Mid-term evaluation of the AgriFutures Rice Program Strategic RD&E Plan (2021-2026)

A snapshot

by ST Strategic Services Pty Ltd
April 2024

AgriFutures® Rice

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In submitting this report, the author has agreed to AgriFutures Australia publishing this material in its edited form.

AgriFutures Australia is the trading name for Rural Industries Research and Development Corporation (RIRDC), a statutory authority of the Australian Government established by the *Primary Industries Research and Development Act 1989*.

Research investments made or managed by AgriFutures Australia, and publications and communication materials pertaining to those investments, are funded by industry levy payers and/or the Australian Government.

Foreword

The AgriFutures Rice Program invests in research, development and extension (RD&E) to support a sustainable and prosperous rice industry that is a global leader in production and water use efficiency.

The Program is funded through statutory levies, paid by rice growers, and Australian Government matching funding. The rice levy, which was established in 1991, is collected at the first point of sale. The levy is currently $6/tonne, with $5.94/t for RD&E managed by AgriFutures Australia on behalf of the industry. The remaining $0.06/t is for Plant Health Australia membership.

AgriFutures Australia conducts mid-term reviews of its Programs to ensure they remain aligned to their five-year RD&E plans, are delivering economic benefits and are positively impacting industry. The process provides accountability to the AgriFutures Australia Board, levy payers and government. In 2024, the organisation engaged ST Strategic Services to review the *AgriFutures Rice Program Strategic RD&E Plan (2021-2026)* and evaluate investments made under the Plan.

The review covered 28 projects across the Program's four priorities – improved genetics and breeding; agronomy and farming systems; coordinated extension; and enhanced industry capacity. Expenditure across the priorities was found to be consistent with the budget allocation outlined in the RD&E Plan, however 30 recommendations were made to assist industry in achieving its objectives.

This report summarises the recommendations of the review, and was compiled to communicate this information to rice industry stakeholders. The constructive input from so many during the review process is greatly appreciated and reflects the strong commitment to supporting and promoting the sustainable production of rice in Australia.

For more information about the AgriFutures Rice Program, visit agrifutures.com.au/rice.

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Acknowledgments

ST Strategic Services is grateful to the many people who provided constructive input into this evaluation. The willingness to participate made the evaluation possible and reflects the strong commitment to supporting and promoting the sustainable production of rice in Australia.

Introduction

The Australian rice industry is a world leader in production efficiency, using less water per tonne of grain produced than other comparable countries.[1] On average, rice production in Australia occurs on 55,000 ha of land producing 562,000 t of crop[2] and utilises approximately 12 ML/ha of water (average from 2012-2021[3]).

However, the area and quantum of rice production varies significantly from year to year in response to water availability. Declining access to irrigation water and emerging competition from other industries are major challenges identified by the industry that are reflected in the *AgriFutures Rice Program Strategic RD&E Plan (2021-2026)*[4] (the RD&E Plan). The RD&E Plan has an ambitious objective of achieving average water use efficiency (WUE) of 1.5 tonnes of rice produced per megalitre of water by 2026 that requires targeted efforts across breeding, agronomy and technological advancements, as well as accelerated adoption of R&D outputs.

AgriFutures Australia contracted ST Strategic Services Pty Ltd (STSS) to evaluate the current RD&E Plan and provide recommendations to assist the rice industry in achieving its objectives. The evaluation included a review of project information provided by AgriFutures Australia and public information of relevance, as well as consultation with growers, agronomists, researchers and other industry stakeholders. The constructive input from so many during consultation is greatly appreciated and reflects the strong commitment to supporting and promoting the sustainable production of rice in Australia.

[1] Ricegrowers' Association of Australia. (n.d.). *All About Rice.* https://www.rga.org.au/common/Uploaded%20files/RGA/Publications%20and%20Factsheets/All-About-Rice-Factsheet_website-version.pdf
[2] ABARES. (2022). *Agricultural Commodity Statistics 2022*. Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra. https://doi.org/10.25814/p6td-nm60
[3] ABS. (n.d.). *Water Use on Australian Farms.* Australian Bureau of Statistics, Canberra. https://www.abs.gov.au/statistics/industry/agriculture/water-use-australian-farms
[4] GHD Pty Ltd. (2021). *AgriFutures Rice Program Strategic RD&E Plan (2021-2026).* https://agrifutures.com.au/product/agrifutures-rice-program-strategic-rde-plan-2021-2026/

Recommendations

The RD&E Plan was developed after extensive consultation and is well constructed, highlighting four priority areas, with each further characterised by associated strategies, impacts and consequences.

