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PO BOX 812 Strathfieldsaye VIC Australia 3551 **P:** 03 5441 8166 **E:** info@theaustralianagronomist.com **W:** www.theaustralianagronomist.com

Design & Advertising
Michael Cook
Email: michael@theaustralianagronomist.com
Phone: 03 5441 8166

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

ALL-SEEING ‘TRACTOR’ TAKES CROP SCIENCE TO THE FUTURE

THERE IS NOT MUCH LEFT TO BE KNOWN ABOUT A NEW SORGHUM PLANT ‘ON TRIAL’ AFTER BEING STRADDLED BY THE GEKKO PHENOTYPING TRACTOR – AN ALL-SEEING MOBILE PLATFORM BRISTLING WITH LENSES AND SENSORS PROBING FOR THE VISIBLE AND THE INVISIBLE SECRETS OF CROP PERFORMANCE.

The tractor, which was developed by The Queensland Alliance for Agriculture and Food Innovation (QAAFI), is a remote-sensing vehicle that can drive over trial plots during different growth stages and compile a composite ‘picture’ from the visible to the infrared light spectrums, from thermal and chemical imaging, and laser reflectance (or Lidar, as it is known) for high-definition 3D profiles of the plant canopy.

This data can then be correlated with a crop’s production performance (for example, grain yield) by identifying links with these measured properties – such as plant structure, biochemical and physiological characteristics, photosynthesis efficiency – and the response overall to environmental conditions such as limited water or high temperatures.

The objective is to better understand why a particular variety (genotype) performs a certain way, then address identifiable causes for under performance that can be rectified or isolated from other data so a genotype that might otherwise have potential is not simply discarded on the rudimentary evidence of grain yield alone.

For example, QAAFI’s Director for the Centre of Plant Science, Professor Graeme Hammer explained a genotype that yields less than others would under the usual selection process be thrown out.

“But the data collected by the phenotyping tractor may tell us this particular genotype is growing more leaf area, so it runs out of water faster, gets hotter quicker, and that’s why it yields less. So what if we take that leaf area influence away from the results? We might find we have a genotype of significant potential in other trait areas: possessing genetic potential that under current screening practises could be lost,” he went on to explain.

Professor Hammer is a node leader with The Australian Research Council (ARC) Centre of Excellence for Translational Photosynthesis, and a specialist in crop modelling.

He co-leads the phenotyping tractor project with the head of QAAFI’s sorghum breeding program and co-program leader in the ARC Centre of Excellence for Translational Photosynthesis, geneticist Professor David Jordan.

QAAFI’s sorghum breeding program is a collaborative program with the Queensland Department of Agriculture and Fisheries, and is supported by the Grains Research Development Corporation (GRDC).

Professor Hammer’s job is to run the data collected by the phenotyping tractor through analytical models to identify ‘confounding’ factors and stop them from obscuring the identification and potential use of other genetic gains that are bound to exist in the tens of thousands of genotypes that are screened.

Professor Jordan’s work is to try to find the genetic regions controlling variation in traits measured by the tractor.

"What is exciting is that this equipment allows us to see how the crop develops over time because the tractor's sensors allow us to measure non-destructively and regularly so we can see not just the end point, such as leaf area at maturity, but also how a plant gets to a certain end point. For this research we can progressively log the interactions that are determining, for example, a leaf's final dimensions. It is important to know if leaf area, or shape, is affecting photosynthesis, which is a key determinant of yield. In effect we are now able to deconstruct a phenotype into its parts and from this learn how, through breeding or management, we can change the way a plant develops to optimise its use of land, light, water and nutrients," he explained.

However, before then Professor Jordan said the challenge is to make sense of the vast amount of data coming in, which is why it needs to be a multidisciplinary effort. "My team is on the genetics, Graeme's team is on the crop physiology and modelling, and we're also working with the photosynthesis group at the Australian National University in Canberra," he added.

"An example of how the physiological data collected by the phenotyping tractor and genetics research will come together could be, say, measuring leaf temperature at a particular crop growth stage. If we can find the gene associations with that growth stage we can delve into the species natural gene diversity to find even 'better' performing versions of those genes. In this way we can incrementally improve or optimise the different plant processes that contribute to a particular goal such as higher yield," Professor Jordan explained further.

"We are looking for the genetic changes we can make to improve photosynthesis, which drives productivity," he added.

Professor Hammer said the tractor can cover thousands of plots relatively quickly and take genotype selection to a whole new level of efficiency. "My team's job is to use our crop-modelling expertise to make this massive amount of data useful for David's team," he said.

"The data has to be able to connect to selection strategies in the breeding program, from which David will package superior germplasm for use by commercial breeders," he added.

Sorghum is Queensland's most valuable cereal crop, worth an estimated $432 million per year. The phenotyping tractor, built onto the frame of a modified self-propelled sprayer, represents a $500,000 investment by the University of Queensland. Professor Jordan says that the tractor will also be applicable to other crops, including barley, wheat and pulses.

Sorghum is the fifth most important cereal worldwide, and a critical food security crop in parts of Africa and Asia. The sorghum research in Queensland will directly contribute to lifting the crop's climate resilience.

BIG EXPECTATIONS FOR NEW BARLEY VARIETY

Grain grower, Andy Ryan from Rankin Springs in the Riverina, New South Wales, is a fourth-generation farmer with some twenty years' experience under his belt. His cropping rotation consists of 2,500 ha wheat, pulses and 300 ha barley.

This year, Andy was looking for a new barley variety that would provide him with superior yield advantages and agronomic benefits.

He introduced Spartacus CL based on its performance in NVT trials and believes the seed block, on the back of a good season, could be one of his best performing barley blocks ever.

"This is the first year I've grown Spartacus CL," Andy said.

"I kept a close eye on the variety in the National Variety Trials and saw that it performed really well, which got me excited," he added.

Spartacus CL is the most recent barley variety released from the collaboration between Syngenta and InterGrain. It has caught the attention of barley growers across Australia due to its high yields, Clearfield® tolerance, good straw strength, lodging resistance and disease profile.

"The main reason we are looking to move to Spartacus CL is due to its yield advantage compared to Scope CL. We used to chase malt, however it really isn't a big deal in our area anymore as we have feedlots on our doorstep, so we're now mainly looking for yield," Andy explained.

"We've grown a seed increase of Spartacus CL next door to our Scope CL with the intention of switching to Spartacus CL altogether next season," Andy said.

"Height is also a big issue for us, and a variety like Spartacus CL that is a semi-dwarf really appealed to me," he added.

Andy has big expectations that his seed increase block of Spartacus CL will be some of the best yields he has been able to achieve.

"I'm expecting Spartacus CL to out-yield Scope CL and think we are looking at 4.5 tonnes to the hectare for my Spartacus CL. That will be our best yield of barley ever," he said.

Simon Bonny, local Senior Sales Manager for Syngenta, is not surprised with the rapid adoption of Spartacus CL in his area due to the 10-15 per cent yield advantage it has achieved compared to Scope CL in NVT trials over the past two years.

"It's a real step forward as a Clearfield® barley variety. It's currently undergoing its first year of malt accreditation with an announcement on its final accreditation decision expected in March 2018," Simon said.

"If it is successful it will be a real benefit to growers in my area," he added.

INTERCROPPING - THE INTERSECTION OF SOIL HEALTH AND PRODUCTION

Intercropping is a complex practice of farming where different plant species are grown in the same space. Most conventional farmers only plant one crop per field or plot. This practice of monoculture farming is more convenient for farmers, but it can make the plants more vulnerable. For example, if one plant gets a disease, the others are likely to catch it. Weeds are more likely to find a home in spaces that are very similar. As a result, monoculture farming can be dependent on expensive synthetic chemicals to ward off weeds and diseases. Droughts and other weather events can also damage entire monoculture fields.

Plant scientist Ann Bybee-Finley researches intercropping at Cornell University. She explained her first field experiment was humbling. “I felt like a very small scientist in a very big world,” she said.

Ann said a bad drought in 2012 shaped her vision of agriculture. “The stories of crop failure made me want to understand how to make farming practices more resilient, especially as climate change makes extreme weather events more frequent,” she said.

Intercropping gives farmers more options if one of their crops fails.

“It’s like a diversified stock portfolio,” said Ann. Plant diversity leads to more diversity below ground too. Plants that add organic matter and nutrients when they decompose replenish the soil.

In her experiment, Ann planted four cover crops, which are plants that add fertility to the soil and protect it from erosion. She planted two grasses, pearl millet and sorghum, and two legumes, cowpea and sunn hemp. The grasses are well known for their ability to add organic matter to tired soils whose nutrients have been depleted by years of farming. Legumes are also good for the soil because their roots release nitrogen when they decompose. These cover crops are also a feed source for cows and other livestock, providing farmers another source of income.

She found the grasses and legumes that grew at the same pace were more productive because they weren’t competing for space and resources as much as plants that grew at different rates. On the other hand, she also found that some plant combinations grew more, while others had more nitrogen.

“I’m sure there’s a sweet spot,” said Ann. “There’s so many unexplored avenues and questions to ask. Which species should I plant together? And how many of each?” she added.

Ann said the next step for this experiment is to see which plant combinations were the most nutritious for animals.

For experiments with lots of variables like this one, Ann said you end up with a complex set of conclusions. “When you’re looking at an entire system it makes it harder to have an immediate take-away. It takes longer to come up with a definite conclusion,” she explained.

But Ann is comfortable with complexity. “Diversity begets diversity. Agricultural science is beginning to look beyond the simplified strategy of planting only one crop per rotation,” she said.

For her, intercropping is full of trade-offs, and the life lesson of agriculture is that plants don’t always behave the way you expect them to. “The miracle of biology is that plants, no matter what you do, will do exactly what they want to do,” she concluded.

AUSTRALIAN HORTICULTURE MUST ADAPT TO NEW WORLD ORDER IN GLOBAL TRADE

A 'NEW WORLD ORDER' IS EMERGING IN THE GLOBAL FRESH FRUIT AND VEGETABLE TRADE, ACCORDING TO A RECENTLY-RELEASED RESEARCH REPORT AND AUSTRALIAN HORTICULTURE MUST ADAPT ITS APPROACH IN ORDER COMPETE AND GROW IN THE 'EXPORT MARKETS OF TOMORROW'.

In the report, New World Order? – Up-and-Coming Players in the Fresh Produce Trade, global agribusiness banking specialist Rabobank said the face of the fresh fruit and vegetable trade is rapidly changing – with new growth markets emerging in Asia and the Middle East and up-and-coming exporting nations, such as Mexico and Peru, rising in prominence.

"Consumers worldwide are increasingly demanding a higher-value and more interesting range of fruits and vegetables. The result is that while the volume of fresh fruit and vegetable consumption around the world may be barely increasing, the value of global fruit and vegetable trade is rising," the report said.

And while Australia's horticultural sector is well placed to capitalise on this export value growth, particularly into Asian markets, further investment is needed in infrastructure to unlock key resources, such as irrigation water, while foreign direct investment from partners with close ties to growth markets will also be beneficial, said report co-author Rabobank senior analyst, Marc Soccio.

The report outlined that while Europe remains the world's leading import market for fresh fruit and vegetables – and still a market of significant appeal – in recent years much of the growth in demand has been generated out of the US and Chinese markets, with Australian horticultural exporters among those experiencing rapid growth into China.

"Both the US and Chinese markets are very diverse in terms of their stage of development and the demands they place on produce exporters from around the world, but they have one thing in common, the rising diversity and quality expectations they have when it comes to their fresh fruit and vegetable imports," Marc said.

The report also outlined that while China and the US remain the two big 'growth engines' for global fruit and vegetable import demand, over recent years a number of other countries have been emerging as attractive growth markets.

These include Thailand (where fresh fruit and nut imports grew by 120 per cent or US$387 million from 2009 to 2014), Malaysia (+108 per cent or US$274 million), South Korea (+173 per cent or US$1.038 billion) and the United Arab Emirates (+102 per cent or US$1.082 billion).

In these countries, more temperate climate fruits, such as citrus, grapes, pome fruit, stone fruit, kiwifruit and berries, are also being imported in far greater volumes and values.

In rising to meet the challenges of these new growth markets, the ranks of the world's leading produce exporters are also changing, the Rabobank report states, as new and ambitious suppliers, such as Mexico and Peru, quickly establish their credentials on the world stage across a growing range of crops.

Nations including Morocco, Thailand and Vietnam are also seen as being strategically well-placed to capitalise, as they look to better organise and orientate themselves to meet the product and quality requirements of today's high-value import markets.

Marc said established fruit and vegetable exporters, such as New Zealand, Chile, China and the US, are "naturally looking to play a growing role in global trade", although the up-and-coming nations including Mexico and Peru are undeniably rising in prominence. It is in this environment that many Australian horticultural producers are also looking to expand their fresh export sales, a vital step towards reducing their dependence on the highly-concentrated domestic grocery market, he added.

"Those in the world's leading high-value fruit and vegetable-exporting nations are seeing these two up-and-coming nations looming increasingly large on their radar screens. Both Mexico and Peru have experienced remarkable growth in recent years, especially in many of the high-value categories where other more established horticultural-exporting nations have previously staked their claim," Marc said.

The report stated that similar to Chile before them, both Mexico and Peru have benefited from strong inflows of foreign direct investment which have helped them to capitalise on their reliable and versatile growing climates, strong government support and relatively low labour costs.

"While countries like Chile continue to display good growth in many selected crops, the impact countries such as Mexico and Peru are having on global trade in many major horticultural crops is quite remarkable," Marc said.

Mexico is already established as the world's third-largest volume exporter of fresh fruits and vegetables, with a predominant focus on North American markets, and continues to rapidly grow both its export volume and value.

While the value of Peru's fresh fruit and vegetable exports equated to roughly one-fifth of the size of Mexico's exports in 2015, these exports have grown at double the rate of those of Mexico over the past five years to become Peru's second-largest export earner, after minerals and energy.

