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THE AUSTRALIAN AGRONOMIST MAGAZINE

NEW BLACKLEG RESISTANT GENES IN CANOLA

HOW TO BE A SUCCESSFUL PEST: LESSONS FROM THE GREEN PEACH APHID

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CONTENTS

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HOW TO BE A SUCCESSFUL PEST: LESSONS FROM THE GREEN PEACH APHID

SCIENTISTS IN THE UNITED KINGDOM, IN COLLABORATION WITH GROUPS IN EUROPE AND THE UNITED STATES, HAVE DISCOVERED WHY THE GREEN PEACH APHID (MYZUS PERSICAE) IS ONE OF THE MOST DESTRUCTIVE PESTS TO MANY OF OUR MOST IMPORTANT CROPS. THEIR RESEARCH WILL INFORM INDUSTRY AND RESEARCH PROGRAMMES TO SUPPORT PEST CONTROL AND AID GLOBAL FOOD SECURITY.

Unlike most plant-colonising insects, which have adapted to live on a small range of closely related plants, green peach aphids can colonise over four hundred plant species. Developing resistance to over 70 different pesticides, coupled with the ever changing climate affecting crop losses in the EU and UK, the pest wreaks havoc on crop yields.

The green peach aphid transmits over a hundred different plant viruses and this notorious insect feeds on essential crops such as canola, sugar beet, tomato and potato, as well as wild plant species, which may serve as sources of the plant viruses. An example being the Turnip yellows virus (TuYV) and related viruses, which if left uncontrolled can reduce yields of multiple crops, such as canola and sugar beet, by up to 30%, rendering some crops unprofitable in the UK.

The aphids spend winter living on host plants such as peach, apricot or plum, but in the summer months can colonise a huge range of vegetables - from potatoes to spinach, squash, parsley and parsnip.

Generally, the insect parasites that live on a certain species are genetically very well adapted to live on just that plant. Yet, research led by the Earlham Institute (EI) and the John Innes Centre (JIC), has found that the green peach aphid foregoes this specialisation for a more flexible approach involving turning gene activity 'up' or 'down' in response to different plant hosts and environments.

Dr David Swarbreck, Group Leader at the Earlham Institute said, "Our study has shed light on the genetic plasticity that allows the green peach aphid to survive so well on a multitude of plant species, giving us a greater insight into the survival strategies of one of the most challenging of crop pests."

More intriguing about the insect's strategy is that aphids can reproduce clonally i.e. they produce genetically identical lineages.

This allows biologists to compare individual aphids with the same genetic background and see precisely what genes are more active than others in aphids living on different plant species.

By growing aphid clones on three different plant species, it was possible for the scientists to find the specific genes that were involved in colonising the different host plants. It appears that the genes responsible for helping aphids adjust to different plants are found in clusters within the genome and are rapidly increased or decreased in two days of transfer to a new host plant species.

Dr Yazhou Chen, Postdoctoral Scientist at the John Innes Centre said, "The genes rapidly turn up or down in single aphids in just two days upon transfer to a new host plant. Given that a single aphid can produce her own offspring, and a lot of it, new aphid infestations may start with just a single aphid."

The team found that rapid changes in gene expression were vital for the green peach aphid's generalist lifestyle. Interfering with the expression of one particular gene family, cathepsin B, reduced aphid offspring production, but only on the host plant where the expression of these genes is increased.

Thomas Mathers, Postdoctoral Scientist at the Earlham Institute said, "Surprisingly, many of the genes involved in host adjustment arose during aphid diversification and are not specific to the green peach aphid. This suggests that it may be the ability to rapidly adjust the expression of key genes in a coordinated fashion that enables generalism, rather than the presence of an expanded genomic toolbox of genes."

Professor Saskia Hogenhout at the John Innes Centre said, "Future research is expected to reveal mechanisms involved in the amazing plasticity of the green peach aphid leading to new ways to control this notorious pest. More generally, the research will help understand how some organisms are able to adjust quickly to a broad range of environmental conditions, whereas others are pickier and go extinct more easily, research that is central given our rapidly changing environment due to, for instance, climate change."

The scientific paper, titled: "Rapid transcriptional plasticity of duplicated gene clusters enables a clonally reproducing aphid to colonise diverse plant species" is published in Genome Biology.

“Our study has shed light on the genetic plasticity that allows the green peach aphid to survive so well on a multitude of plant species, giving us a greater insight into the survival strategies of one of the most challenging of crop pests.”

Dr David Swarbreck

NEW PEST OF TOMATOES AND POTATOES DETECTED IN WESTERN AUSTRALIA

THE DEPARTMENT OF AGRICULTURE AND FOOD, WESTERN AUSTRALIA (DAFWA) IS UNDERTAKING SURVEILLANCE IN COMMERCIAL CROPS AND BACKYARD GARDENS FOLLOWING THE DETECTION OF A VEGETABLE PEST IN THE PERTH AREA.

Department Acting Chief Plant Protection Officer Dr Sonya Broughton said officers were working with the horticulture industry to respond to the exotic plant pest, tomato potato psyllid (Bactericera cockerelli).

"The pest has been detected in a capsicum crop in a commercial property north of Perth, backyard tomatoes and eggplants in Belmont and backyard tomatoes at two properties in Mount Hawthorn and in chillies at a property in Palmyra," Dr Broughton said.

"The department has quarantined the impacted properties to restrict the movement of vegetable and plant material off these properties. DNA barcoding results today have confirmed the presence of the pest. This is the first time the psyllid has been detected in Australia," she went on to explain.

This insect pest is a significant production pest in other countries where it is present, including the United States of America, Central America and New Zealand.

“The body is brownish and has white or yellowish markings on the thorax and a broad white band on the abdomen. Its wings are transparent and held vertically over the body. Symptoms of damage on plants can include stunting, yellowing and purpling of leaves, distorted leaf growth and stem death.”

Dr Sonya Broughton

Tomato potato psyllid attacks a range of plants in the Solanaceae family including potato, tomato, eggplant, capsicum, chilli and tamarillo, along with sweet potato.

Dr Broughton said department officers were surveying properties within the wider metropolitan area to determine the location of the pest.

Commercial vegetable producers and backyard growers are urged to check for signs of the psyllid and report any unusual detection to the department’s MyPestGuide Reporter app.

Reporting options are also available on the department website or by contacting the department’s Pest and Disease Information Service info@agric.wa.gov.au or call 1800 084 881.

“Tomato potato psyllid is a tiny sap-sucking insect. Adult psyllids resemble small winged aphids in appearance and are about 3mm long,” Dr Broughton said.

“The body is brownish and has white or yellowish markings on the thorax and a broad white band on the abdomen. Its wings are transparent and held vertically over the body. Symptoms of damage on plants can include stunting, yellowing and purpling of leaves, distorted leaf growth and stem death,” she added.

The tomato potato psyllid can carry the bacterium “Candidatus Liberibacter solanacearum”, causing the ‘zebra chip’ disease in potato. The bacterium has not been found in any samples taken to date.

“Growers who suspect the pest is on their property are advised not to spray for the pest or disturb plants until their crops have been surveyed and an appropriate treatment has been identified,” Dr Broughton said.

Vegetables WA CEO John Shannon said Western Australia’s horticulture industry was critically important to the state’s economy.

“We have access to international expertise which will help us to best respond to this new pest and we will work closely with the department to share this expertise with growers,” John said.

NEW BLACKLEG RESISTANT GENES IN CANOLA

NSW Department of Primary Industry (DPI) scientists have found new canola genes for resistance to blackleg, the major disease threat to Australia's canola industry.

NSW DPI senior principal research scientist, Dr Harsh Raman, said the study has unlocked the genetic make-up of canola to characterise major and minor genes resistant to the fungal pathogen Leptosphaeria maculans, which causes blackleg disease.

"Finding new sources of resistance, particularly resistance which is controlled by minor genes, is extremely important to the canola industry," Dr Raman said.

"Blackleg disease can cause up to 80 per cent yield loss in canola. In Australia, France and Canada resistance has been broken down in some canola varieties due to the emergence of new races of the blackleg pathogen. Significantly for local canola growers, the study revealed new sources of blackleg resistance which were either resistant to the pathogen or had low levels of blackleg," he went on to explain.

Researchers used 18,804 DNA markers in a genome-wide association study to identify genes associated with both major and minor resistance in canola.

Several genes for resistance were mapped on the canola chromosome using molecular markers, which will assist the incorporation of a combination of genes to develop canola varieties with durable resistance to battle blackleg attack.

Researchers used different races of blackleg fungus collected across Australian canola growing sites and infected 180 varieties of canola to deliver a comprehensive evaluation.

New sources of resistance were identified at the DPI Wagga Wagga Agricultural Institute, where researchers screened the canola lines using known races of blackleg fungus under glasshouse conditions.

NSW DPI, in collaboration with Marcroft Grains Pathology and the Victorian DPI, has now validated the presence of new genes in a number of canola varieties.

The blackleg resistance research project was supported by the NSW, Victorian and Australian governments and Grains Research and Development Corporation.

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STICKY GELS TURN INSECT-SIZED DRONES INTO ARTIFICIAL POLLINATORS

AS BEES SLIP ONTO THE ENDANGERED SPECIES LIST IN SOME PARTS OF THE WORLD, RESEARCHERS IN JAPAN ARE POLLINATING LILIES WITH INSECT-SIZED DRONES.

The undersides of these artificial pollinators are coated with horse hairs and an ionic gel just sticky enough to pick up pollen from one flower and deposit it onto another.

Far from replacing bees, the drones' designers are hopeful that their invention could someday help carry the burden that modern agricultural demand has put on colonies and in turn benefit farmers.

The research work appears in a recent edition of the physical science journal Chem, sister publication to Cell.

The gel used for the artificial pollinators was the result of an experiment gone wrong.

In 2007, senior author Eijiro Miyako, a chemist at the National Institute of Advanced Industrial Science and Technology (AIST) Nanomaterial Research Institute, was working to make liquids that could be used as electrical conductors.

One of his attempts generated a gel as sticky as hair wax, which he considered a failure. After a decade of sitting in a storage cabinet in an uncapped bottle, it was rediscovered unchanged during a lab cleanup. Inspired by concerns over honeybees and news reports on robotic insects, Miyako began to explore, by using houseflies and ants, whether the gel could work to pick up pollen.

"This project is the result of serendipity," said Miyako, who worked with postdoctoral fellow and first author Svetlana Chechetka.

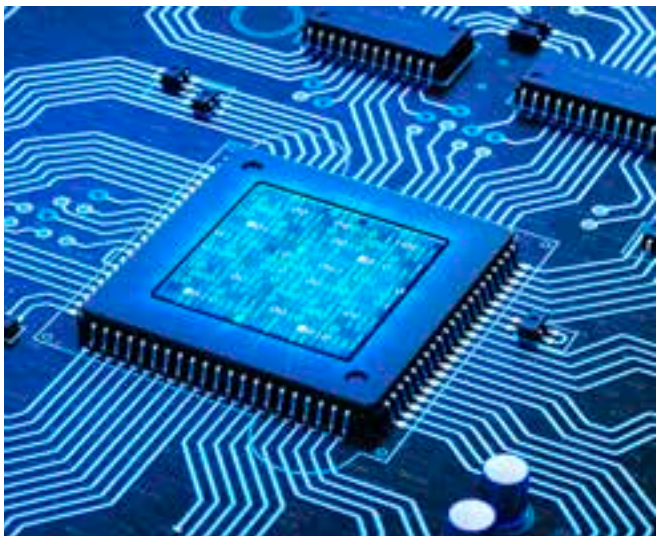
"We were surprised that after eight years, the ionic gel didn't degrade and was still so viscous. Conventional gels are mainly made of water and can't be used for a long time, so we decided to use this material for research," he explained.

To determine whether the gel could grasp onto pollen, Miyako collected ants around his institute, put the ionic goop droplet on their bodies, and left them to roam free in a box of tulips. Compared with ants that didn't have the material applied, the ants with the gel were more likely to have pollen attached to their bodies.

In separate experiments using houseflies, the gel was also found to have a camouflage effect, changing colour in response to different sources of light, which could help artificial pollinators avoid predation.

Miyako next needed a flying machine that was small enough to manoeuvre across a field of flowers, like a bee. He settled on a four-propeller drone, about $100 retail value. However, simply placing the gel on its smooth, plastic surface wouldn't be enough for it to effectively pick up pollen.

Miyako and Chechetka collaborated with AIST colleagues Masayoshi Tange and Yue Yu on using horse hair to mimic the fuzzy exterior of a bee. The bristles create more surface area for pollen to adhere to and generate electric charge to keep the grains in place.



“The findings, which will have applications for agriculture and robotics, among others, could lead to the development of artificial pollinators and help counter the problems caused by declining honeybee populations.”

Eijiro Miyako

Miyako's team flew the remote-controlled drones, with hairs and gel attached, over the flowers of pink-leaved Japanese lilies (Lilium japonicum). The robots absorbed the pollen and then could be flown to a second flower, where the grains were deposited, artificially pollinating the plants and causing them to begin the process of producing seeds. Drones without the gel and hair components did not have this effect.

