Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA
Protect Grow Innovate

Grains Convo

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Contents

National collaboration effort to enhance snail management solutions

Project name and GRDC Code

Mediterranean snails, specifically the small pointed snail or conical snail, Cochlicella barbara, are present in many areas, especially in the broadacre regions of Western Australia (WA) where they feed on crop plants and as grain contaminants.

Effective management of these snails requires a multi-faceted approach, which includes baiting and stubble management strategies that reduce snail habitat.

More tools in the toolbox are needed to curb snail populations especially snails present in non-crop areas of the farm, that can then move into cropped paddocks.

Australian-bred parasitoid flies have been released to help control snail pests and protect crop yields, quality and growers' profitability.

The flesh fly (Sarcophaga villeneuveana), originally introduced to Australia 20 years ago as a biocontrol agent from France, only targets the grains pests pointed snail (Cochlicella acuta) and small pointed snail.

It was originally sourced from Montpellier in France, and subsequently mass-reared and released by the South Australian Research and Development Institute (SARDI) and CSIRO in South Australia's Yorke Peninsula, where it has since established and proliferated.

Research in South Australia has found parasitism levels have exceeded 30% to 40% in localised habitats in recent years, indicating this fly can have an impact on snail populations.

This fly has now been introduced in select areas of WA.

This bio-control program is part of a larger 4-year project by SARDI and the University of Adelaide, is an investment of the Grains Research and Development Corporation (GRDC).

The Department of Primary Industries and Regional Development (DPIRD) and South East Premium Wheat Growers Association (SEPWA) have joined forces with SARDI to release the flies for the first time in WA.

Releases have occurred in the Albany and Esperance port zones.

The goal is to determine if this parasitic fly can establish in WA.

To date, over 1,000 flies have already been released over 4 locations.

These sites will be monitored to see if this fly can survive and thrive under WA’s dry summer conditions.

Safeguarding Western Australian agriculture

All of the pest snails found in WA's crops have been introduced from Mediterranean climes of Europe.

Legumes and canola, especially, recently germinated seedlings, and leaves are most at risk from snail damage.

Snails can also increase harvest costs as they can be a contaminant of grain at harvest, leading to the requirement for grain to be cleaned before it is delivered to grain receivals.

The prevalence of snails has increased in broadacre cropping in WA with the use of minimum tillage and stubble-retention practices.

Monitoring and expansion

Biocontrol offers an additional avenue to curb snail populations alongside baiting and paddock management strategies.

The flies can also reduce snails in the non-crop areas of the farm.

DPIRD Research Scientist (Entomologist) Svetlana Micic said further releases are planned at in non-crop areas to bolster populations and give the flies every chance to establish.

“The team anticipates that if the fly established, it will persist in the areas in which they have been released. Flies will be spread through additional breeding and release programs.

Regular monitoring will gauge the success of establishment, potentially paving the way for expanding the program across the WA Grainbelt.

While acknowledging that biocontrol isn't a cure-all, it can be used as one way to help growers grappling with high snail populations,” she said.

This trial builds upon GRDC-funded research led by CSIRO and SARDI to explore factors influencing fly parasitism of pest snails on South Australia’s Yorke Peninsula.

Funding partners/project collaborators

Grains Research and Development Corporation (GRDC)
South Australian Research and Development Institute (SARDI)
University of Adelaide
Stirlings to Coast Farmers (SCF)
South East Premium Wheat Growers Association (SEPWA)

More information

Click here to read the DPIRD media release on Fly biocontrol released to control farm snail pests
Click here to read more on Identification and control of pest slugs and snails for broadacre crops in Western Australia

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New barley gene for shorter, high yielding crops

Publication name

Diversity of Gibberellin 2-oxidase genes in the barley genome offers opportunities for genetic improvement

Balancing crop productivity with environmental and climatic concerns

Semi-dwarfism is one of the most valuable traits in crop breeding as it reduces crop lodging risks, improves yields, and facilitates mechanical harvesting.

