



Office Use Only

Project Code	
Project Type	

FINAL REPORT 2025

Final reports must be submitted using the online application form at www.sagit.com.au with this Word document attached **within two months** after the completion of the Project Term.

PROJECT CODE	SAR2223
PROJECT TITLE	Profitable Vetch – Agronomy, Breeding, and Market Development

PROJECT DURATION <i>These dates must be the same as those stated in the Funding Agreement.</i>						
Project start date	1/07/2023					
Project end date	30/06/2025					
SAGIT Funding	2023/24		2024/25		(year)	\$

PRINCIPAL INVESTIGATOR <i>(responsible for the overall project and reporting)</i>		
Title:	First Name: Stuart	Surname: Nagel
Organisation:	SARDI	
Mailing address:		
Telephone:		Email:
Mobile:		

ADMINISTRATION CONTACT DETAILS <i>(responsible for all administrative matters relating to project)</i>		
Title:	First Name: Leanne	Surname: Caught
Organisation:	SARDI	
Mailing address:		
Telephone:		Email:
Mobile:		

PROJECT REPORT: *Please provide a clear description for each of the following:*

Executive Summary (200 words maximum)

A few paragraphs covering what was discovered, written in a manner that is easily understood and relevant to SA growers. A number of key dot points should be included which can be used in SAGIT communications.

This project aimed to consolidate existing agronomic knowledge on vetch and assess opportunities to improve productivity through better practices, breeding innovations, and market development. A comprehensive literature review demonstrated the fragmented nature of vetch agronomic research in Australia, identifying critical gaps, especially for hay production and mixed farming systems. The review underscored the positive role of vetch in farming systems but showed that robust, evidence-based recommendations are lacking.

A key project output was the factsheet synthesising research on gibberellic acid (GA) use in vetch. Despite anecdotal interest, results showed no consistent benefit to biomass or development, and GA application was not economically justified.

Rapid Generation Cycling (RGC) methods were developed for common vetch to allow early generation material to be quickly progressed. Previously, a single cycle was possible per year. To validate the method, a large population derived from the cross Timok x Blanche fleur was cycled from F2 generation to F6 generation within 12 months. The population is now ready for use in the development of genetic markers for high-value traits in the program such as flowering time, biomass production and rust resistance.

While limitations in the evidence base prevented the development of full agronomic packages for hay production, this project has laid critical groundwork for future targeted research and industry collaboration.

Key Points:

- Vetch provides system benefits but lacks agronomic best practice guidelines.
- GA use is not recommended due to inconsistent results and poor ROI.
- Rapid Generation Cycling (RGC) has been applied to vetch to shorten the breeding cycle.
- Literature review identifies major gaps, especially for hay-focused research.

Project objectives

A concise statement of the aims of the project in outcome terms should be provided.

- i) Consolidate current and previous agronomic research conducted in vetch, use the information to improve current recommendations and agronomy packages, and map a strategy to address the identified knowledge gaps. Consolidated data could also feed into the development of an APSIM model for vetch.
- ii) Produce agronomy farm notes and communicate results to SA farmers through a mixed media approach, with emphasis on improving production in the low rainfall region.
- iii) Leverage outcomes from oaten hay agronomic and market development to improve domestic vetch hay production capabilities through targeted agronomic + variety packages for producers. Communicate results to SA farmers through a mixed media approach.
- iv) Integrate a new breeding technology, Rapid Generation Cycling (RGC), to accelerate delivery of new varieties from the NVBP.

Overall Performance

A concise statement indicating the extent to which the project objectives were achieved, a list of personnel who participated in the Research Project including co-operators, and any difficulties encountered and the reasons for these difficulties.

This project successfully delivered against its key objectives. The core output, a comprehensive literature review of Australian vetch agronomy, filled a critical knowledge gap by consolidating fragmented research from 1988 to 2024. This review has become a foundational resource for identifying agronomic priorities and guiding future investment.