"The findings, which will have applications for agriculture and robotics, among others, could lead to the development of artificial pollinators and help counter the problems caused by declining honeybee populations," Miyako said.

"We believe that robotic pollinators could be trained to learn pollination paths using global positioning systems and artificial intelligence," he added.

Although the work is still far from being used in the field, it is a creative first step to addressing a future with fewer bees. The goal would be to decrease the stress put on bee populations by commercialisation so that they can do what robots can't - make honey - while the drones take over the demands of crop pollination.

VARIETY SELECTION KEY WHEN EARLY SOWING CANOLA

West Australian growers wanting to take advantage of early rains to sow canola need to consider making changes to their crop management and variety selection to ensure the best possible return.

Results of early sown canola trials from 2015 and 2016 as part of the Western Australia's Department of Agriculture and Food led tactical break crop agronomy project, funded by the Grains Research and Development Corporation (GRDC), will be presented at the GRDC Research Updates later this month.

Department research officer Martin Harries, who will speak at the updates, said in recent years, rains in March and April had provided growers with the opportunity to consider sowing canola early.

"To make this decision, growers need information on whether changes in their existing agronomy practices such as weed management and variety selection would be needed to provide the best chance of success," he said.

Trials looking at yield potential of a range of varieties across different establishment dates were sown at Binnu on 15 April and 29 April 2015 and Wongan Hills on 31 March and 15 April 2016.

Martin said results from Binnu determined that sowing in mid-April resulted in an increase in yield of about 40kg/ha per day compared to late April.

"Choosing a longer season variety for early sowing did not increase yield at this short season site." Martin said.

The highest yielding varieties were the recently released early maturity Roundup Ready hybrids, while gross margins were similar between the best Roundup Ready and Triazine hybrids.

At Wongan Hills in 2016, there was also an increase in yield from sowing in late March compared to mid-April, but the benefit of 13kg/ha per day was less.

Martin said variety selection at this site showed that mid-season varieties such as the 5 and 6 series lines responded best to early sowing and there was little benefit from sowing a 4 series variety in March.

Additional trials looking at crop establishment from early sowing were run across sites from Merredin to Geraldton.

These trials looked at crop establishment from mid-April sowing and how this was impacted by seed depth, seed size and if hybrid or OP varieties were sown.

Martin said trials were sown at three seeding depths 1, 3 and 7 centimetres to see if chasing subsoil moisture would improve establishment.

"Overall results showed that chasing moisture was risky. Sowing at 1cm depth and choosing a hybrid seed resulted in better crop establishment, particularly in difficult conditions," he said.

"This information, together with the results of the variety trials, indicates to growers that most benefit from sowing canola early was achieved at mid-April while some additional benefit accrued from earlier sowing in a medium rainfall area so long as varieties with appropriate maturity were used," Martin explained.

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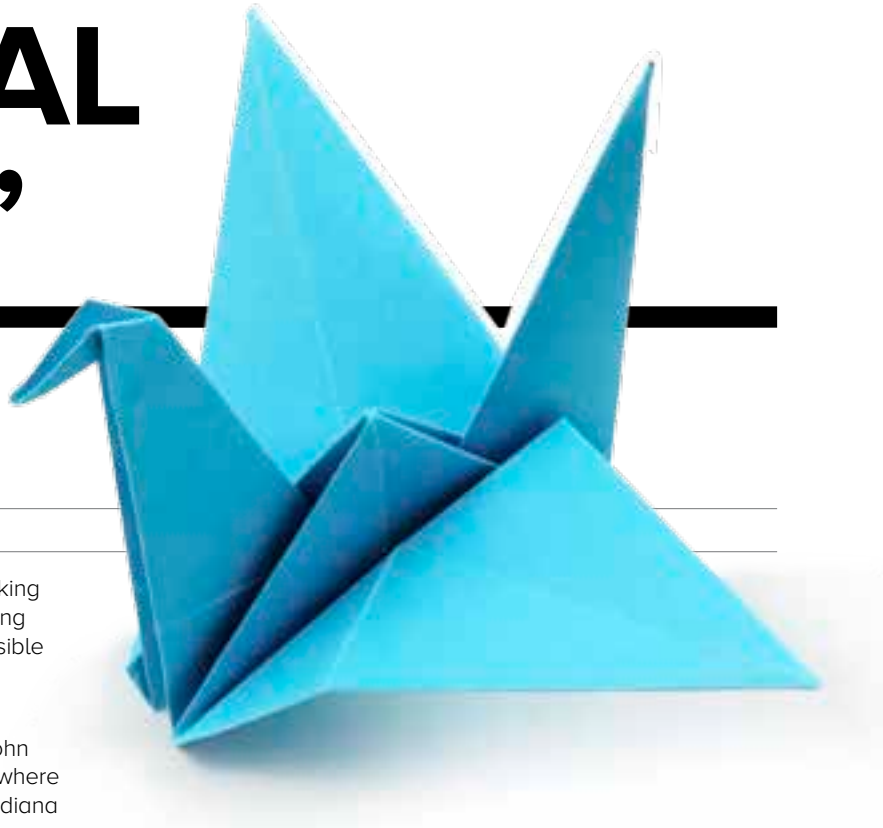

PRODUCES NEW PLANT COMPOUNDS WITH THERAPEUTIC AND ECONOMIC POTENTIAL

BY MERRAN WHITE, AGINNOVATORS

Researchers at the United Kingdom’s John Innes Centre working with US plant scientist Robert Minto have found that by altering the genetic code governing a specific plant enzyme, it’s possible to change the path of that enzyme to create a new natural product with potentially valuable uses.

The groundbreaking plant research was conducted in the John Innes Centre’s Osbourn lab, part of Norwich Research Park, where Robert, an Associate Professor in the School of Science at Indiana University-Purdue University Indianapolis (IUPUI), spent a five-month sabbatical.

The findings of the study were published in November 2016 in the Proceedings of the National Academy of Sciences.

The potential of plant natural compounds

Plants, wild and cultivated, produce countless natural compounds, manufactured by enzymes predetermined by each plant’s genetic code. Many of the resulting natural products have proven immensely useful – as vitamins, antibiotics and anti-cancer drugs, and in a multitude of other therapeutic applications.

While many of these plant-made compounds are too complex to synthesise chemically in the lab, they can be purified from their plant sources.

Robert and his project team looked at triterpenes, a large and highly diverse group of plant natural products with various biological functions and potential uses, including medicinal (as antimicrobials and cancer-fighters, for instance), industrial (as anti-foaming agents) and food-related (for example, as a natural sweetener that’s substantially sweeter than sugar).

Simple triterpenes – such as components of surface waxes and specialised membranes may, potentially, function as signalling molecules. Complex ‘glycosylated’ triterpenes, known as saponins, protect against pathogens and pests. Both types of triterpene have a broad range of applications in the food, health, and industrial biotechnology sectors.

What’s the science behind the study?

Triterpenes are synthesised by the cyclisation of the linear isoprenoid 2,3-oxidosqualene into different triterpene ‘scaffolds’ by specific enzymes known as ‘triterpene synthases’, in one of the most complex enzymatic reactions known – and one that is, to date, little understood.

The UK researchers, under Robert’s guidance, were able to isolate a conserved amino acid residue that they say is “critical for both product and substrate specificity in triterpene synthases from diverse plant species”.

Specifically, Associate Professor Minto and his team at The John Innes Foundation altered the genetic code for an amino acid in the first enzyme occurring in a pathway that generates a natural product protecting oat plants from fungal pathogens, endowing disease resistance.

The team found that by altering the genetic code governing a single amino acid, they could change the shape and function of that enzyme, and hence the way its chemical precursor ‘folds’ – a process likened to “chemical origami” – thereby arriving at a new natural plant product with many potential uses.

The results, say the researchers, “shed new light on mechanisms of triterpene cyclisation in plants and open up the possibility of manipulating both the nature of the precursor and product specificity, findings that can be exploited for the production of diverse and novel triterpenes”.

“Our goal is to identify compounds with medicinal, environmental and other uses that can be renewably produced in substantial amounts at a reasonable cost.”

Professor Robert Minto

What's the significance of this finding?

The knowledge Robert and his research team gained by getting oat plant enzymes to generate new natural product can be applied to numerous other plant species.

He points out that the gene-altering method he and his team used is a far more efficient way of producing a specific natural product than trial-and-error cross-breeding, which can take years or decades.

The discovery promises to make the process of developing plant compounds with valuable medicinal, therapeutic, industrial and environmental uses faster, simpler and cheaper.

As plants function as 'chemical manufacturing factories', they can be altered in specific ways to make new chemical compounds naturally.

Many of the resulting compounds could prove immensely useful, some in ways we may not yet understand.

What's next? Exploring pathways to valuable new natural compounds

In his own laboratory at IUPUI's School of Science in Indiana, USA, Associate Professor Minto is exploring ways to get plants to produce valuable natural compounds.

In previous research, he identified the process by which echinacea plants produce natural products of industrial and agricultural significance – compounds that are used by millions around the world in herbal supplements to reduce symptoms of the common cold.

Right now, he's working with graduate and undergrad students to modify fatty acids in yeast, with the aim of identifying ways to generate natural products that have therapeutic and commercial potential.

"When we attempt biological engineering, we look to something -- like yeast -- that is easy to grow," Robert said.

‘BIOCLAY’ - A GROUND-BREAKING DISCOVERY FOR WORLD FOOD SECURITY

A University of Queensland team has made a discovery that could help conquer the greatest threat to global food security – pests and diseases in plants.

Research leader Professor Neena Mitter said BioClay – an environmentally sustainable alternative to chemicals and pesticides – could be a game-changer for crop protection.

“In agriculture, the need for new control agents grows each year, driven by demand for greater production, the effects of climate change, community and regulatory demands, and toxicity and pesticide resistance,” Professor Mitter said.

“Our disruptive research involves a spray of nano-sized degradable clay used to release double-stranded RNA that protects plants from specific disease-causing pathogens,” she said.

The research, by scientists from the Queensland Alliance for Agriculture and Food Innovation (QAAFI) and UQ’s Australian Institute for Bioengineering and Nanotechnology (AIBN) is published in ‘Nature Plants’.

Professor Mitter said the technology reduced the use of pesticides without altering the genome of the plants.

“Once BioClay is applied, the plant ‘thinks’ it is being attacked by a disease or pest insect and responds by protecting itself from the targeted pest or disease. A single spray of BioClay protects the plant and then degrades, reducing the risk to the environment or human health,” she explained.

She said BioClay met consumer demands for sustainable crop protection and residue-free produce.

“The cleaner approach will value-add to the food and agri-business industry, contributing to global food security and to a cleaner, greener image of Queensland,” Professor Mitter added.

AIBN’s Professor Zhiping Xu said BioClay combined nanotechnology and biotechnology.

“It will produce huge benefits for agriculture in the next several decades, and the applications will expand into a much wider field of primary agricultural production,” Professor Xu said.

The project has been supported by a Queensland Government Accelerate Partnership grant and a partnership with Nufarm Limited.

The Queensland Alliance for Agriculture and Food Innovation is a UQ institute jointly supported by the Queensland Government.

Professor Neena Mitter

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GREAT RESULT FOR NEW CANOLA HYBRID

A NEW HYBRID CANOLA VARIETY TRIALLED ON FARM AT NORTHAMPTON IN WESTERN AUSTRALIA THIS SEASON IS SHOWING GROWERS THAT THERE'S STILL ROOM FOR NEW VARIETIES TO DELIVER HIGHER YIELDS.

The new variety under the spotlight this season was Nuseed's GT-53, a mid-season Roundup Ready® hybrid canola, adaptable to a wide range of growing conditions.

The Stanich family was selected to trial GT-53 as part of Nuseed's nationwide Crop Agronomy Trial (CAT) program, giving them an early insight into its performance before its commercial release.

At harvest in Northampton, it out yielded the comparison Roundup Ready hybrid on the farm by 200 kg/ha.

"At 2.14 t/ha, I was very happy with the yield result for the GT-53," Mr Stanich said.

"It's true that yield is king, especially when it comes to picking canola varieties, so this was the key trial result for us," he added.

Mr Stanich farms with his wife, parents and brother and sister-in-law, growing wheat, canola and lupins and running a small cattle breeding operation and trading livestock.

They have been growing Roundup Ready canola for the past three years.

When choosing a canola variety for their cropping program, he said they considered yield potential, hybrid vigour for its ability compete with weeds, and the seed size.

"A small seed size reduces your upfront costs, because you can plant at a lower seeding rate and still achieve the right density of plants per square metre," he said.

The seeding rate for Nuseed GT-53 was 1.4 kg/ha – 400 g/ha less than the comparison crop, saving them $14.80/ha.

Taking into consideration the yield, oil level and bonification, as well as the cost of seed, Nuseed GT-53 delivered a $103/ha higher gross margin than the comparison hybrid variety in the on-farm trial.

It all adds up to a great result from what was a good looking crop all season, according to Mr Stanich.

He said the crop was sown on the first of May, but was quickly under threat as a deluge of rain washed out some of the emerging plants.

“We had 30 mm of rain in ten minutes and lost a few plants per square metre across all our canola because of that,” he said.