However, the RD&E Plan is not an effective communication tool and, as a result, while the rice industry is broadly aware of its existence, there is not deep understanding of the current projects in the AgriFutures Rice Program portfolio or how the RD&E Plan is utilised to guide investment. Thirty recommendations have been made to AgriFutures Australia as a result of the evaluation. A summary of the key findings are outlined below.

The target WUE of 1.5 t/ML is widely supported, but with provisos

The focus on R&D investment to achieve water use efficiency of 1.5 t/ML is appropriate. The impact on financial return ($/ML) should also be considered, as should the benefits of targeting a 30% increase in WUE, particularly in relation to investments in extension.

Achieving 1.5 t/ML for growers already in the top 20% of average WUE requires a further 30% improvement. Transitioning the entire industry to an average of 1.5 t/ML would require a 75% increase in WUE from the current average of 0.85 t/ML.[5] Unsurprisingly, perceptions on realising that objective are varied. Despite this, there is general support for the objective either as a realistic target or an aspirational one. However, in systems where achieving 1.5 t/ML is challenging, such an ambitious objective is possibly counterproductive to the broader adoption of WUE improvements if it is not believed to be achievable in the short term. For extension activities in particular, greater impact may be achieved if an additional target of a 30% increase in WUE was introduced. This would result in the 20% of growers already achieving higher WUE improving towards 1.5 t/ML, and would increase the average WUE of the industry towards 1.1 t/ML.

Further, most growers and advisers plan and implement production strategies across multiple years and across different crops (often double cropping with winter crops and pastures) and enterprises. WUE is therefore compared on a $/ML return rather than yield/ML. This is particularly true when comparing competing options (e.g. cotton vs rice production) and accounting for risk across enterprises. However, while $/ML underpins grower decision making, prices for agricultural commodities vary significantly in line with short-term changes in global supply and demand, much of which is unlikely to be impacted by domestic RD&E where there can be extended periods between generation of R&D outputs and adoption. It is therefore appropriate that the focus of RD&E, remains on improvements in yield/ML as a measure of effectiveness, but with a regard to the potential impact of investments on $/ML.

Accurate baselines are critical

Accurate and regionally relevant water use efficiency, greenhouse gas and yield baselines are needed.

The delivery of effective RD&E investment begins with identifying an appropriate target. The current objective of 1.5 t/ML is good but the establishment of accurate baselines for on-farm WUE and greenhouse gas emissions, together with maximum yield and WUE limits in core production regions, is essential to determine regionally relevant impact targets. These inform required RD&E, provide the basis to actively monitor and review the progress and impact of investments, and promote the sustainable nature of the rice industry.

[5] Groat, M. (2020). *The Future of Australian Rice Production: A Focus on Water Use Efficiency in the Australian Temperature Rice System.* Nuffield Australia. https://www.nuffieldscholar.org/sites/default/files/reports/2017_AU_Mark-Groat_The-Future-Of-Australian-Rice-Production-A-Focus-On-Water-Use-Efficiency-In-The-Australian-Temperate-Rice-System.pdf

Investment processes are generally well developed, but some improvements are needed

Minor improvements to investment prioritisation, design and reporting would support active investment management and maximise benefits.

Better communication of investment identification, prioritisation, design and procurement processes would increase confidence in the delivery of the RD&E Plan and the 1.5 t/ML objective. Options to increase proactive grower and adviser input (in addition to the current *Voice of the levy payer* project) into investment identification and design activities should be explored while maintaining required governance processes. This may include integration of processes with a proposed participatory RD&E approach.

Consistent interpretation of objectives, outcomes, outputs and activities, as outlined in the current AgriFutures Australia guidelines for proposal preparation,[6] together with improved reporting mechanisms, would enhance active management of individual projects and the investment portfolio as a whole to maximise the benefits delivered to growers and the wider rice industry.

Integration of outputs from multiple projects is required to achieve the 1.5 t/ML objective

An investment framework would highlight project integration and future investment opportunities.

Coordination of investments and co-design during planning is needed to ensure outputs are consistent, relevant and adoptable by growers. The development of a concise strategic framework based on the RD&E Plan that describes how RD&E outputs contribute to an outcome, and ultimately the desired objective, would provide clarity and transparency of investment priorities, and highlight how investment outputs contribute to the 1.5 t/ML objective. A potential framework is attached that should be regularly reviewed and updated with feedback from stakeholders across the rice industry.