The project produced a well-received factsheet on the use of gibberellic acid (GA) in vetch production, synthesising data from multiple trials. It concluded that GA is unlikely to deliver consistent productivity gains, reinforcing the need for growers to base decisions on evidence-based recommendations. This resource has been broadly disseminated through grower groups, regional trial summaries, and national updates.

Rapid Generation Cycling (RGC) was successfully applied to vetch using light emitting diode (LED) lighting supplementing natural daylength within a SARDI glasshouse. Extending the photoperiod to 18h with the LED arrays which featured enrichment in the Far Red light spectrum, we achieved a seed-to-seed interval of 12 weeks. Combined with small pot size, careful plant hygiene management and nutritional optimisation, this allowed for vetch to reach podding and seed set at a reduced size (c. 40 cm). The application of RGC to common vetch represents a key technology advancement for the breeding program delivery pipeline.

This project generated new momentum across research, extension, and industry engagement. It informed our responses to two GRDC Reviews, the first addressing value capture mechanisms from vetch and the second addressing GRDC's general breeding strategy. The project also directly led to new project proposals to address agronomic gaps, demonstrating return on SAGIT's investment through capability building and leveraged opportunities. As a result, vetch has been successfully included into a Zero Net Emissions-Ag CRC project (1020) looking at anti-methanogenic effects when grazed by sheep, and into the SA Drought Hub scoping project aimed at developing future projects for improving the climate resilience of the medium-high rainfall zones. In addition, two other projects were developed but not supported i) AgriFutures – export hay agronomy and ii) SAGIT – assessing the carbon benefit of a multi-use legume crop.

In Summary:

- i) A comprehensive literature review of 'Vetch Agronomic Research in Australia' was completed and is attached (Appendix 1). It allowed for the identification of gaps in current published data for vetch agronomy recommendations and highlighted future research focus that is needed. There was very limited research that could be confidently utilised to produce a APSIM model for vetch.
- ii) A factsheet detailing the use of Gibberellic Acid (GA) in vetch production was produced from research consolidated in the literature review and is attached (Appendix 2). The factsheet was disseminated through SAGIT and Mallee Sustainable Farming distribution lists and included in 2024 trial reviews for Birchip Cropping Group, and Eyre Peninsula farming systems summary. It was also provided to GRDC for dissemination as appropriate. Findings from the factsheet were presented at field days at Birchip and Rupanyup in Spring 2024.
- iii) We were unable to produce agronomic packages for vetch hay agronomy as insufficient information was available within the literature. An application was submitted to AgriFutures to improve agronomic knowledge of vetch production targeting an export vetch hay product. However, this was unsuccessful. Conversations have continued with JT Johnsons about vetch hay production and potential projects and industry needs.
- iv) Rapid Generation Cycling (RGC) was successfully used to accelerate a Timok x Blanchefleur mapping population from F2:6.

Personnel

- Project led by Stuart Nagel
- Melissa McCallum was appointed as the Research Officer for this project in January 2024
- Julie Hayes, Hieu Bui and Janine Croser supported work on the Rapid Generation Cycling

Difficulties

- Lack of published data on vetch agronomy.

KEY PERFORMANCE INDICATORS (KPI)

Please indicate whether KPIs were achieved. The KPIs **must** be the same as those stated in the Application for Funding and a brief explanation provided as to how they were achieved or why they were not achieved.