“We also had some downy mildew early, but with a bit of sunlight and nitrogen it was soon up and away. The canopy closed up nicely and it grew a nice green colour, with GT-53 developing more biomass than the canola next to it. It flowered a bit later, but it developed quite quickly after that,” he went on to explain.

He said the extra biomass made direct heading Nuseed GT-53 a little slower than the rest of the paddock.

Nuseed GT-53 will be their preferred option next season if they got an early break.

“We have quite a short season up here and I bet it would do really well with the extra time,” Mr Stanich said.

According to Hugh Trenorden, Nuseed’s Area Sales Manager for northern Western Australia, Nuseed GT-53 is a variety that can take full advantage of good seasons, while still being highly competitive if the going gets tough.

He has seen a lot of the crop in on-farm trials this year and has been impressed by how well it 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, the highest possible resistance level.

“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,” he 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,” Hugh concluded.

PADDOCK SELECTION FOR BROADLEAF CROPS IN 2017

BY PHIL BOWDEN (PULSE AUSTRALIA), DON MCCAFFERY (NSW DPI) AND KURT LINDBECK (NSW DPI)

WITH THE HARVEST FINALLY OVER, ATTENTION NOW TURNS TO FINE-TUNING PLANNED CROP ROTATIONS AND MAKING PADDOCK SELECTIONS THAT TAKE INTO ACCOUNT THE HIGHER DISEASE PRESSURE IN MANY CROPS IN 2016, DUE TO PROLONGED WET CONDITIONS IN WINTER AND SPRING.

In particular, sclerotinia stem rot, a common fungal disease of broadleaf crops such as canola that has become more prevalent in chickpeas and lentils, had an impact on crop yields in many regions and must be considered when selecting paddocks for broadleaf crops in 2017 season and beyond.

Sclerotinia sclerotiorum, the fungus that causes sclerotinia stem rot, has a wide host range including many common broadleaf weed species and nearly all the broadleaf crops. Ideal conditions last season will have boosted inoculum levels in paddocks growing these crops and weeds. The main drivers of disease severity are the frequency and amount of late winter and spring rainfall, the length of crop flowering and how frequently a broadleaf crop has been grown in each paddock.

The survival structures of the pathogen are known as 'sclerotes' and can remain viable in the soil for as long as ten years. Multiple rainfall events in late winter and spring in 2016 triggered germination of sclerotia and the subsequent release of air-borne spores, which infected flower petals and other plant parts, such as old leaves. Continued wet conditions allowed infected petals to cause stem lesions, and return more sclerotia to the soil. Direct infection of young plants can also occur, but is less common than petal and stem infection.

"Fungicides are only effective for about three weeks, so timing is important to provide crop protection when the spores are released from the soil."

Breaking the disease cycle involves careful planning, particularly for high risk paddocks, including:

- Seed cleaning
- Variety selection and sowing time
- Foliar fungicide program
- Crop rotation sequence
- Soil and paddock drainage

Early sclerotinia stem rot lesion development on canola (Kurt Lindbeck, NSW DPI).

Sclerotes from North Star chickpea sample showing irregular types typical of S. sclerotiorum with the atypical cylindrical types. Photo: Gail Chiplin NSW DPI Tamworth

Sclerotinia sclerote forming inside chickpea stem at Pallamallawa (TR8867) resulting in atypical, cylindrical shape. Photo: Gail Chiplin NSW DPI Tamworth

Seed cleaning

Sclerotes can end up in the header bin in seed retained to sow following crops. Grade oilseed and pulse seed used for sowing to remove sclerotes. Also apply a registered fungicide seed dressing at the same time to protect seedlings from seed-borne disease.

Variety selection and sowing time

There are no Sclerotinia resistant crop varieties but variety selection is still important because the timing and duration of flowering are factors in disease development.

The timing of the commencement of flowering can significantly influence the susceptibility of pulse and oilseed crops to Sclerotinia infection. Crops that commence flowering early (late June–July) are at a significantly higher disease risk. Flowers are emerging at a time of ascospore release from sclerotia and extended periods of leaf wetness, which are ideal for infection. Early flowering also exposes the crop to multiple infection events and more opportunities for the disease to develop to damaging levels.

Follow the recommended sowing times for canola and pulse varieties best suited to your district. These recommended sowing times have been developed to optimise yield and minimise disease.

Generally, early sown pulse crops are more prone to disease and frost injury. Early sowing exposes field peas to blackspot and bacterial blight, lupins are more prone to frost injury and chickpeas are more susceptible to sclerotinia stem rot.

Foliar fungicide program

Use of registered foliar fungicides to manage sclerotinia stem rot can assist in reducing the disease, but timing is critical for success. The recommendation for canola is to apply fungicide at 20–30% bloom, when 15–20 flowers are open along the main stem.

Fungicides are only effective for about three weeks, so timing is important to provide crop protection when the spores are released from the soil. Rainfall events during flowering can affect the result, so applications of fungicide need to be carefully planned. Good coverage of the protectant fungicides on plant stems is required. For best results, use higher water rates and droplet sizes that will penetrate into the canopy.

Crop rotation sequences

The rotation sequence can help reduce the overall amount of inoculum in a paddock. With Sclerotinia being such a widely hosted pathogen and with the sclerotes able to survive for up to 10 years in soil, getting a non-host crop or a less susceptible variety into the rotation can be one of the most effective cultural controls.

Inoculum levels can build up under some of the close cropped rotation sequences (e.g. canola–wheat–canola). To minimise canola diseases such as blackleg and sclerotinia stem rot it is important to maintain a distance of at least 500 metres between the canola crop and the stubble of canola or other susceptible crops. Many foliar pathogens of pulse crops also survive in old stubble residue, ready to release spores the following year to infect emerging crops. Avoid sowing new season pulse crops adjacent to last season's pulse stubble.

A conflicting issue with rotations for disease management has been the use of double breaks with canola and pulses for herbicide resistant weed control. Herbicide resistant weeds are the biggest problem in most cropping areas so alternate cultural controls have become more important, but disease inoculum often builds up when susceptible crops are grown in sequence. This is particularly important when conditions for disease are favourable, as witnessed in many regions in 2016.

Canola is the largest break crop for cereal crop weed management because of the numerous herbicide choices, but seedling canola crops do not compete well with some weed species, especially from within the Brassica family, that are all potential hosts for Sclerotinia. Pulse crops also are a good choice when managing weeds as they can either be sprayed with selective grass herbicides or green or brown manured prior to weed seed heads appearing, but again are susceptible to Sclerotinia.

The choice of rotation sequence crops is important and should be flexible enough to take into account the paddock history of weed species and resistance status, disease and insect pests, economics of the crop, and the benefits that crop will bring to future uses of the paddock.

Canola and pulse crops provide an opportunity to use different chemistry for weed control, which may assist in the management of herbicide resistance, and care needs to be taken when considering how diseases will affect the crops both in the current season and the future build-up of pathogen inoculum.

Soil and paddock drainage

Another paddock selection consideration is ensuring adequate soil and paddock drainage to avoid waterlogging. Most pulse and oilseed crop species have poor tolerance to waterlogging, so be aware of soil types, paddock topography and the presence of hardpans that can promote waterlogging. Poor drainage exposes these crops to increased root rot diseases, such as phytophthora root rot, or premature crop death due to anaerobic conditions in the root zone.

$12 MILLION BOOST FOR POSITIONING TECHNOLOGY IN AUSTRALIA

The Australian Government will invest $12 million in a two-year program looking into the future of positioning technology in Australia.

From using Google Maps on your smartphone to emergency management and farming, most Australians use and benefit from positioning technology every day without realising it.

The funding will be used to test instant, accurate and reliable positioning technology that could provide future safety, productivity, efficiency and environmental benefits across many industries in Australia, including transport, agriculture, construction, and resources.

Research has shown that the wide-spread adoption of improved positioning technology has the potential to generate upwards of $73 billion of value to Australia by 2030.

Federal Minister for Infrastructure and Transport Darren Chester said the program could test the potential of SBAS technology in the four transport sectors—aviation, maritime, rail and road.

“SBAS utilises space-based and ground-based infrastructure to improve and augment the accuracy, integrity and availability of basic Global Navigation Satellite System (GNSS) signals, such as those currently provided by the USA Global Positioning System (GPS),” THE Minister said.

“The future use of SBAS technology was strongly supported by the aviation industry to assist in high accuracy GPS-dependent aircraft navigation. Positioning data can also be used in a range of other transport applications including maritime navigation, automated train management systems and in the future, driverless and connected cars,” he added.

Minister for Resources and Northern Australia Matt Canavan said access to more accurate data about the Australian landscape would also help unlock the potential of the north.

“This technology has potential uses in a range of sectors, including agriculture and mining, which have always played an important role in our economy, and will also be at the heart of future growth in Northern Australia,” Senator Canavan said.

“Access to this type of technology can help industry and Government make informed decisions about future investments,” he added.

The two-year project will test SBAS technology that has the potential to improve positioning accuracy in Australia to less than five centimetres. Currently, positioning in Australia is usually accurate to five to 10 metres.

The SBAS test-bed is Australia's first step towards joining countries such as the US, Russia, India, Japan and many across Europe in investing in SBAS technology and capitalising on the link between precise positioning, productivity and innovation.

Early this year, Geoscience Australia with the Collaborative Research Centre for Spatial Information (CRCSI) will call for organisations from a number of industries including agriculture, aviation, construction, mining, maritime, rail, road, spatial, and utilities to participate in the test-bed.

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RENEWED GROWER INTEREST IN LEGUME BREAK CROPS

Growers in Western Australia are showing renewed interest in legume 'break crop' rotations, particularly lentils, as a result of improved prices and the potential of new varieties.

As part of tactical break crop agronomy research led by the Department of Agriculture and Food and supported by the Grains Research and Development Corporation (GRDC), field trials were undertaken in 2016 to determine the legume varieties best suited to Esperance region growing conditions.

Trials sites were located in Wittenoom Hills (lentil and faba bean), Grass Patch (lentil and vetch) and Kumarl (lentil).

Department senior research officer Mark Seymour has just presented the results of seven of the trials on day two of the 2017 GRDC Grains Research Update, Perth which ran on 27 and 28 February at Crown Perth.

Mark said for lentil growers, PBA Bolt was the best choice with no other variety out-yielding it.

"PBA Ace may prove to be a good lentil option for early sowing or longer seasons," he said.

When considering plant-back tolerance in situations of imidazolamine and sulfonlyurea (SU) carryover, new lentil XT line CIPAL1422 performed well.

Mark said CIPAL1422, yet to be released commercially, looked to be a valuable alternative in addition to current variety PBA Hurricane XT to overcome SU carryover issues.

"Hurricane XT provided good tolerance to SU carryover compared to field peas and conventional lentil varieties, and also tolerated label and double label rates of Spinnaker herbicide application at Grass Patch," he explained.

Current vetch varieties Timok, Morava and Volga all had similar yields around 1.8 t/ha, while pre-commercial lines under evaluation showed considerable promise yielding between 1.9 and 2.2 t/ha.

PBA Samira was the highest yielding released faba bean variety in the trials.

Mark said faba beans had consistently produced good yields in the Esperance region for a number of years and current varieties have very useful levels of disease resistance.

"The uptake of faba beans will be reliant on early sowing opportunities, improved price signals and increased seed availability in WA," he added.

"The latest lentil varieties appear to provide superior yield potential and we can expect more grower interest in them if prices remain at current levels," concluded Mark.

Mark has also be presented the trial findings at the South East Premium Wheat Growers Association Esperance harvest review on 24 February and Albany zone Grain Research Update in Kendenup on March 7.

DRIVING A 40 PER CENT RISE IN VEGETABLE EXPORTS

The future is bright for Australia's vegetable industry, following the release of an industry strategy that aims to increase the value of vegetable exports to $315 million, or 40 per cent, by 2020.

'The Vegetable Industry Export Strategy 2020', being delivered by Horticulture Innovation Australia (Hort Innovation) and developed in conjunction with AUSVEG, outlines a range of methods to help more growers and the wider industry export Australian vegetables to overseas markets.

Hort Innovation Chief Executive John Lloyd said: "The Australian vegetable industry has a huge appetite for export growth and there is a lot of untapped potential there. Horticulture Innovation Australia is working with growers and AUSVEG to do everything it can to drive this growth and develop a financially sustainable vegetable export sector."

John said currently, vegetables make up around five per cent of national export production for horticulture and through relationship building, working with industry to get it export ready, boosting supply chain efficiencies and overseas activities, that figure could significantly rise.

"With all the necessary mechanisms in place, the Australian vegetable industry could increase its exports by 40 per cent within four years, and close to double exports within the next decade," he said.

AUSVEG National Manager – Export Development Michael Coote said data from the Global Trade Atlas and the Australian Bureau of Statistics showed Australia exported around 210,000 tonnes of vegetables valued at $227 million this past financial year.

In comparison, the strategy outlines an industry target of 310,000 tonnes of vegetable exports by 2020.

"The Australian vegetable industry has invested significantly in export development to help growers successfully export fresh Australian vegetables. The development of these markets is critical to the long-term viability of the industry," Michael said.

