural industry that has remained strong. With COVID-19 numbers remaining low and restrictions winding back, Australia is in an enviable position. Still, there are significant challenges to overcome. Rising trade tensions with China are hitting Australian farmers hard. Unemployment figures remain high, and many industries are greatly burdened by international travel restrictions and a lack of consumer confidence.

Confounded by rising economic strain and with the threat of state lockdowns ever-looming, 2020/21 saw the mass internal migration of many people from Australia's major cities to regional communities. Traditionally, over 70% of Australia's population resides in the nation's capital cities, but with the feasibility of remote work lasting well into the future, many are packing up and opting for the bush.

As more people leave the city behind, regional infrastructure, in particular jobs and education, needs to be prioritised to support our growing rural areas. Agriculture remains the leading employer in most regional centres, heightening the need to keep the sector strong. Pathways into agriculture must be made more accessible to the next generation that is still reeling from the economic impacts of COVID-19.

Young people continue to be disproportionately affected by the economic ramifications of COVID-19. Of the 600,000 COVID-19 job losses, one in three affected young Australian workers (28%) aged 18-24. The employment rate for 18–24-year old's remains disappointingly at under 60%.

Burdened by an economic recession, limited job market, climbing HECs debt and surging house prices younger Australians are finding it harder than ever before to set themselves up for the future.

Now is the time to look at debt discounts and incentives to encourage high-school graduates and university students into seasonal agricultural jobs. NT Farmers Chief Executive Paul Burke has put forward a recommended scheme that incentivises high school graduates and university students into seasonal work by offering reductions and discounts to HECs debt.

This is a proposition that has some clout. Not only does it address the urgent need for seasonal workers, but it also encourages the best and brightest of the next generation to gain experience in the agricultural industry. This exposure at such a formative time, as students embark on their career paths will make the agricultural industry a more attractive career option.

More broadly, the scheme stimulates multiple areas of the economy. It will put more money in young Australian's pockets, both from seasonal employment and debt reductions. This will allow them to engage more meaningfully in our economy. They'll be able to spend more on goods and services, at a time when consumer confidence is unprecedently low. Importantly, it will also enable younger Australians to access the housing market.

Additionally, younger Australians will gain employment and valuable skills in the agricultural industry, experience that will invariably become necessary if regional populations continue to grow. Young people are integral contributors to our economy. Reducing the burden of debt from them simultaneously safeguards our agricultural industry whilst also bolstering our economy.

The average age of workers in the agricultural industry is 48. There remains an urgent need to shape the next generation of the agricultural workforce. As the industry continues to develop and evolve, it needs innovative minds to facilitate this growth. More needs to be done to encourage young workers into the industry and to position the agricultural industry as an appealing career route. Offering student debt exemptions and discounts will also ensure there is a seasonal workforce for years to come, setting up the agricultural sector for the long-haul.

Justin Whitford, CEO at PFG Australia

PEST CONTROL ESSENTIAL FOR HOME GARDENERS TO PROTECT OUR NATION'S FARMS

With months of lockdown a reality for many Australians, lots of people have chosen to use the extra time at home to get into the garden, start their own veggie patch and even undertake new landscaping projects. While exercising the green thumb is a great activity, it is crucial that home gardeners remember to practice responsible pest and disease management in order to protect themselves, their future harvest and Australian farming.

Chief Executive Officer of CropLife Australia, the national peak industry organisation for the plant science sector, Mr Matthew Cossey, said, "While Australia's farmers have our food security covered for us, it's great to see so many people around the country choosing to start growing some produce at home during lockdowns. For anyone embarking on this great hobby, it's very important to practice responsible pest and disease management. This is especially important for home gardeners who are in close proximity to farms, as untreated pests, weeds and diseases, can have disastrous impacts if they spread from backyard gardens into major commercial farms. Particular care and attention will be required as people return to normal work and aren't home as often to tend to their backyard veggie patch or fruit trees.

"Most people wouldn't even think that their backyard veggie patch could possibly cause widescale issue, but pests and diseases are as attracted to produce there as they are to crops on farms.

If left unchecked, these pests can pose real and serious threats to major farming operations. Likewise, many common decorative plants can be invasive, allergenic or toxic. We've seen this happen before – insect pests, weeds and diseases can spread very quickly.

"So that home gardeners don't inadvertently threaten farms and our nation's food supply, they should equip themselves with appropriate pest management tools and consult their local garden centre for the best advice on what to use for different produce and how to use those products safely.

Mr Cossey concluded, "Australia's agriculture industry continues to play a huge role in getting all Australians through this pandemic and it's important we all do our bit to support the great efforts of the nation's farmers."

WORLD COTTON DAY

CELEBRATING A GREAT FIBRE AND AMAZING BIOTECHNOLOGY INNOVATION

The seventh of October was World Cotton Day, a celebration of a fibre like no other and an opportunity to show its enduring important impact.

Cotton is grown in more than 75 countries around the world and in more than 100 regional Australian communities. Although Australia is a relatively small cotton producer on a global scale, it is the world's third-to-sixth largest exporter depending on the season.

Chief Executive Officer of CropLife Australia, the national peak industry organisation for the plant science sector, Mr Matthew Cossey, said of World Cotton Day, "2021 marks 25 years that Australian farmers have benefited from the advantages of growing genetically modified cotton, which has assisted them in adopting more environmentally sustainable and profitable farming practices.

"Gaining popularity with cotton growers since 1996, cotton with GM traits now makes up more than 99.5 per cent of all cotton grown in Australia."

GM cotton plants are either herbicide-tolerant, resistant to the major caterpillar pest Helicoverpa spp., or both.

Mr Cossey continued, "The positive impact of GM cotton on the environment and on farming practices has been clearly demonstrated through the Australian cotton industry. GM insect resistant and herbicide tolerant cotton has reduced the need for insecticide sprays by up to 85 per cent compared with conventional cotton which in turn reduces emissions through fewer sprays.

"The economic gains and savings have been significant with an average increase of on-farm income at $27.87 per hectare and the average reduction in weed control costs at $90.95 per hectare. This has gained Australian cotton farmers an additional almost $1.1 billion since 1996.

"The plant science industry has been a key partner of the Australian cotton industry for decades now and CropLife member companies are continuing to invest millions annually in research and development to find new innovations in areas like cotton production."

Other environmental, social and economic benefits of GM cotton include: increased populations of beneficial insects and wildlife in cotton fields, reduced spray drift, improved soil quality, improved opportunities to grow cotton in areas of high pest infestation, reduced production costs, increased yield, reduced risks, decreased labour and fuel usage and improved farm worker and neighbour safety.

Mr Cossey concluded, "On a global scale, cotton is a commodity grown in over 75 countries across five continents and traded worldwide".

Cotton is also a major source of livelihoods and incomes, providing employment and income to many developing countries around the world.

"The success of GM cotton cultivation in Australia demonstrates the vast potential that production and trade of this valuable commodity can have now and into the future."

