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THE AUSTRALIAN AGRONOMIST MAGAZINE

Beware the pitfalls of herbicide carryover

Research is unlocking opportunities to conquer sandy soils

Penetrating the soil's surface with radar

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THE AUSTRALIAN AGRONOMIST

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RESEARCH IS UNLOCKING OPPORTUNITIES TO CONQUER SANDY SOILS

RESEARCH IS DEMONSTRATING THAT SUBSTANTIAL OPPORTUNITIES EXIST TO INCREASE THE PRODUCTIVITY OF CROPS GROWN ON POOR PERFORMING SANDY SOILS IN THE SOUTHERN CROPPING REGION.

Trials undertaken through a Grains Research and Development Corporation (GRDC) project investment have shown that some treatments applied to sandy soils can deliver returns on investment of up to 520 per cent.

However, researchers involved in the ongoing studies are advising growers to assess the potential to increase yields and any associated risks before implementing any new treatments and practices.

The GRDC investment, 'Increasing production on sandy soils in low and medium rainfall areas of the southern region', is exploring cost-effective techniques to diagnose and overcome the primary constraints to poor crop water use on about five million hectares of under-performing sandy soils in the southern region.

The study is a collaborative effort involving CSIRO, Primary Industries and Regions South Australia, the University of South Australia, Mallee Sustainable Farming, Ag Grow Agronomy and Trengove Consulting.

CSIRO research scientist Dr Therese McBeath said a spectrum of crop constraints and interventions across different types of sand and environments is being assessed at several sites in South Australia, Victoria and southern New South Wales.

Interventions include application of soil wetters, improved fertiliser management, lime applications, deep ripping and more aggressive tillage, incorporation of clay or organic matter, and delving.

"There has been significant work into sandy soils in recent years, and research has been separated into mitigation strategies which are low-cost annual interventions that typically have a small impact on yield, and high cost, high impact and long term amelioration treatments," Therese said.

"This project aims to bring all these intervention strategies together, so when a grower is approaching a sandy soil on their farm they can think about all the options available, to decide what management practice is best from a financial and productivity perspective," she explained.

Therese has discussed the research investment in a new GRDC podcast. In the podcast, she refers to results being generated from trial sites at Bute in South Australia, where treatments combining deep ripping with surface applied nutrition (fertiliser or chicken litter) delivered the highest marginal returns on a sandy soil, ranging from $934 to $1249 per hectare over three years. Depending on treatment cost, these treatments delivered return on investment ranging from 142 to 521 per cent.

While the results are extremely encouraging, Therese said understanding the rainfall limited yield potential and season specific effects is important for assessing the likely scope of yield gains and the associated investment risk.

"The aim is to develop appropriate and cost effective management strategies, with high returns and that are low risk, so growers can increase their actual crop yields closer to their yield potential based on rainfall," she said.

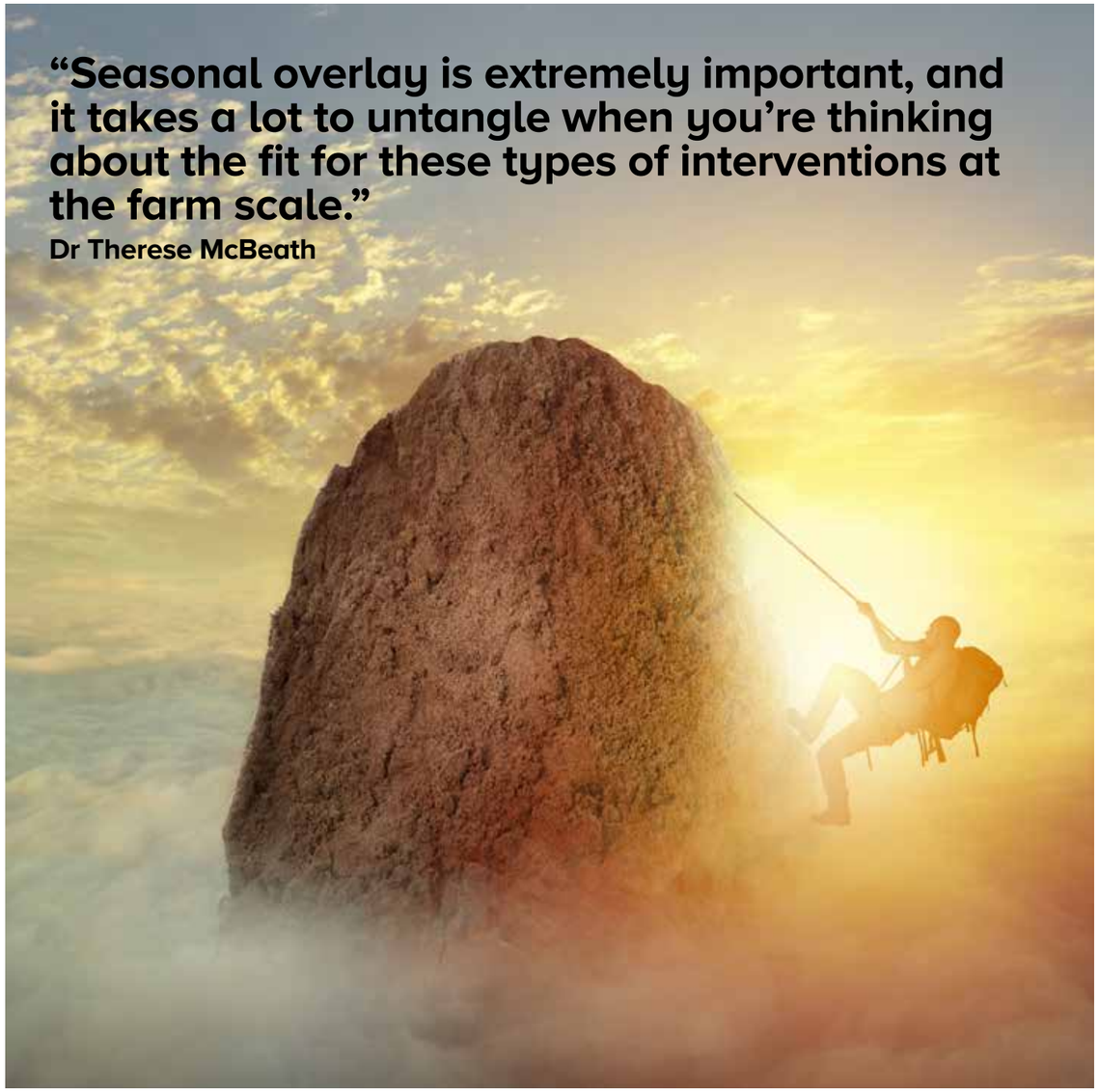
Therese said the season to season effects of different interventions are also important factors to consider when contemplating sandy soil treatment options.

"Seasonal overlay is extremely important, and it takes a lot to untangle when you're thinking about the fit for these types of interventions at the farm scale," Therese also said in the podcast.

Constraints to productivity on sandy soil is a priority issue identified by the GRDC's Southern Regional Cropping Solutions Network (RCSN) and the GRDC Southern Region Panel, on behalf of growers.

Through the GRDC research investment, characterisation of sandy soil sites across the southern region have confirmed that compaction, water repellency and a range of nutritional deficiencies are common issues.

The podcast featuring Dr McBeath is the latest in a new series of GRDC podcasts in which some of the grains sector's most preeminent researchers, growers, advisers and industry stakeholders share their insights and advice on the latest seasonal issues, groundbreaking research and trial results with on farm application.



THINK BEFORE YOU SPRAY

THINK ABOUT YOUR NEIGHBOURS, PARTICULARLY WITH VINEYARDS AND DON'T UNDERESTIMATE THE POTENTIAL DISTANCE OF IMPACT BEFORE SPRAYING WEEDS THIS SPRING IS THE REMINDER TO PRODUCERS FROM PRIMARY INDUSTRIES AND REGIONS SOUTH AUSTRALIA (PIRSA) BIOSECURITY SA.

Manager, Rural Chemical Operations at PIRSA Biosecurity SA Michael McManus said actively growing grapevines are highly susceptible to off-target herbicides.

"Earlier this year we saw off-target damage reported in both the Clare Valley and Riverland which have been the subject of investigations by PIRSA, however consideration before planning any spraying operation we believe is a key to avoiding such issues," Michael said.

"It is vitally important to be aware of sensitive crops in your surrounding area and check that weather conditions are suitable for spraying before you start," he added.

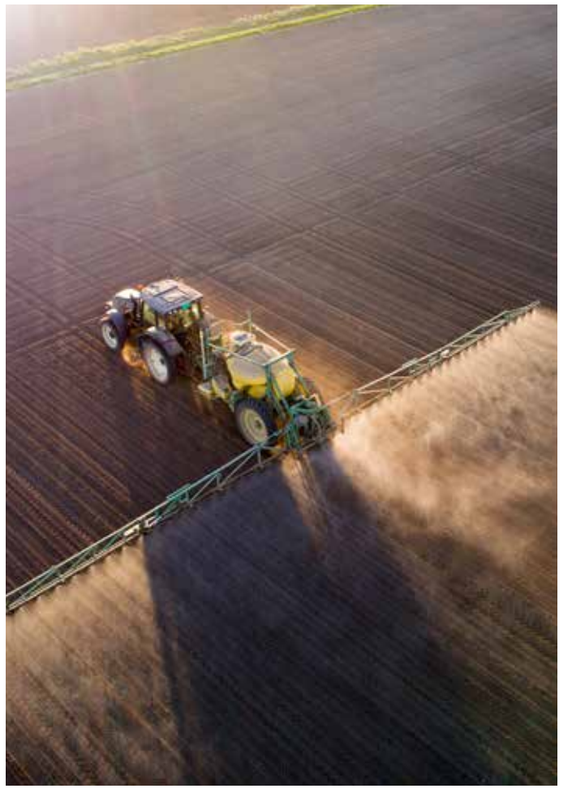
Michael said being careless when spraying can not only result in unnecessary damage to someone else's crops but can also hit the hip pocket.

"Biosecurity SA will pursue all reports of anyone who has either deliberately or negligently caused damage to others by not following regulatory requirements. If caught offences can carry a maximum penalty of $35,000," he said.

"We therefore urge farmers not to spray in inversion conditions, keep their booms no higher than 50 cm above the target and to slow down," Michael pointed out.

This reminder on spray drift awareness follows the issuing of new label instructions on 2,4-D products by the Australian Pesticides and Veterinary Medicines Authority (APVMA), which recently came into effect.

Michael said the new instructions, are a direct result of spray drift damage from 2,4-D products in the past. PIRSA Biosecurity SA, along with the Riverland/Northern Mallee Spray Drift Group, provided feedback to APVMA during their development.



"The use of Group I herbicides such as 2,4-D is sometimes the difference between profit and loss for growers."

Peter Cousins

The instructions aim to address the risk of spray drift damage to non- target crops and will include new mandatory label requirements to produce very coarse (VC) droplets for all 2,4-D products. There are also advisory instructions specifically for 2,4-D use in cereals, fallow and pasture between 1 October and 15 April for summer weed control aimed at producing extremely coarse(EC) to ultra-coarse (UC) droplet sizes.

"They also include instructions for mandatory no spray zones, more clearly defined mandatory instructions for suitable weather conditions and application techniques, and detailed mandatory record keeping for all users," Michael said.

Grain Producers SA (GPSA) Director Peter Cousins, who was also instrumental in establishing GPSA's Hit Your Target campaign in 2017, welcomes the implementation of the new label requirements and believes they will assist grain producers in minimising spray drift.

"The use of Group I herbicides such as 2,4-D is sometimes the difference between profit and loss for growers," Peter said.

"So they are an important part of our tool kit as they are effective and cheap compared to other herbicides. However unless the right steps are taken to minimise and reduce off-target damage there is a risk access to such chemicals will not be there in the future or they will be become restricted herbicides that will require more training before purchase and use," he added.

"Therefore it is vitally important that all growers are aware of the various steps they need to put in place. So following these new label instructions will help them to stay on top of any potential issue before they spray," Peter said in conclusion.

CANOLA GUIDE HAS THE 'GOOD OIL' ON A BOUNTY OF NEW LINES

Thirteen new varieties are featured in the recently published '2019 Canola Variety Sowing Guide for Western Australia'.

The annual guide, produced by the Department of Primary Industries and Regional Development with co-investment from the Grains Research and Development Corporation (GRDC), is essential reading for growers planning next season's cropping program.

It harnesses commercial and agronomic information, drawing on extensive National Variety Trials (NVT) and blackleg testing results, for all available canola varieties.

This latest edition provides an overview of seven new Triazine Tolerant (TT) varieties, four new Roundup Ready® (RR) varieties and two new Clearfield® (CL) lines, alongside summaries of 35 existing canola varieties.

Department development officer Jackie Bucat said with new varieties came new opportunities, particularly with the release of two lines that were the first of their kind.