KPI	Achieved	If not achieved, please state reason.
<p>1. Employ SAGIT Vetch Research Officer Melissa McCallum appointed to position in January 2024. To begin the agronomy and hay components of this project, Stuart Nagel attended the AFIA conference in 2023, initiating contact with hay exporters and AgriFutures. He also approached farming systems groups that had conducted agronomic research on vetch in Australia to provide/share research and data related to vetch agronomy research that had been conducted previously.</p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Delayed in appointment till January 2024, enabling ability to i) attract the right candidate and enable her to complete other projects. During this period, progress was made towards Output 4, Rapid Generation Cycling.
<p>2. Produce a review of current vetch agronomic research and literature Completed comprehensive literature review, attached with 2025 progress report and also with final report.</p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
<p>3. Successfully negotiate long term funding for NVBP with GRDC, SAGIT, and SARDI</p>	Yes <input type="checkbox"/> No <input type="checkbox"/>	In December 2024, GRDC have offered an 18 month extension to the NVBP to take funding through to October 2026. Negotiations around a long term approach to vetch breeding are continuing with GRDC.
<p>4. Present findings on gaps in knowledge and research funding applications at the 2024 SAGIT research update Janine Croser presented at the 2024 SAGIT Research update in July 2024. She covered both the preliminary findings of the literature review, rapid generation cycling and SAGIT project UAD1123 on removing toxins from vetch through physical processing strategies.</p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
<p>5. In conjunction with SAGIT communications team, produce a fact sheet/guide on best practice agronomics for the production of vetch hay 'Use of GA in Vetch' factsheet produced in November 2024 and disseminated. No further potential factsheets identified in literature review.</p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	
<p>6. Attend AFIA conference to interact with hay producers and exporters and promote the work on vetch hay Stuart Nagel and Angus Kennedy attended the 2023 AFIA conference and FODDERGANZA in Bendigo. Melissa McCallum attended the 2024 AFIA Conference in Coffs Harbour and presented</p>	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	

on the barriers and opportunities for vetch as a fodder crop.		
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TECHNICAL INFORMATION (Not to exceed **three** pages)
Provide sufficient data and short clear statements of outcomes.

A comprehensive literature search was conducted to review the state of vetch agronomic research in Australia from 1988 to 2024. The review highlighted that while vetch has demonstrated strong potential as a legume break crop and contributes positively to farming systems through nitrogen fixation and rotational benefits, the research base remains fragmented and limited in scale and consistency. Most studies were short-term, conducted at single sites over single years, and frequently included vetch as a comparator rather than a focus species. As a result, long-term, robust recommendations for vetch agronomy remain scarce.

The review identified specific inconsistencies in measurement approaches across studies, particularly in assessing biomass for hay production. Sampling protocols were highly variable, with measurements reported by calendar date, days after sowing, growth stage, or simply as “peak biomass,” often without clear contextual detail. This variability significantly limits the comparability of results and the ability to develop consistent recommendations for growers. There was a paucity of research that directly considered the implications of management decisions on fodder quality, end use, or long-term system returns.

Despite these limitations, the review brought together available insights on sowing time, row spacing, intercropping, deep ripping, and fertiliser management. Earlier sowing was generally associated with higher biomass, but impacts on grain yield were inconsistent. Intercropping vetch with cereals occasionally improved fodder quality, while intercropping with other break crops showed limited benefit. Fertiliser responses, particularly phosphorus, were under-researched, and trials evaluating fungicide use for hay markets were largely absent. These findings have informed new project proposals aimed at addressing identified gaps.

Factsheet: Gibberellic Acid use in Vetch.

One clearly defined sub-topic was the use of gibberellic acid (GA) in vetch production. This was the subject of research by multiple groups over several years, allowing for a consolidated analysis. The hypothesis tested across trials was that GA application could improve biomass production, crop standability, and extend the window for hay cutting. While GA application did consistently increase plant height in the weeks immediately following treatment, no improvements were observed at the time of cutting, and no measurable impact was found on crop development or flowering. In some cases, treated plants were shorter than controls later in the season. NDVI and visual observations indicated changes in plant colour, suggesting stress or altered physiology. Yield data from most trials showed no significant changes in biomass, and in some cases, biomass was reduced. Only two trials showed marginal increases in early biomass following GA application, but these effects did not persist. One trial looked at fodder quality after GA treatment and demonstrated a decrease of 1-2% in crude protein. Overall, the cost of GA application (\$8-9/ha) was not justified by any consistent productivity gain, leading to a clear recommendation against its use in commercial vetch production. A factsheet summarising these findings was published and disseminated widely.