SESAME STREETS AHEAD:

NEW STRATEGY TO DRIVE THE GROWTH OF AUSTRALIA'S SESAME INDUSTRY

An ancient oilseed revered for its medicinal and nutritional properties, interest in sesame seeds and its derivative products is rapidly gaining around the world.

Changing attitudes towards food, increasing wealth and consumer interest in health foods has driven market growth, with the global yield of sesame doubling between 2001 and 2014, an increase from 3 million tonnes to a peak of more than 6 million tonnes.

The production of sesame has traditionally been dominated by African and Asian countries. Australia has been a net importer of sesame products since 1966 with domestic demand rising steadily since. In 2020, Australia imported over 13,000 tonnes of whole sesame and sesame products such as oil and tahini (Coriolis, 2021), with the figure set to rise to nearly 20,000 tonnes by 2025.

With both a domestic and international surge for sesame products, Australia is in a prime position to develop a sustainable and profitable industry. With such an encouraging outlook, AgriFutures Australia has committed to developing the market by establishing a five-year industry-led research, development and extension (RD&E) plan.

"The Strategic RD&E Plan will inform future investments and provide a clear plan to enable industry growth and development," said Dr Olivia Reynolds, Director of Susentom and project lead for the establishment of the sesame RD&E plan. "It is crucial that we have a good basis and direction for the sesame industry to meet the projected target of $10 million gross value product," she added.

Developing varieties for Australian conditions

Currently, the Australian sesame market is made up of a handful of growers across Western Australia, the Northern Territory and Queensland with a total of just 525 hectares planted in 2019. With a tolerance to drought and heat, Australia is well positioned to significantly increase the amount of land planted to sesame, with data modelling suggesting that the industry could grow to in excess of $100 million in North West Queensland alone.

While the whole sesame value chain requires development, agronomy is one topic of significant interest to stakeholders. Current knowledge gaps include the interaction between regional conditions and time of sowing, sowing configurations and weed management. Seed technology companies AgriVentis and Equinom are currently in the process of trialling sesame varieties for Australian growing conditions.

"Equinom produce the only sesame varieties currently available in Australia that are 'shatter resistant', which means that the crop can be mechanically harvested. This is a game changer for the industry and a major reason why we are seeing the industry emerge in Australia," said Dr Olivia Reynolds.

Equinom VP Product Management, Dr Oron Gar said the ability to produce sesame on a large scale and proximity to the Asian market puts the Australian sesame industry in an attractive position.

"We have seen great demand for high-quality Australian sesame and sesame products. If an export market is established, the Australian sesame market could reach a value of AUD$200-300 million."

Equinom are currently trialling seed varieties in Queensland, Western Australia, Northern Territory and New South Wales to select elite varieties based on their yield, oil content and other quality parameters.

"Our vision is to offer a leading alternative summer crop to cotton in New South Wales and Queensland, and a leading row crop for the evolving summer crop industries in Western Australia and Northern Territory," said Dr Gar.

AgriVentis' experience in the Australian market echo's Equinom's, and the company sees huge potential. "We're focusing our work to develop varieties suitable for the Northern Australian tropics, and to improve yield, disease tolerance and quality," said Lewis Hunter, CEO of AgriVentis Australia.

"Australia has the ideal growing conditions for sesame and an abundance of broadacre country, in addition to proximity to Asian markets and a reputation for clean, green agriculture," he added.

Sesame facts

- Domestic consumption of sesame products is predicated to increase by 30% between 2016 (6,740 tonnes) and 2025 (10,000 tonnes).
- All sesame currently consumed in Australia comes from international imports.
- International demand for sesame showed a 100% increase in production between 2001 (3 million) and 2014 (6 million tonnes).
- Currently, sesame is grown in Australia by a handful of growers. In 2019, just 525 hectares were planted to sesame.
- Backed by AgriFutures Australia, the Sesame Strategic RD&E plan aims to increase domestic production over five years to become a $10 million industry.
- Data modelling predicts that over the long term, North West Queensland alone could grow a sesame industry valued at well over $100 million.

Mr Hunter said that an Australian sesame industry held exciting potential for stakeholders throughout the value chain.

“Sesame suits a wide range of crop rotations and Australian growing conditions with positive soil health benefits and low sowing rates. Developing the domestic industry would mean that marketers and processors would have access to Australian sesame seeds, including organically grown seed and the opportunity to produce sesame oil.”

Equipping growers for success

While the sesame market holds strong potential, one challenge for the industry is the management of the pest moth, the Sesame Leaf Webber. Although growers in other countries have a range of control options, these need to be explored in relation to Australian conditions.

“Growers need access to specific information about integrated pest and disease management and agronomic practices,” said Dr Reynolds, “and we also need to better understand consumer demands, social license and markets.”

“A major opportunity for the industry lies in processing, and we are now observing companies such as Savannah Sun Foods invest in key areas such as dehulling, to drive the development of an Australian industry with the view to the first Australian grown and processed range of sesame products.”

Establishing a benchmark for seed prices will continue to be a major focus for industry. The Australian import market is currently valued at approximately AUD$57 million per annum, growing at a rate of 4.5% annually. In 2020, sesame seed had an average value of around AUD$2,500 per tonne with black sesame seeds attracting a 45% premium.

Globally, 57% of sesame is used to produce oil, which attracts a significantly higher price than seed in its raw form.

“We believe sesame will be more competitive for growers than other high value seed lines,” said Mr Hunter.

Tony Matchett, Chair of the Australian Sesame Industry Development Association, believes there is a real drive to take this crop forward in Australia and is excited about the opportunities the future holds.

”As we are confronted with the challenges of increasing global food demand in the face of climate variability, sesame is a feasible option for future farming systems in northern Australia. Growers require crops in their rotation that provide sustainable and profitable returns as extended heat and drought conditions become increasingly common place. Australia imports $20billion of agricultural produce, including sesame. As a high value crop and together with the elite genetics now available, this crop provides an opportunity in modern Australian farming systems to disrupt these existing supply chains”.

For more information about the AgriFutures Emerging Industries Program, visit agrifutures.com.au/emerging-industries.

FISHERS, FARMERS AND FORESTERS TRUSTED BY THE COMMUNITY

A new report shows trust in, and acceptance of, Australia's rural industries is strong and increasing. The majority of Australians see fishers, farmers and foresters as responsible stewards of the land and sea.

The report, *Community Trust in Rural Industries (Year Two)*, is the result of a collaboration of Australia's rural industries since 2019 to collectively and proactively address community trust in the sector. The Program's aim is to develop an aligned approach to long-term engagement with the community via a three-year research and engagement program.

The program is an Australian first – a partnership involving eleven Rural Research and Development Corporations, as well as the National Farmers' Federation and the NSW Department of Primary Industries.

According to Margo Andrae, Chief Executive Officer of Australian Pork Limited, a partner in the Program, collaboration has given the sector access to a deeper, clearer understanding of what leads to community trust in rural industries.