"The guide details the first variety to be released with tolerance to a combination of Clearfield® (CL) and TT herbicides, Hyola® 580T, which can be sown following CL crops or to broaden the weed control spectrum," Jackie said.

"The first varieties that incorporate the new TruFlex® trait, which have a combination of glyphosate and triazine tolerance, Hyola® 410XX and the 'stacked' variety, Hyola®530XT, are also profiled.

"Growers should note seed availability for TruFlex® varieties, which allow for higher glyphosate rates and a wider application window, is pending regulatory approvals," Jackie said.

The other new RR varieties detailed in the guide are Pioneer 43Y29, Pioneer 45Y28 (PR) and InVigor R 4020P.

An overview of the new TT hybrid varieties InVigor® T 3510, SF Spark TT, HyTTec® Trophy, Hyola® 550TT and Pioneer 45T03(TT) is also included, although NVT data is not available for all new varieties as several will enter the program for the first time this season.

There is also information on the new CL varieties Saintly CL and Pioneer 45Y93 (CL).

The most recent sowing figures from 2017 show that 78 per cent of plantings were to OP TT varieties, with three varieties, ATR Bonito, ATR Stingray and ATR Mako, making up 70 per cent of the area sown.

Hybrid TT varieties made up 2 per cent, bringing the total proportion of TT canola up to 80 per cent, while RR varieties made up 18 per cent.

Jackie said the Canola Variety Sowing Guide would be useful to growers sowing hybrid TT and RR varieties, as it could be difficult to assess the benefits of these varieties.

"The guide has valuable information on disease and maturity ratings that will assist growers to evaluate which variety is best suited to their location and the 2019 season," Jackie said.

The publication contains the usual summary of yield, oil and blackleg resistance for all varieties, as well as an overview of NVT trial data and updates on blackleg resistance ratings.

There is also a new section on calculating seeding rates, including the optimum canola density and expected field establishment, which can be used with the department's online seeding rate calculator.

BEWARE THE PITFALLS OF HERBICIDE CARRY-OVER

Planting potatoes into pasture country or into ground following crops such as cereals can pose significant risk. Growers need to be aware of any plant-back restrictions. Residual herbicides may persist in the soil for quite some time and if taken up by susceptible crops can cause real damage.

Herbicide symptoms can include plant stunting, yellowing of foliage, whitening or bleaching of foliage, malformed roots or tubers, leaf puckering, distorted growth, leaf speckling, and of course, in extreme cases plant death.

The unfortunate truth is that injury from residual herbicides is not as uncommon as it should be. As horticultural areas continue to expand into more traditional broadacre farming country, the need to be on top of this issue is important.

Some of the more common herbicide families to cause plant-back issues in potatoes are the:

- Synthetic auxin type plant growth regulators e.g. carboxylic acids or pyridine or picolynic acid
- ALS/AHAS enzyme inhibitors
- Photosynthesis inhibitors

Carboxylic acid, pyridine or picolynic acid growth regulator type injury is similar to that from 2,4D based products. General symptoms are curling of young leaves. Tuber yields can be greatly reduced. Overseas information indicates crop exposure may carry over into seed tubers and affect the following year's crop.

Inhibitors of ALS/AHAS enzyme include the imidazolinones e.g. imazethapyr, imazaquin and imazamox and the sulfonylurea family e.g. chlorimuron, chlorsulfuron, metsulfuron and triasulfuron. Symptoms include a light green appearance of leaves especially new ones. Leaves can be cupped upward, and the leaf may disintegrate leaving the mid-rib. Leaves may also appear drought stressed. Severe injury results in stunting and purpling. Tuber yield and quality are greatly reduced.

The triazine photosynthetic inhibitors include atrazine, cyanazine, simazine and hexazinone. Carry-over injury can occur when high label rates of metribuzin is used in potatoes after triazine has been applied in the previous crop.

What makes the situation worse? If injury is mild and the crop is actively growing, it often grows out of herbicide damage to yield a decent harvest. Unfavourable weather conditions such as heavy rain and subsequent water logging or cool temperatures can exacerbate the severity of herbicide injury by slowing early crop growth and plant metabolism.

A worst case scenario would be if the crop dies or is so badly damaged that it won't grow through to provide a viable harvest. In that situation you'll likely have to do your research and replant a less susceptible crop. That's costly, so it's well worth taking the following steps to avoid the risk.

What you can do to reduce the carryover risk:

Pay attention to any plant back restrictions on herbicide labels. Plant back restrictions are more than friendly recommendations for you to consider. As part of the herbicide label, they are the law. If you are leasing land to grow your crop, get the herbicide records from the owner.

Wherever possible, you should be thinking and planning your crop and chemical rotations over the long term. Aim to manage herbicide applications to minimise persistence in the soil that can impact on subsequent crops. Consider such factors as product selection, application rate, application timing, expected rainfall, soil texture and pH and tillage in the preceding crop.

Where possible, choose herbicides without plant back restrictions to give you the ultimate flexibility.

Keep records of all chemical use and conditions. Records are your best tool for unravelling what's really going on.

$1.25 MILLION BOOST TO PROTECT AUSTRALIA FROM FRUIT FLY

New insect monitoring technology start up RapidAIM is receiving a $1.25M boost to protect Australia from the world's biggest biosecurity barrier to trade: the fruit fly, which costs Australia more than $300 million every year.

Founded by researchers from Australia's national science agency CSIRO Dr Nancy Schellhorn, Darren Moore, and Laura Jones, RapidAIM provides real-time fruit fly detection and monitoring to help Australian producers battle against the devastating pest , and it could revolutionise pest monitoring around the globe.

Main Sequence Ventures, who manage the CSIRO Innovation Fund, is making the $1.25M investment in the start up, which successfully trialled the technology with fruit producers in Victoria last year.

"Growers rely on weather radar and take action accordingly, but until now they haven't had any pest 'radar' to support them against pests like fruit fly," RapidAIM co-founder and Chief Executive Dr Nancy Schellhorn said.

"Existing fruit fly monitoring relies solely on manual trap checking, which limits the scale and depth of available information and costs valuable resources," Nancy added.

Fruit flies lay eggs in fruits and vegetables as they ripen. The hatched maggots ruin the produce from the inside, creating huge losses for producers and costing millions in clean-up efforts. Current fruit fly monitoring involves manually checking traps containing pheromones or food to lure the pests in.

The RapidAIM system uses low powered smart sensors to detect insects like fruit fly from their characteristic movements. The sensors, which can be placed by the thousands, send data to the cloud using a radio modulated technique, giving producers real-time data flow of the pest on their farms and regions through a linked mobile app.

Nancy said the new technology can reduce crop loss and provide early warnings of future pest hotspots.

"Our new technology can reduce the time spent checking traps by more than 35 per cent, and provides an immediate picture of fruit fly presence in specific locations to enable a rapid response for control," she said.

CSIRO's Chief Executive Dr Larry Marshall said RapidAIM was set to make a huge difference to growers around the world.

"As Australia's national science agency, we're committed to solving Australia's greatest challenges – in this case a more than $300 million cost to Australian fruit and vegetable industry," Larry said.

"Taking technology developed inside of CSIRO, turned into a new Aussie start up through our innovation program and the CSIRO Innovation Fund, is a great example of accelerating science solutions to deliver real-world solutions. As an accomplished scientist, entrepreneur, and now CEO, Nancy Schellhorn is an inspiration to our next generation of women STEM leaders," he went on to add.

Nancy said the technology had huge potential for managing food and fibre pests around the world.

"Around the world, more than 900 million tonnes of insecticide is used to control insect pests every year, but 98 per cent reaches a target other than the intended destination. With RapidAIM technology, crop protection products can be used in a more targeted way," she added.

The RapidAIM team was supported by CSIRO's innovation program ON. Both Main Sequence Ventures and ON were created through the National Innovation and Science Agenda (NISA).

PENETRATING THE SOIL'S SURFACE WITH RADAR

GROUND PENETRATING RADAR ISN'T SOMETHING FROM THE LATEST SCI-FI MOVIE. IT'S ACTUALLY A TOOL USED BY SOIL SCIENTISTS TO MEASURE THE AMOUNT OF MOISTURE IN SOIL QUICKLY AND EASILY.

As with most technologies, it is getting better and new ways to use it are being tested. Jonathan Algeo, a graduate student at Rutgers University in the United States, has spent his studies making ground penetrating radar better for different uses, such as measuring soil moisture.

"It's a very common tool in research, agriculture, engineering, and the military for looking at buried objects and measuring water content," Jonathan said.

"One of its main benefits is that it is very fast. One example is a tool with a wheel that allows the radar to take measurements as you drag it along the ground. In this way, you can very quickly take measurements across a large field or a line that's miles in length. Radar can be used quickly over a large area to answer many different questions," he explained.

The technology can be used to find underground tunnels, bedrock, or cracks of metal in the supports of a bridge. In terms of soil, the questions can vary. How much water is near the surface? How does it vary throughout a field site? The near-surface water content can affect climate, so it's important for computer-based climate models as well.

Being able to measure soil moisture in a paddock can allow farmers to optimise water usage so they aren't using too much or too little, especially in dry areas where water is limited. Looking at the very shallow subsurface allows farmers to test the efficiency of their irrigation systems.

A soil core, with researchers' feet to give perspective.

How does it do this? "Ground penetrating radar uses two antennae. One puts out a signal and another receives it.

The outgoing signal is similar to a microwave or cell phone signal. That signal travels in all directions, but most of the energy is directed into the ground. When there is a buried object or a change in material, the radar signal reflects back to the surface, where it is picked up by the other antenna," Jonathon explained.

He added that when there is more water in the soil, the waves move slower. When there is less water, they move faster. A scientist can use information the antennae collect from the waves to estimate the water content of the soil.

The equations and methods researchers use to estimate water content come in many different forms. Jonathon's recent research tested which ones were best at estimating water content. The equations analyse the early time signal. These are the first radar waves to get back to the receiving antenna after going through just the top of the soil. The strength of this signal changes based on the water content of the top of the soil. It can be measured even in clay rich soils where radar wouldn't normally be helpful.

"One of its main benefits is that it is very fast. One example is a tool with a wheel that allows the radar to take measurements as you drag it along the ground."

Jonathan Algeo

Jonathon and his team compared two methods of calculating a value for the early time signal to determine which, if either, was better at tracking changes in soil moisture. They found both methods were successful. This gives researchers the ability to quickly estimate water content across large field sites.

"In order for a method to get widespread use in industry, it needs to be proven beyond doubt by researchers like us. We are trying to figure out all the details of where, how, and when early time signal analysis is most useful. This means users of ground penetrating radar will have another tool in their toolbox when they are trying to quickly measure subsurface water content," Jonathon explained.

"Ground penetrating radar is my favourite geophysical tool because we can get such a wide variety of information from the subsurface with it. If there is a question about the subsurface, chances are it will be able to give you some insight into what's going on," he said in conclusion.

Lee Slater, dragging the ground penetrating radar equipment over the soil's surface. Credit: Chris Watts, Rothamsted Research.

KEEPING DRY COWS COOL IS GOOD FOR THE BOTTOM LINE

KEEPING A DRY COW COOL AND COMFORTABLE IS BENEFICIAL TO HER, HER CALF AND A DAIRYFARMERS' BOTTOM LINE, ACCORDING TO US ANIMAL SCIENTIST PROFESSOR GEOFF DAHL, WHO PRESENTED AT A SERIES OF WORKSHOPS IN THE MURRAY DAIRY REGION IN OCTOBER.

Professor Geoff Dahl was a keynote speaker at the 2018 Australian Association of Ruminant Nutrition Conference recently held in Victoria, and his visit was supported by Dairy Australia.

During the workshops Geoff outlined that understanding heat stress management is not only important for the whole dairy herd but particularly vital for dry cows, with updated research showing that it results both in lower milk production and can have a 'generational effect' on future progeny.

At the workshops Geoff explained how heat stress limits mammary growth, metabolism and immune function, with these factors setting the stage for a more challenging transition, resulting in lower yield in the next lactation.

Geoff's research found that cooling dry cows increased milk for 40 weeks after calving. Yields from cows cooled during the dry period were 4 - 5 litres/day higher than cows that experienced heat stress, he reported, despite zero differences in how the animals were treated after calving.

'Across the board, they all show the same thing. Animals cooled when dry make more milk in their next lactation,' Geoff said.

Cooling dry cows increases body weight pre-partum, but decreases body weight post-partum. Geoff explained that cooled animals actually gained weight during their dry period and, because they are making a lot more milk after calving, they're metabolising more body tissue.

Research also found that cooling dry cows has positive effects on their immune function, including lymphocyte proliferation and increased neutrophil action postpartum.

Geoff noted the effects on acquired immunity and antibody production could be important to vaccination profiles.

