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Australian Export Grains Innovation Centre

Optimising mill settings for Australian wheat

Mathew Rees

GOVERNMENT OF WESTERN AUSTRALIA

Department of Primary Industries and Regional Development

GRAINS AUSTRALIA

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

Overview:

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Background

Input variation

Wheat

- Grade
- Season
- Locality

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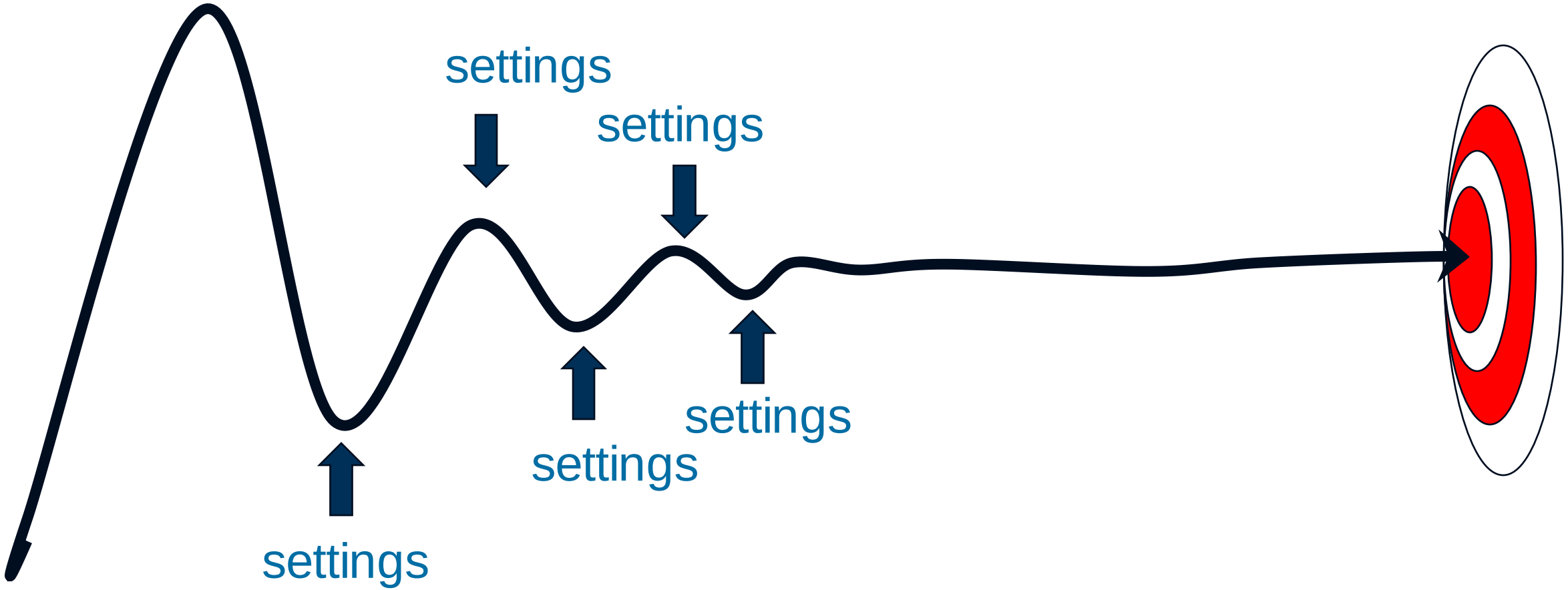
Background



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Background

Output targets

- Processing targets
- Flour specs

Yield, throughput, etc

- Food specs

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Background

AEGIC mill

- Mills differ - trends
- Targets differ – range of outputs
- Have data – extremes?

Methods

1. Source wheat

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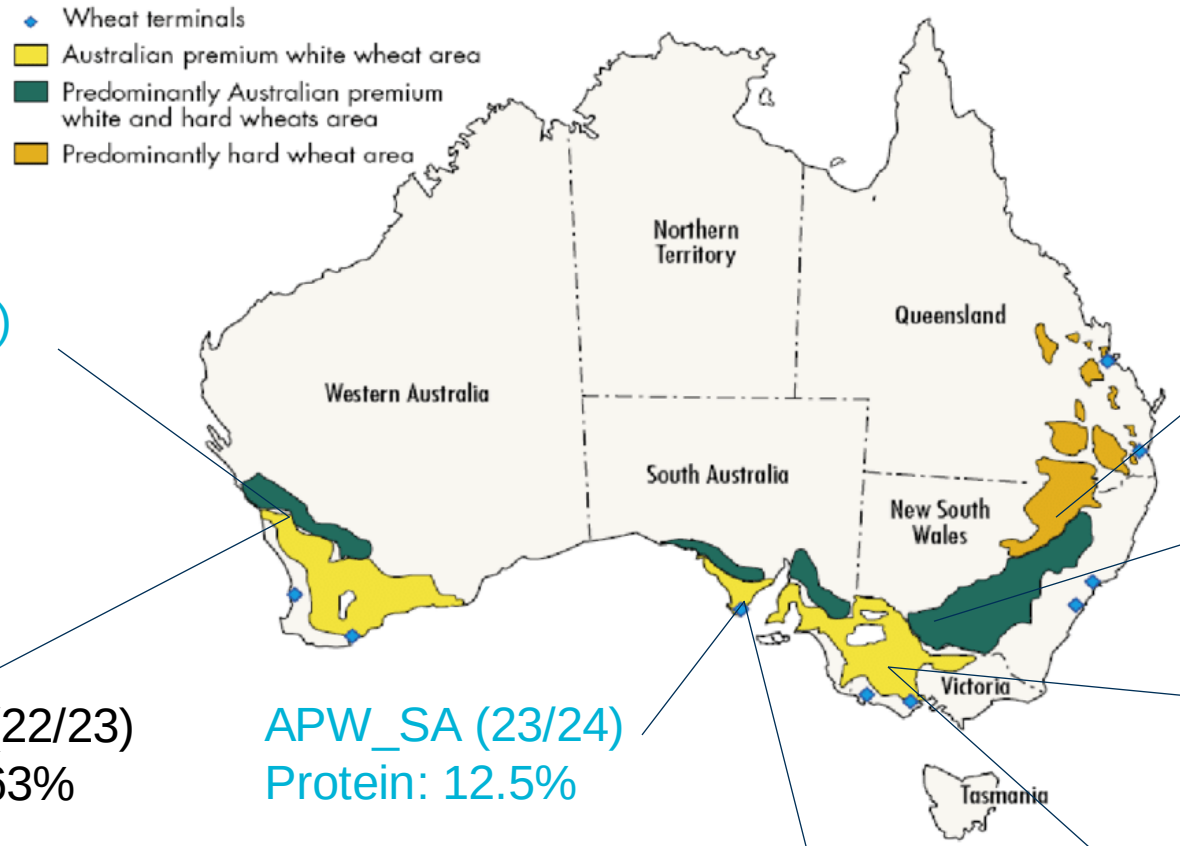
Methods