"The research is telling us that the community sees rural industries as one – not a collection of separate industries with unique challenges – so this program is our way of embracing that and working and learning together," she said.

"Community trust and visibility of the pork industry is central to our commitment to social responsibility. But our own preliminary research indicated that while communities were willing to give us the benefit of the doubt, they knew very little about pork production. This is why it is so important to share our stories.

Being involved in this program has shown how community acceptance of rural industries, has increased from 87% to 93% in the past 12 months.

This research has also helped us understand some of the key drivers of trust like environmental responsibility. So, seeing a rise in community trust from 87% to 89% in year two tells us we're on the right track," said Ms Andrae.

To date more than 14,000 Australians have been engaged in this program of work and shared their views on a wide range of topics and issues related to rural industries, through national surveys by research agency Voconiq.

The research revealed trust in rural industries is dependent on four drivers: environmental responsibility, responsiveness to community concerns, the importance of products produced by rural industries and (new in Year Two) – distributional fairness (that the benefits of rural industries are shared fairly – especially with regional communities).

According to lead researcher and CEO/ Founder of Voconiq, Dr Kieren Moffat, the more community members feel a connection to the land themselves, the greater their level of trust in rural industries.

"Currently, Australians find this connection via the rural industry food and fibre products they purchase and use. This may be the most important advancement in the Year Two data, a clearer understanding of why industry products drive trust.

“Feeling connected to farmers, fishers and foresters through this exchange speaks to the power of a natural product; a transactional exchange that leads to a relational outcome,” he said.

The important role Australia’s farmers, fishers and foresters play in Australian society has been highlighted through the COVID-19 pandemic. It has increased community focus on, and confidence in, the work of rural industries in ensuring a safe and reliable source of food and natural products.

However, increased support for – and positive sentiment toward – rural industries brings with it great responsibility. The community expects fishers, farmers and foresters not to compromise environmental responsibility for economic sustainability.

Year Two research analysis revealed that taking action based on community concerns is fundamental to building trust with Australians.

“Acknowledging when things go wrong and actively responding, rather than remaining silent on challenging issues, received strong endorsement from community members. Industry responsiveness via listening and responding to community concerns remained a strong driver of trust in the Year Two research,” said Dr Moffat.

In Years Two and Three, the Program will inform and then examine industry activities designed to consolidate and build community trust through a series of industry-specific focal studies, as well as a sector-wide initiative to address a shared issue.

In a first for the sector, individual rural industries have volunteered to examine critical issues that also present community trust challenges. They will uncover the community’s concerns around a specific issue, respond to those concerns and share the results back to the sector. This will create a unique opportunity for the whole sector to learn from the process.

“The aim of these focal studies is to describe tangible steps to build community trust by building confidence through considered research,” said Matt Brand, Chief Executive Officer of Hort Innovation, a partner in the Program.

“In 2022, the program will also facilitate a sector-wide initiative to understand and address a shared community trust issue across all rural industries.

“Looking ahead, the program is evolving to consider how we can work together in the long-term and present a unified response to critical shared issues, in response to community concerns,” Mr Brand concluded.

For more information on the program, visit: https://www.agrifutures.com.au/national-rural-issues/community-trust/

NEW BARLEY POWDERY MILDEW RESISTANCE GENES KEY TO FUTURE RESISTANCE

Australian researchers have discovered a set of unique and potentially durable resistance genes from exotic barley lines and landraces that breeders can use to develop crops with more stable resistance to powdery mildew.

Discovered at the Centre for Crop and Disease Management (CCDM) – a leading Australian research centre with co-investment by the Grains Research and Development Corporation (GRDC) and Curtin University – the three adult resistance genes (RBgh1-3) share new mechanisms for fighting the barley powdery mildew pathogen, making them the best hope yet of achieving long term resistance to the disease.

Powdery mildew is a challenging disease for Australian barley growers, especially in high-rainfall and humid weather conditions favoured by the pathogen and can result in substantial losses in quality and yield.

The pathogen readily mutates to overcome conventional resistance genes, while chemical controls are similarly rendered ineffective. Fungicide resistance to triazole class (Group 3 Dimethylation Inhibitors – DMI fungicides) is now widespread in areas such as southern Western Australia, where the disease has at times reached epidemic levels.

Led by Dr Simon Ellwood, the CCDM's barley research team had noticed some barley lines were resistant to powdery mildew at adult stage but not as seedlings.

"This led us to focus our research on adult barley plants, specifically in exotic lines and landraces that are not closely related to modern barley cultivars and which have a limited range of resistance genes to powdery mildew disease," Dr Ellwood said.

"While these exotic and wild types of barley are not ideal as grain crops, their desirable traits can be bred into elite barley lines, including the new resistance genes we have identified."

CCDM Director Professor Mark Gibberd said the discovery of the new sources of resistance is the result of strong investment in the CCDM by Australian grain producers through the GRDC and Curtin University, which has enabled researchers to take a long-term approach to powdery mildew research.

"Until now, research to identify sources of durable genetic resistance to barley powdery mildew in Australia and overseas has mainly been done at seedling stage," he said.

"With co-investment by the GRDC and Curtin University, our barley researchers were able to work on novel research with adult plants over a sustained period to identify the first set of durable resistance genes for the disease, which shows their commitment and support to our research is paying off."

The team searched for resistance in over 1000 exotic lines and wild relatives of barley from regions of the crop's diversity in the horn of Africa, the Near East and Asia, accessed through the Australian Grains Genebank. Carrying out genetic mapping and multi-pathogen disease screening, the team discovered that not only were the exotic barley lines themselves diverse, so were their types of resistance.

"What makes our newly discovered resistances useful to breeders is their atypical nature," Dr Ellwood said.

"They share common features that suggest they operate by a different mechanism to conventional genes to resist powdery mildew, so integrating them into Australian barley cultivars should make for a strong defence that is difficult for the pathogen to overcome.

"They also appear to be broad-spectrum showing resistance to all powdery mildew pathotypes tested and they are each single genes which makes them easier for breeders to work with. The new genes will allow breeders to reduce the reliance on mlo, a broad-spectrum resistance that is the only current alternative. Adding to their uniqueness, no previous genes for resistance have been identified in regions of the genome where we found these genes."

The newfound resistances is not the first discovery by Dr Ellwood's team. In 2016, they discovered a mlo resistance mutation variant from an Ethiopian landrace that showed less necrotic spotting and loss of photosynthetic capacity, which was released to Australian barley breeders.

"Breeders now have a set of options they can use separately or together in various combinations to build strong, multi-mechanism resistances into our Australian barley cultivars," Dr Ellwood said.

"Having the resistances effective in adult barley plants ensures they are effective when growers need them the most – in the later growth stages when yield is at stake.

"By providing breeders with the knowledge and tools to deliver stable resistance in barley cultivars, we are supporting the adoption of improved germplasm and helping Australian growers to cost-effectively manage powdery mildew disease."