"Biopsies revealed that cooling dry cows has a direct impact on their mammary cells. The difference is an effect on the proliferation, or growth, of these cells," he explained. "There are a lot more in cooled cows," Geoff observed.

Heat stress on the cow also impacts the unborn calf, both early in life and when she begins lactating. Geoff termed this a 'generational issue' and not just on the affected animal, likening it to human mothers smoking during pregnancy and its resulting effect on a child's development.

"We have essentially created a situation where calves cannot reach their genetic potential when they suffer heat stress in the dry period," Geoff said.

Geoff confirmed that cooling the cow increases her calf's birth weight.

"We found the difference persists into weaning, as does the persistence of lower birth weights of hot cattle," he said, citing research that found in-utero heat stress of about six weeks in length reduced calf body weight and height at weaning.

"Cooled calves were heavier and taller," Geoff reported.

Cooling also improves immunity, measured by the higher circulating IgG.

"In fact, it looked like calves born to hot cows had lower ability to absorb IgG," Geoff said.

Geoff's studies also show that in-utero heat stress decreases reproductive performance, with cooled calves requiring fewer services and achieving pregnancy at an earlier age at pregnancy, by almost a month.

Geoff emphasised that it makes good financial sense to cool cows, for the present and long term. While the ideal approach would be to build a barn to accommodate heat stress, or retrofitting it with a cooling system like fans or soakers, he recognises this is not always feasible.

"Creating temporary shade structures, providing tree shade, sprinklers or even planning calving patterns that allow cows to be dry in the cool months of the year, will all help," he said.

"At a minimum we need to be allowing animals to recover from heat stress to ensure core body temperature does reduce, and that will have positive flow-on effects for the whole business," Geoff added.

"It makes sense to cool dry cows," he concluded.

"Cooled calves were heavier and taller."

Professor Geoff Dahl

GENETIC SEARCH REVEAL KEY TO RESISTANCE IN GLOBAL COTTON PEST

RESEARCHERS HAVE PINPOINTED A DOMINANT GENETIC MUTATION THAT MAKES COTTON BOLLWORMS, ONE OF THE WORLD'S MOST DESTRUCTIVE CROP PESTS, RESISTANT TO GENETICALLY ENGINEERED COTTON. THE STUDY'S CUTTING-EDGE USE OF GENOMICS AND GENE EDITING SIGNALS A NEW ERA IN GLOBAL EFFORTS TO PROMOTE MORE SUSTAINABLE PEST CONTROL.

In the most recent battle in the unending war between farmers and bugs, the bugs are biting back by adapting to crops genetically engineered to kill them.

A new study published in the Proceedings of the National Academy of Sciences identifies a dominantly inherited mutation that confers resistance to engineered cotton in caterpillars of the cotton bollworm, one of the world's most destructive crop pests. The study's cutting-edge use of genomics and gene editing signals a new era in global efforts to promote more sustainable pest control.

Cotton, corn and soybean have been genetically engineered to produce pest-killing proteins from the widespread soil bacterium Bacillus thuringiensis, or Bt.

Non-toxic to people and wildlife including bees, these environmentally friendly Bt proteins have been used in sprays by organic growers for more than 50 years and in engineered Bt crops planted by millions of farmers worldwide on a cumulative total of more than two billion acres since 1996.

Entomologists at the University of Arizona and the University of Tennessee in the United States and the Nanjing Agricultural University in China collaborated in a three part study. Their goals were to pinpoint the mutation conferring Bt resistance in bollworms, precisely edit one bollworm gene to prove this mutation causes resistance, and discover how the resistance is spreading through cotton fields in China.

"It's a remarkable detective story," said Bruce Tabashnik, Regents' Professor in the University of Arizona Department of Entomology and co-author of the study. "Without the latest advances in genetic technology, it would not have been possible to find the single DNA base pair change causing resistance among the hundreds of millions of base pairs in the bollworm's genome," he said.

For years, scientists have known that insects can evolve resistance to Bt proteins, just as they have to conventional insecticides. However, Bt resistance is inherited recessively in nearly all previously studied cases. This means insects must have two copies of the resistance gene, one from each parent, to enable them to feed and survive on the Bt crop.

To combat resistance, farmers plant refuges of non-Bt crops, where susceptible insects can thrive. The idea is the rare resistant insects will mate with the more abundant susceptible insects from refuges, producing offspring that harbour only one copy of the resistance gene. With recessively inherited resistance, such offspring do not survive on the Bt crop.

Though refuges do not stop evolution of resistance altogether, they can delay it substantially, particularly when resistance is recessive.

But in China, the paper reports, dominant bollworm resistance to Bt is on the rise. Only one copy of a dominant mutation makes a bollworm resistant.

"It gives them the information to make constructive, proactive decisions before it's too late."

Bruce Tabashnik

Because the genetic basis of dominant Bt resistance was previously unknown, the researchers had to scrutinise the bollworm's entire genome to find the culprit. By comparing the DNA of resistant and susceptible bollworms, they narrowed the search from 17,000 genes to a region of just 21 genes associated with resistance.

"But only 17 of those genes code for proteins that are produced by the caterpillars," Bruce said, explaining that only the bollworm caterpillars feed on cotton and can be killed by Bt proteins.

"In comparing the sequences of those 17 genes between the strains, there was only one consistent difference. There was one position where all of the resistant bollworms had one DNA base pair and all of the susceptible bollworms had a different DNA base pair," brice explained.

This pivotal base pair is in a newly identified gene named HaTSPAN1, which codes for a tetraspanin, a protein containing four segments that span cell membranes.

Although the normal function of HaTSPAN1 is not known, many other tetraspanins are important in cell-to-cell communication. Despite nearly 30,000 previous studies of either Bt or tetraspanins, the new study is the first to find a strong connection between them.

With the mutant base pair identified, the second challenge was to determine if this single mutation causes resistance. To find out, the research team used the gene-editing tool CRISPR to precisely alter only the HaTSPAN1 gene.

When the gene was disrupted in resistant bollworms, they became completely susceptible to Bt. Conversely, when the mutation was inserted in the DNA of susceptible bollworms, they became resistant, proving this single base pair change alone can cause resistance.

The final step was to test the hypothesis that this mutation contributes to resistance to Bt cotton in the field. By screening for the mutation in the DNA of thousands of preserved bollworm moths collected between 2006 and 2016, the researchers found the frequency of the mutation increased by a factor of 100, from 1 in 1,000 to 1 in 10.

The resistant bollworms are not yet numerous enough to noticeably decrease cotton production in China, but the dominant gene is spreading faster than other resistance genes. Bruce's analysis predicts that if the current trend continues, half of northern China's cotton bollworms will have resistance conferred by this mutation within five years.

"If things continue on the same trajectory, this is the mutation that is going to cause problems for the farmers in the field," he said.

It is early enough, however, for farmers in China to change their tactics and ward off Bt resistance. The paper mentions they could switch from cotton that produces only one Bt protein to the types of cotton grown in the United States and Australia, which produce two or three distinct Bt proteins. Bruce hopes the new research will spur enhanced sustainability for farmers.

"It gives them the information to make constructive, proactive decisions before it's too late," he said.

By sampling pest populations from year to year, farmers and researchers may be able to learn which methods are most effective for thwarting resistance.

Understanding bollworm resistance has global implications because it occurs in over 150 countries and now threatens to invade the United States as well.

"It will be interesting to screen for this mutation in cotton bollworm from Australia, India, and Brazil," said Yidong Wu, a professor of entomology at Nanjing Agricultural University who led the research in China.

Of course, the technology to scan genomes is not limited to one species of crop pest.

"The data shows that genomic scans will be helpful in monitoring resistance evolution not only for Bt, but for insecticides in general," said Fred Gould, who was not involved in the study but is a professor of entomology at North Carolina State University and member of the National Academy of Sciences.

"If things continue on the same trajectory, this is the mutation that is going to cause problems for the farmers in the field."

Yidong Wu

COORDINATED DEFENCE AGAINST AUSTRALIA'S MOST THREATENING PLANT DISEASE

Wine Australia and Hort Innovation have teamed up through the Plant Biosecurity Research Initiative (PBRI) to safeguard the country against a devastating bacteria that could cripple the country's multi-billion dollar wine and horticulture sectors.

Xylella fastidiosa is an exotic bacteria that prevents a plant from feeding by impeding the movement of rising sap.

While Australia is currently free from Xylella, it threatens more than 350 commercial, ornamental and native plant species across the country.

The impact of Xylella overseas has been catastrophic, infecting more than 200 million citrus trees in Brazil, destroying one million olive trees in Italy and devastating the Californian grape sector, causing annual losses in excess of US$100 million.

Dr Jo Luck, program director at the PBRI, said there was no known cure and prevention was the only safeguard against what has been deemed Australia's most threatening exotic plant disease.

"If established, the Australian Bureau of Agricultural and Resource Economics and Sciences(ABARES) has estimated the potential cost to Australia's grape and wine sector alone at up to $7.9 billion. The impact on Australian horticulture would be just as devastating," Jo said.

"Through the PBRI, we are taking a coordinated approach, together with the nation's seven plant focused research and development corporations, Plant Health Australia, the Department of Agriculture and Water Resources, industry, state and federal biosecurity stakeholders, to stamp this threat out before it can take root," she added.

Wine Australia and Hort Innovation are currently recruiting a Xylella coordinator to develop research and development priorities and projects to help protect Australia's wine and horticulture sectors.

Dr Liz Waters, Wine Australia's General Manager for Research, Development and Extension (RD&E), said the coordinator role was a vital investment in protecting all of Australia's rural communities against Xylella.

"Xylella has the potential to impact many different plant industries and the coordinator will manage cross-sectoral biosecurity preparedness, act in a liaison role for potentially affected sectors, and ensure there is national awareness and coordination of high-priority RD&E to prevent the pest arriving and establishing," Liz said.

David Moore, Hort Innovation General Manager for Research and Development, said the Xylella Coordinator would help to facilitate project management of two further projects currently under evaluation.

"The threat that this disease poses across Australia has seen a focus on collaboration across agricultural research and development corporations," David said.

"Not only have we joined forces with Wine Australia on this project, we are also working with a number of stakeholders on two additional projects to investigate strategies for prevention and preparedness, as well as the review and adoption of the world's best-practice diagnostic methods for the detection and identification of Xylella," he said in conclusion.

Infected grapevines typically show symptoms of water stress, such as leaf scorch, and the plant progressively weakens and dies. Source: Department of Agriculture and Water Resources

BE ALERT TO AVOID LUPIN ANTHRACNOSE OUTBREAK

With dry seasonal conditions being experienced throughout most lupin growing regions of Victoria, growers will be looking further afield to source their seed and stockfeed.

Agriculture Victoria is asking growers to follow restrictions for lupin seed entering Victoria to avoid a lupin anthracnose outbreak.

Lupin seed must be certified for lupin anthracnose freedom.

Chief Plant Health Officer Dr Rosa Crnov said businesses receiving stock feed from states and areas affected by lupin anthracnose should immediately implement best-practice biosecurity measures to reduce the risk of inadvertently importing the disease into Victoria.

"Businesses using imported stockfeed containing lupins and lupin host material should ensure that lupin crops are not planted in paddocks where the material was fed to stock in the previous season," Rosa said.

"Growers should also be vigilant for volunteer plants the following season due to uneaten grain," she added.

"By not planting lupins in these paddocks the following season and removing volunteer plants, the risk of lupin anthracnose establishing in Victoria is very low. These simple measures will manage the risk of lupin anthracnose affecting growers in Victoria," Rosa explained.

Victoria's quarantine entry requirements for lupin anthracnose were reviewed as part of an Import Risk Analysis (IRA) in 2015.

While the IRA found that permit requirements regarding the movement of lupin seed were no longer required, lupin seed must still be certified for lupin anthracnose freedom.

Growers wanting to import agricultural machinery or packages used with lupins or lupin diagnostic samples must obtain a permit from Agriculture Victoria's Plant Standards Officer by telephoning 136 186.

Oval shaped lesions on stems contain a beige pink spore mass with an oozy appearance. If infection occurs early in the season lesions can be found on seedlings. Photo: Kurt Lindbeck, NSW Department of Primary Industries

FERTILISERS' IMPACT ON SOIL HEALTH COMPARED

In a recently published American study, researchers dug into how fertilising with manure affects soil quality, compared with inorganic fertiliser.

Ekrem Ozlu of the University of Wisconsin-Madison in the United States led the study.

Sandeep Kumar of South Dakota State University also contributed to this research. It is published in Soil Science Society of America Journal. This research work was partially supported by the Agricultural Experiment Station (AES) of South Dakota State University (SDSU), and the General Directorate of Agricultural Research and Policies, Ministry of Food, Agriculture, and Livestock, Republic of Turkey.