Mapping of past, current and new investments against the framework identifies areas of focused research (e.g. in genetic improvement for cold tolerance), as well as some areas where further investment may be warranted (e.g. in understanding and addressing potential subsoil constraints). Importantly, the framework highlights where integrated programs of R&D investment can be developed to address specific issues (e.g. an integrated program to manage lodging might include R&D on aspects of genetics for lodging resistance in varieties, anomaly detection in the field, agronomy practices to manage crop height and density, irrigation methods and/or chemistries if available).

[6] AgriFutures Australia. (2022). *Submitting a Full Research Proposal (FRP)*. https://agrifutures.com.au/wp-content/uploads/2022/02/User-Guide-Submitting-a-Full-Research-Proposal-FRP.pdf

The current investment portfolio is largely aligned with the budget allocations in the RD&E Plan

An efficiency framework was adapted from Keating *et al*. (2013)[7] applying available WUE estimates,[8] and was used to map investments. The framework describes six pathways to improving efficiency, of which five are of relevance to the rice industry in Australia (Figure 1).

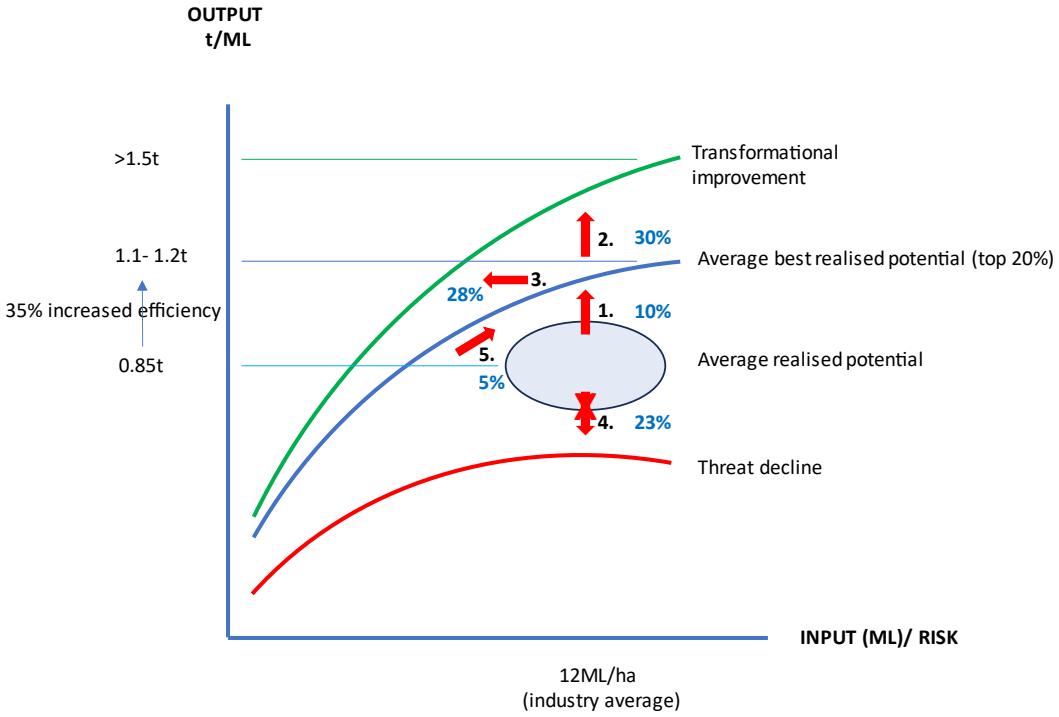

Figure 1. Towards 1.5 t/ML in the Australian rice industry – efficiency framework mapping (adapted from Keating *et al*. 2013). The total percentage does not add up to 100% as investments in industry support and capacity building (4%) are not included.

Pathway 1 focuses on assisting growers to become more efficient by adopting current knowledge, practices and technologies. Investment under Pathway 1 generally encompasses development and extension activities to validate results across different environments and production systems, and assist grower adoption. The pathway also has relevance to more efficient growers in minimising the short-term loss of efficiency that ultimately occurs when adopting new production practices.

Pathway 2 targets transformational change to increase yield (and/or price) for the same level of inputs (water and nutrition). Investments under Pathway 2 target strategic and applied research with longer lag times to impact.

Pathway 3 focuses on reducing inputs required to achieve a given yield. Key inputs include water, nutrition, ameliorants and crop protection chemicals. Investments under Pathway 3 target strategic and applied research with long and medium lag times to impact.