Ultimately, the rising value of global food and export demand suggests there will be room for all export players in this 'new world order', the report said, but among more established exporters, this will "require some adjustment and continued investment in the means of production and markets in order to underpin growth and prosperity in years to come".

In some aspects, it outlined, lessons can be learned from the success of up-and-coming fruit and vegetable exporters, in particular in investing in infrastructure to unlock the potential of key resources such as irrigation water, and welcoming foreign direct investment from partners with close ties to growth markets.

"In Australia, we have already seen this undertaken well in Tasmania, with increased public and private sector investment to improve availability of natural resources, particularly irrigation water, for agriculture," Marc said. "Typically market demand is not the constraint for growth and where this investment is taking place, there is growing confidence on behalf of industry to expand both new and existing operations," he added.

At the same time, sustained investment in R&D, both at individual business and industry level, continues to be an essential driver of the innovations that set countries apart, both now and into the future, Marc also said.

"It is important for new on-farm/post-harvest technologies to be developed in order to raise the bar beyond the reach of up-and-coming supplier countries. Together with a strong understanding of the needs of consumers and customers in key export markets, this can deliver valuable and sustainable points of difference from which to compete and grow," he said in conclusion.

"In Australia, we have already seen this undertaken well in Tasmania, with increased public and private sector investment to improve availability of natural resources, particularly irrigation water, for agriculture."

Marc Soccio.

‘SNOTTY GOBBLE’ COULD BE GOOD WEED CONTROLLER

A native parasitic plant found commonly throughout south-eastern Australia is showing great promise as a potential biological control agent against introduced weeds that cost millions of dollars every year to control.

University of Adelaide research has found that the native vine Cassytha pubescens, better known as snotty gobble, is able to kill gorse, blackberry and Scotch broom, while not damaging native shrubs.

“Parasitic plants attach to host plants via ‘suckers’, latching on and sucking out the water and nutrients so they can grow at the expense of the plants they infect,” said Dr Robert Cirocco, recent PhD graduate in the University’s School of Biological Sciences.

Dr Cirooco said Cassytha is particularly successful, growing on pretty much anything, and very effective against several designated ‘Weeds of National Significance’ such as European gorse, blackberry and Scotch broom.

“These introduced weeds cost millions of dollars annually to eradicate from farmland, forestry, roadsides, national parks and other environmental areas. They have significant negative impacts on native vegetation and biodiversity and can increase bushfire risk. They are very hard to get rid of because they produce large amounts of seeds that may remain viable in the soil for decades. Cassytha, as a promising native biocontrol agent, has huge potential in cutting costs of weed control, and reducing the negative impact of weeds on the environment,” he explained.

The most recent research, published in the journal ‘New Phytologist’ by Dr Cirocco, Professor Jennifer R. Watling and Associate Professor José M. Facelli, shows that Cassytha pubescens strongly affects performance of gorse, (which is a nitrogen-fixing legume), regardless of the nitrogen condition of the soil. A native legume, Acacia paradoxa, was much less affected.

“Parasitic plants are well known to remove nitrogen from their host plants but little was known about whether nitrogen in the soil affects their impact on host plants that are legumes, including gorse,” said Dr Cirocco.

“In low nitrogen environments, legumes boost their relationships with nitrogen-fixing bacteria, which comes at an additional energy cost to the plant. It was possible that plants could be more vulnerable to Cassytha under low nitrogen. However, we found that manipulation of nitrogen supply had no influence on the effect of Cassytha on either the introduced weed or native legume plant host. These findings suggest that Cassytha continues to show promise as a native biocontrol for major invasive shrubs in Australia, while not damaging native plants, regardless of soil nitrogen conditions,” he explained.

Dr Cirocco said there is still more work to be done before Cassytha could be used as a biocontrol. Field trials are needed to further evaluate its success and ensure there is no significant threat to native vegetation.

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INTERNATIONAL CENTRE TURNS TO CSIRO TO PLAN FOR A FOOD-SECURE FUTURE

WORK BY CSIRO TO PREDICT AUSTRALIA'S POSSIBLE AGRICULTURAL FUTURE IS GAINING INTERNATIONAL ATTENTION FOR ITS POTENTIAL TO IMPROVE FOOD SECURITY IN THE DEVELOPING WORLD.

The organisation that catalysed the 'Green Revolution', improving crop yields and food security and preventing hundreds of millions of people from starving, is this year celebrating its 50th anniversary.

The International Maize and Wheat Improvement Center (known as CIMMYT by its Spanish acronym) is a global leader in the development of high-yielding grain varieties and improved farming practices.

Dr Steve Hatfield-Dodds, who led CSIRO's integration science and modelling work, was asked to present the 2015 Australian National Outlook at CIMMYT's definitive 50th birthday party in September in Mexico, a conference themed: Turning research into impact: past, present and future.

The first of its kind, the outlook linked nine national and global models to provide an integrated analysis of economic activity, agriculture and food, energy, water, land use, biodiversity, material flows and climate change.

"The aim of the outlook was to find and explore the ways Australia could navigate through interconnected future challenges, to better meet the needs of a growing national and global population," Dr Hatfield-Dodds said.

"These challenges are not unique to Australia, and CIMMYT can see how the flexible integrated approach demonstrated by CSIRO can help identify and test options for reducing poverty and improving food security across diverse developing world contexts," he added.

While CIMMYT is best known for supplying the world with hardier and higher-yielding wheat and maize varieties, the best science estimates this is only likely to contribute about half of the productivity gains needed to meet future food demands.

The remainder will need to come from more productive and efficient farming systems, such as precision maize and wheat farming, with efficient use of soil, water and fertiliser.

"In Australia, the outlook told us that for agriculture to thrive, we need to focus our efforts on innovative technologies, enabling infrastructure and meeting and developing new markets for agrifood exports," Dr Hatfield-Dodds said.

"Most importantly, the outlook highlighted the need for continuing agricultural productivity increases to meet greater demand globally and that higher food and energy costs were likely," he added.

It also revealed significant opportunities for reducing carbon emissions, promoting voluntary conservation and diversifying farm incomes.

While it warned of future challenges for agriculture in the face of climate change, it showed that with the right choices, sustainability and economic growth can be partners rather than competitors.

"These insights into what is required to ensure a sustainable agricultural sector in Australia have been welcomed by business, government agencies, and NGO groups, and CSIRO is developing new partnerships within Australia to extend this analysis across a wider range of issues," Dr Hatfield-Dodds said.

"Similarly, amid increased pressure on land and other resources, CIMMYT is looking for insights into where it can best target its efforts to have the greatest impact on farm productivity and sustainability, and ultimately on poverty reduction and food security. With the outlook, we have shown how analysing interactions across different sectors can help identify new opportunities, unlocking previously unrecognised potential and improving risk management," he added.

CSIRO and CIMMYT have a long history of collaboration over many of the past 50 years.

A particular focus has been on the breeding of rust-resistant wheat varieties addressing the global food security cost where millions of tonnes of wheat are lost to rust pathogens each year.

CSIRO researchers have provided wheat breeders, both locally and internationally, with more than 20 genetic markers, helping the industry keep one step ahead of this costly disease.

This collaboration continues, with an increased emphasis on farm system modelling.

CSIRO is one of many international organisations which is proud to be associated with CIMMYT and its achievements over the past 50 years, most notable of which are a Nobel laureate (Norman Borlaug), three World Food Prize Winners and the training of more than 10,000 scientists.

CIMMYT's work is estimated to provide at least $2 billion in annual benefits to farmers.

More than 70 per cent of the wheat grown in developing countries and more than 50 per cent of improved maize varieties originate from CIMMYT.

Each year, the organisation sends half a million seed packages to 100 countries.

"CSIRO is looking forward to many more years of collaboration, and is excited to partner with CIMMYT in working towards a world without hunger, improved food security, and sustainable and resilient agricultural systems," Dr Hatfield-Dodds concluded.

" The aim of the outlook was to find and explore the ways Australia could navigate through interconnected future challenges, to better meet the needs of a growing national and global population."

Dr Steve Hatfield-Dodds

FARMING SMARTER MEANS NEW SKILLS

Regional Development Australia (RDA) Central West, in collaboration with Agrifoods Skills Solutions, has commenced work on an important Skills Needs Analysis on innovation in agriculture, specifically targeting Central West beef, lamb/sheep and horticultural enterprises.

“The way we farm is changing rapidly, and it’s critical that we understand the skills needs of our farmers and agribusinesses if our agriculture sector is to be competitive into the future,” said RDA Central West Deputy Chair, Reg Kidd.

“We have to stay ahead of the game when it comes to skills and knowledge,” he added.

RDA Central West was awarded funding for the study from the New South Wales Small Business Energise Enterprise Fund, which provides grants to New South Wales local councils and not-for-profit organisations in the Murray-Darling Basin for the delivery of economic development and diversification projects.

“One of the great strengths of RDA Central West is our ability to engage, at a grass roots level, with communities, businesses and industries in the region and feed critical information back to where it is needed to make an impact,” said Mr Kidd.

“For this project we are talking to beef, sheep, lamb and horticultural enterprises in Central West NSW to better understand their changing skills needs and concerns,” he explained.

RDA Central West is undertaking the Ag Skills project as part of a strategic approach to drive a ‘farming smarter’ region that builds an innovative workforce culture with the skill and knowledge capacity to increase economic productivity and job creation.

RDA Central West has also recently released a major report into value adding to agriculture, which will provide significant background information and case studies for the current Ag Skills Needs Analysis study. The “Value Adding to Central West Agriculture” report is the result of a six month investigation into trends and opportunities within the region.

NAMING AND SHAMING AUSTRALIA’S MOST UNWANTED PESTS

Crippled plant industries, trade suspensions and a devastated environment—Australia’s Top 40 National Priority Plant Pests have damaging potential, from vine-attacking bacteria to a giant snail.

Australian Chief Plant Protection officer, Dr Kim Ritman, said the Top 40 pests include a range of exotic invertebrates and pathogens that pose the most significant threat on a national scale.

“These 40 most unwanted pests are not yet present or not widely established in Australia and we want to keep it that way. Our strong biosecurity system does most of the work, but everybody has a role to play too,” Dr Ritman said.

He explained that if these pests were to come to Australia, our $30 billion broadacre and horticulture crops and forestry industries could be devastated and our environment and economy would be severely affected.

“While by no means the only plant pests of biosecurity concern, the Top 40 serves to highlight the serious plant pest threats Australia faces,” Dr Ritman said.

“The risks these pests pose are real and growing. Number one on our Top 40 is Xylella fastidiosa, which is currently destroying olive tree groves in Italy and is known to infect more than 350 plant species in 89 plant families. A study has also estimated that a Xylella incursion into an iconic wine growing region like the Barossa Valley or the Hunter Valley could cost up to $4.2 billion in losses over 19 years,” he went to explain.

“While the biosecurity work we do in Australia—off-shore, at our borders, and on-shore—helps manage the risk, support from the public is crucial in making sure these pests never get here. By not bringing plants or seeds into Australia through the airport or mail and keeping an eye out and reporting any unusual pest or disease symptoms, we can work together to safeguard Australia’s industries and unique environment,” said Dr Ritman.

The Top 40 pests were recently endorsed by Plant Health Committee, Australia’s top committee for plant biosecurity. They were identified through a national expert elicitation process, which considered the economic, social and environment threats the pests posed to Australia.

They will be used to guide future work to strengthen Australia’s biosecurity system, by identifying any gaps in prevention and preparedness and regularly reviewing the nation’s capability to manage each of the pests.

More information on Australia’s Top 40 National Priority Plant Pests is available at agriculture.gov.au/priority-plant-pests.

RESEARCH SHOWS HOW PLANT ROOTS SENSE AND REACT TO SOIL FLOODING

While it's already known that plant roots are capable of sensing many individual soil characteristics (water, nutrients and oxygen availability), until recently, we did not have any understanding of how they integrated these signals in order to respond in an appropriate way.

However, French researchers from CNRS and INRA have just discovered a mechanism that allows a plant to adjust its water status and growth according to different soil flooding conditions.

The results of this study were published in the journal Cell, and describe how roots sense and respond to soil oxygen and potassium levels jointly, so as to change their water uptake capacity. Aside from their scientific importance, these findings could make it possible to optimise crop flood tolerance.

Although hidden from view, roots are essential for plant growth and survival. Their growth and branching in the soil allows the plant to take up the water and nutrients it needs. This underground activity requires energy and, therefore, a high respiration rate in the roots, which uses the oxygen present in soil pores.

If the soil becomes waterlogged, an oxygen deficit can develop because oxygen diffuses poorly in water, putting a severe stress on the roots and the plant as a whole. This reduces root water permeability in many plants. Plants growing in flooded soil can therefore suffer from reduced water content and their leaves wilt, a paradox that agronomists are familiar with.

By using different lines of model plant Arabidopsis thaliana, researchers from the Biochimie et physiologie moléculaire des plantes laboratory (CNRS/INRA/Université Montpellier/Montpellier SupAgro) and Institut Jean-Pierre Bourgin (INRA/AgroParisTech/CNRS) identified a gene that controls root water permeability and which is influenced jointly by soil oxygen and potassium levels.

Named HCR1, this gene reduces water entry into the roots when there's a lack of oxygen, but only when the soil is also rich in potassium, a mineral salt essential for plant growth. In fact, such conditions favour better plant recovery after flood conditions have ceased. In fact, the HCR1 gene also sets off a whole series of metabolic 'survival' reactions that contribute to plant resilience. Once the soil is re-oxygenated, the plant rehydrates its leaves and will grow more than if it had previously been deprived of potassium.

These findings are not only important from a fundamental scientific point of view, but also open new avenues for agronomy.

Plant water use and root performance are key targets for plant breeders. In nature, however, plants are never exposed to only one stress at a time, so breeders have also taken an interest in the plants' capacity to resist multiple environmental stresses. The identification of this mechanism linking oxygen availability, mineral levels and root water permeability is thus an important step forward for agronomy. This mechanism is a promising target for future plant improvement.