Ekrem and his team studied two fields in South Dakota. From 2003 to 2015, the research team applied either manure or inorganic fertiliser to field plots growing corn and soybeans. They used low, medium, and high manure levels, and medium and high inorganic fertiliser levels. They also had a control treatment of no soil additives to provide a comparison.

In the summer of 2015, they collected soil samples at a variety of depths using a push probe auger. Then they analysed the samples.

Their findings included:

- Manure helped keep soil pH, a measure of acidity or alkalinity, in a healthy range for crops. Inorganic fertiliser made the soil more acidic.
- Manure increased soil organic carbon for all the measured soil depths compared to inorganic fertiliser and control treatments. More carbon means better soil structure.
- Manure significantly increased total nitrogen compared to fertiliser treatments. Nitrogen is key to plant growth.
- Manure increased water-stable aggregates. These are groups of soil particles that stick to each other. Increased water-stable aggregates help soil resist water erosion. Inorganic fertiliser application decreased these aggregates.
- Manure increased soil electrical conductivity at all soil depths in comparison to inorganic fertiliser and control treatments. Higher soil electrical conductivity means higher salt levels in the soil.

Ekrem and his team concluded that long term annual application of manure improved most soil quality properties compared to inorganic fertiliser.

"Increased electrical conductivity is one of the few negative impacts of manure," he said.

The team also measured the effects of larger and smaller doses of each treatment at different soil depths. This will provide useful guidance to growers.

Ekrem said, "I recommend growers use composted manure, especially in solid form, because manure is the fertiliser that supports better soil quality by improving almost all soil properties. Inorganic fertiliser is better in terms of electrical conductivity, but it does not improve other soil properties and crop yields better than manure."

Ekrem concluded, "If you think of soil as a heart, manure is the lifeblood going through it."

This is a poetic view of manure, to be sure. But perhaps this humble yet enormously useful substance deserves a little poetry.

HARD WATER IS FINE WHEN THE CHEMISTRY IS RIGHT

For robust results from summer knockdown herbicides, namely glyphosate, resellers and agronomists should ensure farmer clients choose the right chemistry for their water hardness.

That's the advice of Peter Jones, technical services manager with Australia's own Vicchem, a leading R&D based manufacturer which has developed a range of unique 3-in-1 spray adjuvants for summer knockdown weed control.

"Trials show Hot-Up is ideal when using soft to moderate water such as town and most channel water , typically less than 300 ppm of hard water ions. Being oil-based, Hot-Up prevents droplet breakdown in the hot and dry conditions of Australian summers," said Peter.

"For moderate to hard water from dams, open channels and bores, up to 750 ppm, we recommend new spray adjuvant Outright 770, which delivers better adhesion and spread of glyphosate as well as water conditioning," he added.

"For very hard bore water or channel water, harder than 750 ppm, glyphosate works best when tank mixed with Infiltrator and Assert," he also said.

Director of Vicchem's adjuvant research program for more than 10 years, Peter said hard water often contained calcium or magnesium ions which could interact with glyphosate to form insoluble complexes, rendering it inactive.

"However, hard water can be managed with Vicchem's summer adjuvant range because the ammonium sulphate in Hot-Up, Outright 770 and Assert prevents this interaction, instead forming glyphosate-ammonium which is readily dissolved and absorbed," he explained.

Peter said the main source of hard water ions came from limestone leaching which was common in Australian aquifers. Zinc and iron could also influence water hardness but were less common.

"Many commercial laboratories offer water testing services which can quantify the range of minerals in a water sample. Simple DIY test kits are also available which can provide a useful guide to water hardness within a few seconds," Peter said.

"Hard water can also affect the function of surfactants, leading to problems such as poor wetting, flocculation and nozzle blockage. However, these problems are largely avoided if the right adjuvant chemistry is chosen for the level of water hardness," he said in conclusion.

RURAL MENTAL HEALTH; PART OF EVERYONE'S BUSINESS

DRY CONDITIONS ACROSS MANY PARTS OF REGIONAL AUSTRALIA HAVE SEEN A RENEWED CONCERN OVER THE FINANCIAL AND EMOTIONAL WELLBEING OF THOSE WHO RELY ON RAIN FOR THEIR LIVELIHOOD. WE HAVE SEEN FUNDRAISING DRIVES AT PRIMARY SCHOOLS AND HOSPITALS ACROSS AUSTRALIA, AND REGIONAL VISITS FROM CONCERNED AND WELL-WISHING POLITICIANS AND THEIR ASSOCIATED MEDIA PACK.

Sadly, clouds don't rain money or an established crop when you have missed your planting window. Nor do they rain relief from the tension and anxiety of the previous months. Unfortunately, these are often the misconceptions that drive mainstream media attention, and with it, the general publics' perception that all is well for those back on the land once a little interspersed rain has fallen.

In mid 2018, it became evident to the Board of Crop Consultants Australia (CCA) that many of its members, and their clients were doing it tough. Emerald based Consultant and CCA President Jamie Iker says that while farmers and growers are struggling, the flow on effects to rural support businesses are just as devastating. In addition, consultants often find themselves in a role of accidental counsellor as they are a 'sounding board' for their clients who are trying to make tough decisions.

"It can be a double hit for someone who may already be struggling themselves," said Jamie.

Whilst it is not the usual core business of CCA, they decided to make mental health a priority issue for the organisation and put a plan together to try to make a difference.

CCA recently partnered with Lifeline Darling Downs and Mate helping Mate and organised a series of workshops across Queensland and NSW that integrated an element of rural mental health first aid into what was otherwise a technical agronomy session. The workshops dealt with a number of topics including recognising the signs of depression and anxiety, how to talk to clients / loved ones at risk, and where to seek help. The positive response was overwhelming.

"I am sure that if we had we just put on a mental health workshop we would have had pretty poor attendance. Instead, we had great attendance at all of the meetings, and the mental health session was given the most positive feedback. At times, they were quite emotional sessions, but we hope that our members left with some skills and resources to help themselves, their families and their communities going forward,' said Jamie.

It is very easy to put depression and anxiety down to the forces of nature. The simple fact remains however, that people living and working in rural areas are statistically at greater risk of more exacerbated effects of mental illness. The Australian Bureau of Statistics (ABS) reports that the incidence of mental illness is relatively static across the nation – at around 20% of the population. According to the Australian Institute of Health and Welfare however, the issues arise because those in rural areas are less likely to receive a prompt diagnosis, nor effective and ongoing treatment and support. The ultimate outcomes of this are reflected in much higher rates in suicide and self-harm in rural and remote Australia (ABS).

Many of us chose to live where we do for the social benefits that come from living a rural lifestyle. When it comes to dealing with mental illness, this lifestyle itself presents us with a dichotomy. While we are more connected than ever by technology, we often live and work in solitary conditions. Our once more traditional

support networks of churches, sporting clubs and local schools are no longer in place in many regions. Our once connected and 'close knit' communities do not function in the same way as in times gone by. On the other hand, this life in a smaller community can become a barrier to seeking help. The perceived stigma that surrounds a mental health diagnosis often leads to apprehension around seeking treatment and support for fear of lack of anonymity and confidentiality. It is this reluctance to get help that is our real problem.

The reality is that the mental health sector has a variety of resources that are very readily accessible to people in regional Australia, many of which are tailored specifically towards the needs of rural and remote people and provide complete confidentiality. Responses and resources vary from emergency help, to providing long term, life changing treatment to the patient, and support for their partners, children and carers. Utilising digital technologies, organisations such as The Black Dog Institute provide both online resources, and more personalised services are also available via Skype and teleconferencing. These services are breaking down the barriers of distance and boosting the availability of regional services.

We must never fall into the trap of believing that a good season will lead to the end of mental health issues. Mental illness is no different to any other illness – it can strike anyone, at any time, with little or no warning. It can affect the most unlikely and strongest of us and its impact is far reaching. Research shows that the best way to rebuilding wellness is through the support and action of those around us. Whilst this is not an agronomic topic, it is a real concern for all of us who work in Agronomy and we are well positioned to make a difference. We spend our working lives nurturing crops and it is time that we did a little to nurture ourselves and our mates.

If you, or anyone else you know is in need of assistance, please contact Lifeline on 13 11 14 or Beyond Blue on 1300 224 636 to speak to a trained counsellor.

"It can be a double hit for someone who may already be struggling themselves."

Jamie Iker

TURNING AGRICULTURAL WASTE INTO NEW INDUSTRIES

Increasing the value of agriculture waste and turning it into new products will be the outcome of a new $10.9 million research consortium led by the University of Adelaide.

The Research Consortium, Agricultural Product Development, has been granted $4 million over four years by the State Government through its Research Consortia Program. The University of Adelaide is contributing $2.3 million (cash and in-kind) with the remaining support coming from a range of partners.

The Consortium will bring together a total of 18 partners to develop high value products from agricultural waste, nine South Australian-based companies from the agriculture and food sector, and another nine national and international academic institutions and industry partners.

The Consortium partners are: University of Adelaide, University of South Australia, CSIRO, KTH Royal Institute of Technology (Sweden), Filsell's Orchards Pty Ltd, Raw Nation Wholefoods Pty Ltd, AE Cranwell & Sons, Ashton Valley Fresh, JVJ Co Pty Ltd, Vanquish Technologies, SA Mushrooms, Coopers Brewery Ltd, Potatoes South Australia Inc, CarbOzide Pty Ltd, Agilent Technologies Australia Pty Ltd, Plant & Food Research, Ingredion Inc (USA), Carlsberg Group A/S (Denmark).

"Agriculture is already a key contributor to South Australia's economy but its huge potential to generate high value products and create new post-farm gate industries has not yet been realised," says Professor Vincent Bulone, Research Consortium Lead Investigator and Director of Adelaide Glycomics at the University's Waite campus.

"Our agricultural and horticultural industries generate abundant waste biomass, which is currently disposed of at a cost to the producer, or only a low return. But there are compounds we can derive from this waste, a range of different 'biomolecules', that have high value potential applications for their structural or health properties," Vincent explained.

Some biomolecules that can be derived from South Australian crop waste show anti-oxidant, anti-inflammatory, anti-microbial, anti-cancer or gut-health properties, while others provide mechanical strength or texturising properties in food, structural materials, lubricants and cosmetics.

Examples include anthocyanins from apples and cherries, and chitosan from mushrooms for use in skin care products, sulforaphane from brassica vegetables with potential benefits for diabetic patients, and cellulose used for composite materials.

South Australian Minister for Industry and Skills the Hon. David Pisoni said South Australia's agricultural sector is a significant contributor to the growth of South Australia's economy.

"The outcomes from this major research consortia that includes local, national and international research institutions along with industry partners, will contribute to the creation of new post-farm gate industries through the development and commercialisation of value-added products from agricultural waste," he added.

A strong focus of the Consortium will be attracting students and researchers and providing training across multiple disciplines and industrial specialisations.

The Consortium will build on the work of Adelaide Glycomics, a carbohydrate analytical facility at the Waite campus, and make use of other, complementary analytical activities provided by the Adelaide Proteomics Centre at the University's North Terrace campus.

"This Consortium draws together a unique combination of research expertise, facilities, industry know-how and resources. It promises increased profitability and sustainability for our local agricultural and horticultural industries, and significant health and economic benefit for our whole state," says University of Adelaide Deputy Vice-Chancellor (Research) Professor Mike Brooks.

"The Consortium has already drawn the support of four international industry partners, which shows the incredible commercial potential to be developed," Mike added.

PEANUT GROWERS URGED TO GET BACK TO BASICS THIS SEASON

With a significant peanut plant expected across Queensland and New South Wales this year, growers are being urged to `keep it simple' when it comes to agronomic management to maximise yield and quality.

Over the years, peanuts have attracted a reputation as being easy to grow but difficult to grow well, given their reliance on adequate water, nutrition and protection from weeds and diseases, resulting at times in concerns over unreliable yield and quality.

However, plantings are on the rise as growers increasingly embrace the rotational benefits of improved soil nutrition, broader weed control options and more effective management of soil-borne pests and disease.

This has sparked calls for growers to focus on the agronomy `basics' in order to maximise economic gains from this season's crop.

Department of Agriculture and Fisheries (DAF) principal agronomist and project leader of the Grains Research and Development Corporation's (GRDC) Coastal and Hinterland Grower Solutions Group, Neil Halpin, said recent research had highlighted the importance of factors such as time of sowing, row configuration and plant population.

The research is part of a GRDC investment into tactical agronomy focusing on optimal legume selection within a cane system and maximising the productivity of Kairi. Kairi is a new variety offering improved foliar disease resistance to rust and higher yield potential that was jointly developed by Peanut Company of Australia (PCA), GRDC and DAF.

"The take-home message from last year's research work was if the peanut crop is managed well agronomically it can generate significant gross margin returns," Neil said.

"In the cane/legume rotation research, both the Kairi and Holt peanut varieties generated a significantly higher gross margin than soybean, mung bean, pigeon pea, or cow pea when grown in rotation with cane, returning over $3000/hectare," he added.

