



Department of
Primary Industries and
Regional Development

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DPIRD Broadacre Systems R&D Stakeholder Update

October 2026 Edition



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How this work supports WA priorities

Every project featured in this update contributes to broader WA Government priorities focused on strengthening the future of agriculture, regional communities and food production.

From Broadacre Systems Executive Director, Kaara Klepper

Welcome to the latest Broadacre Systems R&D Stakeholder Update!

This edition features recent research into farming systems, soil productivity, crop protection and new tools and technologies to support better decision making.

DPIRD remains committed to delivering research and development that supports WA Government priorities and creates practical value for WA agriculture.

The work featured in this edition demonstrates that commitment. From improving the productivity of constrained soils and making better use of fertiliser, to strengthening farming systems and protecting crops from weeds, pests and disease, our research is focused on the challenges and opportunities that matter to WA agriculture.

This is R&D with a broader purpose, helping to grow the WA economy, strengthen regional communities, support our export industries and keep WA agriculture productive, competitive and resilient into the future.

I hope you enjoy this latest update and the insights it provides into our work.

Dr Kaara Klepper

Executive Director, Broadacre Systems



*Dr Kaara Klepper,
Broadacre Systems (DPIRD)*

Research delivering results

Measuring the impact of our research is a priority for DPIRD Broadacre Systems.

We are strengthening how we capture and communicate results so you can clearly see how our work is contributing to more productive, profitable and resilient farming systems across Western Australia.

This update brings together some of our most recent findings. It highlights the measurable advances being achieved by DPIRD researchers and the potential value this science can create for WA growers and industry.



Latest findings at a glance:



180%

higher wheat yield

following two years of legume pasture compared with continuous wheat at **Northampton**.



29%

higher wheat grain yield

when clay, lime, gypsum and compost were combined to improve constrained sandy soil in a glasshouse study using soil from **Bolgart**.



Up to 18%

higher wheat yield

from monoammonium phosphate compared with single superphosphate on responsive acidic, gravelly soil near **Kojonup**.





Latest findings at a glance (continued):



50%

lower *serradella* nodulation

when imazethapyr was applied at only 40 per cent of the recommended label rate, highlighting a potential risk to nitrogen fixation.



70%

higher wheat biomass

from gravel mulching compared with untreated control plots in a commercial scale trial at **Moorine Rock**.



Weed seeds remain viable for

**at least
8 years**

after soil inversion, posing a risk when soils are disturbed again.





Gravel mulch boosts wheat growth by 70 per cent

New DPIRD research has found gravel mulching increased average wheat biomass by 70 per cent in a commercial scale trial in the eastern Wheatbelt.

Led by DPIRD Senior Research Scientist Dr Shuangxi Zhou, the trial at Moorine Rock is investigating whether a layer of locally sourced gravel can help crops make better use of limited rainfall.

The latest results show average biomass increased from 99 grams per metre of row in untreated control plots to 169 grams per metre of row in gravel treated plots.

Biomass measures how much crop growth has been produced, including the wheat stems, leaves and developing grain. The result provides strong evidence of the difference the gravel treatment is making to crop growth.



*DPIRD Senior Research Scientist
Dr Shuangxi Zhou inspecting*

The research forms part of the Soil Water and Nutrition (SWAN) Program, a five-year collaboration between DPIRD and the Grains Research and Development Corporation (GRDC).





Wheat growing in gravel treated plots at Moorine Rock.



Wheat biomass samples from untreated control plots (left) and gravel treated plots (right), showing differences in crop growth.

This trial is at commercial scale with plots approximately 60 metres long. The trial was sown and managed by the grower with the untreated areas reflecting standard commercial farming practices.

Locally sourced gravel was spread to an approximate depth of four centimetres on the soil surface using conventional farm machinery. The trial was designed with practical adoption in mind as no specialised application equipment was required.

The gravel reduces evaporation from the soil surface, helping retain more rainfall in the root zone where it can be accessed by the crop. The treated areas have produced stronger crop growth across the paddock, with the latest biomass measurements quantifying the size of that response.