A Rapid Generation Cycling (RGC) protocol was optimised for vetch, using a new SARDI facility featuring LED lighting with enrichment in the Far Red end of the light spectrum and adapting accelerated Single Seed Descent pulse protocols developed over many years by Dr Croser and her colleagues at The University of Western Australia. Key aspects of the protocol were pot size (small pots to restrict plant height), photoperiod (18 h/6 h day/night supplemented with LED lighting arrays), fertilizer application (high doses weekly from emergence through to pod fill) and effective fungal gnat control. The protocol shortened the seed-to-seed interval for vetch to 12 weeks with seasonal independence, allowing annual progression through four generations. Further shortening of generation time may be achieved by harvesting of immature seed and by addressing an apparent seed dormancy effect. We observed emergence of re-sown mature vetch grain produced by the RGC platform to be delayed by up to two weeks.

The RGC protocol was used to advance a large F2 population produced from the cross Timok x Blanchefleur, through to F6. The final population (n=280 lines) would be suitable for genetic studies of high value traits such as flowering time, biomass production and rust resistance. Genetic knowledge could be used to design strategies to achieve more rapid and cost-effective improvements in these traits within the breeding program.

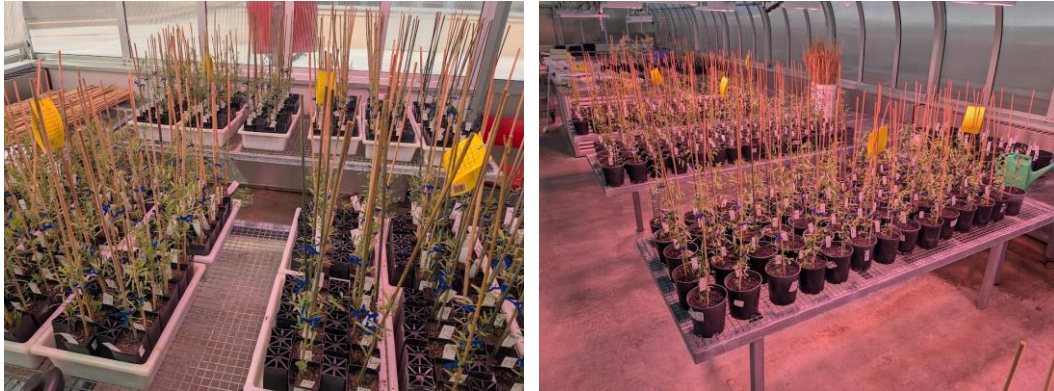


Figure1. Images of Timok x Blanchefleur RIL population at F4:5 (left, February 2025) and F5:6 (right, June 2025) growing under extended daylength conditions for Rapid Generation Cycling.

Collectively, the outputs of this project provide a solid platform for future investment in vetch agronomy. While the limited availability of high-quality, consistent trial data restricted the development of comprehensive agronomy packages, particularly for hay production, the literature review and technical synthesis have helped map a clear pathway for future work. Several research proposals were submitted as a direct result of the findings, and engagement with industry stakeholders such as hay exporters and grower groups has laid the groundwork for future collaboration.

Project applications:

Gaps identified in the literature review led to project development and the following applications being submitted.

AgriFutures

An application was submitted to AgriFutures Export Fodder open call in September 2024. This project aimed to improve the knowledge of vetch hay agronomy with a focus on fodder yields and quality as well as the implications of vetch on soil N and C levels. The treatments include time of sowing, variety (both woolly-pods and common vetch) and nutrition to investigate maximisation of yields and quality with a focus on gross margin impacts based on decisions. However, this project was unsuccessful. Feedback suggested that as the vetch export market was very limited there was not capacity to fund large agronomy-based projects. The project application outline is attached as well as the project rejection letter.

Zero Net Emission-Ag CRC – Project 1020 Southern Feedbase

An application was submitted to the ZNE-Ag CRC in December 2024 and then to the MLA MDC to leverage further funding. The project aimed to look at the effect of pastures and different plant secondary compounds on livestock methane production. This is a national project with nodes in NSW, WA, and SA. A vetch-based pasture will be included in the SA component as a comparison with Lucerne and Burr Medic. International literature suggests vetch has the similar secondary plant components to lucerne with the same, if not better, methane reduction abilities. The ZNE-Ag component was successful, but the MLA MDC component was not supported. SARDI took the decision to independently support the addition of vetch into this trial.