"In terms of maximising the productivity of Kairi, research over the past couple of seasons has focused on factors such as time of sowing, plant population, row configuration and nutrition inputs. When it comes to yield response, population was found to be the dominant factor," Neil explained.

Neil said that with this year's peanut season about to begin, it's important for growers to start with soil testing pre-plant to help determine their soil ameliorant and fertiliser programs and from there, optimise sowing time and plant population.

"At the end of the day, if growers can focus on getting the agronomic basics right, especially in terms of ground preparation, planting and in-crop pest and disease management, then the gross margin returns can be extremely attractive," he said.

Interest in peanut production due to the crop's gross margin potential and farming system benefits has been particularly strong within sugar cane farming systems where it has helped alleviate the impact of root lesion (Pratylenchus zeae) and root-knot (Meloidogyne javanica and M. incognita) nematodes, improve available soil nitrogen, improve weed management effectiveness and enable employment of a year-round workforce.

This has coincided with favourable market prices which have been partly underpinned by Bega Cheese's recent acquisition of PCA and its pledge to increase the domestic supply of peanuts by expanding plantings and production.

THE FUTURE OF GM: AN ALTERNATIVE VIEW

BY JOHN BARBER, MARANOA PEST MANAGEMENT

ANYONE READING THE ARTICLE, "MONSANTO PREVIEWS CURRENT AND FUTURE PIPELINE OFFERINGS", PUBLISHED IN THE AUSTRALIAN COTTON GROWER, APR – MAY, 2018, MIGHT BE EXCUSED FOR THINKING THAT GENETIC MODIFICATION, OR GM, IS THE SOLUTION TO ALL AGRICULTURAL PROBLEMS.

GM research and development appears to be moving as quickly as ever, even though the associated public relations have been less successful. The cultivation and sale of GM products is banned in some European countries including France and Germany, and now Roundup, the most popular herbicide used in GM crops and the most widely use herbicide in the world, has been judged to be carcinogenic in California, despite a mountain of peer reviewed evidence to the contrary.

The problems so far show that if profit rather than scientific method is the first objective of research then more problems lie ahead. That will be unfortunate because the farming sector would be the loser.

There is no doubt that GM crops have made farming easier in the last two decades, and therefore the principle is sound. On the other hand some of the reasoning behind certain GM research and development is anything but sound, and therefore the judgement in the Californian courtroom could be seen as a consequence of some bad decisions taken in the Monsanto boardroom.

Apparently, the year 2018 "will mark the fifth consecutive year that Monsanto has seen more than 20 advancements to products in its research and development pipeline".

There is more insect control for corn, both above and below ground, more weed control for corn in conjunction with Sumitomo, more insect and weed control for soybeans, and thrips and weed control in cotton. The herbicide technology will provide tolerance to glyphosate, dicamba and gluphosinate in a single plant "to increase the choices farmers have to protect their crops against weed damage".

There is also a GM product for nematode control in all three crops, and of course a prediction that sometime in the future there will be products to improve disease and stress tolerances. Even despite all this glitter, my favourite is still a statement not from this article, but from the Monsanto representative at the last Australian cotton conference, that Monsanto is going to put five GM genes in Bollgard cotton.

All this, "as always is to support farmers as they work to meet food security needs" and it will "improve yields and reduce insecticide use on more than 10 million acres in both the United States and Australia".

How should we react to these statements? Are they true and are they realistic objectives? In 2018 what is there to show for the so called 100 'advancements' in the last five years?

Of course we should be grateful that we live in a developed country where biotechnology, and all sorts of electronic technology for that matter, is a very important part of farming. But are the claims too good to be true, what are the advantages and disadvantages of relying so much on GM and of one company having so much influence over agriculture in developed countries? Could Monsanto be so blinded by commercialism that it is missing bigger and better opportunities elsewhere?

"The problems so far show that if profit rather than scientific method is the first objective of research then more problems lie ahead. That will be unfortunate because the farming sector would be the loser."
John Barber

Why put tolerance to three major herbicides in one plant? Why not put separate herbicide tolerances in separate plants of the one species, each with the same yield and quality potentials, then rotate?

The triple stack, as it is called, has been in commercial cotton in the United States for a few years with the objective of controlling weeds with at least one of the herbicides if they became resistant to the others. Apparently it is not obvious to the Monsanto board that if there is already resistance to two, or even just one of the herbicides in the stack, then continued exposure of the corresponding herbicide GM traits will select for even greater resistance in more weed populations at more locations. The scientists in Monsanto would know that. Already, there is resistance to all herbicides in the triple stack in some US cotton fields. It was predictable. Weeds in the cotton crop cannot be controlled by either Roundup, gluphosinate or dicamba.

Contrary to the Monsanto claim, farmers now have fewer choices to control weeds. Monsanto was given scientific advice which warned against the stack but chose to ignore it.

Australian farmers know about Roundup resistance. It is much worse in the United States because the Roundup tolerance trait has been inserted into more crops, namely maize, soybeans, cotton, canola, sorghum, lucerne and wheat.

Roundup resistance in Palmer amaranth and in so many grasses both here and in the United States has happened because over reliance was placed on Roundup in Roundup Ready crops and a resistance management plan was not followed. It would have been obvious that a resistance problem was developing in the United States, but nothing was done to restrict the use of the Roundup tolerance gene.

On the other hand, rotating herbicides and crops and using management strategies such as double knock and strategic cultivations will control all weeds.

Nor is there any evidence or logic to support the claim that controlling thrips with another GM product will increase cotton yield and reduce insecticide use in Australia and the United States. That is a knowingly false claim. Does anybody in the Australian cotton industry really believe that thrips limit yield? They might be inconvenient for a few people for a short while, but they don't limit yield.

It has been relatively easy to develop a GM product in the lab for Lygus bugs, a US pest, but using the same product to control thrips in Australian cotton will increase the cost of production, not decrease it, because thrips are a beneficial insect.

Thrips coming from cereal stubble near cotton can reduce cotton seedling vigour, but that is not a widespread problem in the industry, and after the seedling stage thrips are totally beneficial. There is no data which even suggests that thrips negatively impact yield, nor could there ever be, because there are too many other variables which affect yield between the seedling stage and picking.

“Science and plenty of experience have shown that only integrated pest management and integrated weed management are sustainable, so why put all eggs in the GM basket.”

John barber

Removing the thrip will almost certainly mean that more conventional chemistry will be needed, not less. It is not an exaggeration or emotion to say that removing thrip from the cotton system will be disastrous.

After two decades of Bollgard cotton production, Bollgard resistance levels determined in the laboratory have been static at around two per cent. This was also the approximate background resistance level when the single gene Bollgard, called Ingard at the time, was first released in 1996. It is almost certainly an over estimate of field survival because there is no natural mortality in the laboratory. Planning to put up to five genes in Bollgard to counter a possible future resistance threat is ridiculous and unscientific.

We aim to manage insects and can do so very successfully using integrated pest management (IPM). There is no reason why IPM will be less successful in the future. In fact, it will be more successful when it is adopted by more farmers.

Monsanto sells its GM products to people who pay for them in the normal monetary way, that is, farmers in developed countries. Those farmers have plenty of food. Monsanto scientists are not working to meet food security needs.

Even if the food crops were produced in developed countries and exported, could they be paid for? Of course not. If biotechnology brings greater food security would it not be better to give that security where it is needed and avoid freight, rather than increase the imbalance in standards of living between developed and undeveloped countries which presently exists? Imagine how the world would change if Monsanto sold at a reduced price or even gave some products which minimised insect and disease attack, and even gave some drought tolerance, to countries which really needed food security.

Science and plenty of experience have shown that only integrated pest management and integrated weed management are sustainable, so why put all eggs in the GM basket? Yet we are heading that way, and Australian agencies such as seed companies and the CSIRO are promoting it, and for only one reason.

I suggest there are at least three very important messages. First, if you have the money you can do just about anything with GM. Second, it is a true life example of the “genie out of the bottle” syndrome, but third, it is not too late to halt the purely commercial drive and put science first.

STATEMENT

GLYPHOSATE DEBATE SHOULD BE BASED ON SCIENTIFIC EVIDENCE

BY MATTHEW COSSEY, CEO, CROPLIFE AUSTRALIA

CropLife Australia, the national peak industry organisation for the plant science sector, welcomes public and media interest in glyphosate and crop protection innovations. Consumer safety is the top priority of CropLife and our members.

It is crucial any debate on farming and agricultural chemistry is informed and based on scientific evidence and independent assessment.

Public discourse based on hype and myth risks disastrous ramifications for Australia's agricultural sector and the environmental sustainability of farming. CropLife Australia and our member companies strongly support the robust, rigorous and independent regulatory systems that crop protection products are subjected to here in Australia.

Following an extensive assessment of the International Agency for Research on Cancer (IARC) glyphosate monograph, Health Canada, the United States Environmental Protection Agency, and New Zealand's Environmental Protection Authority all concluded glyphosate is safe to use.

Australia's own independent regulator, the Australian Pesticides and Veterinary Medicines Authority (APVMA), undertook a comprehensive reconsideration nomination assessment of glyphosate as recently as 2016 following the IARC report and found no grounds for its approved uses to be reconsidered.

The APVMA takes new data, information and science into account when considering the ongoing safety of a registered product. Agricultural chemical registrants have a legislated obligation to supply the APVMA with any new data regarding their products as and when it becomes available. The Australian regulatory system for these products is independent and evidence based to ensure the human health and safety for users and consumers. The Australian regulatory system for these products is independent and evidence based to ensure the human health and safety for users and consumers.

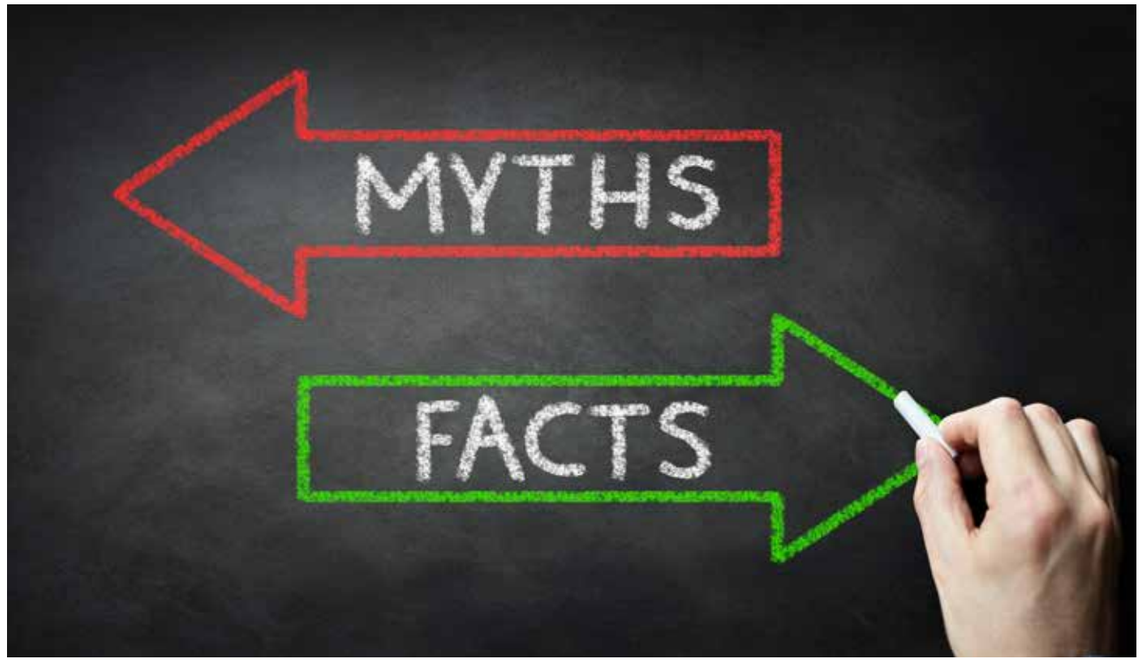
Recent evaluations by the European Food Safety Authority, Germany's Federal Institute for risk assessment (BfR), and the European Chemicals Agency (ECHA) found unequivocally that glyphosate poses no unacceptable risks either to human health or to the environment.

More than 800 scientific studies and independent regulatory safety assessments support the fact that glyphosate does not cause harm to humans or the environment.

The US Agricultural Health Study investigated the risk between glyphosate exposure and non-Hodgkin lymphoma. The study analysed data from over 89,000 farmers and their spouses and found no association between glyphosate and non-Hodgkin lymphoma, regardless of the exposure level.

Glyphosate is a crucial tool for farmers to manage weeds, improve productivity and protect the environment on which they farm. In broadacre cropping, glyphosate has helped farmers adopt minimum or no tillage practices. With conservation tillage, farmers disturb less soil. Conservation tillage can reduce soil erosion by up to 90 per cent and significantly improve water retention. It also increases and maintains carbon storage.