Over the past 70 years, adding specific short-height genes to cereal crops like wheat, rice, and barley sparked a huge increase in food production, known as the 'Green Revolution.' These genes work by slowing down the production and effects of a growth-promoting chemical in plants called gibberellin.

However, this approach has some caveats, such as delayed flowering and shortened coleoptiles, which are not suitable for warm and dry climates.

Also, relying on a few specific short-height genes can lead to problems, like making it harder to breed new types of crops and making them more vulnerable to diseases and pests.

Using nitrogen fertiliser to get the most out of these semi-dwarf crops can be expensive and may harm the environment.

Advancements in barley breeding

The collaboration between the Western Crop Genetics Alliance, University of Tasmania and Chinese Academy of Agricultural Science offers a new opportunity for developing barley varieties that can adapt to modern farming conditions.

The researchers previously reported a new semi-dwarf gene and developed diagnostic markers to support faster breeding of varieties, which carry desirable traits such as enhanced early emergence characteristics with deep seeding.

Recently, a gene family called GA2ox has shown promise for this in cereal crops.

There are different types of GA2ox genes that work on different forms of gibberellin.

In some crops, like rice and wheat, these genes have been found to control plant height by reducing gibberellin levels, but little is known yet about their effects in barley.

The study of all the genes in a crop, or the pangenome, is uncovering new genetic variations that could be useful for breeding better crops.

In barley, GA2ox is validated to reduce the gibberellin biosynthesis by expressing it, which controls the plant's stature, coleoptile length, maturity, and seed size.

Using a gene editing tool called CRISPR/Cas9, researchers have been able to change the gene related to gibberellin works, leading to possible benefits for barley breeding and production.

Future direction

Researchers are looking closely at different GA2ox genes in barley to see if they could be a new option for creating short-height crops.

They’re examining how these genes vary in different barley plants and how they act during the plant's growth.

By silencing or editing these genes and studying their effects, researchers aim to understand how they can be used to overcome the trade-offs of old semi-dwarf genes in current barley varieties.

This could lead to better ways of breeding crops that are short, use less fertiliser (in turn better for the environment) and are more suited to a range of different climates.

Funding partners/project collaborators

Department of Primary Industries and Regional Development/Western Crop Genetics Alliance
University of Tasmania
Chinese Academy of Agricultural Sciences

More information

Click **here** to read the Journal of Advanced Research paper: *Diversity of Gibberellin 2-oxidase genes in the barley genome offers opportunities for genetic improvement.*

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National Hay Agronomy project aims to elevate Australia's oaten hay exports

In 2022-23, the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) reported that oaten hay exports were valued at approximately $349 million, with Western Australia (WA) accounting for over 40% of the national total.

Fluctuating hay yields and quality highlight the need for updated farming guidelines to improve yields and hay quality.

To strengthen Australia’s position as a leading supplier of high-quality oaten hay, AgriFutures launched the 4-year National Hay Agronomy (NHA) project in 2019, in collaboration with the Department of Primary Industries and Regional Development (DPIRD).

The project aims to encourage the adoption of new hay varieties and agronomic practices by delivering research and guidance to farmers.

The 3 key objectives included developing improved agronomic guidelines by June 2022, reporting on the use of growth regulators, and updating disease management strategies for issues like red leather leaf and septoria.

Trial program

The agronomy component of the NHA project made significant strides over its 4-year span by undertaking several important studies.

The team conducted 12 agronomy trials to understand how oat varieties react to different planting times and nitrogen levels, focusing on how these factors influence both yield and quality of hay.

From there, researchers tested 5 new oat varieties at 3 separate locations in 2021 to assess their performance.

From 2019 to 2021, replicated field trials were carried out at Muresk in WA and at other locations throughout Australia.

Early sowing benefits

Sowing early is essential for maximising both yield and grain quality in milling oats, however, this practice does not yield the same benefits for hay oats.