SAGIT

An application was submitted to SAGIT in January 2025. The project aimed to look at the effect of legume end use on rotations with a focus on reducing synthetic N fertilisers and

greenhouse gas emissions as well as the economic impacts of decisions. Vetch was proposed as a model multiple end-use legume. This project was unsuccessful.

Churchill Fellowship

An application was submitted to the Churchill Trust in May 2025 for the Ron Badman Family supported Churchill Fellowship. The project proposal focuses on Melissa travelling internationally to investigate potential disease resistance genetics in common vetch and screening methods. The Ron Badman Family sponsored fellowship focus on seed production, pasture development and irrigation.

Conversations were had with GRDC around the potential to support allied vetch agronomy research alongside the National Vetch Breeding Program. A meeting was held with the Sustainable Cropping Systems team in March 2025 to discuss gaps identified in the literature review.

CONCLUSIONS REACHED &/OR DISCOVERIES MADE (Not to exceed **one** page)

Please provide concise statement of any conclusions reached &/or discoveries made.

This project has highlighted the fragmented and inconsistent nature of vetch agronomic research in Australia, confirming that while vetch offers considerable benefits to farming systems, the evidence base to support best practice agronomy remains limited. The comprehensive literature review consolidated nearly four decades of research and revealed that most trials were short-term, lacked consistent methodology, and often treated vetch as a comparator crop rather than a focal species. As a result, clear, evidence-based agronomic recommendations, particularly for hay production, are largely absent.

One of the few areas with sufficient data to enable synthesis was the use of gibberellic acid (GA) in vetch. Analysis across multiple trials demonstrated that GA application does not consistently improve biomass, has no measurable effect on crop development or flowering, and may cause undesirable changes in plant physiology. The associated costs outweigh any potential benefit, leading to a recommendation against its routine use in vetch production.

The successful integration of Rapid Generation Cycling (RGC) into the National Vetch Breeding Program represents a major outcome. RGC reduced generation time, enabling the advancement of four generations per year, compared to one. The validation of the RGC tool through advancement of the Timok x Blanche fleur mapping to F6 is a tangible output of this investment. We expect the RGC tool will enhance the breeding pipeline's efficiency and responsiveness.

These outcomes lay the foundation for more targeted research to close the identified knowledge gaps and support vetch's role in diverse and sustainable farming systems.

INTELLECTUAL PROPERTY

Please provide concise statement of any intellectual property generated and potential for commercialisation.

N/a

APPLICATION / COMMUNICATION OF RESULTS

A concise statement describing activities undertaken to communicate the results of the project to the grains industry. This should include:

- *Main findings of the project in a dot point form suitable for use in communications to farmers;*
- *A statement of potential industry impact*
- *Publications and extension articles delivered as part of the project; and,*
- *Suggested path to market for the results including barriers to adoption.*

Note that SAGIT may directly extend information from Final reports to growers. If applicable, attach a list of published material.

Main Findings

- Agronomy research for vetch in Australia has significant limitations. Vetch is often included as a comparison species rather than as the focus species within a trial.
- A comprehensive review of literature and trial data has been instrumental in identifying critical gaps in agronomic data for hay production, fodder quality and use of vetch in mixed farming systems.
- The literature review has informed the design of subsequent project proposals submitted to AgriFutures, the Zero Net Emissions-Ag CRC, MLA MDC, and SAGIT itself, demonstrating the value of the review as a strategic planning tool.
- The key technical output—a factsheet on the use of gibberellic acid (GA) in vetch—was widely disseminated to growers, advisers, and industry stakeholders. It was published on the SAGIT website and featured in multiple industry channels, including the Mallee Sustainable Farming (MSF) social media platforms, the Birchip Cropping Group’s 2024 Trial Summary Book, and the Eyre Peninsula Farming Systems Summary. It was also circulated through Hart Field Site Group, SARDI farmer meetings across the Eyre Peninsula, and provided to GRDC for broader distribution. This factsheet distils complex trial data into a clear, evidence-based recommendation: that GA use in vetch is unlikely to be economically or agronomically beneficial.
- Rapid Generation Cycling (RGC) has been adapted to vetch. RGC reduces time between generations (seed to seed) to 12 weeks under controlled conditions. In other crop species, this has led to improved rate of genetic gain (Croser et al. 2022).