We encourage all Australians to become informed on these issues from qualified and credible sources.



WA RESEARCH TO HELP FARMERS MAKE MORE INFORMED DECISIONS

A new partnership involving University of Western Australia (UWA) will see vast amounts of Western Australian agricultural data collected and analysed, at an unprecedented scale, to help farmers make more informed decisions.

Field workers and researchers will compile data on crop varieties, their growth, and how they are impacted by weather conditions, soil varieties and fertilisers. The WA data along with national data will be made broadly available to farmers through the Agriculture Research Data Cloud project, helping to unlock the $19.1 billion potential value of agriculture in Australia.

Recent advances in on-farm data collection has resulted in a world where everything relating to agriculture can be monitored, however significant challenges lie ahead in integrating such data to best inform real time farming decisions.

WA Project team leader Dr Nic Taylor from UWA's School of Molecular Sciences and the ARC Centre of Excellence in Plant Energy Biology said using technology to capture and analyse data was vital for the future of agriculture.

"This is an important stepping stone towards a new way of approaching agriculture," Nic said.

"With 'Decision Agriculture,' we can make use of an amazing array of data and technology that can be accessed remotely by farmers anywhere in Australia to help inform key managerial decisions including seasonal programs, fertiliser inputs and disease and pest control. This is in addition to responding to seasonal conditions in a timely manner," he added.

"This complexity of data has not been available broadly across the agriculture industry before so it's an exciting step. Agriculture is at a really exciting juncture. This project is perfectly timed to take advantage of the latest developments in on-farm data capture and to kick-start the process of providing end users with knowledge and tools to make data-driven farming decisions," Nic further explained.

Dr Ben Biddulph from the Western Australian Department of Primary Industries and Regional Development said the scale of data being collected, both for crop research and on farms had consistently increased in the past decade.

"Every year, cheaper solutions become available which make in-depth data collection more feasible," Ben said.

The Agriculture Research Data Cloud project has provided the WA research team with $163,000 in funding through the Australian Research Data Commons (ARDC), bringing together knowledge and expertise to make a significant difference to the way the industry operates. ARDC is supported by the Australian Government through the National Collaborative Research Infrastructure Strategy.

WITH A LITTLE HELP FROM THEIR FRIENDS

A NEW STUDY SHOWS THAT PLANT ASSOCIATED BACTERIA PROTECT THEIR HOSTS BY COMPETING WITH HARMFUL FILAMENTOUS MICROBES FOR ACCESS TO PLANT ROOTS.

Fungi and other filamentous microbes called oomycetes cause many devastating plant diseases and are together responsible for more than 10% of all crop loss.

However, a ground breaking new study now shows that even healthy plants host potentially harmful fungi and oomycetes in plant roots. That they do not succumb to illness is due to the simultaneous presence of a wide range of different co-residing bacteria, which regulate the balance among these different microorganisms in plant roots and thus ensure plant survival in nature.

These are the conclusions of a study published in the journal CELL that was led by Stephane Hacquard and Paul Schulze-Lefert at the Max Planck Institute for Plant Breeding Research in Cologne, Germany.

Soil hosts a staggering diversity and number of different microbial organisms such as bacteria, fungi, and oomycetes. These microbes from different kingdoms of life are known to engage in complex interactions with each other and a small subset, collectively called the 'root microbiota', is capable of colonising the roots of healthy plants.

Plants are soil-anchored organisms and their below and above ground parts are constantly under attack by various microbial pathogens. An elaborate innate immune system is long known to protect plants against many of these harmful microbes, but it remains unclear whether this machinery alone is sufficient to fully protect plants in nature. Little is known about whether interactions among microbiota members can influence microbial colonisation of roots and promote plant health.

The research team addressed these questions by first performing a census of the different microbes associated with the roots and surrounding soil of healthy individuals of the model plant Arabidopsis thaliana from different geographical sites.

While root-associated fungal and oomycetal communities exhibited large differences between the different sites, the bacterial communities had a more similar structure, indicating potentially important functions for these root inhabiting bacteria. Further, the authors found a potential signature of mutual exclusion between bacteria and filamentous microbes in roots, suggesting competition for access to the root niche.

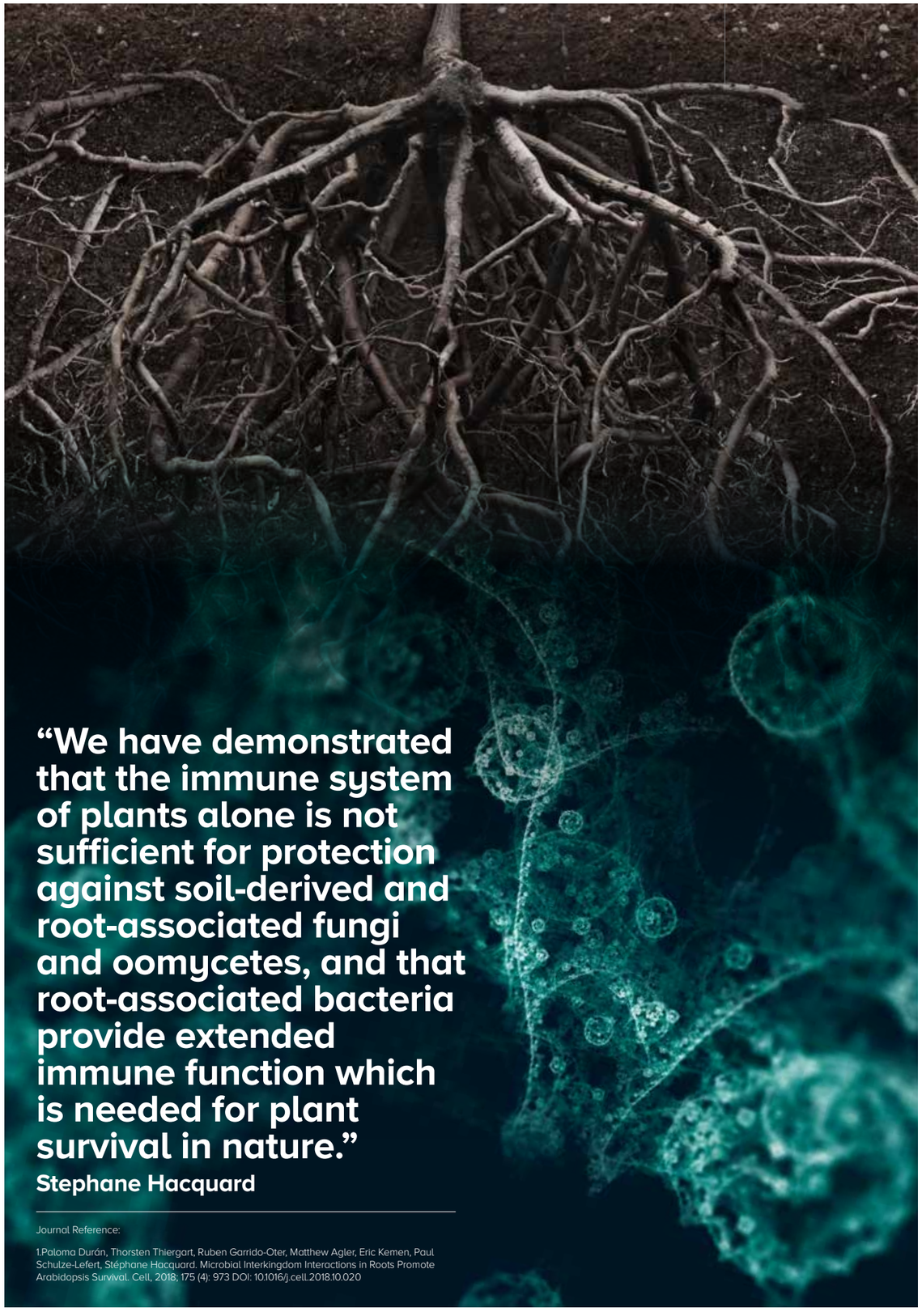
To more rigorously study whether these different microorganisms compete in plant roots, the researchers first deconstructed the microbiota of healthy Arabidopsis thaliana by establishing pure cultures of root-associated individual bacteria, fungi, and oomycetes.

Then, in a reconstruction approach, they introduced different combinations of bacteria, fungi, and oomycetes to germ-free plants to test the impact of these different microbial groups on plant health.

Using this system, the scientists observed that plant survival in the presence of fungi and oomycetes is fully dependent on the simultaneous presence of bacteria. These bacteria promote plant health by restricting the growth of fungi and oomycetes in roots. Moreover, several individual bacteria of the consortium were sufficient for this protective activity, showing that plant protection is a widely shared trait among distantly related root-associated bacteria.

"We have demonstrated that the immune system of plants alone is not sufficient for protection against soil-derived and root-associated fungi and oomycetes, and that root-associated bacteria provide extended immune function which is needed for plant survival in nature," said Stephane.

The authors' findings could contribute to the rational design of probiotic bacteria or bacterial communities that safeguard the health of agricultural crops. The group is now interested in defining which genes and molecules are involved in this protective function of bacteria.



Journal Reference:

1.Paloma Durán, Thorsten Thiergart, Ruben Garrido-Oter, Matthew Agler, Eric Kemen, Paul Schulze-Lefert, Stéphane Hacquard. Microbial Interkingdom Interactions in Roots Promote Arabidopsis Survival. Cell, 2018; 175 (4): 973 DOI: 10.1016/j.cell.2018.10.020

DRY CONDITIONS PROMPT SOIL MANAGEMENT DECISIONS

Soil erosion management promises to be high priority for grain growers in New South Wales battling the effects of diminishing stubble cover on fallow cropping country.

The run of dry weather has forced some growers to graze failed crops and cut crops for hay, resulting in less-than-ideal stubble loads in some paddocks and heightening the risk of wind and rainfall erosion.

With many growers yet to receive useful falls of rain, summer crop planting has been limited to date and growers are weighing up their erosion management strategies in case planting opportunities don't arise before next winter.

While the state's cropping soils vary in susceptibility to wind and water erosion due to type and topography, the Grains Research and Development Corporation (GRDC) has encouraged growers to actively monitor stubble and soil status through spring and into summer.

Over the years, GRDC research has backed up the rule of thumb recommendation that growers, and particularly mixed farming operations, should aim to retain at least 70 per cent ground cover (or about two tonnes per hectare of cereal stubble cover) over summer to ensure crop yields are not affected next year.

However, with stubble loads in drought affected areas now likely to be well below that 70 per cent benchmark, GRDC Manager Agronomy – North, John Rochecouste said growers should aim to maintain current soil conditions.

"In these type of situations, it's important to minimise any activities which will further expose the surface and make it vulnerable to erosion, such as grazing," he said.

"If the situation becomes desperate, growers can consider a strategic cultivation to curb erosion and maximise water infiltration, although the suitability is very dependent on slope and implement choice. At the same time, it's very important that any cultivation leaves the surface coarse and lumpy to slow runoff and reduce soil surface wind speed," John added.

While some growers may question the longer term implications of strategic tillage, a GRDC investment into its use within conservation farming systems found that although tillage damages soil structure, when it's used as an occasional strategic option the effects are not long-lasting.

Researchers found that recovery time varied between one and four years, depending on the type of tillage and subsequent rotations with soil structure returning more quickly to its pre-tillage state following a pasture phase.

The GRDC is actively investing in several other research programs aimed at helping growers improve soil management and water use efficiency.

These include a cover cropping project which is analysing how to balance moisture loss due to evaporation and plant uptake using a short term cover crop, and a soil constraints project investigating the economics of ameliorating key soil constraints to improve soil water use efficiency.

KINGAROY FAMILY MARK QUARTER CENTURY AS FARMING TRIAL CO-OPERATORS

Kingaroy farming family the Barbelers have reached a career milestone this year, marking a quarter century of trialling pre-commercial and commercial crops on their farm.

Father and son Graham and Jeff Barbeler partnered with seed company Pacific Seeds in 1993, planting a multitude of grain sorghum and corn varieties on their property, and have been going ever since.

Jeff Barbeler said the trials were hard work but the information they could extract from them was invaluable.

"There's a lot of set up involved. You need the right equipment, you need to ensure the machinery is clean when moving from one crop to another, and conditions need to be consistent across all plots," Jeff said.

"It doesn't cost us anything aside from labour and a section of our paddock. We then get an idea of which varieties work in our environment, the company gets data to feed back to its agronomists and breeders, and the wider industry can access this information later on. When people ask us which varieties we plant, we can tell them which ones and why, because you have all this yield, planting, harvest, chemical and rainfall data going back decades to support your decisions," he went to explain.

Their most recent trial was grain sorghum, which they planted in early December 2017 on 90cm rows with John Deere MaxEmerge planter boxes and moisture seeking tynes.