HOW TO MANAGE THE EFFECTS OF WATERLOGGING

BY SCOTT MATHEW - SENIOR SOLUTIONS DEVELOPMENT LEAD, SYNGENTA

Travelling around Tasmania, northern Victoria and southern New South Wales recently it was obvious crops in many areas are suffering the affliction of waterlogging.

Crops suffering from this stress often wilt, the leaves can turn yellow due to iron chlorosis or nitrogen deficiency, tree branches may dieback and in some cases the crops even die. Vegetable crops, young trees and vines are most at risk due to their lack of a sufficiently strong, extensive root system to cope with the conditions.

Prolonged periods of high rainfall can impact on the yield and quality of crops already in the ground and can have ongoing effects on the program, such as delaying the planting dates of future crops or changing the cropping options.

Waterlogging is caused when the soil becomes saturated due to more rain falling than the soil can absorb, or the atmosphere simply doesn't evaporate the water quickly enough.

Whenever the soil profile has excess water, the pores in the soil contain less oxygen. Plant roots require the presence of oxygen to respire and maintain health. Over time, insufficient oxygen in the soil causes root cells to die before the roots themselves start to expire. If this is prolonged, and the roots are not feeding the plant with sufficient nutrients, yield or crop quality is compromised and ultimately the plant can die.

Different plant species have different demands for oxygen. For example, vegetable and flower crops are not able to survive as long as certain tree crops can without soil oxygen. However, it's not all about oxygen, as other gases can also accumulate in waterlogged root zones, such as carbon dioxide and ethylene, causing the plant distress and demotes root growth.

Furthermore, additional problems associated with excess water either laying on, or flowing across, the soil surface include possible heat load from stagnant water and chemical and biological contaminants. Shallow still water can heat up on warm days and cause further damage to plants, and in some circumstances, if the water is moving over your land, may contain chemical or biological contaminants. This scenario can pose serious issues in terms of MRL breeches, chemical damage to existing or future crops, or plant-back issues.

Crops affected by waterlogging or flood damage are likely to already have significant root damage, so managing irrigation after periods of flooding or waterlogging is absolutely critical.

To maximise the chance of crop recovery and to avoid continuing plant stress, growers should schedule small amounts of frequent irrigations until the root system has recovered.

Roots often rot as a result of periods of prolonged soil saturation and many of these 'root rots' are caused by the wide array of pythium and phytophthora fungi that abound in the soil just waiting for the right opportunity.

Metalaxyl-M (found in RIDOMIL® products) can be useful in managing pythium and phytophthora. The product label should be referred to for further directions.

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MICROBES HELP PLANTS SURVIVE IN SEVERE DROUGHT

MANY AUSTRALIAN PRIMARY PRODUCERS WELL KNOW AND UNDERSTAND THE EFFECTS OF SEVERE DROUGHT, AND CURRENTLY, IN SOME PARTS OF THE UNITED STATES, AMERICAN PRIMARY PRODUCERS ARE EXPERIENCING THEIR OWN DIFFICULT TIMES.

With California in its fifth year of severe drought and many western states experiencing another year of unusually dry conditions, plants are stressed.

Agricultural crops, grasses and garden plants alike can get sick and die when factors such as drought and excess sun force them to work harder to survive.

Now, plants can better tolerate drought and other stressors with the help of natural microbes, University of Washington research has found.

Specifically, plants that are given a dose of microbes stay green longer and are able to withstand drought conditions by growing more leaves and roots and using less water.

“Plants are less stressed if they have these natural microbes,” said senior author Sharon Doty, a University of Washington professor of environmental and forest sciences. “They will help plants deal with environmental challenges, especially with climate change,” she added.

The findings were recently published online in the journal Current Plant Biology.

Microbes and their benefits to plants is a burgeoning field, and Sharon’s laboratory in the last 15 years has explored many different aspects of this mutual symbiosis. Earlier this year, her team demonstrated that microbes in plants help them grow in otherwise inhospitable environments, essentially serving as a natural fertiliser.

Naturally providing nutrients and boosting drought resistance could make it easier and more environmentally friendly to grow grain and vegetable crops, fruit and nut trees, and even keep golf courses looking lush and green without using excess amounts of water and chemical fertiliser.

“The more I learn, the more I do research in this field, the more exciting it gets, especially in the applied aspects,” said lead author Zareen Khan, a University of Washington research scientist in environmental and forest sciences. “I think this knowledge can be used to develop strategies to face the challenges of climate change,” he added.

In this study, the researchers looked at the ability of young poplar trees to tolerate drought conditions over a month-long period, with and without the help of added microbes, called endophytes, bacteria that live inside a plant without causing disease.

Researchers inoculated the young poplar cuttings with a cocktail of microbes isolated from wild poplar and willow trees growing in unfavourable conditions. They poured the mixture at the base of the stems of 10 poplars, while the other 10 cuttings did not receive any microbes. After a short growth period in a greenhouse, all 20 plants were subjected to drought conditions for a month.

It’s important to note that all of the poplars had microbes inside, they are naturally present in every living thing. But when the researchers added microbes from wild poplar and willow, they noticed a benefit to the plants.

“Endophytes are helping plants make more roots, so they have more surface area to hang onto water and survive the stress of drought longer.”

Zareen Khan

Specifically, the poplars that were given the probiotics doubled their root biomass and experienced nearly 30 percent more leaf and stem growth than poplars without the added microbes. When exposed to drought conditions, the poplars with microbes also stayed green with robust leaves and stems, while their counterparts browned and wilted.

“Plants are overall greener and healthier if they have these microbes,” Sharon said.

The researchers chose poplar trees to demonstrate this beneficial relationship because the fast-growing trees are important for biofuels, or plant-based renewable energy.

“One of the limitations of biofuel is large-scale production,” Zareen said. “If we can reduce water usage on poplar tree plantations by adding naturally occurring endophytes, then that could provide huge economic and environmental benefits,” he added.

Microbes also help crop plants such as tomatoes, corn and peppers to be more tolerant of drought. The researchers are collaborating with an engineering company, Intrinsyx Technologies, to show this same beneficial relationship between microbes and agricultural plants, with crops given the beneficial microbes yielding more vegetables and responding better in dry, hot weather.

“Having microbes that can help plants establish early, grow fast and protect them from some of the stresses in their environment, especially drought, is a big deal,” said John Freeman, chief science officer at Intrinsyx who works with Sharon’s team at the University of Washington. “Using these endophytes in agricultural settings holds a lot of promise for growers and farmers,” he added.

The researchers suspect a number of factors are at work. Microbes enable plants to accumulate more nutrients like nitrogen and phosphorus. The microbes also help plants use water more efficiently, and even produce molecules that promote plant growth and help them stay green.

Gaining more root, stem and leaf mass also makes plants able to store more water.

“Endophytes are helping plants make more roots, so they have more surface area to hang onto water and survive the stress of drought longer,” Zareen said.

Next steps include better understanding exactly how microbes bolster plants, and finding the best strains to help different plants deal with various stresses.

“Finding the most beneficial ones for the job is the key in using this technology,” Zareen said in conclusion.

WORLD-LEADING FACILITY BOOSTS FRUIT FLY DEFENCE

South Australia's world-leading $3.8 million fruit fly facility was recently officially opened, providing a powerful new line of defence against one of horticulture's most damaging pests.

Agriculture Minister Leon Bignell opened the National Sterile Insect Technology (SIT) Centre in Port Augusta in late November.

The Centre will produce 50 million sterile male Queensland fruit flies each week. The flies will be released to mate with females, collapsing wild populations in fruit fly affected horticulture growing regions.

Fruit flies are the world's worst horticultural pest, destroying fruit and vegetables in commercial crops, home gardens and impacting trade access. The Queensland fruit fly, or Q-fly, is a major pest which attacks fruit and vegetable crops in Australia.

South Australia is the only mainland state to be declared fruit fly free with the State Government committing around $5 million each year to fight the threat of fruit fly.

The SIT facility is supported by SITplus, a national research and development effort, which now has a combined program budget of $45 million. Research undertaken at the SIT facility is a game-changer for the future management of Queensland fruit fly.

The SITPlus program is led by Horticulture Innovation Australia Ltd, in partnership with Primary Industries and Regions SA, South Australian Research and Development Institute, Victorian Department of Economic Development, Jobs, Transport and Resources, CSIRO, Plant and Food Research Australia, NSW Department of Primary Industries and Macquarie University – all with interconnected interests in the development and uptake of science solutions for the management of Q-fly.

Agriculture Minister, Leon Bignell, said "This new facility is putting us on the world map in Sterile Insect Technology. It is transforming the way Q-fly is managed around Australia and will help increase global confidence in South Australia's biosecurity, product integrity and food safety standards."

"The facility will reinforce South Australia's enviable status as the only mainland state in Australia which is fruit fly free. It will also help to reduce fruit fly populations in other major horticulture regions across Australia. It is a critical breakthrough for our horticulture industries and has the potential to mitigate Q-fly as a major pest problem and increase returns to growers," he went on to explain.

Horticulture Innovation Australia Chairman, Selwyn Snell, said "In the development of this vital centre, our researchers travelled to Austria, Spain, Israel, Guatemala, Mexico and the USA to investigate similar, leading operations. This facility combines all the best aspects of that research, making it one of the most progressive and advanced in the world."

"Queensland fruit fly is one of the leading pests which plagues the Australian horticulture industry. Each year, the pest is estimated to cost the industry more than $300 million in lost markets and through damaged produce both pre-and post-harvest," he added.

Selwyn concluded, "The new centre is not only a win for the nation's horticulture industry, it is also a win for consumers who stand to soon benefit from increased quality produce at markets and on shop shelves."

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CAN HARVEST WEED-SEED CONTROL WORK IN THE NORTH?

SPECIALIST WEEDS RESEARCHER DR MICHAEL WALSH BELIEVES NORTHERN GRAIN GROWERS WILL START TO TAKE UP HARVEST WEED-SEED CONTROL BECAUSE OF THE BENEFIT IT OFFERS IN RETAINING HERBICIDE EFFECTIVENESS.

Many northern grain growers have been "a little skeptical" about introducing harvest weed-seed control (HWSC) as another tool for combating herbicide resistance. Department of Agriculture and Fisheries (DAF) principal weed science researcher Dr Michael Widderick said few growers in Queensland or New South Wales incorporate HWSC into their management practices, but, like other leading researchers, he believes this will change.

"Many northern growers thought weed seeds were shed before harvest, so there was little point in using HWSC tactics," Dr Widderick said. But he added GRDC-supported research has found excellent seed retention at harvest of several key weed species in northern winter crops.

"Our work has found seed retention and the height of weed seeds in winter crops is well suited to HWSC. However, there are not as many opportunities in our summer crops," Dr Widderick said.

"But HWSC nationally has proved to reduce the weed seedbank and if we can make that work in the northern region it is a major positive for weed control in what is an increasing herbicide-resistant environment," he went on to explain.

The northern battle against herbicide resistance has been boosted this year with the arrival of former Western Australian-based weed specialist Michael Walsh.

Internationally recognised for his work in this field, Dr Walsh has moved from Perth, where he worked with the Australian Herbicide Resistance Initiative (AHRI) at the University of Western Australia.

His new role as director of weeds research at the University of Sydney was created with the GRDC in response to the escalating problem of herbicide resistance in the northern region.

Dr Walsh said weed control is easy when herbicides work, but when chemical resistance starts, an integrated approach incorporating herbicide and non-herbicide tools is critical.

The associate professor has been integral in developing HWSC processes, and says his research shows regardless of method (Harrington Seed Destructor, chaff cart behind the header, direct baling harvest residues or narrow windrow burning), the key is to capture and destroy weed seeds.

"Annual weeds such as ryegrass, wild radish, brome grass and wild oats have adapted to cropping systems, growing to similar heights as cereals and maturing at the same time as annual crops," Dr Walsh said.

"There is some weed-seed shedding at maturity, which may make some growers a little skeptical about how much seed is captured at harvest, but research shows a high percentage of total weed-seed production is retained on plants at a height that ensures collection during harvesting. We know at the start of harvest that high proportions of weed seeds are retained above a low harvest height (15 centimetres) for annual ryegrass (88 per cent), wild radish (99 per cent), brome grass (73 per cent), and wild oats (85 per cent), and by harvesting at this height these weed seeds are captured by the header and can be dealt with from there," he explained.

“Our work has found seed retention and the height of weed seeds in winter crops is well suited to HWSC. However, there are not as many opportunities in our summer crops.”

Dr Michael Widderick

Which northern weeds suit HWSC?

Dr Widderick said DAF research has shown some northern weeds are candidates for HWSC.

Definitely in – turnip weed and African turnip weed are potentially very good candidates for HWSC, although these species are not yet affected by resistance issues.

Definitely in (winter crops) – annual ryegrass and wild oats. “We know wild oats shed seed at about two per cent per day compared to ryegrass at one per cent a day, but there is still a good opportunity for HWSC at the start of harvest,” Dr Widderick said.

Possibly in (winter crops) – barnyard grass and feathertop Rhodes grass are known to shed their seed in summer crops, but where they germinate in spring in winter crops they may be suitable for HWSC.

Possibly in (summer crops) – feathertop Rhodes grass provides an opportunity for HWSC in summer crops where there is a high percentage of seed retention at the start of harvest.

Why HWSC in winter crops?

“Our research shows weeds in winter crops retain more of their seed at harvest than weeds in summer crops, like sorghum. There are a couple of reasons for this,” Dr Widderick said.

“Firstly, the growing conditions in summer allow for weeds such as barnyard grass and feathertop Rhodes grass to germinate with the crop, so by the time harvest comes around they have matured, set seed and these seeds then have the opportunity to shed. In contrast, sorghum is planted on wide rows (one metre) giving the weeds opportunity to grow with low levels of competition. This may reduce the height of the weeds at harvest,” he explained.

He said weeds such as barnyard grass and feathertop Rhodes grass need warm soil to germinate. These weeds can germinate in spring in winter crops and, as a result, may retain their seed at winter crop harvest.

How to start?