The next major result will come at harvest.

Based on crop performance to date, Dr Zhou estimates the stronger growth could translate into a 30 to 50 per cent increase in grain yield. Final yield measurements are expected later this year.

This research is already moving towards commercial adoption. The participating grower has invested in materials to expand the gravel treatment on the farm next season.

If the final yield results confirm the strong biomass response, the research could provide growers in low rainfall environments with a practical approach to improving water use efficiency and making more productive use of limited rainfall.

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Acknowledgement: *The Soil Water and Nutrition Program is a five-year collaboration between DPIRD and the Grains Research and Development Corporation.*



Pasture rotation lifts wheat yield by 180 per cent

Trials initiated in 2023 have demonstrated the dramatic changes in productivity that can be realised by employing different crop and pasture rotations.

In 2025, wheat following two years of legume pastures yielded about 7.0 tonnes per hectare, compared with just 2.5 tonnes per hectare under continuous wheat. The result represents an increase of about 180 per cent.

Led by DPIRD research scientist Martin Harries, the project is testing crop and pasture rotations, sowing strategies and nitrogen rates through large scale trials at Northampton, Merredin and Lake Grace.

“The wheat after pasture yielded well in 2025 because it was a good year where water was not limiting and the nitrogen from the pasture was converted to yield,” Martin said.

“While these results show what is possible from pastures we have also seen weeds and soil borne diseases increasing in plots with pasture, so we are already seeing both the positive and negative aspects of pastures in the rotation.

“This result shows the scale of the opportunity diverse rotations can create.



Field walk at Merredin Farming Systems Trials site Sept 2026

“At Northampton, two years of pasture changed the performance of the following wheat crop. These trials are helping us identify where pasture and legume phases could lift cereal and canola yield and grain quality, improve nitrogen efficiency and strengthen the whole farming system.”

Rotation benefits were also recorded at Lake Grace, where barley following pasture yielded 4.0 tonnes per hectare, compared with 2.9 tonnes per hectare under continuous barley.

At Merredin, wheat following fallow with high nitrogen yielded 2.0 tonnes per hectare, compared with 1.2 tonnes per hectare for continuous wheat without applied nitrogen.

Across the three sites, a rotation combining a grain legume then canola as a double break also achieved high gross margins and relatively low greenhouse gas emissions compared with other rotations tested.

Now in their fourth and final year, the trials are building locally relevant evidence growers can use to make more informed rotation and nitrogen decisions.

For more information:

- **Field trials report 2025:**
WA Farming Systems Project:

Field trials report 2025



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The WA Farming Systems project (DAW2204-003RTX) is a 5-year co-investment by the Department of Primary Industries and Regional Development and the Grains Research and Development Corporation.

**Northampton Farming Systems
Trial site**



Fertiliser choice lifts wheat yield by up to 18 per cent



Choosing the right phosphorus fertiliser increased wheat yield by up to 18 per cent on acidic, gravelly soils in WA field experiments.

DPIRD researchers worked with the Fertiliser Technology Research Centre; Adelaide University to compare commonly used phosphorus fertilisers and investigate why products supplying the same nutrient produced different crop responses.

Wheat treated with monoammonium phosphate, known as MAP, yielded up to 18 per cent more than wheat treated with single superphosphate at one site. At the second site, MAP produced 10 per cent more grain than double superphosphate.

Laboratory analysis found that phosphorus from ammonium phosphate fertilisers diffused further from each granule, making it more accessible to crop roots.

Phosphorus from superphosphate sources remained more concentrated around the granule. Researchers attributed this difference to chemical reactions involving calcium in the fertiliser, which can bind phosphorus close to the granule and reduce its diffusion through the soil.

ABOVE: DPIRD researcher Dr Raj Malik investigating how different phosphorus fertilisers perform on acidic, gravelly soils.

For growers managing phosphorus responsive, acidic gravelly soils, the results show that fertiliser source can have a measurable effect on crop performance.