"The strategy will ensure vegetable exports are treated as a long-term channel to market by delivering industry-specific export training programs for growers, increasing the range of opportunities for growers to connect directly with overseas buyers and exploring product development and collaboration opportunities to determine the best products or business models for export success," he concluded.

PROTECTING MUNGBEAN RHIZOBIA

BY PAUL MCINTOSH, PULSE AUSTRALIA

Effective nodulation of mungbeans can fix about 60 to 70 kgN/ha, sufficient to grow a 1 t/ha crop. If the rhizobial inoculant is not applied or if the bacteria are exposed to high temperatures and die, this nitrogen will need to come from residual N reserves in the soil or from a pre-plant application of urea or Big N.

The survival of Rhizobia bacteria is very low if the inoculant product is exposed directly to the hot sun and temperatures above 33–35 degrees C. It only takes a few hours of exposure to the sun and high temperatures on the back of a paddock truck or in seed bins ready for planting for high levels of mortality to occur, rendering the inoculation process ineffective.

Even if you have grown mungbeans in the paddock in the past, you simply rely on a large enough population of the mungbean strain (Group I) of rhizobia being present in the soil. Water injection into the seeding furrow using cool water of neutral pH is the best application method to promote rhizobial survival and efficacy.

Avoid mixing inoculant with liquid fertilisers. Even though liquid fertilisers are a very desirable nutrient application option, rhizobia are very sensitive to pH and direct contact with elements such as copper and zinc.

Some farmers are now adopting the practice of applying nitrogen prior to planting mungbeans to make their planting operation very smooth and staff efficient. Keep in mind that these nitrogen applications should be pre-plant and not just at planting because a wetting front is required to push this relatively mobile nitrogen deeper into the soil profile, where the roots of the young mungbean plants are developing. There is no sense applying nitrogen into dry-ish topsoil while the mungbean roots develop in a good moisture zone lower in the profile. This is particularly important in fast growing mungbean crops where there is very little time to fix a nutrient deficiency.

If you plan to use applied nitrogen rather than (or as well as) fixed nitrogen to meet the mungbean crop's needs, a nutrient analysis of the soil profile well in advance of planting will help avoid having a sad, nitrogen-deprived mungbean crop three to four weeks after planting. There is no advantage in applying a high rate of nitrogen fertiliser and also applying inoculant, because rhizobia will only fix nitrogen effectively if the soil nitrogen levels are low. However, if your applied nitrogen remains positioned in the drier top soil layer, then seed inoculation may still be very effective.

More about rhizobia survival

Rhizobia bacteria are able to live freely in the soil without a host for a time but generally only when soil conditions, especially pH, are favourable to their survival. Rhizobia and their host legume tend to have similar pH tolerance. Inoculation is generally recommended for pulses (other than lupins) grown on soils with pH below 6 ($CaCl_2$) or below 6.5 (in water).

In higher pH soils, rhizobia associated with all pulse crops can survive for several months without a host plant. Many growers choose to use inoculant every time they grow mungbeans to be sure that the crop will nodulate effectively and fix atmospheric nitrogen to at least meet its own needs.

High biomass crops and narrow row spacing promote increased nitrogen production through fixation, contributing more to the N-budget of the rotation.

PLANT'S RESPONSE TO HEAT STRESS FLUCTUATES BETWEEN DAY AND NIGHT

Climate change has put agricultural crops at risk, which means that understanding how plants respond to elevated temperatures is crucial for protecting our environment and food supply.

For many plants, even a small increase in average temperature can profoundly affect their growth and development. In the often-studied mustard plant called Arabidopsis, elevated temperatures cause the plants to grow longer stems and thinner leaves in order to cope with the heat stress.

New work led by the USA located Carnegie Institute for Science's Zhiyong Wang uncovers the system by which plants regulate their response to heat differently between daytime and nighttime. It is published by Nature Communications.

One protein called Phytochrome Interacting Factor 4 (PIF4) is crucial to coordinating a plant's response to elevated temperature by activating the genes that help the plant deal with heat stress. But it only seems to be active during daylight hours. Wang and his team set out to find out what was constraining PIF4's activity to daytime.

They found that PIF4 is, in turn, regulated by another protein called Timing of CAB Expression 1 (TOC1), which is a part of the biological circadian clock proteins that accumulate at the end of the day. TOC1 binds to PIF4 and inhibits its activity in the evening and through the night. The disappearance of TOC1 at dawn allows PIF4 to respond to warm temperature in the morning.

Until now, how the circadian clock helps a plant's survival of heat stress was unknown.

"Since the hottest temperatures usually occur around noon and continue through the early afternoon, a plant's survival during a heat wave is most threatened during this period. By tying the heat response to the circadian clock, plants maximise their chances of survival during heat waves," Zhiyong explained. "

"Zhiyong's new work reveals a potential energy-saving strategy in plants where heat-stress response genes are prevented from being turned on at night when there is less chance of heat stress. Using a circadian clock machinery to do this is quite elegant," said Sue Rhee, Director of Carnegie Plant Biology.

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IMPORTED FLY PERFORMS IN MATING TRIALS

An imported fruit fly from the United Kingdom has shown great potential to biologically control the damaging horticultural pest Mediterranean fruit fly (Medfly), following glasshouse trials in Western Australia.

Research by the Department of Agriculture and Food has tested the fly's mating performance and found it stacks up against current control techniques using sterile radiation-treated flies.

The department sourced the new Medfly strain from UK-based company Oxitec and reared a colony of 2400 flies at a specialised facility in South Perth.

Department horticulture director David Windsor said the research was examining whether the fly offered an improved option for industry to control Medfly, which costs West Australian producers millions of dollars each year.

Dr Windsor said the Oxitec technology, like the sterile insect technique, aimed to break the breeding cycle of the Medfly through the rearing and release of the control flies.

Instead of using radiation to sterilise the male flies for release, the Oxitec fly has been developed to include a self-limiting gene which shortens the lifespan of female flies.

"When the male flies mate, they pass on the self-limiting gene to their offspring which causes females to die before reaching adulthood so they cannot breed," Dr Windsor explained.

Scientists from the department and Oxitec undertook glasshouse studies comparing the performance of the Oxitec flies against the sterile flies. Replicates were run with 21 mating trials in total under strict regulatory conditions.

"These involved releasing either Oxitec or sterile male flies, competing with wild male flies, to mate with females, in glasshouse trials," Dr Windsor said.

"During the trials each mating pair was collected and checked to determine the male's genotype," he added.

The mating performance by Oxitec males was comparable with that of sterile males irradiated at low levels, and exceeded that of sterile males treated with a higher dose of radiation which is used to provide a better guarantee of sterility.

"The research found the Oxitec male flies are compatible with wild female flies, and their mating performance is promising. We now need to consider how the new strain will perform under field conditions," Dr Windsor said.

Dr Windsor said the department was now in consultation with Australian Government regulatory bodies including the Office of the Gene Technology Regulator for the next phase of testing.

The research is funded by the department and Horticulture Innovation Australia Limited.

Horticulture Innovation Australia Chief Executive Officer John Lloyd said, "Horticulture Innovation Australia supports evidence-based research that can add to the growers' control options."

GOOD ON-FARM BIOSECURITY WILL STOP UNWANTED PESTS

Grain growers are reminded to review their on-farm biosecurity as they gear up for the 2017 season.

WA grains biosecurity officer Jeff Russell is with the Department of Agriculture and Food. He said good biosecurity was like insurance, protecting livelihoods, lifestyles and the environment from potentially harmful pests and diseases.

"Now is a good time for farm and related businesses to review their management practices and activities to protect the business from the entry and spread of pests," Jeff said.

"On-farm biosecurity is as much about protecting the farm from existing or endemic pests, as it is about keeping out exotic pests. Each year endemic weeds, pest insects or diseases cost farmers millions of dollars through lost production, reduced grain quality and control costs," he explained.

Jeff said the introduction and spread of snails onto properties was one example of a common pest that required ongoing management and control.

"Most notably the common white snail, small pointed snail and the brown field slug, have potential to become significant pests of grain and pastures, feeding on seedling crops and legume pastures, particularly early in the growing season. Good farm hygiene should be employed by all grain growers and industry members to help limit the further expansion of snail and slugs," he went on to say.

"Applying a 'Come clean, Go clean' philosophy to the movement of machinery, livestock and products and people on your property is one of the most important steps people can take to protect their farm," Jeff said.

Providing a clean down area on the property to ensure all vehicles and machinery are clean before entering production areas is also important particularly if machinery is coming in from outside the district," Jeff concluded.

SOIL MOISTURE FAVOURS SLUG POPULATIONS

Monitoring of slug populations in western Victoria has seen a marked increase in slugs during the 2016 spring, especially striped field slugs that are still active. This is similar to what was recorded back in 2013.

Extended wet spring conditions have allowed breeding to continue, and it is these juvenile and adult slugs that survive over hot dry summers to become a threat to establishing crops the following season.

Grey field slug activity and egg-laying are associated with 25% soil moisture. Soil moisture probes have shown at 0 to 10 centimetre soil moisture is above 25% where slugs are still active in February 2017.

A Grains Research and Development Corporation (GRDC) project aims to understand and validate 'slug risk' from year to year. Slugs are thought to become active after 75-80mm of rain at the autumn break, which will also be tested.

Southern Farming Systems (SFS) is collaborating with the South Australian Research and Development Institute (SARDI) understanding slug biology and manipulating stubble conditions to lessen slug population build up.

Previous research has shown the value of cultivation and removal of stubble in reducing slug populations, and there is an interaction with crop establishment, as demonstrated from research in a high pressure slug year (2014).

Cultivation improved seedling establishment even when it was only one week prior to sowing. Where no cultivation took place, control was solely reliant on more expensive bait products such as Metarex® or multiple applications of bran based baits such as Meta®.

Basic rules for successful crop establishment are: quick establishment sowing into warm soil using larger seed, cultivation prior to sowing, rolling directly after sowing then bait to protect seedlings, follow up monitoring to ensure baits are present and consider re-applying bait to problem areas or high pressure years such as expected in 2017.

Where canola is being established into no-till situations in 2017, growers should consider more expensive bait products or multiple applications.

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NSW grower Andy Stewart, pictured with Syngenta Territory Sales Manager Alec Duffy.

"Honestly, it's the cleanest crop we've ever had, and we usually apply two fungicides, which I haven't had to do this year."

Wayne Newbey of WA (pictured left with farm manager) commenting on the families wheat crop treated with UNIFORM.

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GEARING UP FOR THE NEW STRAIN OF THE BUNNY BUGS

ALL THREE LEVELS OF GOVERNMENT ARE WAGING A WAR AGAINST RABBITS IN VICTORIA'S KERANG LANDSCAPE, PREPARING THE GROUNDWORK TO BRING IN THE BIG GUNS.

With support from the Australian Government's National Landcare Programme, the Victorian Government and the Gannawarra Shire, the North Central Catchment Management Authority (CMA) has been hard at work in recent years supporting landholders and protecting significant natural assets.

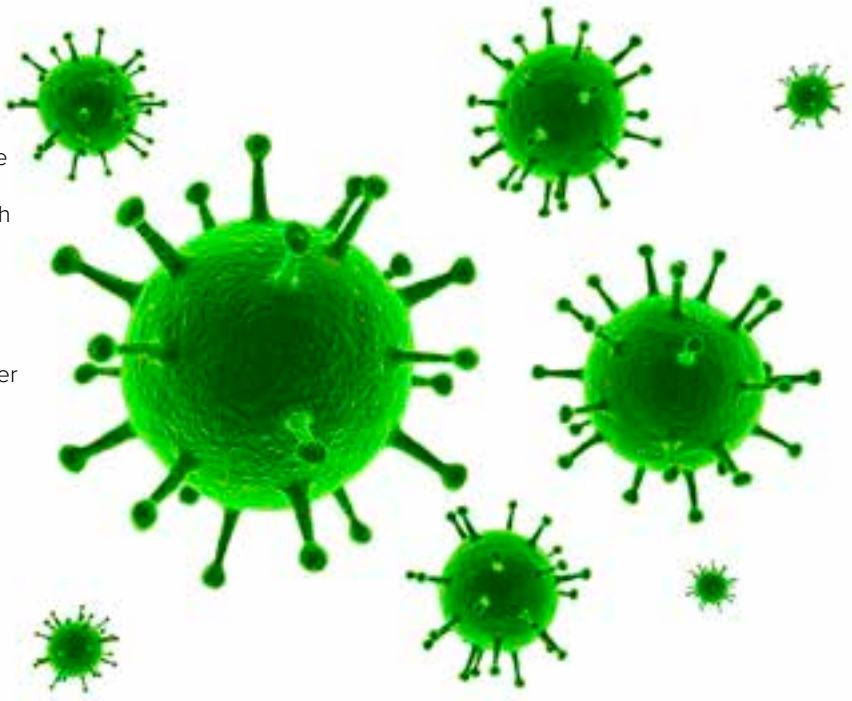
"Working with governments, we have protected threatened environmentally sensitive areas at places like Lake Kelly and Lake William, and supported Landcare members with supplies to bait their own properties," North Central CMA Project Manager Adrian Martins said.