Pathway 4 covers all aspects of RD&E and seeks to minimise losses predominantly associated with biotic stresses and some abiotic stresses (e.g. rectifying subsoil constraints). Investments have short, medium and long lag times before impact depending on the type of investment (e.g. adoption of cultural disease control may be achieved relatively quickly while breeding for resistance is a longer-term proposition).

[7] Keating, B., Carberry, P., Thomas, S. and Clark, J. (2013). Eco-Efficient Agriculture and Climate Change: Conceptual Foundations and Frameworks. In: Hershey, C. H. and Neate, P. (eds), *Eco-efficiency: From Vision to Reality*, CIAT, pp. 19-28.
[8] Groat, M. (2020). *The Future of Australian Rice Production: A Focus on Water Use Efficiency in the Australian Temperature Rice System.* Nuffield Australia. https://www.nuffieldscholar.org/sites/default/files/reports/2017_AU_Mark-Groat_The-Future-Of-Australian-Rice-Production-A-Focus-On-Water-Use-Efficiency-In-The-Australian-Temperate-Rice-System.pdf

Pathway 5 is most closely associated with Pathway 1. It targets efficient growers that could increase production if practices to manage the associated increase in risk were adopted. As with Pathway 1, it focuses on development and extension to facilitate adoption of current knowledge.

Investments were also mapped against the budget allocations outlined in the RD&E Plan. While the analysis provides only a snapshot in time, both mapping exercises reveal that the current investment portfolio is mostly aligned with budget allocations and is balanced across different efficiency pathways. It does, however, highlight a potential under-investment in extension activities needed to support adoption of R&D outputs and improve average WUE towards the average best realised potential (Pathway 1).

Most projects are delivering value but there are opportunities to significantly improve WUE especially in adoption of R&D outputs.

The investment in genetics is consistent with a focus on transformational change towards production systems that improve WUE through higher yields (Pathway 2) or lower water use (e.g. cold tolerance under Pathway 3). Improved integration of pre-breeding and breeding investments would provide more focus on developing germplasm and selection tools (phenotyping platforms and molecular markers) for important production and quality traits that can be quickly incorporated into the breeding program.

Irrigation research is a critical component of achieving improved WUE regardless of the production system, especially in ensuring yields are maximised (Pathway 2) and decreasing the amount of water required to achieve the desired yield (Pathway 3). Irrigation research can also contribute to establishing relevant WUE baselines and maximum yield targets at the regional and farm scales.

Similarly, crop protection RD&E is well developed, delivering valuable outputs, particularly associated with integrated weed and insect management (Pathway 4). The recent identification of rice blast is an important reminder of the need for biosecurity investment to pre-emptively prepare for the possibility of an incursion and to rapidly respond if one occurs. Many current and emerging crop protection issues under delayed permanent water and potentially under aerobic production systems are also evident in other broadacre crops. Coordination of RD&E efforts with the Grains Research and Development Corporation (GRDC) and others would enhance the identification and provision of effective integrated control measures.

The collaboration between modelling and agronomy R&D is developing predictive models and growth curves to support grower decision making at critical times, particularly in relation to nitrogen nutrition (e.g. nitrogen application and panicle initiation). This has contributed to WUE improvements under pathways 1, 2 and 3. In addition to current collaboration with modelling investments, agronomy R&D should focus on the constraints and opportunities to achieving improved WUE identified by growers and agronomists.

Growers and agronomists are best placed to advise on adoption of R&D outputs in an integrated farming system.

There is a limited focus on increasing efficient production by increasing inputs, albeit with increased risk (Pathway 5), which is justified given the more pressing issues facing the industry. However, there are some constraints under this pathway that might warrant further consideration in the future. This may include assessing the potential issue of channel capacity and the lag between ordering water and its availability for irrigation under a potential future aerobic production system or even very delayed permanent water.

Outputs from projects need to be validated and adopted on farm across different production regions

To achieve maximum potential WUE (and profitability), outputs from multiple projects need to be regionally validated and integrated into different farming systems across the rice-growing regions (Pathway 1). Some extension activities to achieve this are undertaken within individual research projects, but there is considerable reliance on the generation of independent data and information from the current extension project investment.