Dr Walsh said winter crops are the obvious starting point as seed retention is highest here. The national weeds survey found 15 per cent of northern region growers are already diverting the weed-bearing chaff fraction onto permanent wheel tracks in controlled-traffic farming (CTF) systems. Growers already practising CTF can do this at low cost.

“Narrow windrow burning in chickpea crops is the other easy place to make a start on HWSC,” he said. “Seed retention was excellent in chickpea crops and it is simple to burn chickpea windrows without burning the entire paddock. Burning cereal windrows is also possible, but more challenging given the higher yields and dry matter.”

NEW CANOLA HYBRID FOR NEXT SEASON ALREADY SPARKING INTEREST IN WA

Growers looking for a high yielding, adaptable canola variety that can perform across a range of conditions can choose an exciting new hybrid for season 2017. This new release from Nuseed is already garnering interest in Western Australia.

Nuseed GT-53 is expected to out perform current Roundup Ready® hybrid canola varieties, based on its trial results over the past two years.

According to Hugh Trenorden, Nuseed's Area Sales Manager for northern Western Australia, the new variety is all class, with an appealing tough streak.

"Nuseed GT-53 is a variety that can take full advantage of good seasons, while still being highly competitive if the going gets tough," Hugh said.

Nuseed GT-53 topped the National Variety Trials in Roundup Ready canola last year in Corrigin, Muresk and Dandaragan, where the crops suffered from severe heat events from mid to late September.

It also yielded at or above the mean yield in all the other NVT sites featuring Roundup Ready canola across Western Australia last season. Nuseed GT-53 yielded as much as 3.43 t/ha at Gibson, near Esperance.

The new variety has been tested extensively in Nuseed trials, National Variety Trials and on-farm demonstrations.

"We've ramped up our testing again this year with small plot NVT trials, Nuseed trials, grower groups and in our farmer scale Crop Agronomy Trial program," Hugh said.

"We're excited to see how it performs this season," he added.

Nuseed's national Crop Agronomy Trial (CAT) program gives growers the opportunity to see how new hybrids perform in their growing conditions before they are commercially released.

One of the farmers growing a strip of Nuseed GT-53 this season is Tristan Stanich from Northampton. He's comparing it side by side with his usual Roundup Ready hybrid.

"I've been pretty impressed with the appearance of the Nuseed GT-53 all year," Tristan said.

"It looks like it's going to have a real fit for early sowing in our environment," he added.

Tristan is keen to see if yields match his expectations so he can fit GT-53 on his farm for season 2017.

Hugh said he's seen a lot of the crop across Western Australia this year and is impressed by how well it has responded to early sowing.

"It's a good looking hybrid with good early vigour and a dark green leaf colour that lets you know it's healthy and growing at a glance," he said.

Nuseed GT-53 is rated 'R' for blackleg resistance and has been classified with a unique Blackleg resistance pattern.

"I'd recommend Nuseed GT-53 for its performance and potential profitability across all regions in anything from an average to a favourable season, while I wouldn't write it off if conditions were tough in spring," Hugh said.

"Our canola varieties, like Nuseed GT-53, are bred in Australia for Australian conditions and we are continuing to develop new, improved varieties to meet the needs of local growers in years to come," he added in conclusion.

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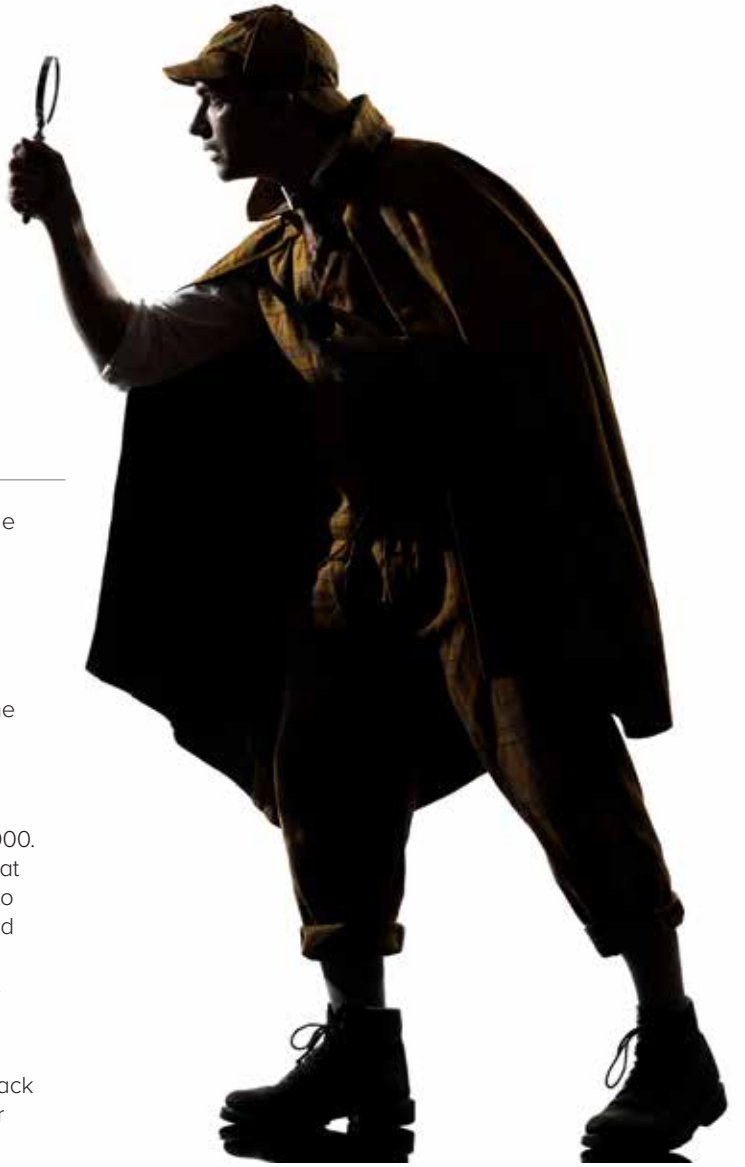
60 YEAR OLD SEPTORIA MYSTERY SOLVED

A NEW PAPER FROM SCIENTISTS AT THE JOHN INNES CENTRE IN NORWICH IN THE UNITED KINGDOM EXPLAINS WHY PLANT BREEDERS HAVE FOUND IT DIFFICULT TO PRODUCE WHEAT VARIETIES WHICH COMBINE HIGH YIELD AND GOOD RESISTANCE TO SEPTORIA, A DISEASE IN WHEAT WHICH CAN CUT YIELD LOSSES BY UP TO 50%. IT TRACES THE PROBLEM BACK TO DECISIONS MADE NEARLY SIXTY YEARS AGO.



Septoria is the most destructive disease affecting wheat in the United Kingdom, also having serious impacts in other wheat growing regions of the world. As the fungus has become insensitive to most fungicides, demand for new Septoria resistant wheat varieties has risen sharply.

Septoria emerged as a serious threat to wheat in the 1970s. Since then, progress in breeding new varieties which combine high yield with resistance to Septoria has been slow.

Professor James Brown and his colleague Dr Lia Arraiano analysed resistance and susceptibility to Septoria in wheat varieties grown in the United Kingdom between 1860 and 2000. Using a technique called association genetics, they found that the gene with the biggest effect on increasing susceptibility to Septoria is very closely linked to one that increases yield and grain size.

Professor Brown explained, “As we studied a historical set of varieties covering more than a century of wheat breeding, we discovered where the small region of the genome that increases both Septoria and yield came from. We traced it back to a variety called Heines Peko, which was used to breed for yield and rust resistance in the late 1950s.”

“It’s surprising,” he added, “that a decision made so long ago has had such a long-lasting effect.”

Professor James Brown

Heines Peko was crossed with Cappelle Desprez, the major wheat variety in Britain at the time. This cross was so influential that all modern wheats bred in Britain are descended from it. Professor Brown suggests that as wheat breeders selected ever more strongly for higher yield, susceptibility to Septoria hitch-hiked along with it.

“My group is now trying to find out if the connection between the two traits can be broken” he added.

Breeders appreciate that increased yield is the main driver of the market for new varieties. Professor Brown points out that although Septoria resistance has improved in recommended varieties over the last ten years, the lack of knowledge about the relationship between yield and susceptibility to Septoria has hindered progress.

“It’s surprising,” he added, “that a decision made so long ago has had such a long-lasting effect.”

Ed Flatman, Head of European Wheat Breeding at Limagrain said, “Professor Brown and Dr Arraiano’s work was one of the very first applications of association genetics in wheat and it has helped us to understand the past history of breeding for resistance to Septoria. We have now taken James’ results and built on them by identifying novel Septoria resistances in current, high yielding elite varieties.”

Dr Arraiano and Professor Brown’s research points to a way of rising to the challenge of combining yield and Septoria resistance. They found ten other genes scattered throughout the genome with smaller effects on Septoria. They also found that nearly half the variation in Septoria was controlled by genes with effects that were too small to identify individually. “We know the genes are there,” said Professor Brown, “but we don’t know where they are.”

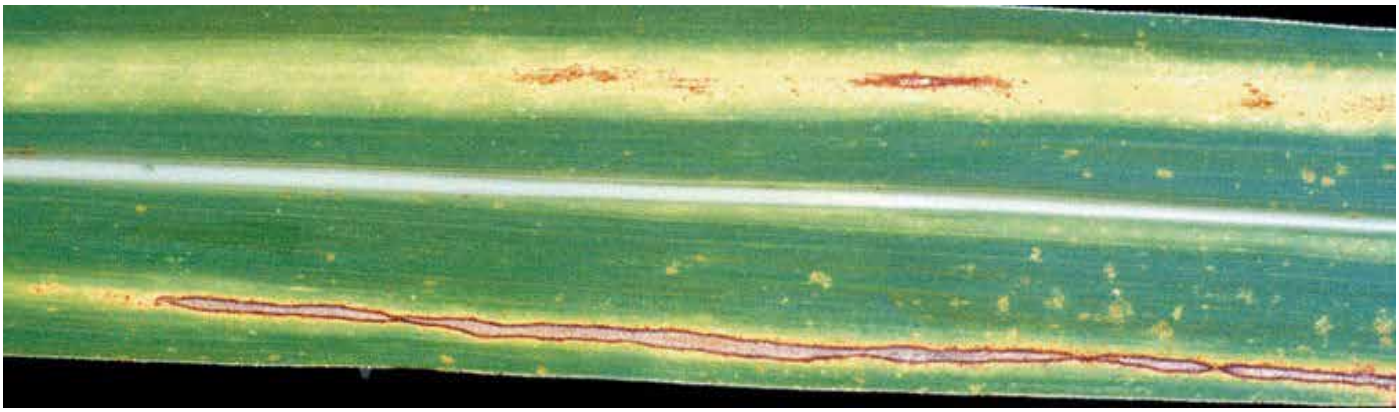
Professor Brown is confident that breeders can make durable advances in Septoria resistance with this knowledge. “When breeders make crosses between diverse varieties, they produce new combinations of genes with small effects,” he explains. “Then if they run field trials at sites where Septoria is really rampant, they can spot the most resistant lines to commercialise and to use in the next generation of breeding,” he explained.

He believes this approach will enable breeders to improve Septoria resistance, while minimising undesirable side-effects, such as reductions in yield.

Professor Brown said, “With the pressures of restrictions on pesticide use added to Septoria becoming insensitive to most fungicides, farmers need varieties which combine yield and quality with resistance to Septoria and other diseases. Our breakthrough should accelerate progress in developing these new varieties.”

NEW AUSTRALIAN RESEARCH CRACKS THE MYSTERY ON CHLOROTIC STREAK DISEASE

RESEARCHERS AT SUGAR RESEARCH AUSTRALIA (SRA) HAVE MADE A MAJOR BREAKTHROUGH IN DETERMINING THE CAUSE OF A SUGARCANE DISEASE THAT HAS REMAINED A MYSTERY FOR 87 YEARS.



Chlorotic Streak Disease (CSD) was first recognised in 1929, and since then there has been research effort from around the world to determine the cause of the disease, how it is spread, and how to manage it.

In a major breakthrough, SRA researchers Dr Kathy Braithwaite, Dr Chuong Ngo and Barry Croft have recently used modern DNA technology and traditional pathology to identify a new type of organism that causes CSD, isolating a microscopic organism that is a type of protozoan.

CSD is a serious and widespread disease of sugarcane. In the worst cases, yield losses can be as much as 40 percent and it has been estimated to cause an annual loss to the sugarcane industry of $8 million to $10 million. Because it is transmitted via water, its impact is worst in wet growing districts of the Australian industry.

SRA Biosecurity Manager, Barry Croft, said it was an important discovery for the Australian sugarcane industry.

"Understanding the cause of a disease is crucial to developing control and management strategies for that disease," Barry said.

"By SRA identifying the protozoan that causes CSD, we hope this leads to better management options and information, which will lead to benefits for sugarcane growers and millers. For example, SRA already gives all of its varieties a rating for resistance to diseases, including CSD. That information is crucial for growers when they choose what variety to plant according to the conditions on their farm. The discovery of this organism has opened up more reliable ways to screen the varieties for resistance to CSD," he explained.

SRA has also developed a technique to diagnose whether sugarcane is infected with CSD, and is working with productivity service organisations to ensure this technique is useful and practical.

"Because CSD can spread so easily, proper use of a diagnostic test for CSD could reduce the spread of CSD via planting material, for example," said Barry.

"Now that we know what the organism is, we also may be able to develop more targeted control methods," he added.

Sugarcane grower Ray Zamora's farms are in one of the highest rainfall areas of the Australian sugarcane industry at Tully, meaning he has faced significant yield losses from CSD in the past when there have been particularly wet years.

He welcomed the news that SRA researchers had discovered the organism that causes CSD.

"Managing CSD is something that I could change on my farm if there was improved information. If I had better resistance information for sugarcane varieties I could avoid planting susceptible varieties in the low lying parts of my farm, so this discovery is welcome news," Ray said.

This research activity has been jointly funded by SRA and the Queensland Department of Agriculture and Fisheries.

