SA Drought Hub Technical Report

Building resilience - Break Crop Suitability Across Landscapes (Stage 2)

PROJECT LEAD: Upper North Farming Systems

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PROJECT SUMMARY

The “Building Resilience - Break Crop Suitability Across Landscapes” project investigated how break crops perform across variable soil types, rainfall zones and farming systems in South Australia. Growers are increasingly interested in break crops for weed control, nitrogen fixation and system diversification; however, profitability and reliability can vary significantly due to constraints such as frost, waterlogging, soil acidity, low fertility and seasonal variability.

Upper North Farming Systems (UNFS), in collaboration with AIR EP, growers, advisors and technical partners, established demonstration sites and case studies across the Upper North and Eyre Peninsula, including Melrose, Spalding, Ungarra and Minnipa. The project assessed crop establishment, soil fertility and constraints, biomass production, yield, nutrient cycling and economic performance across different landscape positions and break crop systems. Extension activities including crop walks and discussion groups supported knowledge sharing between growers and advisors.

The project demonstrated that break crop suitability is highly dependent on matching crop type and management to local soil and seasonal conditions. Lentils showed potential in several environments, while crops such as vetch and faba beans provided more reliable performance in others. The project improved grower understanding of break crop risk, profitability and long-term system impacts, helping support more informed and resilient farming system decisions across low and medium rainfall regions.

EXECUTIVE SUMMARY

The “Building Resilience - Break Crop Suitability Across Landscapes” project was undertaken to improve understanding of how different break crops perform across variable soil types, rainfall environments and farming systems in South Australia. Growers across low and medium rainfall regions are increasingly looking to break crops to improve weed control, diversify rotations, reduce nitrogen fertiliser requirements and improve long-term system resilience. However, break crop performance can vary considerably due to seasonal conditions, frost risk, waterlogging, soil constraints and landscape variability, creating uncertainty around profitability and suitability.

To address this, Upper North Farming Systems (UNFS), in collaboration with AIR EP, growers, advisors and technical partners, established demonstration paddocks and case studies across the Upper North and Eyre Peninsula during the 2025 season. Sites were located at Melrose, Spalding, Ungarra and Minnipa, representing a range of challenging farming environments including acidic soils, sandy soils, frost-prone landscapes, heavier soil types and waterlogging-prone areas. A site was also implemented in the Murray Plains region by Murray Plains Farming Group in 2024 (as part of previous contract - DN3_24_07) which did not continue in 2025.

The project assessed break crop establishment, biomass production, grain and hay performance, soil fertility, nutrient cycling and economic outcomes across different landscapes and management systems. Soil testing, in-crop monitoring, NDVI assessments, harvest measurements and economic analysis were undertaken to better understand the interaction between soil type, seasonal conditions and crop performance.

Key findings from the project demonstrated that break crop suitability is highly dependent on matching crop type and management to local environmental conditions and farming system goals.

At Melrose and Spalding, lentil demonstrations highlighted how soil fertility, subsoil constraints and nutrient cycling strongly influenced grain and hay profitability. In higher fertility environments, grain production generally provided stronger long-term system benefits due to retained nitrogen and lower nutrient removal. In lower-performing environments, hay production provided an important salvage option, although nutrient removal costs significantly reduced long-term profitability.

At Ungarra, lentils showed encouraging establishment and biomass production on more variable and acidic soil types than traditionally considered suitable for lentils. However, faba beans remained the more consistent and reliable option for grain yield and gross margin outcomes across the season, particularly in areas affected by waterlogging and acidity.

At Minnipa, the project reinforced the importance of break crops such as vetch for maintaining ground cover and reducing erosion risk on highly sandy and non-wetting soils. While economic returns were limited in the dry season, the demonstrations highlighted the value of break crops for weed management, soil protection and supporting following crops within the rotation.

The project also generated strong engagement across grower and advisor networks through crop walks, discussion groups and extension activities. One key extension event was the Jamestown Crop Walk in October 2025, which brought together growers, advisors and industry representatives to

discuss lentil agronomy, soil constraints, inoculation strategies, nutrition, weed management, harvestability and marketing opportunities. These activities supported regional knowledge sharing and increased grower confidence in evaluating break crop options across variable landscapes.

The project demonstrated that there is no single break crop solution suitable for all environments. Instead, successful adoption depends on understanding local soil constraints, seasonal risk, crop fit and long-term system impacts. The demonstrations reinforced the importance of considering nutrient cycling, ground cover, erosion risk and rotational benefits alongside short-term gross margins when making break crop decisions.

The findings from this project are directly relevant to growers and advisors across South Australia's low and medium rainfall regions, particularly those managing variable soils and seasonal risk.