The project team actively engaged with growers, researchers, and commercial stakeholders through presentations at major events (see below).

Collectively, these communication activities ensured that the project’s findings were effectively shared with end users and the research contributed to broader industry awareness of vetch’s potential and current research limitations. Future work will build on this engagement.

Potential Industry Impact

The literature review provides industry with a wide-ranging document that includes all current research on vetch agronomy in Australia and the gaps within this research and knowledge.

The rapid generation cycling protocol has been developed and validated within this project and can be implemented into the breeding program.

Furthermore, as part of the project there has been capacity building within the breeding program. New staff have been brought into the program and increased skills and knowledge around vetch agronomy.

Communication

Presentations

- Melissa McCallum present at 2024 AFIA conference in Coffs Harbour to approximately 180 attendees.
- Janine Croser presented at the 2024 SAGIT research update on SAGIT projects UAD1123 and SAR2223
- Melissa and Stuart Nagel present at the 2024 BCG Main field day
- Melissa and Stuart present at the 2024 Wimmera Pulse field day
- Melissa presented at the 2024 SARDI Crop Science Forum
- Melissa and Stuart presented to a group of Nutrien Agronomists at the Waite Campus in November 2024.
- Stuart presented to a group of Agriculturists from Morocco at the Waite Campus in February 2025.
- Julie Hayes and Janine have prepared an abstract for the Australian Pulse Conference in Perth in September 2025.

Event/Conference Attendance

- Stuart and Angus Kennedy attended the 2023 AFIA Conference in Bendigo
- Melissa attended the 2024 Hart Main field Day
- Melissa and Stuart attend the 2025 Adelaide GRDC Updates

Factsheet Dissemination

- The Use of Gibberellic Acid in Vetch Production was disseminated in November/December 2024.
- Accessible on SAGIT website, <https://sagit.com.au/gibberellic-acid-use-in-vetch-sardi-fact-sheet/>.
- MSF shared video on Facebook and X on 5th of December including link to the factsheet
- Linked included in BCG 2024 Trial summary book with vetch breeding trial results.
- Factsheet converted to article and included in 2024 EP Farming Systems Summary Booklet, also to be disseminated as hard copy of the factsheet at SARDI Farmer Meetings across the Eyre Peninsula.
- Factsheet supplied to Hart Field Site Group for dissemination.
- Factsheet supplied to GRDC for appropriate dissemination.

POSSIBLE FUTURE WORK

Provide possible future directions for the research arising from the project including potential for further work and partnerships.

The findings of this project have clarified key priorities for future investment in vetch agronomy and breeding. The literature review provided evidence of substantial knowledge gaps, which represent important opportunities to support productivity, profitability, and sustainability in low to medium rainfall zones.

One priority area is the development of a best-practice guide for vetch hay production. A targeted agronomy research program, incorporating time of sowing, variety selection (including both woolly-pod and common vetch types), and nutrition, would enable better understanding of the interactions driving biomass yield, fodder quality, and rotational value. Gross margin analysis linked to management decisions would support adoption by growers and provide robust economic rationale for varied production strategies.

Another opportunity lies in leveraging the historical trial data generated by the National Vetch Breeding Program. This dataset may contain under-utilised agronomic insights that, if re-analysed and published, could help address gaps identified in this project. Future work could also explore vetch performance under constrained conditions, such as acidic or low-fertility soils, and its legacy impacts on soil health, nitrogen cycling, and greenhouse gas emissions.

Strategic collaboration with industry stakeholders, including hay exporters, advisers, and grower groups, will be essential in co-designing projects that are scientifically rigorous and commercially relevant. The successful integration of rapid generation cycling (RGC) within the National Vetch Breeding Program further opens opportunities for breeding-linked agronomy trials and faster delivery of new varieties.