They planted a total of 105 hectares of sorghum, which included their commercial crops of MR-Taurus, MR-Bazley and MR-Buster. These varieties also featured in trials alongside PAC2745, MR-Apollo and PAC2476.

Jeff said the trial got off to a troubled start due to a powerful hail storm, but then something unexpected happened.

"Rain was a bit light on at the start of the season. We planted on December 7 and got the sorghum up about 10 inches high, then we copped a Boxing Day hail storm which wiped everything out. There were just little stumps sticking out of the ground. After that, there was a bit of a dry spell and rain came later in the season. A lot of it came back up - I was pretty surprised that we still managed a decent crop," he said.

The pair harvested the sorghum in May and recorded an average yield of 4t/ha. Jeff said the standout variety for the 2017-18 trial was MR-Bazley.

"It seemed like a really hardy crop. Bazley is tough, consistent and a good yielder, which are key attributes for us," he said.

They also planted 60ha of corn, but because the corn was planted later, it did not suffer like the sorghum.

Looking at the approaching summer season for their program, as well as beyond in their capacity as trial co-operators, he said they remained positive.

"This season we'll be putting in MR-Bazley, MR-Buster and MR-Taurus as our commercial crops, and hopefully some new hybrids for evaluation too. We'll probably make it past 30 years of trials if we're asked to continue," Jeff said in conclusion.

Norco Kingaroy manager and Graham Babeler

GRITS GROWER EXPANDS INTO FEED CORN MARKET

Long-time gritting corn grower Andrew Free is considering feed corn as another viable income stream for his farm at Junabee in Queensland due to the improved varieties on offer and the changes in the feed market.

Andrew, who also grows sorghum, cotton, mungbeans and wheat at Poplar Woods with son Ben, has been growing grit corn for many years, supplying the nearby mill, Defiance Maize Products.

However, after running a corn trial on farm last season and watching the demand for feed grow across the country from the dairy and livestock industries, he is now looking at both markets.

"We normally grow grit corn, but whatever drives our profit margin, that's what we look it," Andrew said.

"In the last few years grit corn has been in the range of $300 - $350/tonne, and this year feed prices are $100 above that, which is an incentive to try feed varieties. While feed varieties don't usually attract a premium, they can quite often achieve 10-15 per cent more yield due to generally higher starch content, so you have to do your sums. The way the feed market turned out this year, our intention this season is to plant more feed corn," he explained.

Andrew grew 75 hectares of corn last season, which was split over two planting times and included both commercial crops and several trial crops.

The early plant began in November over 45ha and the later plant began in January over 30ha. Varieties included PAC 727IT, PAC 440, P1888, Amadeus and Amadeus IT.

Andrew said their grit variety of choice is PAC 727IT. Unfortunately, it and the rest of the early corn was decimated by the dry and heat.

"We're pretty big fans of PAC 727IT as far as grit corn goes. I'd have to say it's my favourite variety. In our experience, it has been matching feed varieties for yield, where other grit corns lag way behind. It has excellent stress tolerance and retains it grain size and quality. Yield is the most important factor, followed by grain quality, and it delivers for both," Andrew explained.

"All of the early crop was wrecked in the heatwave in January. It was cut for silage a month later when we were looking at potential disaster. Luckily, the later planted corn made it to grain," he added.

Included in the later planted corn was new grain/silage hybrid PAC 440, which was the standout for the season.

"We harvested the PAC 440 in July, three weeks before the rest of the field because it was a quick variety (108CRM). The PAC 440 was exceptional, yielding 5.2t/ha, where the next best variety yielded 4t/ha. If a feed variety like PAC440 comes along and can yield higher, that tends to put the feed market in a positive light for us," he said.

Andrew said this season's crop will consist mostly of PAC 727IT and PAC 440 to capitalise on both the grit and feed markets.

AGAINST THE GRAIN: SOIL CONSTRAINTS HOLDING BACK AUSTRALIAN WHEAT

A model developed by researchers at The University of Queensland (UQ) could address soil problems, which cost Australia's wheat producers almost $2 billion a year.

Dr Yash Dang, from UQ's School of Agriculture and Food Sciences, said the model measures the economic impact of soil problems and could help guide investment decisions on remediation and minimise productivity losses.

"Soil sodicity (too much sodium in the soil), salinity, acidity and alkalinity and compaction significantly affect grain production in Australia," he said.

"Each soil constraint has a different cause, with different treatment options, meaning that the management of each issue has different economic costs and opportunities," he added.

The project used data from a number of sources, including yield data based on previous work by CSIRO, ABS and analysis of remote sensing imagery, soil data from the National Soil Site Collation and climate data from the Scientific Information for Land Owners database.

Dr Thilak Mallawaarachchi, from UQ's School of Economics, said the team managed to isolate the real costs of some of the country's worst soil issues on wheat production.

"The results underlined the large impact of soil sodicity, affecting 68 per cent of Australia's wheat cropping land and costing farmers $1.15 billion annually. On top of that, we estimate that $380 million of our wheat crops are lost per year from soil acidity." Thilak said.

"We know how to address these issues, through traditional treatments like the application of gypsum and lime respectively, so we can use this data to find the best way to make remediation investments," he further explained.

In a follow up project, the team is looking to provide fine scale information for landholders.

"We're building a software tool that can collate and summarise the relevant remote-sensing and soil data in a form that would be useful for individual farmers," Yash said.

"The software tool, along with a soil kit, will help them identify consistently high or low-yielding areas of paddocks, and diagnose potential soil constraints that might be causing any production losses in their paddocks. We're hoping this work not only contributes towards ensuring greater profits for farmers, but also to better global food security," he went on to add.

Funding for this project was provided by the Grains Research and Development Corporation.

DROUGHT IMPACT LAID BARE IN QUEENSLAND SURVEY

A SURVEY OF QUEENSLAND FARMERS HAS REVEALED ABOUT HALF HAD LOST MORE THAN HALF THEIR ANNUAL INCOME DUE TO DROUGHT AND ABOUT 60 PER CENT HAD LESS THAN HALF THEIR POTENTIAL WATER SUPPLY.

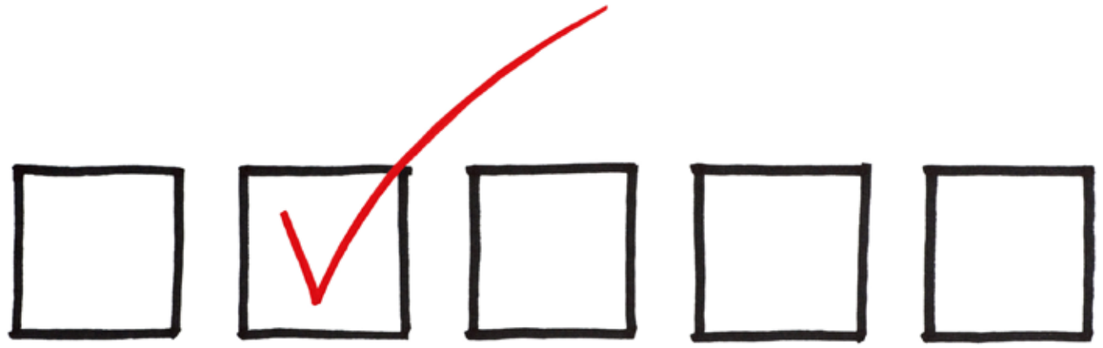
Releasing the results of its 2018 drought survey in late October, AgForce Queensland renewed its calls for immediate, additional support for drought affected communities doing it tough and an overhaul of national drought policy to deliver better long term outcomes.

AgForce General President Grant Maudsley said the prolonged and severe nature of the drought had taken an enormous financial, emotional and environmental toll on many regional communities in Queensland.

"This survey lays bare the impact of the drought with the vast majority of Queensland's cattle and sheep producers running much lower livestock numbers and results indicate almost a quarter of the state's grain growers not planting a crop at all this year," Grant said.

"The survey also highlighted the resilience of farmers in the face of adversity. While almost half of those surveyed rated the financial and personal impacts of this drought as worse than previous droughts, about two thirds were optimistic about the long term outlook for their businesses," he added.

More than 430 primary producers from 49 local government areas responded to the AgForce 2018 drought survey, which was open throughout late September and early October.



Key results include:

- 81.5 per cent of cattle and sheep producers were running less than three quarters their usual livestock numbers.
- Half of those surveyed had lost up to half their annual income with only seven per cent reporting no change to their income as a result of drought.
- Almost half those surveyed held and used Farm Management Deposits.
- More than half are concerned about the lack of rain and the cost and supply of seeds, feed and stock.
- About 60 per cent had less than half of their potential water supply and about 10 per cent reported having no surface water remaining.
- About 42 per cent of those surveyed found the fodder and water freight subsidies available through the Queensland Government's Drought Relief Assistance Scheme useful in managing drought.

Grant said the results highlighted that primary producers needed both immediate support to help them through this tough time and long term policy certainty to promote better planning and risk management.

"This survey lays bare the impact of the drought with the vast majority of Queensland's cattle and sheep producers running much lower livestock numbers and results indicate almost a quarter of the state's grain growers not planting a crop at all this year."

Grant Maudsley

"The ongoing nature of this drought has overwhelmed even the best efforts of many producers to prepare. AgForce believes Queensland and Australia needs an enduring drought policy and have proposed an 'Agricultural Business Cycle' approach to help move governments from mainly responding in crisis and to empower producers to continually better manage the impacts of climate risks across their business," Grant said.

Key measures surveyed farmers identified that would help them through this drought, during recovery and to prepare for future drought events included:

- Relief from council rates and leasehold land rent.
- Subsidies for fuel, freight and fertiliser.
- On farm water investment scheme, including desilting of dams and to build water storages.
- Pest and weed management grants.
- Evaluation tools for land, climate, water and weather.

"Drought has such a big impact on Australian agriculture and extended dry periods are a recurring feature, so we need governments at all levels and politicians on all sides to come together with industry to work on a sustainable approach to manage this issue now and into the future," Grant sai in conclusion.

BIG FISH CHALLENGE IS HELPING TACKLE A BIG ISSUE

From the reel screamers of katanning to the delta hombres of wagga, teams from rural stores and growers across the country have enthusiastically embraced the bayer big fish challenge in support of men's mental health.

Bayer's Big Fish Challenge, which is about to launch a second year of competition on January 1, 2019, has fired up the competitive spirit of over 80 fishing-crazy teams around the country this year. But whilst the Big Fish Challenge is a friendly fishing competition between staff of rural stores and growers nationwide, its main goal is to help tackle another big issue: rural men's mental wellbeing. By partnering with The Fly Program charity for a second year running, Bayer aims to build on the momentum from this year's challenge.

Ben Thompson, National Key Account Manager at Bayer said: "We had overwhelming support for this program in 2018. We knew about the rising trend of men's suicide and depression in rural areas and that matters to us: it's where our customers, families and friends live. We decided to use fishing – the #1 recreational pastime – as a conduit for opening up conversations about issues that are sometimes awkward to talk about. When we partnered with The Fly Program – a charity that incorporates fishing and outdoor adventure into their recovery programs – our agents jumped at the chance to be involved."

Run under the aegis of Bayer's AgSpirit program, the Big Fish Challenge involves teams of up to six anglers who fish for eligible fish types which have been carefully chosen to ensure that each team has an even chance of success. In 2019, Bayer is donating $1 to The Fly Program for every team's biggest (legal) fish caught, per fish type, and has committed to donating $25,000 to The

Fly Program charity. There are prizes and trophies throughout the year, with two representatives from the best performing team per State taking part in a 4-day adventure retreat in the Snowy Mountains for a final fish-off.

The Fly Program is a not-for-profit organisation that seeks to raise awareness and combat the impacts of depression, post-traumatic stress disorder and suicide in the Australian adult male community through a unique program built around four key components: Explore, Cast, Discover and Recover. Whether it's a guided fly fishing day in the streams and creeks of a National Park or mountain biking across the rugged terrain of an epic alpine wilderness, The Fly Program uses participation in the natural world as a reprieve from the day-to-day challenges.

Matt Tripet, CEO of The Fly Program said: "We're incredibly proud to partner with Bayer again for the 2019 Big Fish Challenge. It ties in perfectly with the design of The Fly Program, which is about enhancing men's well-being by bringing them together in the great outdoors as active participants. Farmers are a tough breed but there are too many suicides in our rural communities. The Big Fish Challenge is a great way for Aussie blokes to simply get together and throw in a line in some inspirational locations for a good cause."

One of the teams to take up the challenge this year was the IKC Cobram Cod Catchers, who picked up a trophy for landing the largest Murray Cod: all 117 cm of it. Captain Mathew Mackenzie says the prize-winning fish was caught by team member Kevin Brooks. "It was a last-minute decision to launch one Friday afternoon after snagging another cod the week before. He launched on the Murray River around 4pm and starting casting at sunset – 'Prime Time' - as Kevin calls it. It certainly was for him, because that's when he caught that ripper fish." Mathew added: "We're always keen to support men's mental health causes. But to do so while doing something we love in our spare time, is a win, win."