SEAWEED EXTRACTS COULD REDUCE NITROGEN FERTILISER USE

In some good news for sustainable agriculture, work aided by the APPF with Seasol® has shown the positive effect of seaweed extracts on nitrogen use and photosynthesis.

Future agricultural systems will require sustainable management practices, including the use of fertilisers. We know the application of nitrogen fertiliser enhances yield, but it can also lead to environmental damage and greenhouse gas emissions. Improving the nitrogen use efficiency of crops could alleviate the negative impact of nitrogen fertilisation without yield loss, and that's where seaweed comes into the picture.

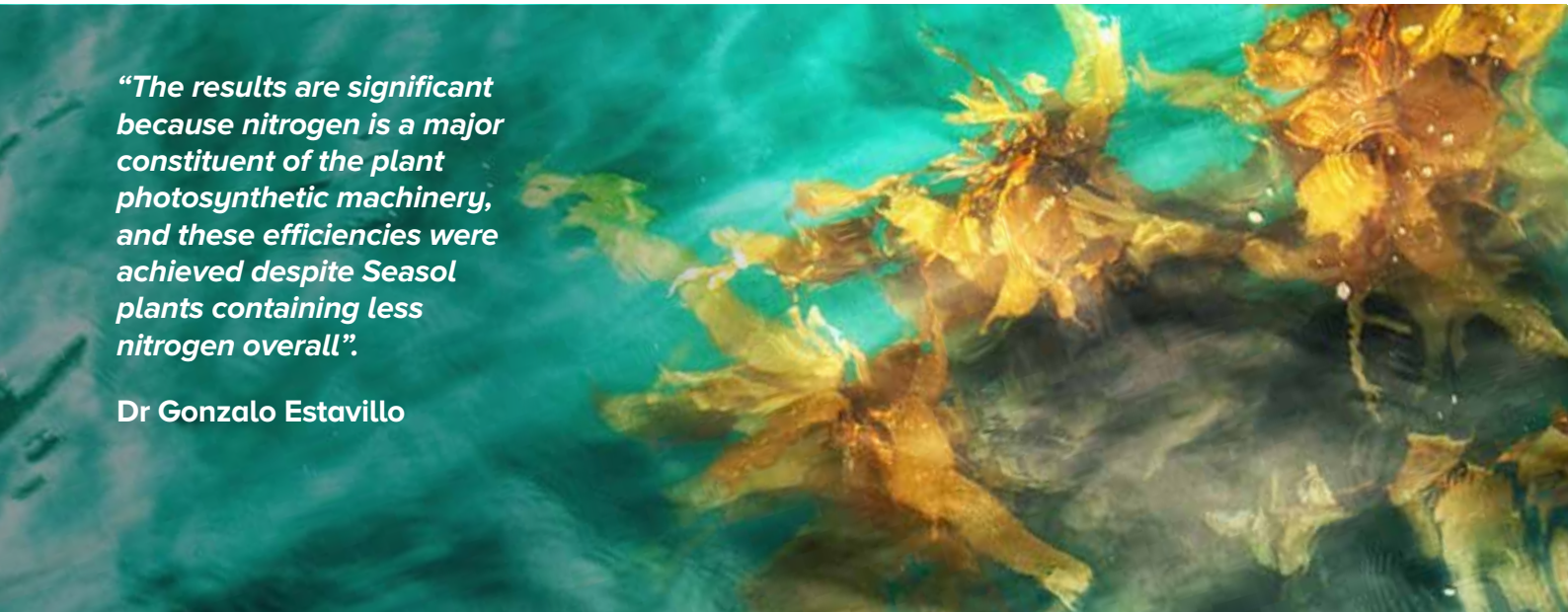
Seasol seaweed extract is an organic liquid fertiliser classified as a plant biostimulant that is known to have a positive effect on plant productivity. The Director for R&D at Seasol International, Dr Tony Arioli, has been working with the APPF and CSIRO to assess the effect of Seasol application on nitrogen uptake and efficiency in bread wheat (Triticum aestivum). Dr Arioli said, "the research aimed to determine whether Seasol could be added as a supplement to nitrogen fertilisation and potentially reduce the quantity of nitrogen applied to agricultural systems".

The research was conducted in glasshouse pot-based experiments at the APPF's controlled environment facilities located at CSIRO in Canberra. The effect of Seasol was assessed at varying nitrogen application rates corresponding to those used in Australian agricultural systems.

Researchers found the addition of Seasol was associated with a positive impact on plant growth with less nitrogen, and lower nitrogen uptake and lower plant nitrogen content. Furthermore, a positive effect was found on plant photosynthesis, which plants use to convert light into chemical energy. Senior Research Scientist on the project Dr Gonzalo Estavillo said, "the results are significant because nitrogen is a major constituent of the plant photosynthetic machinery, and these efficiencies were achieved despite Seasol plants containing less nitrogen overall".

While more work is needed to understand the mechanism leading to these positive effects of seaweed extract on plant performance and carbon assimilation, the research does support looking into the potential application of seaweed extracts in improving nutrient use and developing sustainable agricultural practices. This knowledge could then be applied to improve field crop growth.

The APPF is continuing its collaboration with Seasol to better understand the effect Seasol has on photosynthesis. It is hoped this type of science will lead to the discovery of new plant mechanisms and assist sustainable and regenerative agriculture.



"The results are significant because nitrogen is a major constituent of the plant photosynthetic machinery, and these efficiencies were achieved despite Seasol plants containing less nitrogen overall".

Dr Gonzalo Estavillo

WHAT CAN I DO AT HARVEST TO REDUCE MY FUTURE WEED BURDEN?

By Peter Newman, Western Extension Agronomist, WeedSmart

WeedSmart's western extension agronomist, Peter Newman says efforts made to reduce the spread of weed seed at harvest will soon pay off for growers

If you haven't used harvest weed seed control tools before, it doesn't take long to build and fit a chaff lining chute ready for use this harvest season.

As crops mature and harvesters begin reaping, consider the potential fate of seeds ripening on weeds that escaped in-crop control measures.

Peter Newman, WeedSmart's western extension agronomist, says harvest time is an important opportunity to assess weed burden across the farm and be proactive about driving down the weed seed bank.

"Harvest can either be a super-spreader or a weed suppressing event," he says. "Small patches of weeds can quickly expand when seed is blown out the back of the harvester. On the other hand, the harvester can be a powerful weed management tool if any one of the harvest weed seed control options are implemented."

Australian growers have led the world in inventing and adopting harvest weed seed control tools such as impact mills, chaff carts, chaff decks and chaff lining, all of which can reliably destroy over 90 per cent of the weed seed that enters the front of the harvester.

"In addition to harvest weed seed control there are several other actions in the WeedSmart Big 6 that growers can implement just prior to, during and immediately after harvest that will make a measurable difference to the weed burden in future growing seasons," says Peter. "The WeedSmart Big 6 tactics are scientifically-proven to reduce the risk of herbicide resistance through diverse herbicide use and cultural control to prevent weed seed set."