The development of optimised best management practice (OBM) sites is an important step in demonstrating the results of R&D. However, the apparent under-investment in Pathway 1 is consistent with unrealised potential to drive greater adoption of new technologies, varieties, systems and knowledge to achieve desired improvements in WUE. One option for further investment is participatory RD&E, the basis for which is already established under the extension program. Participatory RD&E groups of growers and agronomists in each production region could focus on identifying opportunities and constraints to achieving improved yield and WUE specific to their production environment, together with validation and adoption (D&E) of potential available solutions. Identification of constraints or opportunities requiring further research (R) would be considered by AgriFutures Australia as part of the standard investment process, providing greater grower and agronomist input to investment identification. Likewise, other projects in the portfolio could utilise the participatory groups to facilitate co-design of R&D to maximise adoption of outputs. A similar program is currently supported by GRDC under its RiskWi$e[9] initiative and includes a number of institutions and farming groups involved in rice production.

Adoption of a participatory RD&E approach would require additional funding as well as the willing input of growers and agronomists, research expertise to identify options to address identified constraints, and, above all, skilled facilitation by people well known and respected by the rice industry.

Development of participatory RD&E groups would not be a simple task, but the potential to generate targeted R&D and rapid adoption of outputs is significant. This is particularly important in understanding grower decision making across multiple crops and enterprises across summer and winter production in a farming systems context. Growers and agronomists have great skill in sustainably generating profit ($/ML) across the entire farming system. However, systems agronomy R&D is currently mostly absent from the investment portfolio. Given the importance of systems and research agronomy, AgriFutures Australia should explore the potential to support training to generate additional required capability (potentially with GRDC), and should also consider the availability of suitable capacity (infrastructure, land, etc.) to support systems and research agronomy, and other R&D, as well as the validation of outputs on a regional scale.

[9] Grains Research and Development Corporation. (2023). *RiskWi$e*. https://grdc.com.au/research/partnerships-and-initiatives/strategic-partnerships/riskwise

Conclusion

The concentrated geographic focus of the Australian rice industry belies significant complexity across production systems. Differences in production practices introduce contrasts in the importance of outputs from different efficiency pathways needed to improve WUE. Overall, AgriFutures Australia's RD&E investment portfolio targets many of the constraints to achieving more sustainable WUE, but a number of opportunities to improve the effectiveness of the RD&E program have been identified. Most of the recommended improvements resulting from the evaluation could be implemented relatively quickly with minimal budget outlay. Proposed timeframes to implement key findings are outlined in Table 1.

Table 1. Proposed timeframes to implement key findings. Immediate actions should be completed before the next summer season, those of a short-term nature within the next two years, and those of a medium-term nature within the next two to five years.

Key findings	Immediate	Short term	Medium term
Introduce a 30% increase in WUE target in addition to the 1.5 t/ML objective.			
Assess investments on improvements in $/ML as well as contribution to the 1.5 t/ML objective.			
Establish accurate regional baselines of average WUE and greenhouse gas emissions.			
Establish accurate maximum realised WUE and yield across production regions.			
Assess options to increase grower and advisor input into investment identification and design activities.			
Adjust project proposal and reporting requirements to provide more consistency and clarity.			
Develop a strategic framework that aligns RD&E outputs, outcomes and the 1.5 t/ML objective.			
Map investments to the strategic framework and actively review for gaps and overlaps.			
Develop integrated RD&E programs across multiple projects where appropriate.			
Improve integration of pre-breeding and breeding investments			
Expand agronomy activities to focus on other constraints and opportunities to achieving improved WUE, including those identified by growers and agronomists.			
Assess the availability of capacity (infrastructure, land, etc.) to support systems and research agronomy, as well as validation of R&D outputs on a regional scale.			
Review the potential impact of subsoil constraints on yield variation and WUE.			
Explore the potential to introduce systems RD&E across multiple farm enterprises (summer and winter cropping, cotton, pasture, and livestock) with other RDCs.			
Establish participatory RD&E with growers and advisors linked to current extension investment and OBM sites.			
Pursue coordination of RD&E efforts with GRDC and others where appropriate (e.g. irrigation, systems agronomy and crop protection).			

The relatively small size of the RD&E budget available to the rice industry ($6.5 million in 2022-2023; $7.75 million in 2023-2024[10]) presents challenges to implementing all the recommendations. This necessitates the active pursuit of co-investment opportunities with other industries (most notably cotton and grains) where priorities are shared (e.g. system agronomy). Other options to attract investment from a range of public and private sources should also be explored.

The Australian rice industry is already a world-leader in WUE because of the willingness of participants to engage and the high standard of many R&D investments that support ongoing improvement. The industry now faces further challenges requiring transformational change, but history suggests it is capable of rising to the challenges and the opportunities ahead.

[10] AgriFutures Australia. (2023). *2023 AgriFutures Rice Program current projects.* https://agrifutures.com.au/resource/agrifutures-rice-program-2023-current-projects-snapshot/

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