Early sowing may lead to increased hay yields, but often at the expense of hay quality. Typically, hay from early-sown crops has denser stems, elevated levels of fibre, and reduced levels of crude protein and water-soluble carbohydrates (WSC).

This was not consistent across sites and years but was the general trend when the data from all sites were averaged.

The project revealed that oat varieties exhibit diverse responses to sowing dates, which are challenging to predict before the growing season or at the time of sowing.

This underscores the need for further research into variety-specific responses to sowing dates, particularly as new varieties of oaten hay are being tested by the industry and InterGrain.

Determining the optimal time for cutting is crucial for growers and advisors to choose suitable varieties and plan effective hay management strategies for the spring season. DPIRD's **"FlowerPower"** for oats model is one tool that WA growers could use for this purpose, but phenology data for new oat varieties are needed.

Other findings

Research on optimising nitrogen rates for oat hay production in the NHA project has shown that nitrogen (N) promotes more biomass, resulting in taller and greener plants.

However, it also increases the risk of lodging, particularly in susceptible varieties.

The optimal hay yield was achieved with an application of 90 kg N/ha, averaged across different varieties and locations.

In some locations, the target nitrogen level was reduced due to below-average rainfall during critical growth periods.
Nitrogen was not a significant factor in causing hay quality defects such as thick stem diameter, high acid detergent fiber (ADF), high neutral detergent fiber (NDF), or high lignin content.

It did, however, increase crude protein levels and decrease WSC.

Applying more than 90 kg N/ha posed a risk of failing to meet the industry's minimum standard of 22 per cent WSC for premium hay.

Different varieties showed similar responses to increased nitrogen in terms of hay quality traits.

A key distinction is that varieties with higher genetic levels of WSC can tolerate more nitrogen before their quality grade decreases, allowing for potentially greater hay production at the same quality level.

The study also found that the planting date did not significantly affect the response to nitrogen, despite variations in agronomic traits, hay yield, and quality parameters (excluding greenness, ADF, and NDF) across different planting dates.

The response to nitrogen was generally consistent between planting dates, though the impact varied.

Over the 3 years the research was conducted (2019 to 2021), seasonal conditions and varietal differences were more influential in determining hay quality than the rate of nitrogen applied.

Variety performance

The four-year NHA project assessed the hay yield and quality of four dual-purpose varieties, Carrolup, Durack, Williams and Yallara and four hay-only varieties Brusher, Koorabup, Mulgara and Wintaroo.

Brusher and Wintaroo were the leading varieties for hay yield at the first sowing date, while Wintaroo had the highest yield of the second sowing date.

Of the eight varieties evaluated, Yallara had the best overall hay quality nationally, with the highest WSC and lowest fibre levels (ADF and NDF) combined with thin stems (data not shown).

Yallara hay yield was comparable to the specialist hay varieties Brusher and Wintaroo, with a lower lodging risk and similar hay colour.

DPIRD Research Scientist Georgie Troup said given the variability in response to delayed planting, it is advisable for farmers to have two varieties in their system.

"This diversity can help manage risks associated with disease and optimise hay cutting timing while aligning with the quality demands of their hay exporters," she said.

Funding partners/project collaborators

AgriFutures
South Australian Research and Development Institute
Agriculture Victoria
New South Wales Department of Primary Industries
Birchip Cropping Group

More information

Click **here** to read the GRDC webpage *National Hay Agronomy – improving the outcomes of oaten hay in the rotation*

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Tackling Heterodera Australis in Australian cereals

Project name

"Nematode diagnostics across industries through capability succession, enhancement of collections and protocol development"
Part of project: Boosting Diagnostics for Plant Production Industries

GRDC code

BIO2004-001RTX (project number: 9177857)

What's in a name?

Heterodera australis (Australian cereal cyst nematode; CCN), a nematode that specifically targets cereals and grasses, has posed significant challenges to Australian agriculture since the 1930s by causing substantial yield losses in infested paddocks.