"Understanding the cause of a disease is crucial to developing control and management strategies for that disease."

Barry Croft

REACHING BACK THROUGH CENTURIES OF CULTIVATION TO TRACK HOW CORN ADAPTED TO DIFFERENT ELEVATIONS AND ENVIRONMENTS.

An Iowa State University scientist is attempting to peel back centuries of adaptations in corn to gain a better understanding of how the plant adjusted to the diverse environments and elevations of the Americas.

Matthew Hufford, an assistant professor of ecology, evolution and organismal biology, said learning how corn adapted to grow beyond the environment of its origins in Mexico could yield clues to help plant breeders produce better performing crops.

Hufford is a co-principal investigator on the project, which also includes personnel at the University of California at Davis, the University of Missouri and the National Laboratory of Genomics for Biodiversity in Irapuato, Mexico.

Corn originated roughly 10,000 years ago in the warm lowlands of southwest Mexico. In a relatively short time, the plant adapted to grow throughout the Americas in higher elevations and in different climates. But the genetic mechanisms that allowed for those adaptations to develop remain murky to scientists, Hufford said.

“With this project, we hope to identify good candidates for genes that played key roles in helping maize adapt,” he said.

“You could use that new knowledge to design corn to deal with the environmental challenges of today, like climate change and other stresses,” he went on to add.

Comparing corn varieties adapted to low elevations with those adapted to high elevations reveals some striking differences, Hufford said. For instance, highland corn stems are a darker colour and grow filamentous macro hairs to insulate the plant from cooler temperatures and higher ultraviolet radiation at high elevations.

The research team will cross highland and lowland corn varieties and study the genetics of both the parents and offspring. Hufford’s laboratory will construct de novo assemblies, or highly detailed series of correctly ordered gene sequences, of the parent varieties.

Corn has adapted to a remarkable range of environments, Hufford said, making it a particularly useful species to study for plant adaptation.

Corn is grown on multiple continents at elevations ranging from near sea level to elevations near 13,000 feet.

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WESTERN VICTORIAN DAIRY REAPS BENEFITS OF FIRST CORN SEASON

The 2014-15 summer marked the first time western Victorian dairy farmer Karl Britt had grown corn. The crop gained favour at their family-run Inglenook Dairy in Dunnstown, east of Ballarat, after a dry spring stunted hay production.

“We had a poor spring with little rainfall, so the lucerne and pasture weren’t going to cut it,” Karl said.

Typically, the 250 Holstein-Friesian herd is fed a mixture of lucerne, annual pasture (ryegrass/clover mix), canola meal, ryegrass and wheat. It is irrigated through a 40-megalitre allocation and available as baled hay or through a mixer wagon.

In the absence of hay, Karl planted seven hectares of a quick, dual-purpose hybrid in early November, which proved to have a high yield for a short maturity (102CRM) when he chopped it for pit silage in late March.

“I was looking for a high quality, high bulk feed to store for winter feeding, and that’s when I decided on corn,” he said.

The crop of PAC 301 averaged 21t/ha of dry matter, and in a feed test, recorded 30.6 for starch, 11.1 for ME content (MJ/kg dry matter) and 8.3 for crude protein.

“We didn’t have any expectations as it was our first time growing corn, but it was a really good fit for us. I was really happy with the yield, quality and starch levels,” Karl said.

Karl also said the home-grown feed also had a number of cost-saving benefits.

“The value of growing the corn ourselves goes a lot further than buying in a load of hay,” he added.

Karl and fiancé Laiken, along with sister Rachael Peterken and her husband Troy, and parents Basil and Shelia, grow their own feed, produce, process and bottle the milk on site, and market the Inglenook brand to cafes, restaurants and retailers around the state.

Karl and Shelia milk the cows twice a day at 6am and 4pm, with production up to 10,000 litres per cow, per lactation (300 days).

Worker Rick Glenane, left, and Karl Britt, Inglenook Dairy, Dunnstown, planted PAC 301 for their first ever corn crop.

NATIONAL RELEASE OF NEW EARLY WARNING APP

The Grains Research and Development Corporation (GRDC) will celebrate the national release of its digital disease, pest and weed early warning and surveillance system – GrowNotes Alert – at the Birchip Cropping Group Main Field Day today.

GrowNotes Alert has been rolled out in recent months to notify subscribers about the Russian wheat aphid (RWA) biosecurity alert, as well as blackleg and sclerotinia in canola, ascochyta of chickpea, and foliar rust pressure on wheat and barley.

These early warnings have resulted in growers actively looking for these diseases and pests in their crops, enabling them to act quickly to contain their spread.

Development of the system was led by Agriculture Victoria project leader Chris Pittock, who said there was now increased demand for the service.

“Over 4000 people saw our sclerotinia alert, with most hits coming from the Northern region – and a large number of those visitors clicked through for further information," Dr Pittock said.

“Critically, the system is two-way, allowing growers to upload photos on the spot, feeding relevant and immediate information back to our extensive range of experts across Australia.”

GrowNotes Alert builds on the existing success of GRDC GrowNotes, which contains a wide body of national expertise in one place, as well as numerous resources, including eXtensionAUS, CropSafe, CropPro, PestFacts, PestFax and Plant Health Australia, to name a few.

GrowNotes Alert directs users to available, up-to-date information regarding an identified issue and delivers notifications at a critical time to ensure immediate action can be taken.

Subscribers can choose to receive that information as push notifications to their smart phones, tablets or computers as an SMS and/or email, or by logging into the GrowNotes Alert subscriber website portal.

Twitter handles @GNAlertNorth @GNAlertSouth and @ GNAlertWest can also be followed.

“Sign up now and you will receive a free super macro lens which can be attached to your phone or tablet – this will literally help users to get a clear, and close up, picture of any crop concerns and make it easy to submit to our experts for identification of emerging issues,” Dr Pittock said.

The free Apple (iOS) app is also available to download now, with an Android version almost store-ready.

If you are yet to subscribe to GrowNotes Alert then act now to reap the rewards of these emerging technologies in agriculture.

Growers, agronomists and grains industry personnel should subscribe now by visiting www.grdc.com.au/grownotesalert and following the prompts to personalise your private subscription.

TARGETING 100% WEED CONTROL IN STUBBLES

In many growing areas this year crop stubbles will be thicker than average.

In stubbles, spray coverage is often compromised due to interception of the spray droplets by the standing stubble. To ensure the highest possible weed control in these situations growers need to be attentive to every detail of the spray application.

There are many factors to consider to achieve effective weed control into stubble situations, but almost all of them can be managed. The three keys to success are herbicide formulation and application rate, sprayer set-up, and sprayer operation.

Herbicide application timing and rate often becomes a balance between spraying small weeds at lower rates or large weeds with robust rates.

Darren Thomas, Marketing Manager at Sinochem Australia, said, "Very small grass weeds will always be difficult to control in thick stubbles and require high product rates and water volumes. Alternatively, delaying control until weeds are larger results in loss of moisture and nutrients."

Even when timing and product rates are taken into consideration, applying an herbicide under sub-optimal conditions can result in reduced efficacy.

"It's in tougher situations, like crop stubbles, that choosing a high performance product matters," Darren added.

The superior and proven formulation of Roundup Ultra MAX, with its unique and proprietary inbuilt surfactant technology, provides additional control under more challenging conditions.

Maximising coverage with correct sprayer setup and operation is also critical to achieving effective weed control. Ideally, sprayer height should operate at 50 cm above the target weeds or the top of false targets (i.e. stubble) and travel speed should be limited to no greater than 25 km/hr.

Travelling at higher working speeds should be avoided, as it not only reduces the amount of droplets retained on targets, but also results in increased dust in wheel tracks and losses to the environment, leading to poor efficacy.

Sinochem is focused on assisting growers to improve weed control so they can achieve better outcomes in the short and long-term.

Getting spray application right will give growers the greatest chance of reaching 100% weed control leading to cleaner crops, less herbicide resistance and higher yield potential.

"This figure shows the effect of faster working speeds of retained droplets on water sensitive paper. The Pulse Width Modulation system allows speed change at a constant pressure and no change in spray quality so the observed effect is purely due to speed effect."

Bill Campbell, Farmanco.

IMPROVED PHS TOLERANCE IN COMMERCIAL, MILLING CLASS, WHITE WHEAT

With good rainfall this season, Australia's wheat crop is set for an exceptional year. However, if rainfall continues during grain ripening and harvest, it could have devastating effects and significantly reduce growers' returns due to pre-harvest sprouting (PHS).

PHS occurs with prolonged rainfall, high humidity and/or low drying conditions when the grain is harvest ripe.

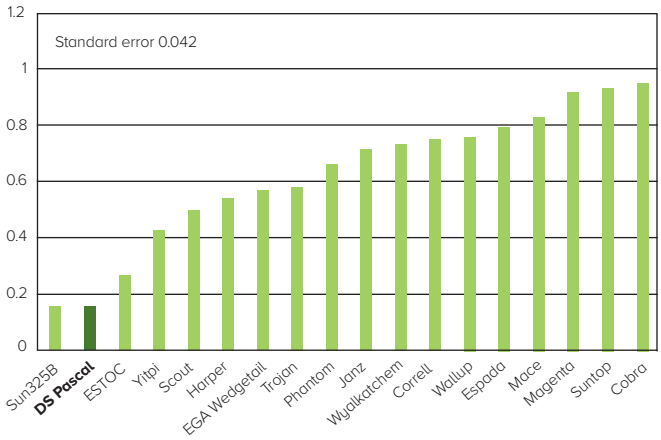
PHS in wheat is where germination begins within the spike before harvest (Fig. 1). During germination, enzymes begin to break down starch, which reduces applications for which the flour is useful.

2010 was the last widespread 'wet harvest', with GRDC estimating losses of approximately $100 million due to PHS, but there are localised losses due to PHS every year, with individual farmers losing 20-40% of their profit.

To date, Australian white-grained wheats demonstrate low PHS tolerance, resulting in widespread economic loses to the entire supply chain each year.

Fig. 1 presents data from a GRDC project with the University of Adelaide. Yitpi is considered the benchmark commercial variety for PHS tolerance, and based on GI data is rated moderately dormant. Breeding line SUN325B is typically considered dormant, and has been a donor by some wheat breeders to improve PHS tolerance. These data highlight the market-leading PHS tolerance of DS Pascal, with a GI value the same as SUN325B, and statistically lower than Yitpi.

Figure 1. Germination index



As falling number is the industry method for assessing PHS at depots, Fig. 2 presents falling number data varieties of similar maturity. Each site encountered rain at maturity, which resulted in a delayed harvest.

The falling number of DS Pascal allowed the variety to avoid downgrades in both trials, whilst Chara was downgraded to feed status on both occasions. Sunvale was downgraded to feed once, whilst Sunvale and EGA Wedgetail would not have been eligible for APH grade once as falling number was <350.

The release of DS Pascal in 2016 provides growers with a new benchmark for PHS tolerance across southern Australia. DS Pascal should be sown early for optimal results across medium to high yield potential areas across southern Australia.

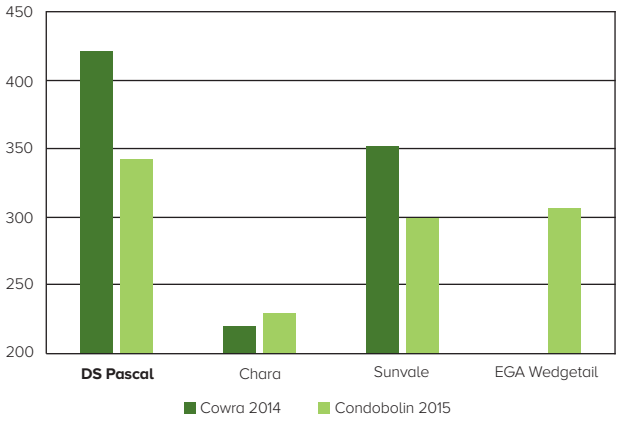
DS Pascal is classified Australian Premium White (APW) for southern New South Wales, Victoria and South Australia. An APW application in Western Australia will soon be submitted.

It is outstanding under irrigation, with excellent standability and harvestability. DS Pascal has a robust rust and disease package, including YLS (MRMS), and has lower screenings compared with other early sown varieties.

“2010 was the last widespread ‘wet harvest’, with GRDC estimating losses of approximately $100 million”

Al Rattey

Figure 2. Fallen numbers



In northern Australia, Dow Seeds are excited about the outputs of a collaboration with the University of Queensland aimed at improving PHS tolerance.

DS Faraday will bring together high yield, APH grain quality and triple rust resistance combined with high levels of PHS tolerance. Germination index studies determined a GI for DS Faraday of 0.3, whilst EGA Gregory is 0.7. This level of tolerance should see a marked change in the ability of a northern variety to resist downgrades due to adverse weather at harvest. DS Faraday has a similar maturity and plant type to EGA Gregory, is suited to a wide range of sowing dates and variable locations, and is currently in NVTs throughout Queensland and New South Wales.

As a result of targeted breeding efforts, Dow Seeds have a robust suite of alleles from DS Pascal and DS Faraday that underpin superior PHS tolerance, combined with higher levels of yield, disease resistance and sound grain quality. Continued breeding and genomic efforts will build on these successes.

NEW TALL FESCUES OFFER HIGHER YIELDS, BETTER QUALITY AND PERSISTENCE

Yield, quality and persistence – three traits Australian pasture producers want with all forage varieties they grow. This important trio of traits is striking a chord with producers across the country who are using high performance new varieties and seeing a difference not only in the paddock, but in the vat, in the yards and over the hooks.

Seed Force is focussed on delivering forages into the Australian market that are thoroughly tested for yield, quality and persistence.

Two new forage tall fescues are not only topping replicated three year yield trials around Australia but delivering greater quality feed and good persistence without reliance on endophyte. Both SF Finesse-Q and SF RoyalQ-100 are nil endophyte tall fescues bred in Europe and South America respectively and thoroughly tested in a range of Australian environments.

Already, these new varieties are making positive impressions and impacts in farm systems around the country.