Ben Thompson says, "Fishing is an ideal way for blokes to get together with their mates, colleagues or clients – male or female, young or old – and spend a few hours together stalking fish with lures or just soaking baits whilst having a yarn. While there's plenty of time for competitive banter, there's also an opportunity to open up about anything that's concerning them."

The 2019 Bayer Big Fish Challenge is now open for entries, although entries are strictly limited. If you're interested in competing, request a registration form from your local Bayer Representative or email agspirit@bayer.com.

Ben Thompson (Bayer) and Matt Tripet (The Fly Program)

Kevin Brooks with his prize winning Murray Cod

TOP PERFORMING PERENNIAL RYEGRASS NOW AVAILABLE TO AUSTRALIAN PRODUCERS.

New Zealands top performing ryegrass has proven to perform at the highest level in both internal and independent trials.

SF Hustle[AR1] has been included in over a dozen trials in Australia since 2013 and has performed consistently in the top bracket at most sites. It has been the highest performing variety with AR1 endophyte.

Whilst Australian data is slow to progress through the Independent PTN program, data for Seed Force SF Hustle[AR1] has been released by NZPBRA where it has been a top performer at multiple sites across New Zealand. For many southern Australian producers this data will give relevant independent data until the independent Australian data is released.

The culmination of a decade of breeding, development and regional screening in Australia, SF Hustle[AR1] is a new generation perennial ryegrass now available to Australian farmers through Seed Force.

The Seed Force joint venture with internationally renowned RAGT spawned a dedicated breeding program. The best performing varieties from Australia and New Zealand were sent to France where they were monitored closely in nurseries and then introduced into some crosses with the best French material. This enabled access to the high-technology capacity of RAGT's breeders, entomologists and pathologists who were all involved in the screening and development of the program.

Those crosses were evaluated in both Europe, Australia and New Zealand and some combinations of the best crosses were made. During the process the AR1 endophyte was bred into those combinations which became new breeder's lines.

Of the resultant lines, the first to be released is SF Hustle[AR1] after undergoing rigorous trialling in Australia.

SF Hustle[AR1] offers Australian livestock producers a high yielding perennial ryegrass with the safe grazing AR1 endophyte proven to deliver higher milk production than some other endophyte types.

AR1 is the only novel endophyte safe for grazing by horses.

SF Hustle's[AR1] forage yields and persistence are better than all other AR1 varieties and similar to the best varieties with any endophyte combination. Its real advantage, however, is the fact it delivers most of its improved forage yield in the autumn and winter, the two most critical seasons for perennial ryegrass in Australia.

It is a diploid perennial ryegrass with mid-late maturity, flowering some 10 days later than Nui.

Hamish Bill in his SF Hustle[AR1] paddock

ORGANIC MUSHROOM GROWER WINS YOUNG FARMER OF THE YEAR AWARD

Victorian organic mushroom grower Chris McLoghin has again been recognised for his passion and commitment to the agriculture industry by winning the Kondinin Group and ABC Rural 2018 Young Australian Farmer of the Year at a ceremony held at Parliament House in Canberra in October.

The award was presented as part of the 2018 Kondinin Group and ABC Rural Australian Farmer of the Year Awards, and follows his announcement as Young Grower of the Year at the Hort Connections 2018 National Awards for Excellence in June.

“Despite his relatively short time in the industry, Chris has proven himself as an innovative businessman and strong advocate for the Australian organic industry,” said AUSVEG CEO James Whiteside.

“Not only has Chris managed to expand his business and directly supply most major retailers with his produce, he has done so while being actively involved with organic industry associations. In addition to his work within his business and the organic industry, Chris has actively engaged with government and universities to facilitate the implementation of new technologies across all areas of the agriculture supply chain,” James explained.

“The horticulture industry recognised Chris’ potential as a future industry leader earlier this year through the Young Grower of the Year Award presented at Hort Connection. It is pleasing to see Chris’ work also acknowledged by the wider agriculture industry,” he added.

Chris was also acknowledged for his innovative and successful adoption of farming technologies by winning the 2018 Award for Excellence in Technology.

“Chris has a focus on discovering and adopting the latest innovations around the world to continue the improvement of his business. He is also a champion for encouraging the latest innovation and research into the wider industry, which sets a great example for his peers young and old alike,” James said.

“The Australian agriculture industry needs more young people like Chris involved and it is important that we recognise their achievements to foster our next generation of leaders. Chris is a very worthy recipient of these prestigious awards and we look forward to seeing what the future has in store for him,” he added.

Winners of the 2018 Kondinin Group and ABC Rural Australian Farmer of the Year Awards will take part in a Leadership Program supported by the Department of Agriculture and Water Resources.

This program is a one day workshop aimed at leadership development within the agricultural industry that will allow award winners to develop their leadership capacity, grow industry networks and build their communication skills to represent the bright future of the industry.

QUEENSLAND FARMS EMBRACE FRESH THINKING FROM UQ STUDENTS

Leading south-east Queensland agricultural businesses are harvesting some fresh ideas from University of Queensland (UQ) agribusiness students, while giving them hands-on experience in the industry.

Students in UQ’s Bachelor of Agribusiness program are acting as ‘consultants’ in the operations of nine major south-east Queensland businesses, in the produce, dairy, beef, sugar cane and food manufacturing sectors.

Dr Phil Currey from the School of Agriculture and Food Sciences said the program enabled students to put what they’d learned in the previous three years into practice.

“This project is the final assessment component of their degree, and aims to create opportunities for students to be employable, by applying theory in a real business,” he said.

“The students are referred to a business, they present as consultants, and are expected to use their skills to research a problem set by the client and then share their findings and recommendations. These recommendations are the clients’ to execute, and our students use what they’ve learned to give clients the tools and confidence to make those changes,” Phil went on to say.

Piñata Farms, based at Wamuran on the Sunshine Coast, is a family farming business which has taken on four UQ students to review its management reporting systems.

Piñata Farms’ Chief Financial Officer Chris Jones said the project offered fresh perspectives into how it could improve as a business.

“The students are looking at measures such as what drives price and quality, what other agribusinesses are doing, what industry is doing and what might be useful benchmarks for us,” he said.

“We want to continue to grow, so we’re always looking for new ideas and new opportunities A collaboration like this also fosters career pathways into agribusiness and helps us identify potential employees. For example, we decided to hire 2016 graduate Reannan Schultz, who now works full time at Piñata Farms, after participating in a similar project”, Chris explained.

“We’re extremely proud to be part of this project and it’s a way to give back to the agribusiness sector and to support the next generation of farming professionals,” he said in conclusion.

FARMING INNOVATOR WINS RURAL WOMEN’S AWARD

A powdery explosion of what was once an unripened green banana has turned into an agricultural revolution that reduces food waste, adds post-harvest value and serves the vegan and coeliac community.

Krista Watkins, a banana farmer from Walkamin in the Atherton Tablelands, northern Queensland, was awarded the 2018 National Rural Women’s Award in Canberra recently.

Eight years ago Krista and her husband Rob discovered banana powder when his forklift drove over a bunch of green bananas that had been baked dry in the sun. They took this concept and transformed their idea into a global phenomenon, becoming the first company in the world to commercially produce the rare gluten free flour.

Natural Evolution now produces a number of products, ranging from protein powders, gluten free flour and cake mix, all natural healing balms and even equine fodder.

One of the more popular items is their Green Banana Resistant Starch powder which research has linked to lower cholesterol, reduced inflammation and an increase in the absorption capacity of vitamins, minerals and antioxidants.

Krista said at least 500 metric tonnes, and as much as 2000 metric tonnes, of green bananas were trashed across north Queensland farms every week because they were either “too small, too big or too misshapen” to be sold by leading grocers.

“When you think about all of this food and the investment of time, money, energy and love poured into producing it, it just doesn’t make any sense for it to be thrown away,” Krista said.

“Originally we were producing about 350kg per week. Now we can produce eight tonnes in a single week, bearing in mind that it takes 10 kilograms of bananas to make one kilogram of flour,” she added.

The process uses award-winning technology designed by Rob, which locks in much higher rates of nutrition than conventional food processing techniques. It also produces one of the richest sources of resistant starch in the world, making it a true ‘super food’.

Krista said the banana powder tasted like flour, and not like bananas at all. “It’s earthy and wholesome and quite delicious,” she added.

But Krista’s success with value adding and creating by-products from banana waste is not what earned her the prestigious accolade at last night’s award ceremony, it was her cross industry work with sweet potato growers.

The farming couple have applied their patented technology to process other foods that would otherwise go to waste, starting with gold sweet potato powder, which last week hit the shelves of health food stores and independent grocers and chemists across the country.

Krista has already started research into developing by-products for the four most common sweet potato varieties grown in Australia and said this was just one example of creating a full circle income stream.

“The sweet potato industry wastes up to 50 tonnes per acre because of over-supply in the market and supermarket size requirements,” Krista said.

“As a primary producer, it’s absolutely heartbreaking to see so much of your crop that you’ve put a lot of love, care and money into simply thrown away. Our approach looks at adding value to reduce waste. It’s a new way of doing business, it’s breaking stereotypes, and it’s conditioning growers to think of alternatives,” she said.

Krista said she is now looking to try and help more growers in the community solve their on-farm issues. She said she hoped her success will inspire other producers to think about how they deal with farm waste.

“The average amount of waste per farm is 20 per cent, if you’re lucky. Some farmers in some weeks will have 80 per cent of their crops not sold,” she said.

It’s estimated that food waste at the farm gate represents 10 per cent of gross food production, valued at $4 billion.

“Repurposing produce is going to be incredibly important for the future of agriculture, in terms of providing new revenue streams and ensuring longer-term sustainability,” Krista said in conclusion.

David Littleproud & Krista Watkins

Krista Watkins & Rob Watkins

Images via AgriFutures Australia

QUEENSLAND AGRICULTURE SCIENTISTS NAMED AS WORLD'S BEST

Three University of Queensland scientists have been named in the world's top one percent of most influential researchers for agricultural sciences in 2018.

Crop modelling pioneer Professor Graeme Hammer; co-inventor of genomic selection Professor Ben Hayes; and leading plant hormone researcher Professor Christine Beveridge are named on the 2018 Highly Cited Researchers list.

Professor Robert Henry, Director of the Queensland Alliance for Agriculture and Innovation (QAAFI), said UQ is ranked 4th in the world for agriculture research, and number one in Australia.

"The calibre of our staff is outstanding, and this R&D capability benefits Queensland's agriculture and food industries," Professor Henry said.

The 2018 Highly Cited Researchers list identifies influential researchers, as determined by their peers around the globe - those who have consistently won recognition in the form of high citation counts over a decade.

Professor Hammer's research interests are in the interactions of genetics, environment and management (G x E x M) in crop and climate modelling and plant breeding to support growers in making more informed choices about varieties and management. He works on the major cereal crops: sorghum, maize and wheat.

Professor Hayes is co-inventor of genomic selection and has extensive research experience in genetic improvement of livestock, crop, pasture and aquaculture species. His focus is on integration of genomic information into breeding programs, including the Northern Beef Genomics Project.

Control of plant development, is the key research area of Professor Christine Beveridge. Her work looks at understanding the role of plant hormones in the regulation and coordination of plant development, with a particular interest in shoot architecture in crop production and horticulture.

Placement on the list has been recognized as a significant achievement for those named. This year's list continues to recognise researchers whose citation records position them in the very highest strata of influence and impact and includes 17 Nobel aureates.

WILD DOG FENCING FUNDS BOOSTING REGIONAL COMMUNITIES

AgForce has welcomed the opening of applications for the next round of wild dog exclusion fencing funding, and urged the Queensland Government to ensure the money gets out on the ground as soon as possible.

AgForce General President Grant Maudsley said the continued Federal and State Government investment in wild dog fencing was helping to revitalise Queensland's sheep and wool industry, create jobs and boost regional economies.

"Wild dogs have significant physical and financial impacts on the sheep, cattle and goat industries in Queensland through predation, the transmission of diseases and lost production," Grant said.

"Exclusion fencing is vital to protect livestock and combat wild dogs. With the release of new guidelines for applications, we urge producers to work with their local natural resource management groups and councils to submit project plans that could benefit their area," he added.

Grant said the $6 million from the State Government towards a new round of the Queensland Feral Pest Initiative over the next year was welcome and a good start, but more needed to be done.

"The roll-out of fencing supported by government programs has been a massive boost for the Queensland sheep and wool industry and needs to continue as rebuilding sheep numbers helps build Queensland's regional communities," he added.

"AgForce is calling for both the Federal and State Governments to allocate at least $5 million a year to help meet the enormous demand for fencing in Queensland and ensure the job gets done properly and promptly," Grant said in conclusion.

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