"We also spend a lot of time on education and making information available. That continued in November when we hosted Dr Tarnya Cox of the NSW Invasive CRC and John Matthews of Agriculture Victoria for our Rabbit Buster Roadshow forums," he added.

Adrian also said that "the work of all these agencies is leading up to the release of the new calicivirus strain RHDV1 K5, which Dr Cox is leading nationally."

Gannawarra Shire is working on the ground to bait and destroy rabbit harbour along roadsides and on council land.

Council's Director of Infrastructure and Development Geoff Rollinson said partnering with other local agencies and communities is important for the success of the project.



“The new calicivirus is not a silver bullet. Land managers need to remain vigilant and follow up with conventional rabbit control to maximise the benefits of the release.”

John Matthews

“A number of works have occurred across the municipality in partnership with Parks Victoria and the North Central CMA, including two kilometres of rabbit and weed works along Reaper Lane near Johnson Swamp, prickly pear treatment along Rifle Butt Road and boxthorn treatment in the Lake Meran area,” Geoff said.

“Council has successfully negotiated with the relevant agencies to see significant complementary rabbit works carried out near Foster’s Swamp and adjacent to the Wandella Forest and along Hayman Lane near Cemetery Swam,” he added.

Agriculture Victoria has developed a nationally accredited Established Invasive Animal Management training program and has been training agency staff across Victoria in best practice rabbit management.

Agriculture Victoria has also been working with community members and the North Central CMA to deliver field demonstration days to build community knowledge and capacity to manage rabbits in preparation of the release of RHDV1 K5.

“The new calicivirus is not a silver bullet. Land managers need to remain vigilant and follow up with conventional rabbit control to maximise the benefits of the release,” John said.

Parks Victoria has been controlling rabbits in parks and reserves near the Kerang township over the past two years with funding from the Good Neighbour program.

“We’re helping neighbours with properties adjacent to crown land to reduce rabbits,” Parks Victoria Ranger and Cohuna Team Leader Murray Thorson said.

“We’ve found a coordinated program between private and public land is the most successful approach. We try to work with neighbours and other agencies as best we can for a landscape scale approach to tackling the problem,” he added.

Adrian said working alongside local landholders and other community members is a key cog in any rabbit eradication program.

“Programs like these are a local step to helping build agricultural sustainability and productivity across Australia. Not only do they benefit the environment, but they can play their part in making a big difference to the economy of the region and the country,” he concluded.

These projects are supported through funding from the Australian Government’s National Landcare Programme and the Victorian Government.

NEW SRA MANUAL HELPS SUGAR CANE INDUSTRY TACKLE A $70 MILLION PROBLEM

Sugarcane growers have access to a tool that provides the latest information on effective weed control in their crops, thanks to a new manual that has just been created by Sugar Research Australia (SRA).

SRA has just released the Weed Management in Sugarcane manual, which provides comprehensive information on weed control for the Australian sugarcane industry.

SRA Adoption Officer Mr Phil Ross wrote the publication with SRA weeds agronomist Ms Emilie Fillols.

“Yield losses from weeds, along with the costs of weed control, are estimated to cost the Australian industry $70 million each year. This manual is targeted at the dual aims of helping growers to combat weeds, and also ensuring that every dollar spent on weed control is efficient,” said Phil.

Phil explained that the end result of targeted and efficient weed control is more tonnes of cane, and a more profitable and productive sugarcane farming system, delivering a benefit to both sugarcane growers and millers.

“More efficient and targeted weed control also results in positive environmental outcomes, which sugarcane farmers are already demonstrating across the industry through improved practice,” he added.

The manual covers all stages of the sugarcane crop cycle, as well as looking at the suitability of various herbicides for various weeds, as well as best application of herbicides. It also provides the latest information on record keeping, environmental considerations, and herbicide resistance. It also provides indicative costs of weed control measures.

“Weeds are a perpetual battle for farmers, but this manual aims to give growers the information they need to reduce their weed problem and deliver benefits to their farm,” Phil said.

Farmer Mr Damian Wirth started growing sugarcane in 2015 after purchasing a property in the Innisfail region. He said that in that time he had put a high priority on effective and efficient weed control to allow him to get the most from his crop.

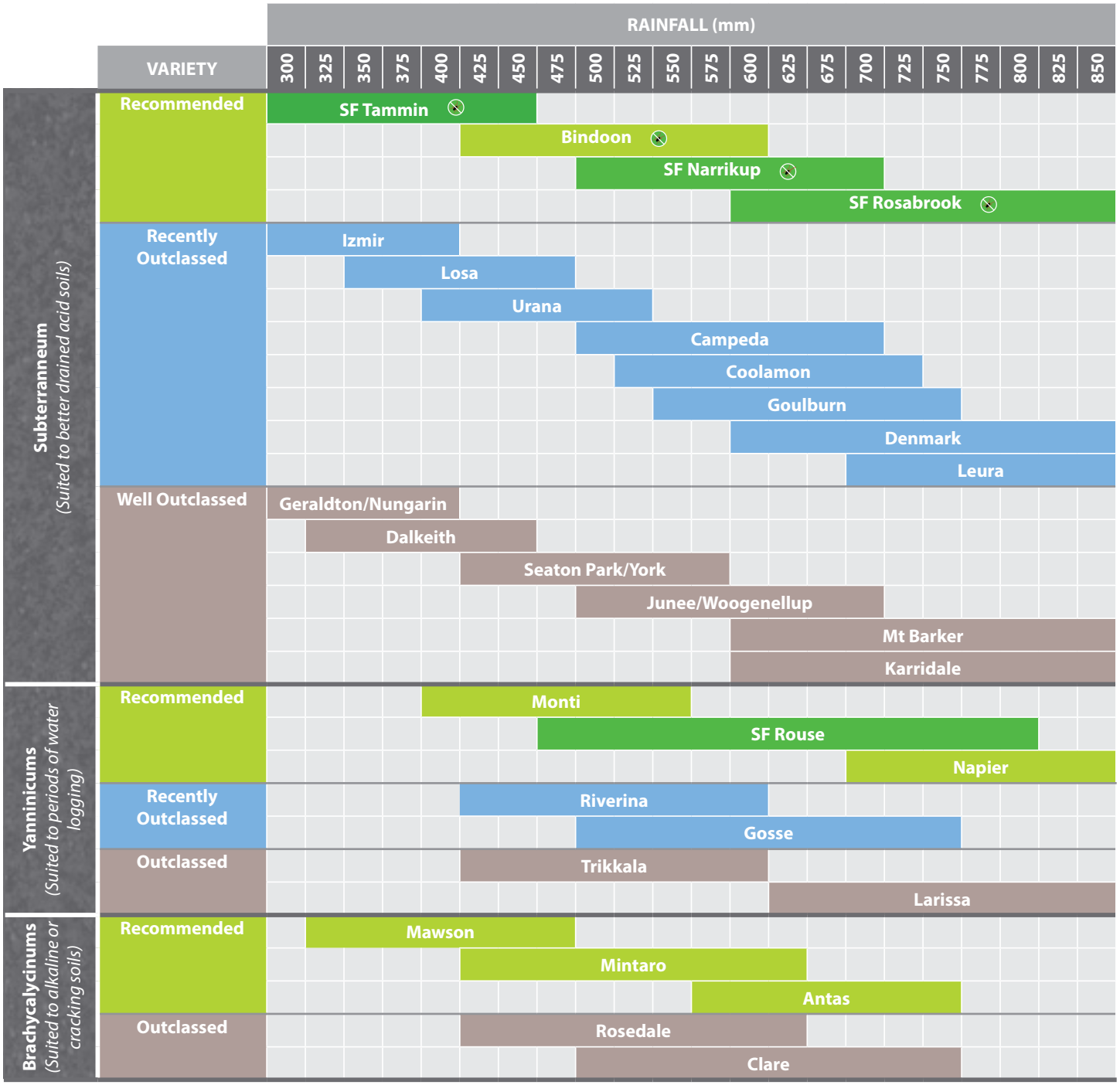
“Here in the wet tropics there is strong pressure from weeds, particularly when you get a flood across the property as we did this January after more than 800mm of rain early in the month, which brings in more weed seeds and adds to the pressure,” said Damian.

“Those weeds take away nutrient from the cane, so a manual like this is useful to learn about the best way to manage weeds, be that mechanical or chemical,” he added in conclusion.

Sub clover guide

This guide is designed to help you select the best sub-clover option for the various rainfall and soil types.

You should choose from the recommended varieties selected for improved forage yield, improved pest and disease resistance and levels of hard seededness most appropriate for the environment.



RAIN OUT, RESEARCH IN

CROP SHELTER PROVIDES GREATER RESEARCH PORTABILITY

In many parts of the world, lack of sufficient water makes it difficult – or impossible – to grow crops. Even in areas with enough water for farming, droughts can drastically lower the yield and quality of crops.

One way to grow crops in dry and drought-prone regions is to breed crop varieties that are better able to tolerate water stress. These crops can expand available arable land and increase food production.

Plant breeders and geneticists are continuously developing new crop varieties. But field-testing these new crop varieties to test whether they can actually tolerate water stress is challenging. Part of the challenge is that it is difficult to predict the timing and amount of rainfall, which can complicate experiments in the field.

So researchers turn to rainout shelters. These are structures designed to exclude rainfall from specific areas on agricultural fields. This allows experimentally-controlled water stress to be applied to the crops being grown in those areas.

In a new study, researchers from Agriculture Victoria describe a fully-automated, portable, and energy-independent rainout shelter. This new design will allow researchers to more effectively field test crop varieties for their tolerances to water stress.

"Developing tools to enable precise testing under natural field conditions is key for breeding water stress-tolerant crops," said Surya Kant, the lead author of the study.

Field testing new crop varieties is vital. Experiments under more controlled conditions – such as in greenhouses – cannot always replicate the variable conditions found outdoors.

"There are always variations between field and greenhouse experiments. That is especially the case for drought tolerance research," said Surya.

During field studies researchers often have to account for various soil types. In contrast, greenhouses often use premade potting mixes or a single kind of soil. There are also differences in plant density, competition with weeds, insects, pests and diseases. All of these differences add up and "results from greenhouse experiments can potentially be unreproducible in the field," said Surya.

The rainout shelters designed by Kant and his colleagues are built using steel arch frames and polyethylene covering. "This lightweight, robust design allows the structures to be portable. It also means that the shelters maintain durability in all weather conditions, especially high winds," he explained.

"Developing tools to enable precise testing under natural field conditions is key for breeding water stress-tolerant crops."

Surya Kant

Plastic road barriers, filled with water, and steel arch frames create the skeleton for this portable rainout shelter. Photo credit Surya Kant.

Drought tolerance in wheat experimental plants growing under rainout shelters. Photo credit Surya Kant.

Solar power, rain sensors, and surveillance cameras complete the setup. Photo credit Surya Kant.

The rainout shelters are mounted on plastic road barriers. These barriers can be filled with water to act as foundations. They can be emptied for maximum portability when the shelters need to be moved.

"Most rainout shelters run on rails that are fixed to the ground, and are therefore non-portable. In contrast, our rainout shelters are portable. They can be relocated to another research station to allow for crop rotation and experimental site changes," Surya added.

Availability of electric power supply is another issue for researchers using rainout shelters. This is especially the case when experimental sites are located in remote areas. Surya and his colleagues incorporated a portable solar power system in their design to ensure that all power is generated onsite. Independent power generation can minimise potential failures due to issues with existing power infrastructure.

The new rainout shelters also have other customised features, such as rain sensors and surveillance cameras. The rain sensors automatically deploy the shelters in the event of rain, such that no rainfall event is missed accidentally. The surveillance cameras allow researchers to monitor their experiments remotely.

The unique features on these rainout shelters can expand their use into more remote areas. This will potentially allow researchers to test crops for drought-tolerance and growth in previously unusable land.

INDUSTRY DEMAND DRIVES NEW AGRIBUSINESS DEGREE

Some of Australia's largest agribusinesses have joined with the University of Adelaide to design a new, business-focused Master of Agribusiness program, to cultivate the industry's next generation of leaders.

Building on the University's reputation for excellence in agriculture, food and business education, the new master's degree will service one of Australia's most important industry sectors, valued at more than $430 billion annually.

Professor Wendy Umberger is Director of the Centre for Global Food and Resources at the University of Adelaide.

"This is a key industry for our nation, employing an estimated 1.4 million Australians. Agribusinesses are currently seeking thousands of graduates to fill demand for agricultural roles – for every graduate there's an estimated six positions available," Professor Umberger said.

"Our new Master of Agribusiness will enable students to develop the skills necessary for agribusiness leadership, management decision making, policy analysis and problem solving, all within an increasingly complex, ever-changing global marketplace," she added.

"Critically, this program has been developed in consultation and close collaboration with leaders in the agribusiness sector. This ensures our program is not only practical and relevant to today's industry needs, it will also foster critical thinking among graduates, which will be invaluable for the industry's future," Professor Umberger explained further.

The Chairman of the University's Agricultural Advisory Board is John Crosby, Director of Ag-Management Pty Ltd. He said, "From the industry's perspective, until now there has been no university program in agribusiness that has provided the elite level of education required for our future leaders."