Until 2024, the nematode identified as CCN in Australia was thought to be *Heterodera avenae*, the same species found in many grain-growing countries across Australasia, Europe, Africa and North America.

Heterodera australis was originally identified in Australia in 2002 using molecular techniques as a distinct cereal cyst nematode species, but morphological assessments and pathogenicity testing were not included in the research.

Due to this, the findings were not generally accepted by the Australian scientific community, but speculation on the correct identification of CCN and its potential differences in pathogenicity and yield loss continued.

In 2020, the project Rural R&D For Profit – Boosting Diagnostic Capacity for Plant Production Industries was established by the CSIRO in Canberra, with support from the Grains Research and Development Corporation (GRDC) and led by Dr Daniel Huston.

With the aid of fellow nematologists and researchers across Australia, Dr Huston collected soil samples from cropping paddocks to extract and identify cyst nematodes.

He sequenced cysts, conducted morphological identifications and tested the pathogenicity of Australian CCN and other cyst nematodes.

The results from the project confirmed that all locations in Australia have *H. australis*, both morphologically and molecularly.

This was significant, as *Heterodera avenae* has not been found anywhere in Australia and it's been concluded that it never was. Therefore, this species has now been added to Western Australia's biosecurity documents as 'not present in Australia,' by DPIRD's Biosecurity team led by Margaret Uloth.

Research methodology and findings

In a comprehensive study conducted from 2020 to 2023, involving collaborators from the Department of Primary Industries and Regional Development (DPIRD), researchers collected soil samples from various cereal-growing regions across Australia for analysis by the CSIRO team.

Using molecular barcoding techniques, Dr Huston identified Heterodera species present, including *H. australis* in 17 South Australian localities, one Victorian locality, and 10 Western Australian localities.

Economic impact and management

Before the development of resistant cereal strains, *H. australis* caused significant economic losses in Australia's cereal production. CCN still causes significant yield losses in infested paddocks where susceptible cereal varieties are grown. In Western Australia, CCN is found in pockets of the Avon Valley, Esperance, Albany and in our more northern growing areas from Yerecoin and Moora to Geraldton. Information on suitable variety choices in infested paddocks are updated annually in DPIRD's Crop sowing guide

DPIRD Research Scientist Sarah Collins said researchers concluded *Heterodera australis* is an acceptable taxonomic name for the Australian cereal cyst nematode and is the only CCN species parasitising cereals in Australia at present.

"We also conclude that *H. australis* is not native to Australia and was most likely introduced from China in the 1850s, rather than from Europe as previously assumed," she said.

Understanding the nematode's origins, backed by molecular, morphological and pathogenicity data, aids in designing biosecurity measures to prevent its spread and potentially forecasting future invasions.

Future directions

The ongoing management of *H. australis* remains a high priority, as does the need for continued efforts in breeding resistant cereal varieties and adapting to changes in the pest's behaviour or biology.

This proactive approach will help mitigate future invasions and ensure sustainable cereal production in Australia.

Funding partners/project collaborators

Australian National Insect Collection, National Research Collections Australia, CSIRO
Plant and Soil Health, South Australian Research and Development Institute
AgriBio, Centre for AgriBioscience, Agriculture Victoria Research
Department of Energy, Environment and Climate Action (DEECA)
School of Applied Systems Biology, La Trobe University

More information

Click **here** to read the full paper DNA barcoding of Australian cereal cyst nematode populations with comments on likely origin and taxonomy (Tylenchoidea: Heterodera)

Click **here** to read Detection of heterodera mani in Western Australia by D. C. Huston, M. Hodda, A. Hills and S. Collins
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Meet the lupin disease team

A new project is underway, with support from the Grains Research and Corporation (GRDC), the Department of Primary Industries and Regional Development (DPIRD), the WA Agricultural Research Collaboration (WAARC), Murdoch University, Curtin University and Australian Grain Technologies (AGT), focusing on fortifying the resistance of narrow-leafed lupins (NLL) to a suite of diseases.