Further information and support regarding project outcomes, demonstrations and adoption opportunities can be obtained through Upper North Farming Systems (UNFS), AIR EP and collaborating advisors and technical partners involved in the project.

PROJECT BACKGROUND AND OBJECTIVES

The project aimed to improve understanding of break crop suitability across diverse farming landscapes through a series of paddock-scale demonstrations, monitoring activities and extension events. The work was led by Upper North Farming Systems (UNFS) in collaboration with AIR EP, growers, advisors and technical partners including Pinion Advisory and SARDI.

The key objectives of the project were to:

- Improve grower understanding of how break crops perform across different soil types and landscapes
- Assess the impact of soil fertility and subsoil constraints on break crop productivity and profitability
- Compare grain and hay systems within break crop rotations, including nutrient cycling and economic implications
- Support growers to identify lower-risk and more resilient break crop options for their farming systems
- Facilitate regional extension and knowledge sharing between growers, advisors and industry stakeholders

To address these objectives, demonstration sites and case studies were established across the Upper North and Eyre Peninsula at Melrose, Spalding, Ungarra and Minnipa during the 2025 season. These sites represented a range of farming environments, including sandy soils, acidic soils, heavier clay soils, frost-prone areas and waterlogging-prone landscapes.

Project activities included:

- Soil testing and characterisation across landscape positions

- Crop establishment assessments
- In-crop monitoring and NDVI measurements
- Biomass, grain yield and hay assessments
- Economic analysis of grain and hay systems
- Evaluation of nutrient cycling and nutrient removal
- Grower extension activities including crop walks and discussion groups

METHODOLOGY

Demonstration Site Selection and Layout

At each demonstration site, growers and project staff identified representative focus areas within paddocks to capture differences in soil type, productivity, stubble load and landscape position. Typically, three zones (A, B and C) were selected within each paddock to assess variability across the landscape.

Sites were managed using commercial grower equipment and standard farming operations to ensure outcomes reflected practical farming system performance.

Soil and Crop Monitoring

Baseline soil sampling was undertaken prior to sowing at each focus location. Soil cores were collected across multiple depth increments (commonly 0-10 cm, 10-30 cm and 30-60 cm) and analysed for: Soil nitrogen, Phosphorus, Potassium, Sulfur, Organic carbon, pH, Exchangeable sodium (sodicity), Boron, Zinc, Phosphorus buffering index (PBI).

Throughout the season, in-crop monitoring was undertaken using:

- NDVI (Normalised Difference Vegetation Index) measurements to assess crop vigour and biomass production
- Visual assessments of crop growth, disease, weed pressure and seasonal stress
- Mid-season biomass cuts and crop observations
- Harvest assessments including grain yield, hay production and grain quality where relevant

At some sites, comparisons between grain and hay systems were undertaken to evaluate short-term profitability alongside longer-term nutrient cycling implications.

Economic Analysis

Pinion Advisory conducted economic analysis using site production data, nutrient removal estimates and grain/hay values. Gross margins were calculated for both grain and hay scenarios across landscape positions where applicable.

Economic analysis incorporated: Grain and hay income, Input costs, Nitrogen carryover benefits, Nutrient replacement costs associated with hay removal, particularly nitrogen and potassium.

LOCATION

Where demonstration sites, field trials, events or other activities have been conducted, provide the following location details in the table below: latitude and longitude for field trials, or LGA for events and other activities. (Add additional rows as required.)

Site # and name	Latitude (decimal degrees)	Longitude (decimal degrees)	LGA
Trial Site #1 / Melrose	32°46'23.3"S	138°16'35.9"E	District Council of Mount Remarkable
Trial Site #2 / Spalding	33°27'38.6"S	138°40'24.1"E	Northern Areas Council
Trial Site #3 / Ungarra	34°21'77.8"S	136°01'77.4"E	District Council of Tumby Bay
Trial Site #4 / Minnipa	32°80'10.7"S	135°05'75.2"E	Wudinna District Council

RESULTS

The project demonstrated that break crop suitability and profitability are highly dependent on soil type, landscape position, seasonal conditions and farming system goals. Significant variability in crop performance was observed both within and between paddocks, reinforcing the importance of matching crop choice and management to local conditions.

Upper North

At Spalding, soil testing identified fertility gradients across the paddock which influenced lentil performance and profitability. Lentil grain yields ranged from 2.15-2.48 t/ha, while hay yields ranged from 3.16-3.82 t/ha depending on landscape position. Higher fertility zones generally supported stronger grain performance and greater nitrogen carryover benefits. Hay systems generated short-term returns in some areas but nutrient removal costs reduced longer-term profitability.