'WeedSmart' is the industry voice delivering science-backed weed control solutions to enhance on-farm practices and promote the long term, sustainable use of herbicides in Australian agriculture.

WeedSmart has support from the Grains Research and Development Corporation (GRDC), major herbicide, machinery and seed companies, and university and government research partners, all of whom have a stake in sustainable farming systems. The GRDC is a Platinum investor in WeedSmart to ensure Australian grain growers have access to world class research in strategies to mitigate weeds and control herbicide resistance.

What can I do before harvest to manage late emerged weeds?

In brief: Scout for and map weedy patches. Consider sacrificing small areas of high density weeds. Swathing can be a very effective way to stop seed set of late emerged or resistant weeds. Collect weed seeds for herbicide susceptibility testing.

The details: Growers across Australia use a variety of methods to map weeds – from the simple to the sublime. 'Dropping a pin' using the tractor's GPS mapping system as you travel through a weedy section when spraying or harvesting is easy and provides useful information about the distribution of weeds in the paddock. Many growers have their own drones and use them to collect images or video footage of the crop that can be viewed or analysed to identify high density weed patches.

Collect seed for herbicide susceptibility testing – knowing what still works is vital information for planning next season's herbicide program. There are three herbicide testing facilities in Australia that are equipped to test weed seed samples – Plant Science Consulting, CSU Herbicide Resistance Testing and UWA Herbicide Resistance Testing.

Collecting weed seed before or at harvest is the most common method used. The collected seed must be mature, from green to when the seed changes colour. Before harvest, collect 30 to 40 ryegrass seedheads or several handfuls of wild oats seed. After harvest, it is common to find seedheads still in the paddock or samples of contaminated grain can be sent for analysis.

Keep samples from different locations separate and details noted on the bag. Only use paper bags (double layer) to collect and send seed samples. Ensure bags are sealed so that the samples don't mix during transit.

Collecting samples prior to harvest for susceptibility testing will help you to plan future herbicide programs and crop rotations.

Which harvest weed seed control tool is best for my situation?

In brief: There are six harvest weed seed control tools used in Australia – impact mills, chaff decks, chaff lining, chaff carts, bale direct and narrow windrow burning. Choose the one that best suits your system and budget.

The details: Impact mills are best suited to continuous cropping situations. Residues are retained and evenly spread. Chaff decks have lower capital cost and are well-suited to controlled traffic situations. Chaff carts are popular with grain producers who also run livestock. Bale direct is also expensive but has a good fit in locations where there is access to straw markets. Chaff lining is currently the best 'entry level' system and can be used in CTF or non-CTF systems, with best results where the harvester runs on the same track each year. Chaff lining has essentially superseded narrow windrow burning, overcoming the time required and risks involved in burning and reducing the loss of nutrients from the system.

If you haven't used harvest weed seed control tools before, it doesn't take long to build and fit a chaff lining chute ready for use this harvest season.

Weed seed heads that remain intact up to harvest, and do not lodge, are easily captured by the harvester.

Baling a round or two along fencelines is an effective way to reduce weed invasion from the border.

What should I be ready to do straight after harvest?

In brief: Spraying weeds immediately after harvest is fairly common practice. Weeds present may be close to maturity or fresh germinations of summer-active weed species.

The details: Some growers get in early with knockdown herbicide applied under the cutter bar when swathing barley or canola. Consider using the double knock strategy, heavy grazing pressure and possibly a soil residual herbicide that is compatible with your planned crop rotation. Pay particular attention to any weedy patches identified before or during harvest. Stopping seed set at every opportunity is the crux of an effective weed management program.

Give some thought to what might be the underlying cause of weedy patches – fixing problems such as pH and soil nutrition imbalances, waterlogging and spray practices that routinely deliver low doses of herbicide.

Impact mills provide the ultimate solution to destroy weed seed during the harvest operation.

EMPOWERING RURAL WOMEN

The 15th of October was International Day of Rural Women. A day which seeks to put a spotlight on gender equality and empowerment of women in rural communities as a key component for a world free from hunger and poverty.

Chief Executive Officer of CropLife Australia, the national peak industry organisation for the plant science sector, Mr Matthew Cossey, said, "As an agricultural industry which supports strong rural and regional communities, we recognise how we all benefit from empowering rural women.

"We see the crucial and innovative role rural women play in the production of food, feed and fibre in our country. Working not just in farming, but in varied agricultural professions such as engineering and programming to food innovation and science, women are shaping the future of farming and our rural communities."

The United Nations established International Day of Rural Women in 2008. In developing countries, women make up almost half of the agricultural labour force. When it comes to education, access to crop inputs and crop productivity, however, there's a significant gap between men and women. The UN Food and Agriculture Organization states that if women had the same access as men to resources like land, financing and technology, agricultural yields could increase by 20-30 per cent, enough to feed between 100 and 150 million people.

Mr Cossey continued, "It's astonishing to think that until 1994, Australian women could not legally claim to be 'farmers', with the law defining them as domestics, helpmates, or even farmers' wives.

"We must continually recognise the critical role, leadership and contribution of rural women and ensure equal opportunities for all, both within our country and around the world. We must commit to ensuring that women have equal influence on the agricultural agenda, which will benefit the entire agricultural sector."

Mr Cossey concluded, "Improving the lives of rural women around the world is key to ensuring a food secure world. We stand to gain so much if we focus on closing the gender gap and empowering rural women worldwide."

SIGNIFICANT ADVANTAGES FOR AUSTRALIAN GROWERS FROM NEW NEMATICIDE

Corteva agriscience Australia is pleased to announce the first global registration of Salibro® Reklemel® active nematicide.

Corteva agriscience Australia Regulatory & Policy Manager, Greg Mitchell said that the Australian Pesticides and Veterinary Medicines Authority (APVMA) did a great job in meeting the regulatory timelines. They were not the first regulator to start the risk assessment; however, they were the worlds-first to issue a registration. There were some adjustments in timelines along the way, which were done jointly, openly, fairly and amicably. Australia is fortunate to have a risk based, rigorous and robust regulatory system based on science that protects the safety of people, animals, and the environment. Australian growers will be the first in the world to access and use Salibro to protect their crops.

Salibro is now approved for the control of root-knot nematode (Meloidogyne spp.) in root and tuber, cucurbit and fruiting vegetable crops. Salibro offers growers significant advantages over existing options.

Corteva agriscience Salibro product manager, Dan Cornally, said nematode control options in the past have typically been quite disruptive to beneficial fauna contained in the soil.

“Nematode control can be very challenging, and many of the current options available to growers are not IPM friendly which results in significant disruption to soil beneficial organisms, they are also generally considered higher risk to growers and the environment.

“Salibro is quite different, it is much lower risk to applicators and the environment. It is also a very effective nematicide that controls root-knot nematode and has negligible impact on the beneficial species that help suppress pests and diseases for healthier soil.”

Mr Cornally said Salibro has a unique mode of action and can be used at relatively low rates.