David Galpin from Penola is South Australia said, “I have always liked fescue but the old fescues were a bit like cardboard. They grow and persist well, but the cattle won’t graze them until they absolutely have to, and because they are so fibrous it takes more energy to digest them than the stock can get out of the plant.”

“Finesse-Q is just so palatable, and it grows all year round. We are only in our second grazing season but if it keeps persisting like it has so far, it’s a pretty impressive plant,” David added.

Gerard Stephen from Armidale in New South Wales said, “In the past, tall fescues have persisted but have not been able to give the weight gains that were needed to improve profitability. The arrival of these new varieties has been able to give us palatability, performance and persistence under our tough New England conditions.”

“Finesse-Q has fitted well into our pasture requirements because it seems to perform well both on heavy and lighter country. This has meant that our stock have been able to gain weight for longer periods of time, which has led to an improvement in our bottom line,” he explained.

“As well as heavier carcases, it helps us produce more lambs as result of better ewe nutrition in late pregnancy. Plus we’re getting more heifers going back into calf after calving for the first time,” Gerard added.

Chris and Heather White are from Finley in New South Wales. They have found SF Finesse-Q tall fescue is a lot more water tolerant than perennial ryegrass or annuals.

Chris said, “If you don’t water it, it won’t die straight away. Even if you never get as much water on it as you want, you still get feed off it.”

“The secret is that the pasture has to be good quality. Cows can only eat so much, so the better the quality the more megajoules of energy and the more milk. In the summer, we give them fescue at night and lucerne during the day because it’s safer, and during the rest of the year we give them fescue during the day and ryegrass at night. We are finding in the spring that the fescue provides slightly higher neutral detergent fibre and it helps the cows ruminate,” he explained in detail.

Seed Force has developed a patented Animal Performance Calculator™ to ensure that the varieties that are released will provide economic benefits to growers, not just agronomic traits. Table 1 summarises how well the new Seed Force tall fescues performed during trials.

Table 1. Pasture Performance Regional Trial Data Summary – relative to Quantum II MaxP = 100%

Tall fescue EBV's	Autumn	Winter	Spring	Summer	Total	Mean yield *kg DM/ha*	ME *MJ/kg DM*	CP %	NDF %
SF RoyalQ-100	**110**	**112**	**119**	**112**	**109**	**8,018**	**9.9**	**14.2**	**54.4**
SF Finesse-Q	**101**	**99**	**103**	**107**	**102**	**7,503**	**10.4**	**16.1**	**51.8**
Quantum II MaxP	100	100	100	101	100	**7,356**	9.5	13.7	56.8
Hummer MaxP	100	107	96	102	100	7,356	nd	nd	nd
Advance MaxP	91	95	94	101	95	6,988	10.4	15.6	51.6
Dovey	83	96	97	75	91	6,707	nd	nd	nd
Festival	87	89	91	97	91	6,694	10.0	15.1	54.6
Demeter	87	81	83	91	86	6,326	9.9	14.8	54.4
Martin 2	77	88	86	84	83	6,105	nd	nd	nd
Jesup	79	110	79	71	81	5,958	nd	nd	nd

* Mean of up to 7 sites – Gundagai 2006, Armidale & Whorouly 2010, Eurongilly and Tenterfield 2011, Warrnambool 2012 and Gloucester 2013.
* Feed Analysis based on mean of five grazings across a full growing season at Tenterfield NSW.
* Testing undertaken by NSW DPI Feed Quality Service Wagga Wagga; nd means no feed quality data is available.

Managing tall fescue for best results

Mike Gout is Director for Business Development at Seed Force. He said that as can be seen from feed quality results of mono-culture feed tests the NDF% of tall fescue is well above the 35% level for optimum rumen function.

He outlined that tall fescue pastures should ideally be a good mix of grass, legume and where possible forage herbs such as chicory and plantain. Legumes and herbs have higher ME (11-13 MJ/kg DM) and lower NDF% (18-25%). This can enable the total sward to have NDF % closer to 35% for increased intake and higher ME for greater energy available above maintenance requirements to drive greater meat of milk production.

"Trial work at Merrina Gundagai highlighted the fact that tall fescue/white clover based pastures managed well were able to maintain legume content of 35% compared to perennial ryegrass/white clover pastures with less than 15%. This is supported by cattle grazing these mixed sward pastures that are able to achieve live-weight gains of 1.0-1.5kg/hd/day when the pasture is well managed, but when feed gets away from stock live-weight gain declines as does clover content," Mike explained.

He added that if feed gets away, it is advisable to either mechanically top or cut for hay/silage and get the paddock short and open to maintain both fescue quality and clover/herb composition in the sward.

Dairy grazing management

When grazing tall fescue for milk production it is important to keep it short and dense with low NDF% and to maintain an open sward for good legume and chicory content. We do not recommend plantain for milk production.

This is best achieved by grazing at 2,000kgDM/ha down to 1,000kgDM/ha residual.

This will require good management of rotation length – from 21-28 days during the cooler months down to 10-12 days over the summer irrigation period. Longer rotations will adversely impact milk production.

It is best fertilised with continued low rates of Urea during summer, usually applied 3-4 days ahead of grazing, followed by irrigation immediately post-grazing. Autumn top-dressing with higher rates can be undertaken when rotation is lengthened.

When your fescue pasture starts to run to head (early to mid-October), mechanically top or cut it for hay or silage to bring it back to vegetative growth.

It should not become reproductive again until the following spring if grazed correctly

Mike believes the key issue is to start with the best tall fescue variety as the base for the pasture based on yield, quality and persistence.

Seed Force recommends different combinations best designed to meet the needs of the area and operation.

Northern NSW – sheep/ beef pastures

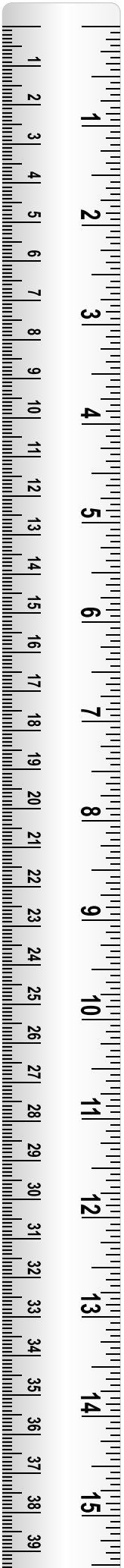
15kg/ha RoyalQ-100/SF Finesse-Q; 2kg/ha Rossi red clover; 1kg/ha Quest white clover; 1 kg/ha Endurance plantain; 1kg/ha SF Punter chicory

Irrigated dairy pastures – SF Finesse-Q

25kg/ha SF Finesse-Q; 2kg/ha Irrigation white clover; 1.5kg/ha Quest white clover; 1.5kg/ha SF Punter chicory

Southern VIC/SA/Tasmania – lamb finishing pastures

15kg/ha SF Finesse-Q; 2kg/ha SF Rosabrook + 2kg/ha SF Narrikup sub-clover; 1kg/ha Quest white clover; 1 kg/ha Endurance plantain; 1kg/ha SF Punter chicory



NEW METHOD PROVIDES A TOOL TO DEVELOP NEMATODE RESISTANT SOYBEAN VARIETIES

Many soybean varieties have a naturally occurring genetic resistance to the soybean cyst nematode, a major pest affecting the crop. The number of copies of the resistance gene varies among cultivars. A new method, developed by University of Illinois researchers in the United States, is able to efficiently quantify this variation for the first time. The new method has been tested in greenhouse trials to show that the more copies of the gene, the greater the resistance to soybean cyst nematode. Breeders can use this method to develop new soybean varieties with greater and more reliable resistance.

Soybean cyst nematode is the number one soybean pest worldwide, accounting for estimated annual losses of nearly $1.3 billion in the United States. Some soybean varieties have resistance to the tiny parasitic worms through conventional breeding of naturally occurring resistance genes, but the current level of resistance is becoming less reliable.

“Our interest is in finding new sources of resistance, because the sources that people have been using are breaking down. Nematodes are becoming better at overcoming the resistance we have in current cultivars. We are also, interested in improving our understanding of how this resistance works so we can do a better job of selecting for it,” said University of Illinois plant breeder, Brian Diers.

In 2012, University of Illinois geneticist Matthew Hudson, Brian Diers, and Andrew Bent, a collaborator at the University of Wisconsin, discovered the naturally occurring genetic locus (region on a chromosome) that is critical in controlling resistance to soybean cyst nematode, but that was only the beginning.

“It turns out that at this locus, there’s a repeat of four genes,” Brian explained. “Different diverse soybean types that are resistant have different numbers of repeats. For example, in PI 88788, which is the original source of SCN resistance for most soybean varieties in the Midwest, there are nine repeats of those four genes. In the susceptible varieties, there’s only one copy of those four genes. Another source of resistance, Peking, has three copies of those repeats.”

This difference in repeat number is known as copy number variation, and is more common than previously thought. But before now, there was no easy or cost-effective way to quantify the number of gene repeats. Using a method recently developed in Matthew Hudson’s laboratory, the number of gene repeats can be accurately monitored by measuring the ratio between two genes.

Although the researchers suspected that having more copies of the gene sequence might confer a greater degree of resistance, they had no way of testing their suspicions before the new assay was developed. After getting the new assay, the team set to work again.

“We grew soybean plants in a greenhouse, inoculated them with nematodes, and then used the assay to determine how many repeats each plant had. As predicted, we found that the more repeats a plant had, the more resistant it was,” Brian explained. “This proved that the number of repeats is important.”

Armed with this information, the researchers plan to look at the number of repeats present in existing nematode-resistant soybean varieties in an attempt to explain why some display better resistance than others in field settings. They also plan to improve breeding programs by ensuring parental lines have the maximum number of repeats available in a given genotype, and to select for new variants with additional copies that may show superior resistance.

“Ultimately, if we can select for more copies, that could benefit farmers because we could get stronger resistance. Breeders will now have better tools to select for and verify resistance,” Brian concluded.

UNIQUE PRE-PLANT PATTERNS EXPAND

As every grower knows, getting a crop off to the best possible start with less crop competition at establishment is one of the best ways to increase yield potential. Add greater flexibility in farm system management, and growers have another tool to help grow a healthy crop, maximising yield potential.

Crop Care' Sentry herbicide is registered for post emergent use in imidazolinone herbicide tolerant wheat (single gene) and canola. With Sentry's unique registration pre-plant incorporated by sowing (IBS) in imidazolinone herbicide tolerant barley (Scope CL and NEW Spartacus CL) wheat (single gene) and imidazolinone herbicide tolerant canola, growers are set to experience significant yield benefits .

Containing 525g/kg imazapic and 175g/kg imazapyr, Sentry's unique pre-plant (IBS) use pattern provides earlier control of key grass and broadleaf weeds than other registered imidazolinone herbicides. This allows the crop to establish free from weeds competing for soil moisture and nutrition, enhancing yield potential.

Rob Walker, National Product Manager at Crop Care, said Sentry also offers robust knockdown and residual weed control in one pass.

Rob explained that "Compatibility with other key pre-emergent herbicides such as trifluralin and triallate enables the convenience of tank mixes to control problem weeds such as annual ryegrass, phalaris spp. and wireweed. Compatibility with knockdown herbicides such as Gladiator Optimax or Shirquat 250 also enables control of emerged weeds with the one pre-plant application."

"For post emergent application to canola, Sentry can be tank mixed with Factor WG or Havoc for broader spectrum control of emerged grass weeds," he also explained.

It is this ability to use Sentry either pre and post emergence that gives growers a greater flexibility in their farm management system.

Rob said "Sentry is registered pre-plant, incorporated by sowing (IBS), in imidazolinone herbicide tolerant barley and canola at 40-50g/ha, and imidazolinone herbicide tolerant wheat (single gene) at 40g/ha, with further development well underway."

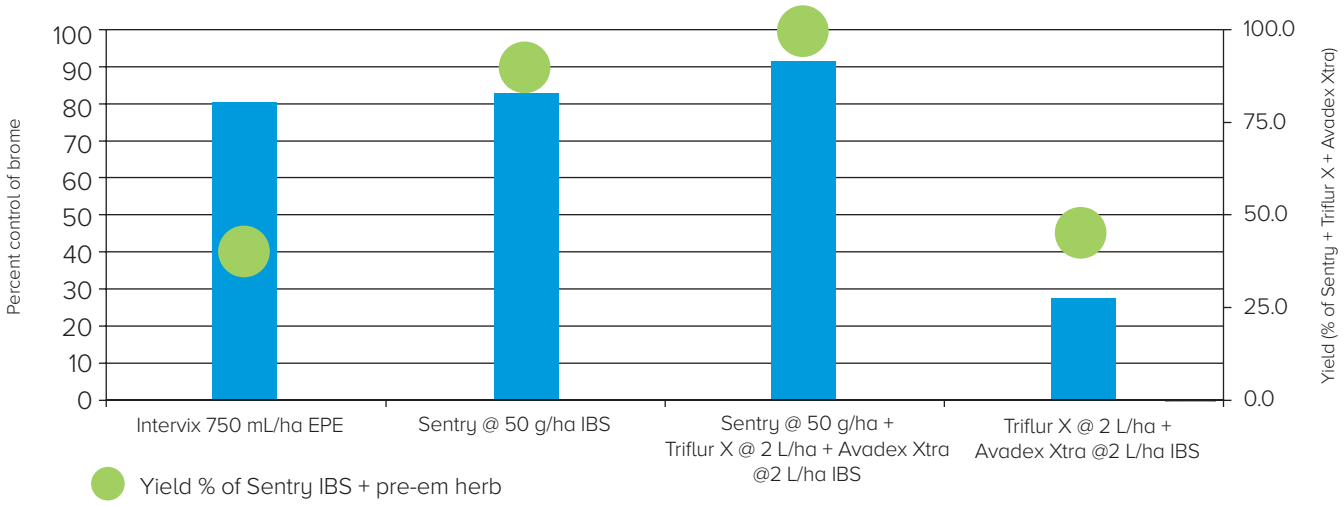
"Sentry is registered post-emergent in imidazolinone herbicide tolerant canola at 20 or 40 or 55g/ha, and imidazolinone herbicide tolerant wheat (single gene only) at 20 or 40g/ha," he added.