At Melrose, subsoil constraints including sodicity, boron and low zinc levels influenced crop performance across zones. Lentil grain yields ranged from 1.39-1.70 t/ha, while hay yields ranged from 2.01-3.60 t/ha. Results demonstrated the importance of considering nutrient cycling and long-term system impacts when comparing grain and hay systems.

AIREP

At Ungarra, lentils showed encouraging establishment and biomass production on variable and acidic soils; however, faba beans remained the more reliable option for yield and gross margin outcomes. Lentil yields ranged from 0.86-3.35 t/ha, while faba bean yields ranged from 2.48-3.93 t/ha depending on soil type and waterlogging severity.

At Minnipa, vetch established more successfully than field peas on sandy and erosion-prone soils, providing stronger biomass production and improved ground cover. The demonstration reinforced the importance of break crops for erosion protection, weed management and rotational benefits in low rainfall systems.

Extension/Adoption

The project generated strong grower and advisor engagement through crop walks, discussion groups and extension activities. A key event was the Jamestown Crop Walk in October 2025, where growers and advisors discussed lentil agronomy, soil constraints, inoculation, nutrition, weed management and harvestability.

The project improved grower understanding of:

- Matching break crop type to soil and landscape position
- Nutrient cycling and nutrient removal impacts
- Grain versus hay decision-making
- Risk management in variable environments

Adoption outcomes were primarily qualitative, with growers indicating increased confidence in selecting break crops suited to their local conditions. Some growers expressed interest in further evaluating lentils in selected environments, while others reinforced the value of crops such as faba beans and vetch in more constrained systems.

Limitations to adoption included seasonal risk, soil constraints, machinery requirements and market considerations. Despite these challenges, the project successfully improved regional knowledge and supported more informed break crop management decisions across South Australian farming systems.



Taken by Rebekah Peters (0447 973 489), 29 July 2025. This photo shows the lentil & faba bean germination side by side at Ungarra.



Taken by Buddhi Chaudhary 16 August 2025. This photo shows the lentil (L) vs field pea (R) crop in the poor sandy areas of the paddock at Minnipa.



Taken by Buddhi Chaudhary 8 August 2025. This photo shows the field pea zone at Minnipa.



Taken by Nathan Peters (0497 913 312), 4 September 2025. This drone photo shows the lentils strip through all of the different soil zones at the Ungarra Break Crop demonstration in the 2025 season. Variation of crop growth is clearly seen in the differing soil types in the faba bean and lentil crop.





Images (Top-Bottom): Lentils at Spalding, August 2025, Taken by Ruth Sommerville. Field Day event at the Jamestown Crop Walk in October 2025 (located at Spalding paddock), taken by Ruth Sommerville.

CONCLUSION

The project demonstrated that break crop performance and profitability are strongly influenced by soil type, landscape position, seasonal conditions and farming system goals. Significant variability was observed both within and between paddocks, highlighting the importance of matching crop choice and management to local conditions. The project reinforced that there is no single break crop solution suitable for all environments and that management decisions must consider local soil and seasonal risk factors.

Key findings included:

- Soil fertility and subsoil constraints strongly influenced crop performance
- Nutrient cycling and nutrient removal need to be considered alongside short-term gross margins
- Grain systems generally provided stronger long-term benefits in higher fertility environments
- Hay systems provided a useful salvage option in some lower yielding areas, although nutrient replacement costs reduced profitability
- Lentils showed strong potential in some environments, while faba beans and vetch were generally more reliable in constrained or sandy soils

Benefits to industry

The project delivered practical, regionally relevant information for growers and advisors across the Upper North and Eyre Peninsula. Demonstration sites improved understanding of break crop suitability across variable landscapes, the impact of soil constraints and fertility variability, grain versus hay decision-making, long-term farming system impacts. Extension activities including crop walks and advisor discussions supported strong grower engagement and peer-to-peer learning.

Future Adoption Opportunities

The project identified opportunities for growers to better match break crop selection and management to soil type, frost risk, waterlogging risk and farming system goals. Future work could further investigate:

- Lentil adaptation to more variable soil types
- Management strategies for constrained soils
- Nutrient cycling and replacement costs
- Break crop resilience under variable seasonal conditions

Key adoption challenges included seasonal variability, soil constraints, machinery requirements and market considerations. Despite these limitations, the project increased grower confidence and supported more informed break crop management decisions across South Australian farming systems.

DISCLAIMER

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REFERENCES

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- https://unfs.com.au/resources/

Newsletters:

- https://unfs.com.au/newsletters-media/

Videos (AIREP):

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- Ungarra 2025: https://www.youtube.com/watch?v=5JvNC4ndhuM&t=1s
- Link to project webpage: https://airep.com.au/research/building-resilience-break-crop-suitability-across-landscapes-stage-2/
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