The findings support the continued use of ammonium phosphate fertilisers in WA grain crops on these soils. The research also has important implications for fertiliser recommendations and research trials that use superphosphate sources to measure crop responses.

Selecting the right phosphorus source for each particular soil type could increase yield without increasing the amount of phosphorus applied. This gives growers an opportunity to improve nutrient use efficiency and generate a greater return from fertiliser investments.

For more information:

- **Ammonium phosphate fertilizers are a more effective phosphorus source than superphosphate for wheat grown on acidic gravelly soils:**

Soil Science Society of America Journal, 2026



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Re-engineered sandy soils lift wheat yield by almost 30 per cent

New research into re-engineering sandy soils has delivered an almost 30 per cent increase in wheat grain yield.

The glasshouse study tested whether incorporating several amendments into the top 20 centimetres of acidic sandy soil could lift wheat productivity by improving soil chemical and biological properties.

Researchers from DPIRD and The University of Western Australia used intact soil cores collected from DPIRD's Soil Re-engineering Project field trial at Bolgart.

They compared untreated soil with three treatments: clay, lime and gypsum; clay, lime and gypsum with conventional NKP fertiliser; and clay, lime and gypsum with compost.



Dr Gaus Azam, Shompa Aktar and Dr Sultan Mia (left to right) inspecting a glasshouse experiment at UWA investigating crop responses to soil re-engineering treatments.

All three treatments significantly increased grain yield compared with the untreated soil.

The combination of clay, lime, gypsum and compost delivered the strongest result, increasing grain yield from 5.99 to 7.70 grams per plant. It also achieved the highest thousand grain weight, shoot and root dry weight, and harvest index.

Important changes were recorded beneath the surface. At flowering, soil pH increased from 5.0 in the untreated soil to 6.9 under the compost treatment.

Microbial biomass carbon more than doubled, increasing from 9.56 to 21.71 milligrams of carbon per kilogram of soil. The amendments also changed the composition of bacterial and archaeal communities and improved nutrient uptake.

The results support the researchers' hypothesis that addressing multiple soil constraints together can improve wheat productivity and the overall soil health supporting plant growth.

The findings provide a strong foundation for longer term research to determine whether these responses can be reproduced across different soils, environments and farming systems under field conditions.

For more information:

- **Effects of Soil Amelioration on Wheat Growth, Nutrition, and Soil Microbiome Dynamics in Sandy Soil:**

Journal of Soil Science and Plant Nutrition, 2026



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Acknowledgement: Soil Re-engineering Project funded by DPIRD and GRDC
UWA School of Agriculture and Environment, The University of Western Australia,
Shompa Akter & Zakaria M. Solaiman



Buried but not beaten: weed seeds survive years underground

Weed seeds buried by soil inversion can remain viable for at least eight years, creating a risk that future soil disturbance could return them to the surface.

DPIRD researchers examined 30 sites across the WA grainbelt where a single soil inversion had occurred between one and 11 years earlier. Soil was collected at depths of up to 40 centimetres and monitored for weed emergence.

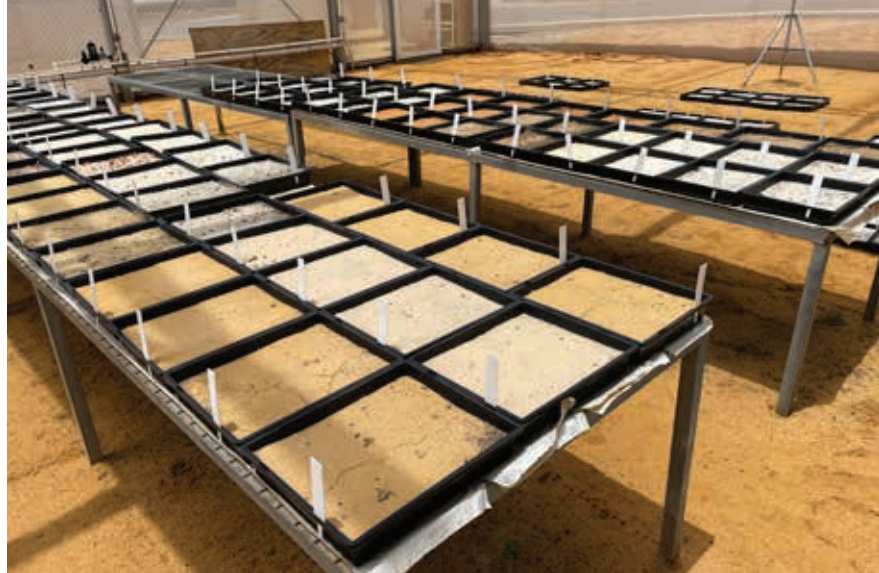
Seeds from several major grass and broadleaf weeds remained viable for at least eight years after burial. These included annual ryegrass, subterranean clover, wireweed, small crumbweed (clammy goosefoot) and capeweed. Wireweed was still detected at a site inverted 11 years earlier.