"The new master's degree at the University of Adelaide requires a high standard for entry and is targeted at those who will truly lead agribusiness in Australia for the decades to come, from key positions of management. We have high expectations for this program. It will be to Australian agribusiness what Harvard currently is to world business management. That is, it's the right place to go if you want to be recognised as a leader in the field," John explained.

The University of Adelaide's new Master of Agribusiness and a Graduate Diploma of Agribusiness are now open for applications.

NEW GRADUATES BEGIN AGRONOMY DEVELOPMENT PROGRAM

Three new graduates have begun an eighteen month Agronomist Development Program with Agriculture Victoria, which includes intensive placements with leading grower groups and agribusiness.

The program, which provides valuable grains industry capability, is an important component of the Regional Research Agronomists program, funded through a bilateral agreement between the Grains Research and Development Corporation (GRDC) and the Victorian Government.

Agriculture Victoria's Senior Regional Research Agronomist Dr James Nuttall said graduates gained direct exposure to grains related research and development and would build invaluable networks across the industry."

"One of the three new graduates, Queenslander Jasmine Marsh, will be based at Horsham working across the state's northwest, completing placements with the Birchip Cropping Group and Landmark at Horsham with a focus on medium rainfall cropping systems" Dr Nuttall said.

Jasmine has a Bachelor of Science with Honours from the University of Queensland.

He went on to say Tom Batters, a graduate of the University of Melbourne from St Arnaud, will be based at Bendigo and will cover the Mallee region, with placements with the Birchip Cropping Group and Agrivision at Swan Hill. And Elly Polonowita, also a University of Melbourne graduate with a Bachelor of Agriculture, will be based at Hamilton, undertaking placements with Southern Farming Systems at Inverleigh and Gorst Rural at Lake Bolac."

"The graduates will build their agronomic knowledge and expertise by gaining experience in key areas including seasonal risk management, nutrition and pathology, trial development and management, pest, weed and disease identification and crop protection options in a regional farming systems context," Dr Nuttall said.

These graduates are the third intake since the program began in 2015. All graduates from the first intake are now working in the agricultural sector, and graduates that commenced in 2016 through the second intake are completing placements with agribusiness, and will finish the program in July.

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SUPPORTING WOMEN IN HORTICULTURE THROUGH NEW SCHOLARSHIPS

The women of contemporary Australian horticulture have spoken. They want affordable access to women's-only development programs, to expand their professional networks and to boost their theoretical education.

In response to their calls, the research and development corporation Horticulture Innovation Australia (Hort Innovation) is working with Women & Leadership Australia (WLA) to roll out 20 targeted industry scholarships per year for the next five years.

Informed by feedback from over 20 of the industry's leading women at a dedicated Hort Innovation workshop in August 2016, the initiative provides three different scholarship opportunities for women with varying leadership experience.

Each year, 10 scholarships will be available for emerging women leaders, five for women working in mid-level management and five for women working at a senior and executive level.

Both Horticulture Innovation and WLA will co-contribute to the part-scholarship for participants, which will reduce the cost of participating by around 60 per cent.

Horticulture Innovation Australia chief executive John Lloyd said a recent Workplace Gender Equality Agency report showed that the agriculture, forestry and fishery industries are male dominated, with only 33.7 per cent of the workforce female.

"Low numbers of women in horticulture, combined with factors such as an ageing workforce, limited access to formal leadership training, declining interest in studying horticulture and a lack of support around post-graduate research means that it is very hard for women to progress and develop in this industry," John said.

"This scholarship program will address these issues, and give women the tools needed to support long and profitable careers in horticulture," he added.

Grower, advisory workshop participant and Voice of Horticulture Chair Tania Chapman said the initiative will prove invaluable to women.

"Women's leadership is an issue that has probably not been tackled in the right way historically. We all know women have a different set of skills to men and all too often we don't actually get women to bring them out," Tania said.

"This leadership program will help keep women in the industry, as strong leaders, reminding them of what they've achieved, the skills they've got and spurring them on to do even greater things," she added.

Participation in the programs will also enable women from the horticultural sector to network with women from a wide range of other sectors.

WLA Head of School Kelly Rothwell said the scholarship program is a first-of-its-kind in Australia.

"We are extremely proud to co-invest with Horticulture Innovation Australia. This is a sustained developmental project that will transform the lives of many women right throughout the industry," said Kelly in conclusion.

2016 HIA AGM. Emma Germano (right) with Tanya Chapman in Sydney. 25th November 2016

AUSTRALIA'S AVERAGE WHEAT YIELDS STALL

Australia's average wheat yields, which had more than tripled due to technological advances between 1900 and 1990, did not increase from 1990 to 2015.

Recent research by CSIRO scientists, published in the journal Global Change Biology, found that Australia's yield potential (determined by the climate and soil type, managed using best practice and current technology) declined by 27 per cent over the past quarter of a century.

CSIRO team leader Dr Zvi Hochman said the study found that Australia's wheat growing zone had experienced an average rainfall decline of 2.8mm or 28 per cent per cropping season, and a maximum daily temperature increase of around 1 from 1990 to 2015.

These observations are consistent with the higher end of future climate change projections for the wheat zone over the coming 26 years.

The findings indicate a risk to the future prosperity of Australia's more than $5 billion per annum wheat industry, which contributes around 12 per cent of the total wheat traded globally.

"Our results are a serious concern to the future livelihood of wheat farmers in marginal growing areas and to the Australian economy, as well as future global food security," Dr Hochman said.

"Wheat farmers are making the most of developments in farming technology and adapting them to their needs. However, their best efforts are merely enabling them to keep pace with the impacts of a changing climate," he added.

He said that despite the adverse trend in growing conditions farmers have so far managed to maintain yields at 1990 levels of around 1.74 tonnes per hectare.

This shows that wheat growers are closing the gap between potential and actual yield.

"1990 was a watershed year for Australia's wheat industry, with a continued decline trend in yield potential since that year," Dr Hochman said.

The study analysed 50 weather stations with the most complete records across Australia's wheat growing regions, spanning five states from the east to the west coast.

"We found that the loss of yield potential is not evenly distributed across Australia's wheat zone," Dr Hochman said.

"While some areas have not suffered any decline, others have reduced yield potential by up to 100kg per hectare per year," he explained.

Wide annual variation in climate, yield potential and actual yields are normal in Australia.

However, the probability of seeing the trends shown by this study across 50 weather stations over 26 years, through random seasonal variability is less than one in 100 billion.

"Assuming the climate trends we have observed over the past 26 years continue at the same rate, even if farmers continue to improve their practices, it is likely that the national wheat yield will fall. We estimate that the recent average yield of 1.74 tonnes per hectare will fall to 1.55 tonnes per hectare by 2041," explained Dr Hochman.

"The 2016 season is expected to result in a bumper crop, however our preliminary estimates show that yield potential in 2016 was about the same as in 2010. So yield potential was high, but not exceptional. The anticipated record yield is consistent with the trend of farmers closing the yield gap," Dr Hochman said.

Although the study focused on wheat, the findings would be broadly applicable to other cereal grains, pulses and oilseed crops, which grow in the same regions and same season as wheat.

DS PASCAL SHINES IN THIS SEASON'S WET HARVEST

THE 2016 CEREAL SEASON DEMONSTRATED THAT DS PASCAL IS A HIGH YIELDING WHEAT VARIETY ADAPTED TO EARLIER SOWING OPPORTUNITIES ACROSS A WIDE RANGE OF ENVIRONMENTS ACROSS SOUTHERN AUSTRALIA. DS PASCAL ALSO OFFERS A STRONG DISEASE PACKAGE WITH AN EXCELLENT PLANT TYPE AND MINIMAL LODGING.

Dow Seeds breeding trial plots (See Figure 1), sown early May at Mallala, Paskeville, Horsham and Streatham showed DS Pascal yielded better than other longer season lines such as Trojan, Kiora and Beckom.

Large (0.2 Ha) SEPWA trials in Hopetoun and Wintenoom Hills further highlighted the wide range of early sown locations that DS Pascal performs well (See Figures 2 & 3).

Figure 1. 2016 Dow Seeds Plot Trial Yields

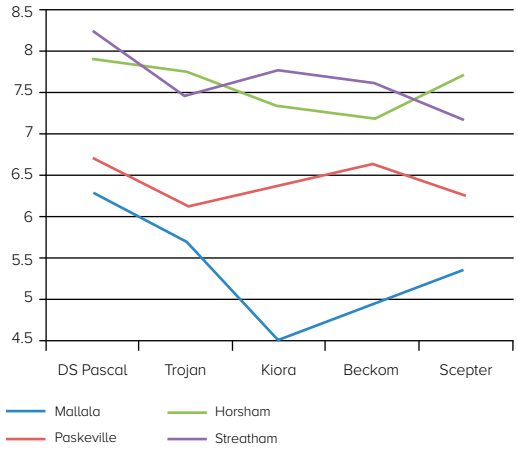


Figure 2.SEPWA Trials, Hopetoun WA

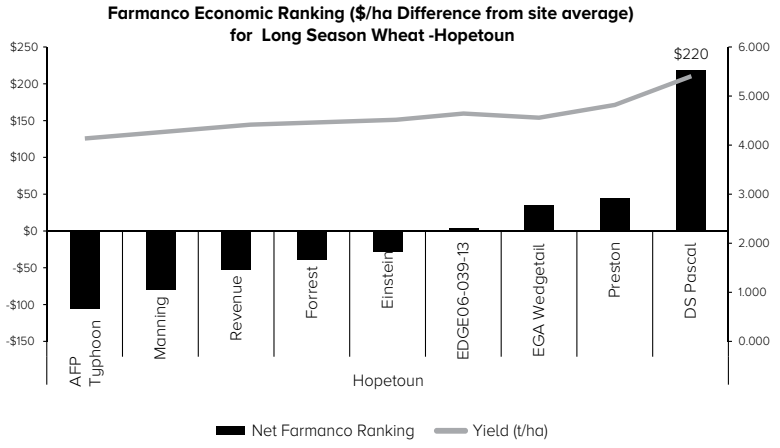


Figure 3. SEPWA Trials, Wittenoom Hills, WA

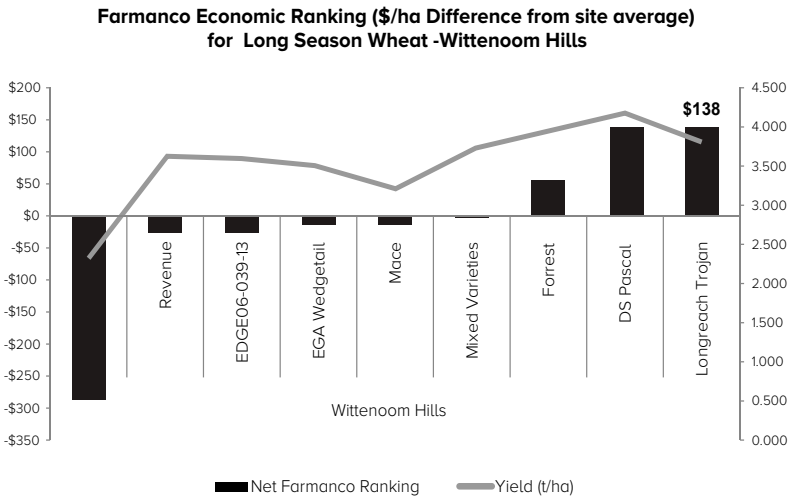
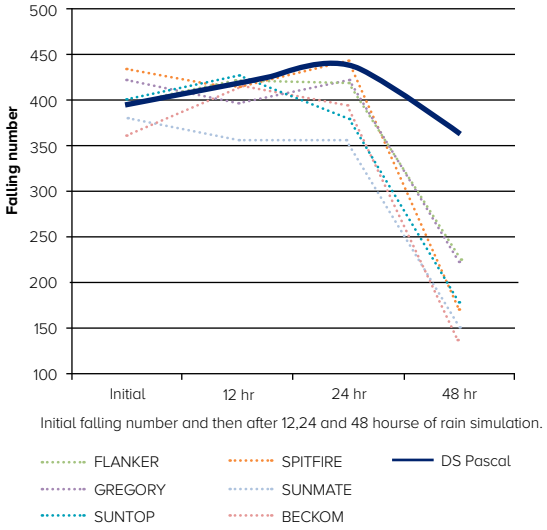


Figure 4. Falling numbers over time in a simulated rain environment



The success of these trials reflected field performance with farmers being ecstatic at the results in their paddock. John Pattison, a farmer north of Wagga reported "DS Pascal is pretty exciting actually, phenomenal. We are very, very pleased with it, we plan to grow some more."

John Anderson, agronomist from Marrar agreed, and said "DS Pascal in our south Wagga trial (15 ha) was 1-1.2 t/ha better than Lancer, our north Wagga trial (26 ha) was 1.3 t/ha better. DS Pascal averaged 7.8t/ha in dryland conditions, so it performed really well. We did a falling number test. DS Pascal was over 500 and Lancer was low 400, so the sprouting tolerance that is on the DS Pascal technote is pretty much to the word. A few blokes are having trouble with falling numbers this season, especially after that rain in spring. DS Pascal came back really well."