“Salibro affects the co-ordination of the nematode, meaning they are unable to move, feed and infect plant roots within hours of treatment. Death will occur in a couple of days as nematodes cannot move or feed effectively.”

In treated soils, parasitic nematodes hatch and juveniles are exposed to Salibro as they move in films of water within the soil in search of a host root. This exposure will result in control of these newly emerged juveniles.

Soil temperature does not have any impact on the performance of Salibro and effective control is observed both at low and high soil temperatures, i.e. 4 to > 35 °C.

“Salibro will typically provide root protection from 20 to 50 days so is an excellent option for growers needing effective robust control of root-knot nematodes.”

Mr Cornally said Salibro offers excellent flexibility in terms of application timing and methods.

The approved use patterns are:

1. At crop establishment through drip from three days before planting up to three days after transplanting depending on the crop.
2. As a bed or furrow spray incorporated mechanically or with irrigation up to three days before planting.
3. Split application through drip – applied at establishment and again 14 - 28 days after transplanting depending on the crop.
4. Post plant drip as a top up treatment following another registered nematicide treatment.

“Salibro has been extensively tested across Australia targeting important horticultural areas on a range of soil types since 2013 and there has been no crop injury or significant impact on crop vigour throughout those trials,” Mr Cornally said.

One of the trials sites was in Bundaberg, Queensland, and included a planned trial of the new product in sweet potatoes, carrots and capsicums.

“This was a particularly useful trial as there were very high rates of nematodes in the soil and Salibro was compared to untreated plots and those treated with current industry nematicides,” Mr Cornally said.

“This trial demonstrated the excellent crop safety of Salibro and its ability to control nematodes to produce high yields of quality vegetables.”

In the carrot trial at the site, the untreated section produced very small and deformed vegetables whereas the Salibro plot had large quality carrots.

Mr Cornally said the advantages of Salibro over current nematicides were evident and would be welcomed by growers in the coming season.

“This product has application flexibility and will help growers produce consistent, quality vegetables while looking after their soil.”

Dan Cornally, of Corteva agriscience, showing the nematode control in carrots of Salibro (right), compared to untreated (left).

SOIL HEALTH TESTING REVEALS SIMPLE SOLUTIONS

With an increasing focus on the importance of soil and soil health, the questions that's front of mind for many Australian farmers and their advisors is how best to achieve and maintain healthy soils within a productive and profitable farming system.

For senior agronomist, Jim Laycock, the ability to measure and monitor the soil's key biological, chemical and physical characteristics is essential to understanding and improving soil health. Based at Cowra in Central West New South Wales, Jim has worked as an agronomist for 26 years, specialising in broadacre cereal and legume crop production.

He has been instrumental in the development of a new soil health test package from the Nutrient Advantage Laboratory, designed to help farmers better measure and manage their soil health.

"The package comprises four tests and looks at the total carbon and total nitrogen, and C:N ratio of soils, as well as aggregate slaking and dispersion, active carbon and microbial respiration," Jim says.

"These four quite simple tests, when taken together, can yield very useful insights that can be addressed in both the short term and over time, in the long term as well."

With soil health being linked to total nitrogen, total carbon and active carbon levels, these tests can alert farmers to shortcomings in their overall soil health, prompting practice changes to fix any problem areas.

Jim has been running IPF's long term trial site near Grenfell in Central West NSW since 2007, with recent results showing how inputs and management can impact on soil health over time.

Selected treatments were sampled and compared active carbon, organic carbon (Walkley & Black method) and total nitrogen in soil with just phosphorous applied versus with both phosphorous and nitrogen applied. The results show both organic carbon and active carbon levels increased by 28% with the addition of nitrogen.

"Samples with 20kg of phosphorous applied annually returned active carbon levels of 234.5mg/kg," Jim says. "Samples with 20kg of phosphorous and 120kg of nitrogen applied annually returned active carbon levels of 299.75mg/kg, so a significant increase.

"While active carbon levels vary greatly across soil and crop types, for the Grenfell site we now have a benchmark for active carbon levels at this point in a long-term cropping rotation. "From here the aim is to continue with current best practice methods of stubble retention and zero tillage, and monitor changes in active carbon levels over time"

The trial returned similar results for organic carbon, with organic carbon levels rising from 0.85% with the application of phosphorous alone to 1.175% with both phosphorous and nitrogen applied. A significant increase in total nitrogen was also seen with the application of nitrogen, from 0.09% to 0.115%.

"Total nitrogen measures all the nitrogen in the soil, including both inorganic or plant available nitrogen and nitrogen in the form of organic matter that will mineralise into plant available nitrogen over time," Jim says.

"The higher the total nitrogen levels in the soil profile, the more potential there is for mineral nitrogen cycling. The more nitrogen you can retain, the quicker that soil nitrogen pool builds up and the quicker your organic and active carbon levels also rise.

"The more you can grow, the higher your yields will be but you're also then able to retain greater levels of biomass, and this residue retains and builds carbon and nitrogen levels in your soil. It's a simple equation, but higher nitrogen and carbon levels lead to higher rates of microbial activity, and ultimately healthier soils."

Simple solutions

Jim says that while soil health and building total carbon in soils is a long-term and wideranging pursuit, there are short term practice changes that can help counter particular issues.

“For example, if a test reveals low levels of labile, or active, carbon in soils, that means soil microbes are short on nutrients and nitrogen supply and recycling can be slowed.

“Fortunately, once identified it’s relatively easy to increase labile carbon levels within a twelve-month period, for instance by implementing a pulse crop into your rotation to boost biomass.”

Similarly, the aggregate slaking and dispersion test looks at the response of a soil aggregate to water by identifying sodic and dispersive soils with structural instability, and determining if a soil will slake, set hard or crust when wet. “Slaking, hard setting and crusting all increase erosion potential and nutrient run off, and reduce air and water movement through soil,” Jim says.

“So, if the soil health package reveals highly dispersible soils, simple agronomic tools like the addition of calcium can be used to correct the issue.”

While increasing data on overall soil health is the first step to improving it, Jim sees the recommendations and guidance that comes with that data as absolutely critical.

“The real value for farmers is in having support around their decision making,” Jim says.

“The Nutrient Advantage soil health package delivers tailored recommendations alongside its laboratory data test results.

“The decision support system is invaluable for growers and farmers as they go about both identifying and then correcting any issues or barriers to soil health.”

About the IPF Grenfell Trial Site

IPF’s long-term nitrogen by phosphorus trial was established to describe the cumulative effect of five different rates of nitrogen fertiliser and phosphorus fertiliser on grain yield and protein percentage in a controlled traffic cropping rotation.

This site was established in 2007, with soil nitrogen to 0-60cm of 160 kg/nitrogen/ha sampled pre-plant in 2007 (field peas, 2006) and a site Colwell phosphorus of 26 mg/kg. There are 25 fertiliser treatments replicated four times, and the crop rotation is sown over the same plots row on row annually.