Dr Sultan Mia, Dr Catherine Borger and Dr Gaus Azam investigated weed seed burial and viability following soil inversion. (Photo courtesy of Peter Maloney)



Wireweed growing in lupin



Weed seedlings being monitored across different soil types

Most weed emergence came from soil buried between 10 and 20 centimetres deep. Great brome was the exception and was not detected at sites where inversion had occurred more than two years earlier. The larger great brome seeds can still germinate following burial at 10 to 20 cm depth, although seedlings emerging at that depth have a low establishment rate.

Soil inversion remains an effective strategic tool for burying weed seeds and managing soil constraints. However, the findings show that burial should not be mistaken for elimination.

For growers, this new evidence can inform the timing and placement of future soil amelioration. Subsequent inversion or deep tillage could bring viable seeds back to a depth where they can successfully establish, potentially replenishing the weed seedbank. Understanding how long different weed seeds survive underground will help growers protect the benefits of soil inversion and integrate future tillage with long term weed management.

For more information:

- **Project: Impact of soil amelioration on weed ecology and control, DPIRD 'Royalties for Regions' Science Partnership'**
- **Weed seed burial and long-term viability following soil inversion, *Weed Science*, 2026:**

Weed Science, 2026



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Will fungicide pay? New lupin app weighs the odds

DPIRD has done it again. Years of research have been transformed into another practical app helping growers make stronger, more profitable decisions in the paddock.

The new SclerotiniaLM app supports lupin growers across Western Australia, Victoria, New South Wales and South Australia decide whether applying fungicide is likely to deliver an economic return.

Sclerotinia stem rot can cause lupin yield losses of up to 20 per cent in WA. The catch is that fungicide control is most effective before symptoms appear, forcing growers to make an investment decision before they can see the disease.

SclerotiniaLM changes that equation.

Growers and advisers can enter their own disease history, seasonal conditions, treatment costs, grain price, and target yield. The app then compares fungicide treatment with taking no action and presents the potential best and worst case returns.

RIGHT: DPIRD Senior Research Scientist Ciara Beard inspects sclerotinia stem rot in a lupin crop.



Developed by DPIRD with co-investment from the Grains Research and Development Corporation (GRDC), the decision support tool turns five years of field research and grower trials into a tool growers can use wherever crop decisions are being made.

DPIRD research scientist Ciara Beard said the app would help growers move beyond the gamble of treating an unpredictable disease and assess the likely return for their own crop.

SclerotiniaLM is the first release in DPIRD's new Lupin Management app series. The app showcases the successful collaboration between DPIRD disease modellers and plant pathologists across Australia, delivering a digital tool to support lupin growers for years to come.

Available on Apple and Android devices, it is another example of WA research delivering practical value well beyond the State's borders.

For growers, that means targeted fungicide investment, fewer unnecessary inputs and more sustainable fungicide use, with a stronger chance of protecting yield and profit.

For more information:

Download SclerotiniaLM



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Healthy looking pasture may hide a nitrogen risk

Imagine you are a farmer. You have put in a pasture phase to feed livestock, break cereal diseases and bank some nitrogen for the next crop. The pasture looks terrific. Job done.