Dr Allan Rattey is Dow Seeds Senior Breeder. He advised, "Estimation of PHS in the field is difficult. In 2016, we sampled physiologcally mature spikes of several varieties. These spikes were snap frozen to preserve dormancy, then transferred to a rain simulator and subjected to 12, 24 and 48 hours of "misting" rain at cool temperature to facilitate sprouting. Figure 4 shows initial falling number (FN) of all varieties were above 360, and that all lines maintained their FN above 360 after 12 and 24 hours of simulated rain. However, after 48 hours a clear pattern emerged, with the enhanced PHS tolerance of DS Pascal enabling it to maintain a FN above 360, whilst the FN of all other varieties fell below 220. These data, combined with previously presented results on GI and FN prior to 2016, demonstrate that DS Pascal is setting a new industry benchmark for PHS tolerance."

Figure 4. Falling numbers over time in a simulated rain environment

"DS Pascal has the benefit of market leading PHS combined with excellent yield, standability and lodging as well as a strong disease package, including MRMS (P) for YLS" Dr Rattey added.

"To get the best from DS Pascal you want to sow early," He also said.

Nick Willey is Dow Seeds northern zone breeder. He said, "We are also excited about the launch DS Faraday in 2017, which combines APH grain quality and a strong disease package, with class leading PHS tolerance in the northern zone. DS Faraday is an early to main season line suited to a wide range sowing dates and environments across this zone".

HARVEST RECORDS BROKE

GrainCorp recently announced that its harvest receivals reached 12 million tonnes, with record or near-record receivals at 26 of its country silos across Queensland, New South Wales and Victoria.

Nigel Lotz, General Manager of Operations for Storage and Logistics, said it had been a massive operation. “This is the biggest winter harvest since 2010/2011, where our network received 12.3 million tonnes by the same time,” he emphasised.

“It’s really exciting to see some areas achieve high yields after extended drought, particularly north western New South Wales and western Victoria. Grain quality has also been good, especially across canola and wheat,” Nigel said.

“Coonamble was our largest silo with nearly 400,000 tonnes of grain received. Walgett and Thallon received nearly 300,000 tonnes. Other silos such as Barellan, Warracknabeal and Quambatook received close to 200,000 tonnes. The planning and resources needed to scale up by over 60 per cent compared to last year posed some challenges, however we were able to take full advantage of our network,” he explained.

Nigel said that In recent years, the focus has been on developing larger and more efficient country silos that provide better turnaround times and more segregations for growers.

“Prior to harvest we spent $21 million on improvements, including new stackers and upgrading existing bunkers and equipment. We also boosted employment of harvest casuals by 60 per cent to 3,000 roles compared to last year,” he said.

Nigel also said, “I want to thank grain growers for working so closely with us, letting us know what they needed from us and how they were going. This helped us in setting opening times, segregations and resources. I also want to thank our local teams who worked tirelessly over a long harvest.

“Our attention is now turning to the export program. We have already moved over 1 million tonnes of grain from our silos to sub-terminals and ports. We have secured additional rail and road capacity to ship this grain, with the shipping stem heavily booked for the next six months,” he added in conclusion.

GrainCorp silos with record or near-record 2016/2017 harvest receivals:

State	Site
Queensland	Talwood
Queensland	Thallon
New South Wales	Burren Junction
New South Wales	Cryon
New South Wales	Walgett
New South Wales	Coonamble
New South Wales	Gilgandra
New South Wales	Rand
New South Wales	Cunningar
New South Wales	Calleen
New South Wales	Barellan
New South Wales	Hillston
New South Wales	Merriwagga
New South Wales	Manildra
New South Wales	Euabalong West
Victoria	Charlton
Victoria	Elmore
Victoria	Murchison East
Victoria	Deniliquin
Victoria	Carwarp
Victoria	Speed
Victoria	Wycheproof
Victoria	Boort
Victoria	Quambatook
Victoria	Nhill
Victoria	Warracknabea

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"DS Pascal is pretty exciting actually; phenomenal! We are very, very pleased with it, and we plan to grow some more. "
- John Pattison, farmer, Wagga Wagga NSW.

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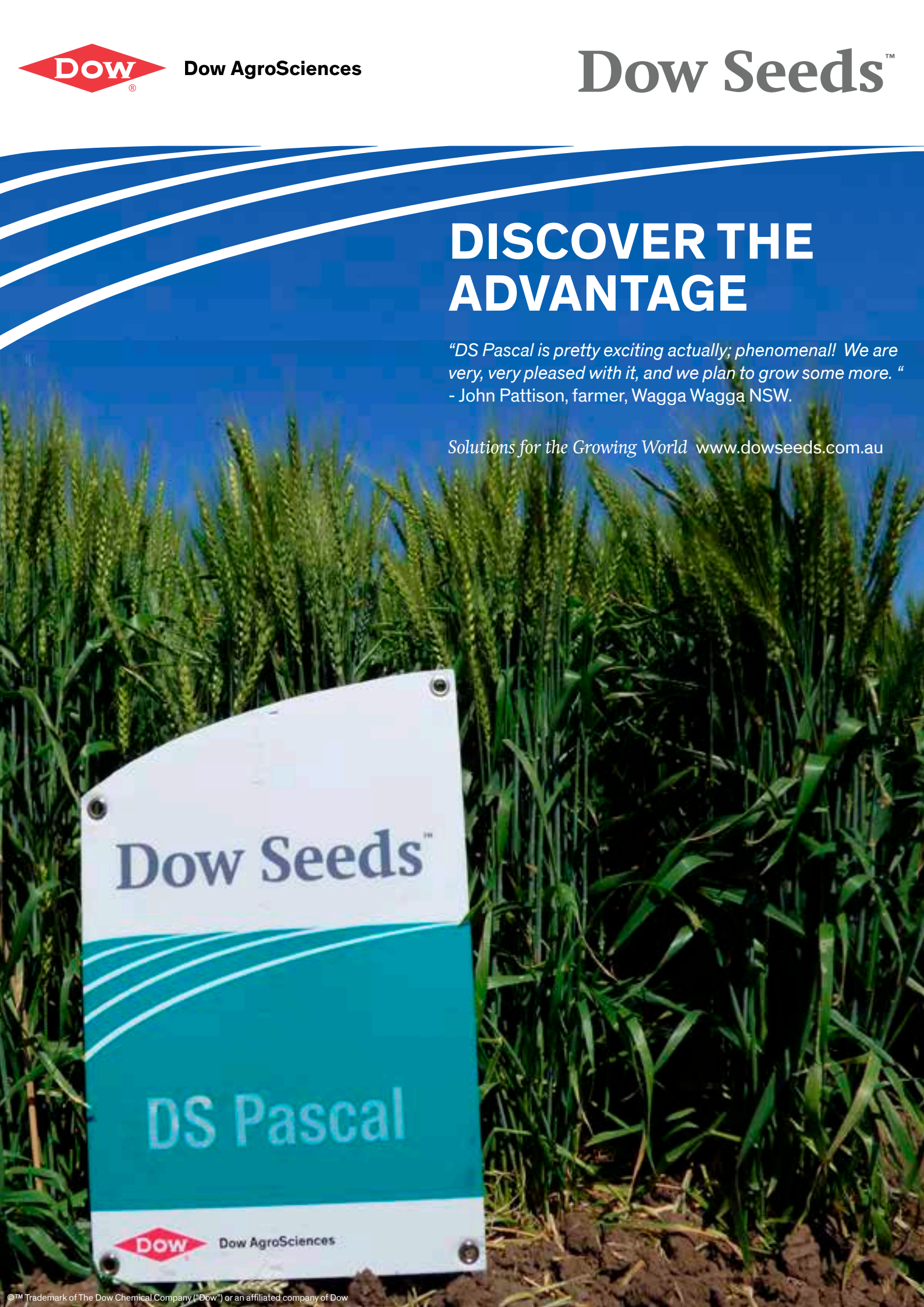

NEW CANOLA ESTABLISHMENT GUARANTEE REDUCES RISK

The perceived greater risks associated with producing canola will now be mitigated for WA growers via a popular crop establishment guarantee program being extended into the State for the 2017 season.

The 'Replace MySeed™' program from Bayer, the first of its kind in Australia to offer 100% replacement cover on hybrid canola seed, enables seed replacement if a crop has not established at 45 days after sowing.

Under the program, growers are covered for drought, water-logging, mice, bird and insect damage, slugs, disease, sandblasting and frost, but not for failures caused by agronomic or application errors, poor management practices and other factors within their control.

The launch of the program is good timing considering the important value of canola to cropping enterprises.

"Consultants are saying it will be the highest gross margin crop for the coming year," said David Peake, Seeds Agronomist with Bayer.

"Demand for canola seed has been the biggest we have ever seen. We have already sold out of three hybrid varieties and another two lines are now in short supply," David added.

He said growers were automatically enrolled in the Replace MySeed program upon purchase of Bayer hybrid canola seed and by indicating to their agronomist the paddock they plan to sow to the variety.

If the crop has not established after 45 days, the paddock is inspected and the claim verified.

"Growers have said producing canola, and particularly hybrid varieties, can be too expensive or risky, so this program takes that risk component away for them," David said.

In addition to this risk management program, Bayer has further supported growers by reducing the price of its IH30RR hybrid variety and offering delayed payment terms, effectively after next harvest on December 15, 2017.

David said paying at the end of the year, after harvest, could especially suit those impacted by frosts last season and with tighter cash flows.

Bayer's wider MySeed program also allows growers to test exciting new varieties in their paddocks and offers online tools to help them calculate their seed requirements and the cost, as well as highly accurate and efficient seeding rates.

GRDC BOARD STEPS INTO GROWERS BOOTS

Early in February the Grains Research and Development (GRDC) Board undertook a three-day fact finding mission to south-east Queensland and northern New South Wales.

Led by Goondiwindi grain grower John Woods, who took on the role of GRDC Board Chairman in October 2016, the seven member board visited farms to listen to growers talk about profit drivers, research gaps and their immediate and long term issues.

John was joined on the three-day board tour by GRDC managing director Steve Jefferies, deputy chair Kim Halbert (WA) and GRDC board directors' Dr Andrew Barr (SA), Dr Helen Garnett (NT), Roseanne Healy (SA), David Shannon (SA) and Dr Jeremy Burdon (ACT).

"This regional engagement was about ensuring the board directors meet with growers to understand the challenges and issues facing farming systems and the industry," John said.

"As a board understanding the research priorities and needs of growers is vital, because we have the responsibility of ensuring the levy investment by grain growers delivers paddock-ready solutions to production constraints, helps reduce production costs and most importantly has a positive impact on farm profitability," he explained.

"We also spent time meeting with our research partners, as GRDC doesn't undertake research itself, we invest with our research partners, so understanding their concerns and opportunities is essential," John added.

John said the presence of regional GRDC staff and an office in Toowoomba further reflected the GRDC's commitment to delivering regionally relevant, locally coordinated and transparent levy investment.

"Our regional offices provide a vital contact point for ongoing engagement with growers and research partners and this two-way conversation between the GRDC and industry is critical. It ensures the GRDC aligns its research investments with the needs and priorities of growers, whilst then co-investing with key research partners," John said.

The board engagement included meeting directly with grain growers in Goondiwindi, Mungindi and Walgett, before visiting researchers in Toowoomba. GRDC northern panel chairman John Minogue also joined the board on the tour reflecting the critical role regional panels play in informing investments.

The final day of the engagement included a tour of the University of Southern Queensland (USQ) to see a jointly funded initiative between USQ and the GRDC.

John this investment was an example of effective R&D collaboration with the aim of ensuring the grain industry's enduring profitability into the future.

GRDC in partnership with USQ is making a $10 million investment, which includes $2 million from GRDC for stage one, and will result in an expansion of the CCH's glasshouse, laboratory and outdoor trial-site capacity, and deliver a new centre for the study of biopesticides. The initiative aims to bolster Australia's ability to protect its multi-million-dollar broadacre industries against plant disease and biosecurity threats.

"Being involved with USQ in this plant pathology and biosecurity project is a key move for the GRDC, allowing us to support plant protection research into crops like sorghum, sunflowers and mungbeans," John said.

"On a broader note, joint partnerships like this give researchers the capacity to develop integrated solutions to provide sustainable and progressive cropping options for Australian grain growers. Going forward the GRDC's ability to support and collaborate with other organisations will be one of our greatest strengths and will encourage us all to think outside the square in terms of R&D that benefits our industry," he said in concluding.

NSW AGRONOMIST WINS PRESTIGIOUS AWARD

Prominent southern New South Wales agronomist Barry Haskins has been recognised for his invaluable contribution to northern grains research, being awarded the 2017 Seed of Light Award by the Grains Research and Development Corporation (GRDC).

The award was presented in mid-February at the GRDC Grains Research Update at Wagga Wagga and recognises an individual who has made a significant contribution to communicating the importance and relevance of research outcomes to the wider grains industry.

GRDC northern panel chair John Minogue said Barry was a worthy award recipient having dedicated enormous time and effort over the years to communicate key research findings to both the grains industry and wider community.

“Barry is extremely passionate about agriculture and agricultural extension and that passion has seen him delivering knowledge and skills both within and outside his grower network,” John said.