In 2015, the original 20 metre long plots were cut in half. From 2015, the 2007 ‘A trial’ nitrogen and phosphorous rates were retained on the western half and the 2015 ‘B trial’ nitrogen and phosphorous rates were applied on the eastern half of the original plots.

The ‘A trial’ treatments continue to build soil phosphorous and nitrogen while ‘B trial’ treatments now run down and also build phosphorous and nitrogen. There are now 200 plots on the site. Triple Super (20% phosphorous) was banded with the seed, 50% of the urea (46% nitrogen) rate applied at planting banded below and to the side of the seed up until 2014. Since 2015, urea is now placed 5cm directly below the seed.

The balance of urea is applied as urea broadcast in wheat at GS31 and at the pre rosette stage in canola. Urea was not applied in 2010 (Albus lupins) and urea was not topdressed in 2007, 2014 (low yield potential due to replant) and 2018 (dry conditions).

Sulphur has been applied four times during the life of the trial as broadcast gypsum (2), banded potassium sulphate (1) and broadcast Gran-Am® (2017). A total of 5kgs/ha of zinc and 2kgs of boron have also been applied.

Nutrient Advantage

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The first in a series of soil health tests, the new package comprises four test components:

1. Total Carbon & Total Nitrogen & C:N ratio (combustion)
2. Aggregate Slaking & Dispersion (Loveday & Pyle)
3. Active (labile) Carbon (0.033M KMnO4)
4. Microbial Respiration (1 day Solvita CO2 burst)

It is recommended the tests be repeated every two to three years at the same time of year.

Using the Health1 code, they can be ordered as a standalone package for $80, or added to any existing Nutrient Advantage test order for $70. Visit www.soilhealthtesting.com.au or call 1800 803 453.

IPF’s long term trial site near Grenfell in Central West NSW

NEW TOOLS TO KEEP AHEAD OF EVOLVING ANNUAL RYEGRASS RESISTANCE

Reports of the continued evolution of annual ryegrass herbicide resistance across the country's major cropping regions has once again reinforced the push for growers to use every possible weed management tool in the proverbial toolbox – and fortunately more tools are coming.

Recent herbicide resistance testing by the Australian Herbicide Resistance Initiative (AHRI) across four States has indicated continued shifts in sensitivity to different herbicide modes of action and the ongoing requirement for robust management strategies to ensure mode of action groups are not lost to the industry.

Using multiple herbicide modes of action has long been a key plank of the industry's major measures to help growers delay the evolution of resistance.

Rotating and mixing multiple herbicide modes of action improves weed control efficacy, particularly of important problem weeds, and helps to increase the lifespan and number of effective applications of herbicides.

The industry is ready to welcome a new three-way mode of action herbicide expected to be registered in time for the 2022 winter cereal season for growers.

Mateno® Complete, from Bayer, contains a new herbicide mode of action for Australia, aclonifen (Group 32), in a complementary co-formulation with pyroxasulfone (Group 15) and diflufenican (Group 12) herbicides.

It is set to be registered for annual ryegrass control in both incorporated by sowing (IBS) and early post-emergent (EPE) application timings in wheat at a rate range from 750 mL/ha up to 1 L/ha, and for IBS application in barley at 750 mL/ha.

Aclonifen and diflufenican are taken up predominantly by plant shoots and leaves and so are particularly effective when supporting pyroxasulfone (predominantly taken up by plant roots) at the EPE timing.

Applied IBS, Mateno Complete offers a higher level of control of annual ryegrass, barley grass, annual phalaris, silver grass and toad rush and suppression of wild oats, great brome and capeweed. Used EPE in wheat, it provides control of small silver grass, toad rush, wild radish, capeweed and prickly lettuce and suppression of annual ryegrass, barley grass and doublegee/spiny emex.

Craig White, Leader of Integrated Weed Management in Australia for Bayer, said the industry needed to keep finding new tools and Mateno Complete, with its complementary active ingredients and especially new aclonifen active ingredient, would need to be adopted in combination with other measures.

"Weeds are always evolving to overcome control techniques, whether that be chemical, non-chemical or cultural," Craig said. "Any management technique can be overcome over time, hence the quote of (retired AHRI Director) Professor Stephen Powles: 'When you're on a good thing, don't stick to it'.

"To keep ahead of evolving resistance, growers need to look at multiple modes of action and active ingredients that are complementary and Mateno Complete has both of these in the one product. Used in a program that integrates other herbicides with different modes of action, it can be very powerful with what it offers."

Trials over several years have shown Mateno Complete provides a slight improvement in annual ryegrass control compared with the industry benchmark herbicide, Sakura®, when applied IBS, and when applied EPE following an effective IBS pre-emergent herbicide, it takes weed control to a whole new level. With metabolic resistance in annual ryegrass a major concern for

Craig White, Leader of Integrated Weed Management in Australia for Bayer

the industry, the EPE use pattern provides the dual benefits of increased weed control with the use of multiple herbicide modes of action within a season.

Compared with IBS applications, the EPE application of Mateno Complete provides weed control across the complete soil surface profile, including in-furrow, on the furrow shoulder and in the inter-row.

It should be applied from the two-leaf crop stage in wheat and trials have indicated the best annual ryegrass timing to be one to two-leaf.

“Weeds can escape IBS applications, particularly weeds emerging in the crop furrow, but with the EPE application, you can come back in and control them,” he said.

“We haven’t had the opportunity to selectively target grasses post-emergence in wheat with new chemistry, and thereby improve weed resistance management, for some time. But it has to be done in combination with other key measures because weeds won’t stop evolving and in another decades’ time we will be facing a different situation that will demand more new tactics.”

Craig said the excellent control of other grass weeds as well as broadleaf weeds from the EPE application of Mateno Complete also could help preserve important broadleaf herbicide tools for use in rotation or elsewhere within weed management programs.

“Mateno Complete controls key broadleaf weeds like wild radish and capeweed, and other important broadleaf weeds including volunteer canola, Indian hedge mustard and sowthistle are now under evaluation,” he said.

“The EPE application provides growers with greater options to rotate post-emergent herbicides, or to use them in other parts of programs – and the ability to gain the biggest bang when they are deployed.

“Achieving longer control of annual ryegrass and other grass weeds whilst at the same time controlling broadleaf weeds and allowing alternate use of other herbicides provides the opportunity to best limit weed seedset for growers.”

PLANT PROTEINS TO 'MEAT' CHANGING CONSUMER DEMANDS

For many people, nothing beats the taste and texture of a big juicy burger, but how do you recreate that eating experience with sustainable plant-based protein?

That is the culinary quest of University of Queensland engineers and food scientists as part of a three-year Australian Research Council project in partnership with US-based Motif FoodWorks, Inc., a food technology company on a mission to make plant-based food taste better and be more nutritious.

Professor Jason Stokes from UQ's School of Chemical Engineering said attributes like taste, texture, and smell combined are primary drivers for consumers when considering a meat-free option.