Except below ground, herbicide damage may be quietly eroding that nitrogen benefit.

The cost may not become clear until the fertiliser bill for the following crop lands.

New research within the Harvestable Annual Legume Options (HALO) project suggests some Group 2 herbicides can reduce root nodulation in French serradella well before causing a comparable decline in visible pasture growth.

The collaborative greenhouse study brought together researchers from DPIRD and Murdoch University to test three Group 2 herbicides on two French serradella varieties.

RIGHT: Herbicide affected serradella, drawing from soil nitrogen rather than symbiotic nitrogen.



French serradella is well suited to the sandy, acidic soils found across much of Western Australia's grainbelt.

Like other pasture legumes, it forms nodules on its roots that enable the plant to capture nitrogen from the atmosphere.

The findings reveal a potential blind spot for mixed farming systems. A pasture may continue producing feed while its potential nitrogen contribution to following crops has been affected. Additionally, herbicide tolerance between cultivars of the same species can vary greatly. However, informed herbicide choices can mitigate this risk.

The study did not measure nitrogen fixation directly or establish new herbicide recommendations. It provides an important foundation for field research and for improving how herbicide effects on pasture legumes are assessed.

Pasture variety	Treatment	Key result
Fran2o	Imazethapyr at the third true-leaf stage	Nodulation fell by 50 per cent at only 40 per cent of the recommended label rate.
Margurita	Imazamox at the recommended rate and timing	Nodulation fell by 42 per cent.
Margurita	Flumetsulam at the recommended rate and timing	Nodulation fell by 20 per cent.

For more information:

- **Group 2 Herbicides Applied Below Label Rates Constrain the *Ornithopus sativus*–*Bradyrhizobium* Sp. Symbiosis:**

Journal of Crop Health, 2026



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Building virus resistance into the next generation of canola

Turnip yellows virus can spread through canola crops before symptoms appear, leaving growers with limited options once plants are infected. DPIRD is working with canola breeders on a longer-term solution: varieties that can resist the virus.

DPIRD researchers have been invited to present their findings at Breeders Week 2026 on the Gold Coast and are collaborating with several breeding companies. The work brings years of resistance research closer to the people developing commercial varieties.



DPIRD Technical Officer Alistair Hall illustrating the stunting caused by TuYV in canola – left an unaffected plot, the right a plot with high levels of infection

One priority is to create a consistent way to rate the resistance of varieties already on the market. DPIRD aims to develop a rating program and publish those ratings in the Crop Sowing Guide, giving growers better information when choosing what to sow.

Researchers are also examining sources of resistance in canola plants identified previously by DPIRD, investigating whether a resistance gene identified in Europe could be introduced into Australian varieties, and searching for new sources breeders can use.

Most Australian canola varieties are susceptible to turnip yellows virus. Building resistance into future varieties would provide growers a firmer foundation for management to better protect yields and reduce the burden of insecticide applications.

For more information:

Manage turnip yellows virus in canola



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Acknowledgement: GRDC DAW2305-003RTX 'Effective virus management in grain crops'



Canola crop near Geraldton showing symptoms of turnip yellows virus in 2024.

Journal papers

- June to September 2026



Crop Innovation

- Phan HTT, Shankar M, Jones DAB, Furuki E, Rybak K, Kamphuis F, Golzar H and Oliver RP (2026) Adaptation of the Australian *Parastagonospora nodorum* population to alterations in the host. *Physiological and Molecular Plant Pathology*, 146: 103510. 
- Broughton S, Castello M, Han Y, Bennett R, Shankar M, Varischetti R and Real D (2026) Fast-Tracking Trait Combination in Triticale Through Doubled Haploid Technology. *Agronomy*, 16(9): 923. 
- Broughton S, Castello M, Liu L, Killen J and McMullan C (2026) Bread Wheat Anther Culture. In Castillo AM, Echávarri B and Vallés MP (eds), *Doubled Haploid Methods in Cereals*. Methods in Molecular Biology, vol. 3029. Humana, New York, NY. ([PubMed](#)) 



Crop Protection

- Peerzada AM, Borger CP, Parker W and Davies SL (2027) Strategic deep tillage in no-till wheat systems affected soil properties, weed seed burial, and pre-emergent herbicide performance in the first year. *Soil and Tillage Research*, 266: 107478. 
- Borger C, Mia S, Azam G and Davies S (2026) Weed seed burial and long-term viability following soil inversion. *Weed Science*, 74(1): e24. 