“He has an extensive following across an area that traditionally hasn’t been widely serviced by extension providers, and over the years, he has successfully filled that knowledge gap. Barry’s helped many growers reach the top of their game where they are producing a maximum amount of grain from a minimum amount of moisture,” he explained.

Barry is a well-known and widely respected figure in the NSW grains industry, having worked as a district agronomist with NSW Department of Primary Industries for 10 years before establishing AgGrow Agronomy and Research, an independent agricultural consulting and research company based at Griffith.

With a renowned ability to work with a diverse range of people and farm businesses, Barry has built an extensive list of clients and over the years and helped raise their individual and collective production benchmarks.

He has vast experience in cropping agronomy in both irrigated and dryland agriculture and offers research-based recommendations to clients covering an area of over 200,000 hectares across the Riverina region.

He’s a passionate advocate for the role research can play in improving production efficiency and farm profitability and has been a leading figure in the move towards conservation farming practices in southern NSW over the past 15 years.

THE SEASONAL OUTLOOK FOR AUTUMN IS HOT AND DRY, BUT WHAT IS CAUSING IT?

Both maximum and minimum temperatures look to be above average, especially for central Australia, extending down through inland New South Wales and western Victoria. Most inland locations of Western Australia, South Australia and Queensland will also be adversely affected by the unseasonal warmth. The far southwest corner of Western Australia and coastal parts of New South Wales and Queensland look to have some relief with onshore winds cooling the average temperatures.

Rainfall amounts also look to be much less than average, particularly for inland parts of South Australia, New South Wales and Victoria. This rainfall trend also extends through the entire country, with the exception of the tropics and the eastern seaboard. It should be noted that this is typically a drying time of year due to tropical moisture decreasing.

In contrast, much of northern Northern Territory looks to receive average rainfall and below average maximum temperatures, due to lingering monsoonal activity.

Despite the warmer and drier than normal outlook, the El Nino Southern Oscillation (ENSO) is in an inactive phase and is providing little abnormal climate influence on Australia. Other major climate drivers (such as the Indian Ocean Dipole) are also neutral.

The models are indicating higher than normal pressure over the Bight and Tasman Sea throughout autumn. This prevents cold fronts from progressively advancing further north during autumn to achieve the 'winter-like' weather. These high pressure systems also direct onshore winds to coastal locations of Queensland and New South Wales, revealing why these regions may not be as hot and dry as their inland counterparts. However, ocean temperatures are still much warmer than average so cooling might not be as dramatic as a typical autumn would see.

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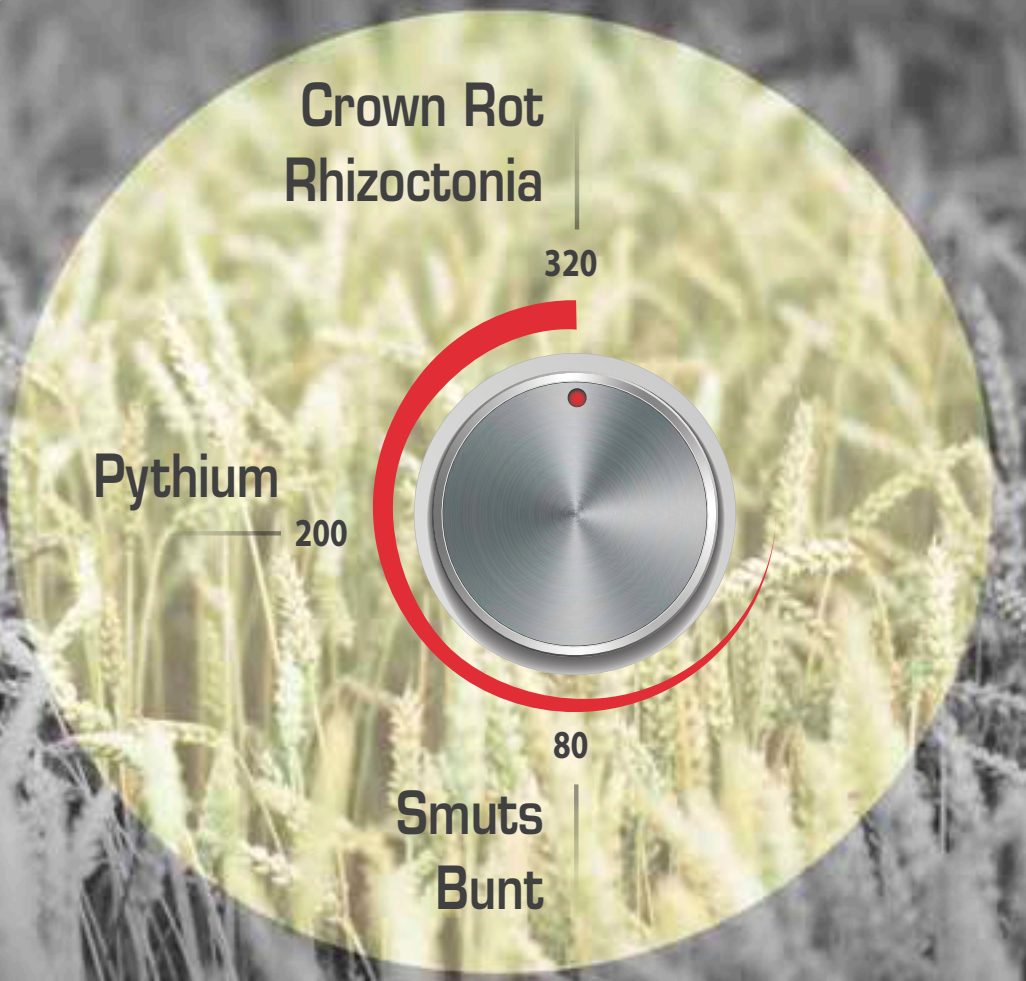

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NEW R&D APPOINTMENT FOR SOUTH AUSTRALIAN MANUFACTURER.

In late 2016 Australian owned biological fertiliser manufacturer, Neutrog Australia, appointed research scientist, Dr Uwe Stroeher Ph.D., to head up its Research and Development team.

Dr Stroeher has been a consultant to Neutrog Australia for almost ten years, working on both the safety and scientific formulations of biological fertilisers, and has been instrumental in the development of Neutrog's liquid probiotic GOGO Juice.

Announcing his permanent appointment, Neutrog Managing Director Angus Irwin said Dr Stroeher's background as a highly regarded scientist, together with his expertise in molecular biology, will allow Neutrog to continue to be at the forefront of biological fertiliser development in the heavily populated world of today and into the future.

"Innovation is central to Neutrog's strategic agenda and by employing a research scientist with the right combination of knowledge, skills and curiosity, we will further strengthen our position as a leader in the development of biological fertilisers worldwide," Angus said.

Since graduating from the University of Adelaide in 1993 with a Ph.D. in Microbiology, Dr Stroeher's research has spanned many projects. Recently he has been actively collaborating with the School of Chemical and Physical Sciences at Flinders University, in particular with clean technology, to examine the use of nanotechnology to enhance antibacterial compounds.

Angus went on to explain that "Dr Stroeher will play a pivotal role at Neutrog, conducting field research and running trials on which to base further development of biological products that are able to pinpoint, extract and proliferate specific soil bacteria which are known for their roles in the soil such as unlocking phosphorus and fixating nitrogen."

"Dr Stroeher's background ensures Neutrog's manufacturing methodologies and processes like batch and DNA testing of raw materials and finished products providing customer reassurance by far exceeding mandatory safety standards," Angus said.

Dr Stroeher is well known to Neutrog, having consulted to the company for the past ten years initially during the concept stages of GOGO Juice (a liquid probiotic for soil). He's been involved in developing processes and technologies aimed at maximising the beneficial microbiology in all of Neutrog's fertiliser products, which has cemented its position as a supplier of high quality fertilisers.

MAKING CHEMICAL COMPLIANCE EASIER: ONLINE REGISTRATION

Agriculture Victoria is continuing to look for ways to make it easier for farmers to safely use chemicals, adding a new online registration service to its website.

Already boasting a detailed information section outlining the safe and appropriate use of farm chemicals, the 'Chemicals' section of the Agriculture Victoria website now includes an online portal that enables farmers to apply for, or renew, their Agricultural Chemical User Permit (ACUP).

An ACUP is a permit issued by Agriculture Victoria to appropriately trained chemical users that authorises the use of high risk 'restricted use' agricultural chemicals in Victoria.

Agriculture Victoria Statewide Specialist for Chemicals, Steve Field, said the new online system will allow people to apply for a new ACUP, renew their ACUP, as well as add additional endorsements to existing ACUPs, for example, 1080 or PAPP baits.

"It's also a quick and easy way to update your contact details," Steve said.

'Restricted use' agricultural chemicals include:

- Schedule 7 poisons (Dangerous Poisons) – substances that have a high potential to cause harm at low exposure and require special precautions during manufacture, handling and use
- Products that contain atrazine, metham sodium or ester formulations of 2,4-D, 2,4-DB, MCPA or triclopyr
- Pest animal bait products that contain 1080 (sodium fluoroacetate) or PAPP (4-aminopropiophenone)
- Pindone concentrate products used for the preparation of poison baits
- Timber treatment products that contain copper chromium arsenic (CCA)

To access the online portal, visit the 'quick links' section of the Agriculture Victoria - Chemicals website.

"The system has been 'live' for a short time and has been working well, cutting 'red tape' for chemical users across Victoria," Steve said.

Hard copy permit application forms are also available and can be found on the Agriculture Victoria website.

NEW STUDY SHOWS HOW PLANTS FIGHT OFF DISEASE

A University of Queensland-led study has highlighted the minute details of how the plant's immune system leads to its ability to resist disease.

UQ School of Chemistry and Molecular Biosciences and Australian Infectious Diseases Research Centre researcher, Professor Bostjan Kobe, said the finding was significant as food security was an increasingly relevant problem worldwide.

"It is estimated that pre-harvest plant diseases account for up to 15 per cent of crop losses per year," he said.

"Breeding resistant plant varieties has been the main strategy to combat plant disease, especially because pesticides can be detrimental to the environment. While many plant resistance genes have been identified in the past 20 years, we have a limited understanding of how the products of these genes work. In the report, we described how one part of the immune receptor protein signals to make the plant resistant to disease," Professor Kobe explained.

The research team used x-ray crystallography to understand how the immune receptors assembled during signalling.

Plant molecular biology experts from Australia, South Korea and USA, demonstrated that these interactions were crucial for converting the signals that ultimately made plants resistant to disease.

"It is vitally important that we understand how plant immune systems function," Professor Kobe said.

"Crop losses present a significant economic, environmental and social challenge in a world facing increased demands on food, fibre and biofuels. In the long-term, this research will help make more effective synthetic resistance genes that can be used to provide additional protection in Australia and worldwide from crop diseases," he added.

The study was funded by an Australian Research Council Discovery Grant and is published in the Proceedings of the National Academy of Sciences of the United States of America.

The collaborative group includes the teams of Dr Peter Dodds at CSIRO Plant Industry, Associate Professor Peter Anderson at Flinders University, Dr Kee Hoon Sohn at Pohang University of Technology, South Korea, and Professor Brian Staskawicz at the University of California Berkeley.

The paper is co-published with a related paper from the team led by Professor Jeffery Dangl at the University of North Carolina in the USA, which reached similar conclusions while studying a different plant immune receptor system.

WATCHING UNDERGROUND WATER ON THE WEB

An open access 'Water Atlas' has gone online, giving the general public a 3D view of groundwater data from eastern Australia's Surat Basin.

Associate Professor Sue Vink of The University of Queensland's Centre for Water in the Minerals Industry said the tool provided diverse information on the chemistry, water level and geology of water bores.

"The atlas is unique in that it presents quality assured and controlled groundwater data in 3D," Professor Vink said.

"Interpreted bore, geology and hydrogeology information gives a greater level of analysis and allows people to avoid compiling individual tables from the state government's groundwater database," she added.

The researchers believe the general public and corporate, government, research and consultancy sectors will find Water Atlas an effective way to visualise, communicate and analyse hydrogeological data.

Professor Vink said the atlas provided information over space and time, via cross-sections, pie charts and layer visualisations.

"Similar to the State Government's 'Queensland Globe', our water atlas shows coal seam gas (CSG) tenements and lot and plan boundaries," she said.

Professor Vink said the 3D Water Atlas resulted from a joint industry and university workshop in 2011.

"We recognised there was no easy-to-use, single source of groundwater information and hydrogeology," she said.

"Data from water levels and water chemistry in individual bores will be updated at least every six months. It will be presented in 2D and 3D sub-surface visualisations. The atlas can be accessed via any common web browser at no cost," Professor Vink added.

The project was developed by UQ's Centre for Coal Seam Gas, Centre for Water in the Minerals Industry and the School of Information Technology and Electrical Engineering.

It was funded through the UQ Centre for Coal Seam Gas, a research collaboration between UQ, Arrow Energy, Santos, Asia Pacific LNG (APLNG) and The Queensland Gas Company (Shell). The Queensland Department of Natural Resources and Mines (DNRM, OGIA) advised and assisted.

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