It's not just the taste, it has to be the texture as well, so the team wanted to understand the mechanics that occur during eating and stimulate them in a laboratory," Professor Stokes said.

"People want to continue to eat meat but supplement their diet with a plant-based protein for environmental and sustainable reasons.

"They've started to demand quite a bit from the product, and want it to have the same characteristics as a normal meat experience while also being healthy."

Queensland Alliance for Agriculture and Food Innovation's (QAAFI) Associate Professor Heather Smyth said innovations around texture mechanics were the key to creating the best plant-based eating experience.

"Are there different ways of pre-treating plant protein in a way that makes it behave more meat-like in the first place, rather than just compensating burger formulations with various synthetic additives?" Dr Smyth said.

"This might include fermenting them, extracting them differently or structurally modifying the plant-protein.

"Making the plant protein behave differently as an ingredient is really the space where we can have those breakthroughs, and already we're seeing some interesting results."

"Through this work with the UQ team we're bringing together the physics and sensory aspects of eating," Dr Stefan Baier, Head of Food Science at Motif FoodWorks said.

"This project will unlock the secrets of food to help us design plant-based options that live up to the taste and texture expectations of consumers."

"We really have been leading this area of research for some time and that's why companies like Motif and others have come to us in Australia, even though we're a long way away from where they do their work," Professor Stokes said.

"The landscape's changed and people now recognise the challenges in food research, and they're large challenges in terms of how we perceive food and how we understand food, and rationally design and engineer their microstructure."

It's a challenge the team will tackle with relish.

Associate Professor Heather Smyth and Professor Jason Stokes. Image: Megan Pope

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ROOTING FOR LENTILS – INCREASING PRODUCTION UNDER A CHANGING AUSTRALIAN CLIMATE

Scientists are unearthing new knowledge about lentils in research that aims to discover root traits that will help breeders develop drought-tolerant varieties to increase production of the pulse.

The research is the first of its kind in Australian lentil varieties, as root research; particularly in pulses, is still in its infancy.

Agriculture Victoria research scientist Dr Shiwangni Rao said knowledge of the whole plant is integral to understanding plant growth.

"I think of it as going to war with a spear, but no shield. If you are trying to increase pulse production and you are only looking at above the ground and not below, you are only addressing half the question," Dr Rao said.

Most of Australia's lentils are produced in Victoria and South Australia and export opportunities were boosted recently after India cut tariffs on Australian lentils from 30 to 10 per cent.

This research involved planting 36 lentil varieties in PVC tubes in the glasshouse at the Agriculture Victoria Research Horsham SmartFarm.

At maturity, the roots were washed, scanned, and measured for a range of traits such as root length, surface area and average diameter. The second part of the experiment involved planting a range of lentil and field pea varieties under rain-fed conditions in the field, and a hydraulic corer was used to collect root samples for analysis.

"Using the corer – a machine that digs out cylinder-shaped samples, we collected 2,600 cores from 408 plots over the growing season."

"Rhizotron is like a colonoscopy for soil, and we can use it to visualise the plant roots. We stick a clear tube in the soil at the start of the season, and as the plant grows around the tube, we can pop a scanner inside and obtain images of the roots at any time," she said.

This research is ongoing; however, the team have so far identified five different root architecture forms associated with different varieties.

"The range of root shapes is greater than we expected, and they differ considerably in terms of distribution, depth and diameter," Dr Rao said.

One interesting correlation the research team aims to reveal is the use of above ground traits such as canopy temperature to predict root traits.

"It is hypothesised that varieties with cooler canopies have deeper roots, but last year the weather was too wet – we hope there will be some interesting correlations this year."

Understanding the root architecture of lentils will benefit breeders and grain growers.

"This information will help breeders when they are looking to cross different varieties for local adaptation to different growing regions," Dr Rao said.

"They may cross a good yielding variety with deep roots for the low rainfall zone or a shallow root system with a lot of biomass for the high rainfall zone, additionally if they need to address boron toxicity or salinity there are roots that are resistant to those constraints."

Dr Rao said this knowledge will also help growers improve production and adapt to the changing climate.

"Drought has a major impact, and it is hard to predict when it will strike so we definitely need all the tools in our toolbox to address unpredictable rainfall, and even when it is not a drought year – an efficient root system means better yield."

This research is part of the Victorian Grains Innovation Partnership between the Grains Research and Development Corporation and Agriculture Victoria, and is aligned with the Grow, Modernise and Protect themes of the Strategy for Agriculture in Victoria.

Dr Shiwangni Rao installing a rhizotron tube as part of her field research at the Agriculture Victoria Research Horsham SmartFarm

TIMING IS RIGHT FOR A CAREER IN AGRICULTURE

Increased confidence in the agriculture sector is resulting in a corresponding rise in employment opportunities with leading agribusiness Nutrien Ag Solutions filling 800 roles to date in 2021.

Speaking ahead of National Ag Day, 19th November 2021, Nutrien Ag Solutions Managing Director Rob Clayton says there's dozens of jobs available in ag, ripe for the picking.

"This year we have recruited just under 800 people across the organisation and almost half of those roles have been filled by women," says Mr Clayton.

Mr Clayton says their recruitment efforts are focused on addressing the changing skillsets required by the Australian agriculture industry.

"Technology, data and digital tools represent the next frontier for agriculture, so it's no surprise that our Digital team has experienced the biggest growth in new roles and opportunities this year. Our Digital experts are developing the tools to better connect the people, processes, products and information that will help our farmers succeed," says Mr Clayton.

"I don't think the ag industry is at risk of 'The Great Resignation', in fact we are seeing an increase in professionals choosing to pursue a career in agriculture who are attracted to the industry's innovation, commitment to sustainably feed the world and the positive outlook working in such an essential industry.

"Our graduate programs continue to attract the top talent from across the country – we had more than 250 applications for our 2022 Agronomy Graduate Program and the same strong response for our Livestock Trainee Program which we are currently recruiting for.

"This year we also launched new IT and Agribusiness Graduate Programs, and shortly we will announce opportunities to join Nutrien Water in our Irrigation Apprenticeships.

"We are also proud to support the passionate and innovative future faces of agriculture through our partnership with AgForce's new Young Producers' Council and our support of Student Horizons which brings students to regional Australia to experience firsthand the career paths available in agriculture," says Mr Clayton.

Animal Production Specialist Sarah Halleen joined the Nutrien Ag Solutions Toowoomba Branch in August 2021.

"There's never been a more exciting time to work in agriculture and take on the challenges that come with producing food and fibre for a growing population," says Miss Halleen.

"Working in the field as an Animal Production Specialist allows me to live and work in my dream job helping communities and producers achieve amazing things.

"There is a buzz in ag at the moment - most farmers are experiencing a really good season, we are seeing high yields and strong commodity prices, and the industry is widely recognised as an essential industry – now is definitely the time to consider a career in ag," says Miss Halleen.

Nutrien Ag Solutions Managing Director Rob Clayton

Animal Production Specialist Sarah Halleen

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