Soil Ecosystem Innovation

- Akter S, Mia MS, Prodhan MA, Azam G, Solaiman ZM and Siddique KHM (2026) Effects of Soil Amelioration on Wheat Growth, Nutrition, and Soil Microbiome Dynamics in Sandy Soil. *Journal of Soil Science and Plant Nutrition*, 26(2): 6421–6437. 
- Wickramarachchi K and Azam G (2026) Improving barley (*Hordeum vulgare* L.) yield through deeper root architecture impacted by nitrogen management in a re-engineered Kurosol. *Soil Research*, 64(3). 
- McBeath T, Davies S and Kirkegaard J (2026) Never say never: The interdependence of no-till and strategic deep tillage in sustainable production systems. *Crop and Environment*, 5(3): 100130. 
- Scanlan CA, Malik R, Degryse F, Van Burgel A and McLaughlin MJ (2026) Ammonium phosphate fertilizers are a more effective phosphorus source than superphosphate for wheat grown on acidic gravelly soils. *Soil Science Society of America Journal*, 90(4): e70309. 
- Rahman MS and Azam G (2026) Physical and chemical ameliorations of a heavy soil constrained by sodicity and alkalinity for improving productivity in the low rainfall regions of Western Australia. *Soil Advances*, 6: 100128. ([ScienceDirect](#)) 
- Arthur B, Edwards TJ, Harrison RJ, Steel E, O'Hara G and Yates RJ (2026) Group 2 Herbicides Applied Below Label Rates Constrain the *Ornithopus Sativus*–*Bradyrhizobium* Sp. Symbiosis. *Journal of Crop Health*, 78(4): 109. ([Springer](#)) 

Where to hear about our work

**1–5
November 2026**

**Soils Science Conference
Pan Pacific, Perth**



DPIRD researchers will present the following research at the Soils Science Conference:

Presenter	Presentation
Kanch Wickramarachchi	Improving wheat yield in a low fertility Arenosol: insights from a grower scale re engineering trial in the central wheatbelt of Western Australia.
Raj Malik	Evaluating post emergent phosphorus strategies for wheat grown on high phosphorus buffering gravelly soils of southwest WA.
Geoff Anderson	Management of calcareous soils that are alkaline, sodic, and saline in the Western Australian wheatbelt.
Shahinur Rahman	Subsoil moisture status governs liming efficacy, nutrient availability, and crop root growth.
Alice Butler	Long term impacts of strategic tillage on soil carbon in sand soils.
Wayne Parker	From small plot theory to broadacre practice: the success of grower engagement from the ground up.
Kanch Wickramarachchi	Soil re-engineering: a new approach to improve crop productivity on constrained sandy soils in water limited environments in Western Australia.
Tom Edwards	One off strategic deep tillage followed by a return to conservation tillage provides a long term increase in crop production while preserving soil quality.
Glenn McDonald	Subsoil amelioration can have long term benefits on sodic grey clay duplex soils in southern Western Australia.
Ed Barrett Lennard	Exaggerated mound and furrow tillage and covering the soil surface with plastic or polymer can increase stored soil water and the grain yield of crops.
Maria Pfeifle	The effects of climatic and soil properties on soil water repellency.
Benedict Arthur	Group two herbicide timing, strategic deep tillage and the production of nitrogen in legumes.
Bidhyut Banik	Evaluating greenhouse gas emissions from the Western Australian crop residue decomposition.



Reach out to the team



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