Sentry offers effective knockdown and residual control of many annual grass and broad leaved weeds in one pass. It provides excellent activity against brome and barley grass, as shown in Figure 1.

"Years or research and development have resulted in the registration of this unique use pattern, exclusive to Sentry. "The response to the pre-plant (IBS) use pattern has been extremely positive from consultants and growers, providing greater flexibility to target grass and broadleaf weeds, and resulting in significant yield benefits compared with post emergent imidazolinone herbicide applications" said Rob in conclusion.

Figure 1: CONTROL OF RIGID BROME IN SCOPE CL

67 days post treatment. KA12-168, Corrigin WA



INNOVATIVE IMPROVEMENTS TO ONLINE GRAIN TRADING

Online grain trading will be simpler, more secure and more competitive to users of the online grain trading platform igrain under a partnership agreement with NZX Ltd, which owns Profarmer Australia. The partnership agreement will see some of Profarmer's market leading technology, including the grain exchange NZX operates, rolled out across the igrain platform.

One of the key benefits of the new technology is automatic matching of bids to offers, which will simplify the transaction process.

"Sellers currently set an indicative price, and they then need to approve sales when bids come in. Through this partnership we're able to offer growers the alternative option of a streamlined sales process where a bid is automatically accepted when the right price is offered," explained igrain managing director Tom Roberts.

"It's a quicker, lower-touch approach which means growers will see money in the bank in a shorter time, up to several weeks sooner in some cases," he added.

Inbuilt payment security means sellers can be confident they'll be paid for their grain, which will help open up the online grain trading space to new buyers who may not have a track record in direct grower transactions.

"The system enables settlement within seven days and the grower retains title to the grain until payment is made, so it's a very straightforward and secure way to sell. We also provide insurance for sellers marketing grain ex-farm or into delivered markets. We try to eliminate as much risk for the grower as possible," Tom said.

Profarmer Australia's general manager Nathan Cattle said the partnership will make it easier for buyers and sellers to connect directly, creating a more transparent market and ultimately a more vibrant online grain trading environment.

"We're enabling growers to put up a parcel of grain at a price they want in an open market, so they'll have access to more potential buyers. And it's good for buyers too because it will be easier for them to search for and buy grain direct from the grower," Nathan said.

"A robust online market place creates more competition to purchase grain at the farmgate, resulting in increased price transparency and ultimately better returns for growers," he added.

Growers will also have access to Profarmer's market insights from within the igrain platform, including bid, offer and trade data, so it will be easier for them to work out the best time to sell and to set the appropriate price for their business.

Tom said the partnership is exciting news for the Australian grain industry. "igrain is already well known for our great customer relationships and service. Through this partnership we're able to focus even more on our customers while enhancing our technical offering to make online trading a safer, more viable and lucrative option for more growers," he concluded.

Dow AgroSciences

Dow Seeds™

DS DARWIN

- High yielding early-mid season wheat variety
- AH Classification for southern NSW, Vic and SA
- Strong grain package: low screenings, black point tolerance, large grain size
- Solid rust package
- Adapts maturity to the season
- Excellent harvestability

DS PASCAL

- High yielding early season wheat variety
- APW Classification for southern NSW, Vic and SA
- Best suited to med-high potential yield areas and irrigation
- Market leading pre-harvest sprouting tolerance
- Good standability and harvestability

For more information visit www.dowseeds.com.au or call your local Dow AgroSciences territory Manager on 1800 700 096.

MANAGING GLYPHOSATE-RESISTANT ANNUAL RYEGRASS IN ORCHARDS AND VINEYARDS

DISAPPOINTING WEED CONTROL IS A CONCERN IN AUSTRALIAN ORCHARDS AND VINEYARDS, WITH A GROWING INCIDENCE OF GLYPHOSATE RESISTANCE, ESPECIALLY IN ANNUAL RYEGRASS.

The current register of known cases of glyphosate-resistant annual ryegrass in horticulture includes 37 incidences in South Australia, Western Australia, New South Wales and Victoria, plus glyphosate-resistance in fleabane in both orchards and vineyards. All have occurred where there has been continuous reliance on glyphosate for several years, with little or no other use of alternative mode-of-action herbicides or other weed-control practices.

Australian Glyphosate Sustainability Working Group (AGSWG) and Crop Life recommendations for growers to reduce the risk of herbicide-resistant weeds include:

- Rotating herbicide mode-of-action groups within and across years, and using herbicides with lower frequency of herbicide resistance.
- Using robust label rates for maximum, consistent control of target weeds.
- Using non-herbicide weed control to reduce weed seed banks and prevent weeds going to seed– including cover cropping, mowing, mulching, strategic grazing.
- Good farm hygiene with only clean machinery, vehicles, stock and footwear allowed in the orchard.

Research and development specialist for Crop Care, David Hughes, said growers had successfully lowered the incidence of herbicide-resistant weeds by adopting those practices.

“Like most cropping enterprises across Australia, under-tree and under-vine weed control has depended heavily on glyphosate which has provided excellent and cost-efficient weed control. However, growers are increasingly noticing glyphosate no longer effectively controlling particular weeds, especially annual ryegrass,” he explained.

Signs of glyphosate resistance

“Growers notice a scattering of single plants or patches of plants surviving a glyphosate application. They might initially appear to be affected by the spray, but recover after a few weeks. Early and rapid control of these patches with an alternative mode-of-action will prevent them from setting seed and spreading the resistance problem further,” David said.

He advised growers suspecting herbicide resistance to have surviving weeds tested.

Mode of action matters

David said Australia was the first country to classify herbicides in groups according to their mode-of-action, indicated by a letter code clearly marked on all product labels, enabling Australian growers and advisers to clearly understand herbicide groupings when making weed-control plans, and to avoid resistance development through repeated use of herbicides from the same group.

“Glyphosate is represented in Group M. The key to effectively controlling resistant ryegrass and minimising the seed set of resistant strains is to use effective herbicides from other mode-of-action groups. Rotating herbicides with different modes of action is also the key to preventing or minimising herbicide resistance in the first place,” David explained.

Top left
Barossa valley trial site, in vineyard with a high incidence of glyphosate-resistant ryegrass.

Top right
Good control of glyphosate-resistant ryegrass provided by Alliance (4L/ha) followed by an application of Rifle 440 (9L/ha) plus Shirquat (2 L/ha)

Bottom right
Poor control of glyphosate-resistance annual ryegrass after glyphosate application

Bottom left
Resistant annual ryegrass testing - glyphosate susceptible annual ryegrass vs resistant annual ryegrass. Weedsmart picture.

Successful control of herbicide-resistant ryegrass

David said that three years of trials in South Australia had investigated herbicide options for controlling glyphosate-resistant ryegrass in vineyards and orchards.

He added that the results were heartening, even where the incidence of resistance was particularly high.

“Herbicides in the trials included Alliance (containing mode-of-action Groups Land Q), Shirquat (Group L) and Rifle 440 (Group D), either alone or in combination. Effective control of a wide range of glyphosate-resistant annual ryegrass biotypes was obtained with Alliance, and with a combination of Shirquat plus Rifle 440,” David said.

“Alliance, combining Amitrol (the Group Q part) and paraquat (the Group L part) has provided a very effective, alternative option for managing resistant weeds. Amitrole is a systemic herbicide like glyphosate. It’s quirky that this slow systemic has worked so well in combination with a fast burn-down like paraquat. The combination provides more rapid control than glyphosate, quickly killing green tissue on contact, and longer-term control resulting in fewer survivors or transplants,” he went on to explain.

David said in the South Australia trials, control of other key orchard and vineyard weeds was assessed at the same time, with Alliance also providing good control of barnyard grass, fleabane, capeweed, prickly lettuce, sow thistle, marshmallow, medic, wireweed, radish, turnip and mustard, as well as resistant ryegrass.

“Its wide range of target weeds, flexible use-rate and spray-pattern, compatibility and rainfastness make Alliance suitable for use in a wide range of horticultural enterprises across Australia,” David added.

For effective control of annual ryegrass, David recommended a higher spray volume (250L/ha and above) with nozzles delivering medium spray-quality droplets.

“Resistance can develop within 3-4 years of using products with the same mode of action.

With more than 35 weed species in Australia now resistant to at least one herbicide mode-of-action group, and known resistance to 13 different mode-of- action groups, it’s time for everyone in the industry to take more care,” concluded David.

“Growers are increasingly noticing glyphosate no longer effectively controlling particular weeds, especially annual ryegrass.”
David Hughes

A RECIPE FOR GRAPE BOTRYTIS

Botrytis is often considered the most difficult fungal disease to control in vineyards. That's partly because many fungicides registered for its control cannot be applied after flowering if the grapes are destined for export wine production.

Botrytis thrives in high humidity and still air. Good canopy management and viticultural practices such as leaf plucking are important to minimise these conditions within the fruit zone.

Whilst it can be a devastating disease, it is sometimes considered a weak pathogen, in as much as it needs some help to establish.

It often gains entrance into young fruit through wilting blossom parts that remain attached to them, old blossom or trash that gets trapped within clusters after it falls from the old flowers, and scars left on the young berries by the fallen caps. It can also enter through wounds caused by mechanical injury, birds, insects, other fungal pathogens or berries split by rain.

A wet flowering period can lead to latent infections becoming established, and how the disease progresses from there is really driven by the weather. If conditions remain dry leading up to harvest, infections most often remain latent and cause little damage.

If a wet flowering period is followed by a wet lead up to harvest, the conditions activate latent infections, assist with their spread and it becomes a perfect recipe for botrytis.

The challenge for growers in assessing the risk is that they often do not see significant disease levels until the season is quite advanced. That's because this fungus does not grow well in berries until they start to ripen.

Serious botrytis losses are the result of rampant disease spread during the post veraison/pre-harvest period, after the berries begin to ripen and when they become highly susceptible to rot by the fungus.

"Latent infections established at bloom can be important, even if only a few of them become active and provide the initial 'foot hold' from which subsequent spread can occur during ripening," said Scott Mathew, Syngenta's Solutions Development Manager.

Scott said, "Controlling this early infection with a consistently effective product such as Switch Fungicide at 80% capfall, is critical in a year when a wet pre-harvest period favours both the increased activation of latent infections and their rapid spread. So in one sense, the 80% capfall spray could be considered as an insurance policy against the future unknown."

"If the flowering period has been dry with little or no latent infection periods then Switch can be used right up to growth stage E-L 29, when the berries are pepper-corn size (4 mm diameter). Switch has the benefits that it penetrates and protects the berries, has built in resistance management with two different modes of action and acts at four different stages of the disease development life cycle," he explained.

Scott said viticulturists should note that if they have already used SWITCH at 80% capfall, they should not use Switch again, based on resistance management guidelines.

"When assessing the risk, growers should take into consideration the susceptibility of their cultivars, site conditions and pressure from other pests such as light brown apple moth. Past experience is a great asset and previously infected sites and sheltered vineyard areas such as hollows will be at greatest risk of developing the disease," Scott said in conclusion.

WHEN CABBAGES GET STRESSED THEY ADOPT HUMAN QUALITIES

Plants get stressed and send defensive signals in the same way humans do, researchers from The University of Queensland have found.

The international study found that plants have adapted the genetic machinery that humans use to see and smell the environment, and to ward off threats.

Plant Biotechnology Professor Jimmy Botella of University of Queensland's Plant Genetic Engineering Laboratory in the School of Agriculture and Food Sciences said the University of North Carolina-led research studied a family of proteins called G-proteins in thale cress from the brassica family, which includes cabbages.

"Plants have adapted the machinery that humans use to see in order to defend themselves against pathogens and water stress," Professor Botella said.

"In humans, G-proteins help people to sense light, flavour, odour, and are involved in behaviour and mood regulation via things such as adrenalin, histamine, dopamine and serotonin. G-proteins are present in almost all living organisms and about half of all human medications achieve their effect through G-protein–coupled receptors," he explained.

Professor Botella's laboratory has previously explored the important role that G-proteins play in enhancing yield in crops such as rice and is looking at other grain crops to help tackle world food security.

"Our laboratory has also previously discovered that plants contain a larger variety of these G-proteins than humans," Professor Botella said.

"In this new paper we provide the 'history' part – how they evolved and what we think is the main cause for that evolution. We show that plant G-proteins have overtaken humans in evolutionary term," he continued.

He said 'classic' members of the G-protein machinery in plants retained their role in development (like humans) while newer members of the G-protein family had specialised in environmental stress responses.

"This reflects the main difference between most animals and plants. That while animals can avoid stress situations by moving, most plants are stuck in one place and need to come up with ingenious solutions to survive," Professor Botella said.

The research led by Dr Alan Jones and Dr Daisuke Urano and involved researchers from the National University of Singapore and Cold Spring Harbor Laboratory, New York.

"This family of proteins is vital and extensively studied in animal systems, but their role in plant systems is still largely unknown," he said.

YEARS OF TESTING COMES TO FRUITION

Summer means the arrival of delicious stone fruit like peaches and nectarines to our tables. But with a short picking season and the delicate nature of the fruit, ensuring quality at the shop shelf is the ever-present challenge.

After years of testing, Agriculture Victoria's Dr Dario Stefanelli and his team have developed a way to test for and predict fruit quality.

"As fruit ripens it produces a gas called ethylene. With our research we found that if the fruit is picked too early and hasn't started to produce ethylene, then it won't develop proper taste and ripeness," Dr Stefaneli said.

"The fruit can look the right colour, feel ripe when you hold it and even smell good when you buy it. But when you bite into it, the taste just isn't there," Dr Stefanelli explained further.

Dr Stefanelli has been working with a research group in Italy to develop a simple handheld tool to measure fruit maturity before it is picked. The tool is known as the DA meter. The researchers are now actively working with Summerfruit Australia to get growers to use the testing method to improve the timing of fruit harvest.