Over the course of 5years, this project will conduct screening and genetic analysis on chosen lines of lupins and assemble a collection of genetic resources.

This collection will include selected varieties, breeding lines, and wild strains to pinpoint genes that provide resistance against four major diseases: phomopsis, cucumber mosaic virus (CMV), anthracnose, and sclerotinia.

Leading the team is Principal Research Scientist (Pathologist) Geoff Thomas.
Geoff has over 20 years of experience in cereal and grain crop pathology.

He has been involved in the National Variety Trial program for many years, providing a disease screening service for new lupin varieties as well as screening for breeding companies.

He is passionate about presenting extension material to growers and improving disease resistance within the grain industry.

In the new lupin disease project, Geoff will be providing mentorship to Dr Elaine Gough who will develop new high throughput phenotyping methods for stem and pod phomopsis, anthracnose and CMV.

The team will also be working with Dr Ben Congdon and his team to understand the virus titer for CMV.
Research Scientist Elaine Gough is a plant pathologist who completed her PhD on interactions of nematodes, mycorrhizae, and rhizobium in mungbeans at the University of Southern Queensland.

Elaine also brings knowledge and experience of working internationally in commercial pathology.

Sharon Westcott is filling the pivotal role of project coordinator, liaising between the institutions partnering on the project.

Sharon has worked at the department for 20 years and is based at Murdoch University as a member of the Western Crop Genetics Alliance, where she coordinates activities of a few projects between Murdoch and DPIRD.

Her role within this project is to coordinate activities and communications between the multiple collaborators.

Daniel Renshaw is the Technical Officer of the team and is unique in that he has expertise in both the lab and field.

Daniel was part of the lupin breeding team, where he screened molecular markers to advance lupin lines for disease resistance and domestication traits, conducted the crossing to advance generations and managed disease nurseries.

He has worked closely with colleagues at Murdoch University and was involved in developing the lupin genome information for the variety Tanjil.

Daniel's skills are a perfect fit for the new lupin disease project and joined the team in January 2024, where he will be working closely with Elaine and other members of the pathology team to improve disease resistance in lupins.

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Industry news: Diversifying noodle markets

The Australian Export Grains Innovation Centre (AEGIC) is investigating whether there is potential to expand the use of Australian Noodle Wheat (ANW) and Australian premium noodle wheat (APWN) outside Japan, such as South East Asian noodles, breads and steamed products.

For almost 35 years, Japan has exclusively imported noodle wheat from Western Australia (WA) that has been bred especially for udon. WA supplies about 750,000 t of a special noodle wheat blend to Japan at a value of around $300 million annually. A similar market exists for Korean style noodles.

AEGIC is seeking to build interest in ANW and APWN among South East Asian customers to potentially increase demand outside Japan and Korea. We have been visiting flour mills to explain the benefits of these types of wheats and the opportunities they might deliver for them as part of their grists.

Local udon noodles made in South East Asia for local consumers are a clear potential opportunity, but ANW and APWN have potential applications for other noodle types, as well as confectionary products and steamed buns.

There are challenges involved, with some South East Asian millers cautious because of the reputation of ANW and APWN as niche 'premium' wheat as well as the limited supply. There are also technical challenges to overcome, including different consumer preferences

between Japan/Korea and South East Asia when it comes to texture preferences of wheat based noodles, steamed buns and confectionary style products.

AEGIC will continue to work with South East Asian customers to determine whether there are viable opportunities for ANW and APWN in South East Asia. This project is a co-investment with InterGrain.

AEGIC's wheat experts will be back in South East Asia in the second half of the year working with key customers in Indonesia, Vietnam, Thailand and the Philippines to demonstrate why Australian wheat should remain their number one choice when it comes to noodles. Visit our **Events page** for more information.

AEGIC is an initiative of the Western Australian State Government and Grains Australia

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