The key is to calibrate the DA meter against ethylene for each cultivar. To do this, a measurement with the DA meter is taken in the field. At the same time, on the same piece of fruit, an ethylene gas sample is collected and then sent to the laboratory for analysis.

"In Victoria alone we grow over 300 cultivars of stone fruit. To really define what quality means for each, we need to collect data for each cultivar. To get the data we will continue to work closely with industry," Dr Stefanelli said.

"It is also very important to growers that fruit can be tested quickly and without destroying the fruit. The DA meter is a real step forward because we can measure the fruit when it is intact on the tree. So there is no loss," he went on to say.

With the Australian industry worth well over $300 million, there are significant gains to be made in better planning for and managing fruit quality. One industry player who has taken note is Jason Size from Quality Fruit Marketing Pty Ltd in South Australia.

"Understanding how to measure fruit quality really is the 'Holy Grail' for our industry," Jason said.

"Currently most testing uses a general visual approach looking at colour, feel and shape, so there's a lot of guesswork. But this method gives a reading of actual maturity and therefore the ability to predict harvest more accurately," Jason went on to add.

The researchers want to see their work contribute to the best quality fruit reaching customers.

PUTTING VEGETABLE WEEDS ON NOTICE

Horticulture Innovation Australia and the University of New England (UNE) are taking up the fight against weeds that are impacting vegetable crops through a $1 million investment that will deliver crucial management tools for industry.

Being undertaken by the University of New England, the four-year project aims to safeguard the vegetable industry by reducing its dependence on herbicides and tillage for weed control, which are ineffective when used repeatedly.

Project leader Dr Paul Kristiansen, from UNE's School of Environmental and Rural Science, said weed management needs to be strategic.

"Herbicides or tillage can't be sustained in isolation year after year. If growers continually use only one method of weed control, they apply evolutionary pressure that encourages the growth of weeds resistant to those methods," he said.

"We have seen a worrying rise in herbicide-resistant weeds in broadacre agriculture, and vegetable growers may see similar signs emerging in their industry," Dr Kristiansen added.

Dr Kristiansen also said constant tillage takes a toll on soil health, and growers, especially younger growers, are increasingly protective of their soils because its health is key to their productivity.

The project will deliver a suite of tools and techniques to make vegetable fields naturally less hospitable to weeds, minimising the need for intervention and dealing weeds a knockout blow.

"It's about chaining together a series of small management changes to produce a big result," Dr Kristiansen said.

"For instance, the grower might increase sowing rates to crowd out small weeds, use biodegradable mulches, and pay more attention to soil hygiene to reduce weed seeds in the soil seedbank. Each practice in itself doesn't require a drastic change in management, but together they could add up to a profound difference in the weed burden that growers deal with from year to year," he explained.

As part of the project, researchers will conduct field trials in various states, and consult with growers across the nation, including those using organic production methods. These findings will culminate in a comprehensive Vegetable Industry Weed Manual which will be made available to industry in several different languages.

Horticulture Innovation Australia chief executive John Lloyd said vegetable growers face unique challenges when it comes to weed management, and this project will help.

"Weeds are a persistent problem for many vegetable producers in Australia. Favourable growing conditions and regular soil disturbances are just two contributing factors," John said.

"This investment will give producers the very best management practices to ensure they can continue to deliver quality vegetables to Australian consumers and export markets for years to come," he concluded.

This project is being funded by Horticulture Innovation Australia using vegetable industry levies and funds from the Australian Government.

JAPAN OPENS THE DOOR TO AUSSIE PUMPKINS

The Australian vegetable industry has welcomed the news that Japan has granted market access for Australian pumpkins and melons, paving the way for Australian pumpkins to be exported to Japan immediately.

Market access was granted following recent bi-lateral discussions between the two countries and follows a recent free trade agreement that led to the elimination of tariffs on Australian pumpkins exported to Japan.

"This is fantastic news for export-ready pumpkin growers throughout Australia who are now in a much stronger position to expand their growing operations to meet increasing demand in Japan for high quality vegetable produce," said AUSVEG National Manager – Export Development, Michael Coote.

"Japan is one of Australia's largest export markets for horticultural produce, with total vegetable exports worth AUD$44 million in 2015-16, up five per cent on the previous year. It is a potentially lucrative export market for Australian pumpkin growers as it imports more than 100,000 tonnes of pumpkins from around the world each year." Michael explained.

"The agreement between Australia and Japan presents a huge growth opportunity for Australian vegetable growers to build trade into a high-value export market in a region that is increasingly calling for high quality Australian vegetables," he added.

AUSVEG is the leading horticultural body representing more than 9,000 Australian vegetable and potato growers, and is committed to its activities in the field of export development and opening new markets for Australian growers.

"AUSVEG organised a successful trade mission to Japan earlier this year, where Australian vegetable growers were able to display their high quality produce to key buyers and develop trade relationships. A number of these buyers have also travelled to Australia to see our vegetable growing operations in action," said Michael.

"The challenge now is for Australian growers to investigate the pumpkin varieties that are popular in Japan, so that they can grow the varieties that are in high demand with Japanese consumers and maximise their ability to sell their produce into this market," he added.

HONOUR FOR PRECISION AGRICULTURE RESEARCHER

The University of New England (UNE) has conferred the inaugural title of McClymont Distinguished Professor (Research) upon precision agriculture expert David Lamb. The title is in honour of Gordon Lee 'Bill' McClymont, who established rural science at the university.

UNE Chancellor James Harris says the McClymont title was awarded to Professor Lamb for his leadership and outstanding contribution to agricultural research.

"Professor Lamb is an international industry leader in the application of precision agriculture technology to the cropping, pasture and livestock industries. He has helped develop UNE's SMART (sustainable, manageable, accessible rural technologies) Farm facility, as well as building the research reputation and outcomes for the university," Mr Harris said.

Professor Lamb is a physicist whose research interests include applied optics and precision agriculture. He has been working in precision agriculture since the early 1990's, and works on sensors and sensor networks for crop, pasture, livestock and soil monitoring.

Professor Lamb leads UNE's SMART Farm – a 2800-hectare commercial farm and 'landscape laboratory'.

With its award-winning innovation centre, SMART Farm acts as a test site for new technologies. With a farm-wide telemetry system to link up whatever stakeholders want to deploy on the landscape (plant, soil and animal sensors), the farm takes advantage of high-speed internet connectivity to showcase what is possible in commercial agriculture.

Professor Lamb also heads the university's Precision Agriculture Research Group (PARG), which is engaged in the development and application of new technologies and processes in support of precision agriculture. PARG projects currently span grains, beef and sheep, as well as intensive horticultural agricultural systems.

The Distinguished Professor title is the pre-eminent honorary award available to serving members of UNE's academic staff and is an honorary title for four years. It recognises academic leadership, a significant contribution to teaching or research and an outstanding record of research publication, and is an acknowledgement by peers as a researcher leader in their discipline.

"It is truly gratifying to receive this acknowledgement, bearing in mind my non-agricultural background – I'm actually a physics graduate of UNE – and the profound impact that Bill McClymont had on the way we look at agriculture," Professor Lamb said.

"It also acknowledges the critical importance of science and technology in helping meet our farming future," he added.

RESEARCH LEADS THE WAY AT AWARDS HONOURING AGRICULTURAL INNOVATION

As Australasian agriculture faces mounting pressure to enhance operations, 25 agricultural professionals have been recognised for their innovative work towards improving the industry.

As testament to their significant contributions, 25 growers and advisers across Australia and New Zealand have been selected as Regional Winners in the 2016 Syngenta Growth Awards.

Currently in its third year, the Syngenta Growth Awards champion growers and agricultural advisers who lead the way in their profession.

"Today there's a pressure to do more with less, and the top 25 are developing innovative ways to overcome challenges of modern day farming, such as water availability and pest management," said Paul Luxton, Territory Head – Australasia, Syngenta.

Paul said they are constantly challenging themselves to stay abreast of new technology and incorporating the latest trial and research data into their everyday operations to increase productivity and sustainability.

"Across all 25 Regional Winners, we are seeing incredible efforts in research and development. Some are partnering with industry groups such as the GRDC to carry out field trials, while others are conducting their own, independent trials," he added.

Regardless of what trials they conduct, there is a shared mentality amongst the top 25 that cooperation across the whole industry is imperative to remain viable.

"I'm inspired by the dedication shown by the Regional Winners and their sense of community and social responsibility," Paul said.

The Syngenta Growth Awards are presented in partnership with Case IH and Fairfax Agricultural Media and have three nomination categories: Productivity; Sustainability; and Community and People.

The 25 Regional Winners have been chosen based on a rigorous selection criteria for each category and will now advance to the next stage of the Awards.

"Selecting the top 25 was challenging because we had such a competitive pool of nominees this year. But we are proud to announce the Regional Winners and showcase their contributions towards increasing productivity, innovation and camaraderie throughout our industry," Paul said.

Seven Australasian winners will be selected by an independent judging panel and announced at the Growth Awards gala dinner in Sydney on 1 December 2016. The winners will then have the opportunity to participate in a study tour to the UK and Europe in 2017.

"The Awards have become a mainstay in the industry and as testament to this, we have an extremely high caliber of finalists moving into the next stage of the Awards," Paul said.

The 25 Regional Winners are:

New South Wales

- Graeme Callaghan: COONAMBLE, NSW: Adviser
- Jim Cronin: FORBES, NSW: Adviser
- Colin Arnold: BERRIGAN, NSW: Grower
- Dean Salvestro: BENEREMBAH, NSW: Grower

Queensland

- Richard Daniel: TOOWOOMBA, QLD: Adviser
- Tommy Le: GLENORE GROVE, QLD: Adviser
- Simon Chapman: GUMLU, QLD: Grower
- Nigel Corish: GOONDIWINDI, QLD: Grower
- Trevor & Wendy Cross: BUNDABERG, QLD: Grower

South Australia

- Peter Boutsalis: PROSPECT, SA: Adviser
- Richard Porter: NEWTON, SA: Adviser
- Naresh Singh: VIRGINIA, SA: Grower
- Randall Wilksch: YEELANNA, SA: Grower

Tasmania

- Stuart Millwood: LAUNCESTON, TAS: Adviser

Victoria

- James Dickson: WERRIBEE SOUTH, VIC: Grower
- Andrew McMahen: MANANGATANG, VIC: Adviser

Western Australia

- David Cameron: MOORA, WA: Adviser
- Geoff Fosbery: NORTHAM, WA: Adviser
- Duc Nguyen: CARNARVON, WA: Grower
- Michael Fels: ESPERANCE, WA: Grower
- Michael Nixon: NORTH PLANTATIONS, WA: Grower

New Zealand

- Howard Clarke: GORE, NZ: Adviser
- Tayah Ryan: KATIKATI, NZ: Adviser
- Allan Fong: PUKEKOHE, NZ: Grower
- Craig Whiteside: OTAGO, NZ: Grower

Jim Cronin is a Senior Agronomist with Landmark in Forbes, NSW. He has been named a Regional Winner in the Productivity category for delivering high returns for his clients despite increasing operational costs.

BREAKTHROUGH IN SALT-TOLERANCE IN PLANTS RESEARCH

University of Adelaide researchers have made a breakthrough in investigating salt tolerance in plants which could lead to new salt tolerant varieties of crops, and also answer unresolved questions in plant biology.

The researchers, from the ARC Centre of Excellence in Plant Energy Biology and in collaboration with the University's School of Medicine, have discovered that a protein known to control salt balance in animals works the same way in plants.

The research, published in the journal Plant Cell and Environment, found that in plants, as in animals, a group of proteins, a type of 'aquaporin', can transport salt ions as well as water.

Aquaporins have long been known to act as pores by transporting water across membranes in plants and animals, and they play critical roles in controlling the water content of cells. But, until now, it was not known they could do the same with sodium ions (salt).

"In animals, aquaporins are extremely important in water filtration in the kidney," said project leader, Professor Steve Tyerman.

"In plants they can do the same thing, filter the water that goes through the plant. But under certain conditions some aquaporins can also let sodium ions through. This may explain a lot of unsolved problems in plant biology, for instance how salt gets into the plants in the first place," he explained.

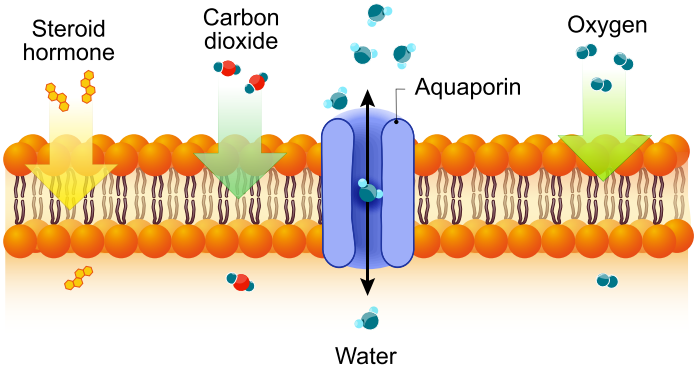
The researchers believe these 'double-barrelled' aquaporins may be the elusive proteins that let sodium ions the toxic component of salt in and out of plant roots.

Since the early 1990's researchers have known that salt enters plant roots in saline conditions via pores in the membrane, but the identity of these pores has remained a mystery. This particular aquaporin is abundant on the surface of roots.

"We discovered that it has characteristics similar to the properties previously identified for the pores responsible for sodium ion transport," said co-lead author Dr Caitlin Byrt, Postdoctoral Fellow in the School of Agriculture, Food and Wine. "This finding opens new possibilities for modifying how plants respond to high salt and low water conditions," she added.

The researchers say that this discovery will help them target ways of blocking the pathway of salt into plants. And plant breeders may be able to select varieties which have differences in the aquaporin protein.

There are also exciting implications for understanding how plants function. The discovery will help plant scientists dissect the role these 'double barrelled' aquaporins play in how roots respond to osmotic shock and salt stress, how long distance water transport in plants occurs, and how leaves control the entry of carbon dioxide for photosynthesis.



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