AH_WA (23/24)
Protein: 12.5%

AH_NSW (22/23)
Protein: 12.84%

ASW_NSW (22/23)
Protein: 9.66%

AH_VIC (23/24)
Protein: 12.18%

ASW_WA (22/23)
Protein: 7.63%

APW_SA (23/24)
Protein: 12.5%

ASW_SA (23/24)
Protein: 9.9%

ASW_VIC (23/24)
Protein: 9.76%

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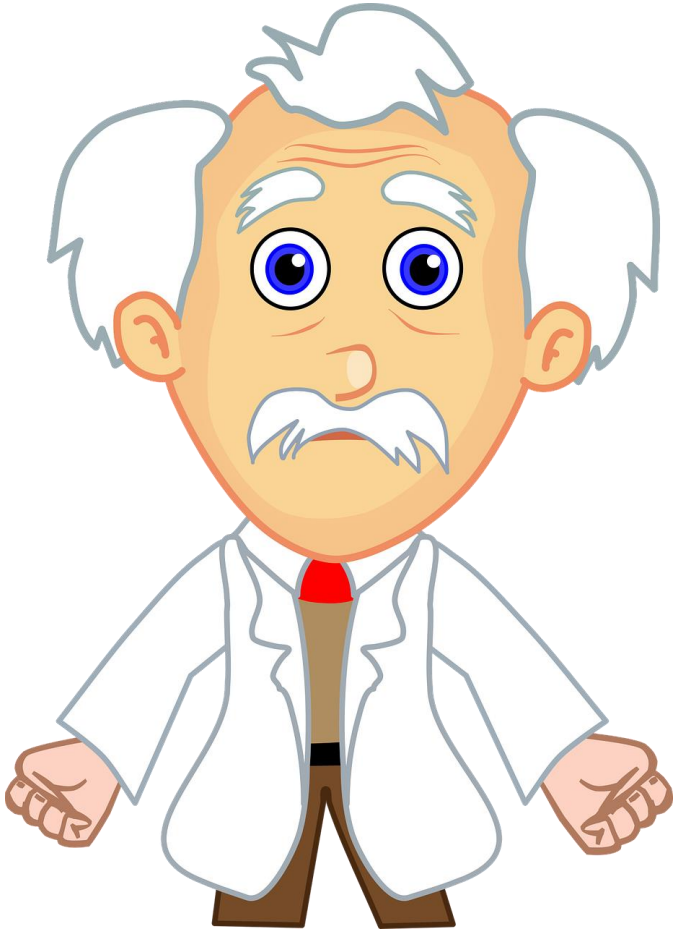
Methods

2. Experimental design



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Methods

No	Variable	Process	Units	Level		
				-1	0	+1
1						
2						
3						
4						

Methods

No	Variable	Process	Units	Level		
				-1	0	+1
1	Conditioning Moisture Content		%	14	16	18
2						
3						
4						

Methods

No	Variable	Process	Units	Level		
				-1	0	+1
1	Conditioning Moisture Content		%	14	16	18
2	Tempering Time		hours	8	24	48
3						
4						


Clean
Wheat Bin
Dirty
Wheat Bin

Methods

No	Variable	Process	Units	Level		
				-1	0	+1
1	Conditioning Moisture Content		%	14	16	18
2	Tempering Time		hours	8	24	48
3	Break Intensity			1	2	3
		1st Break Roll Gap	µm	150	300	500
		2nd Break Roll Gap	µm	100	150	250
4						

Methods

No	Variable	Process	Units	Level		
				-1	0	+1
1	Conditioning Moisture Content		%	14	16	18
2	Tempering Time		hours	8	24	48
3	Break Intensity			1	2	3
		1st Break Roll Gap	µm	150	300	500
		2nd Break Roll Gap	µm	100	150	250
4	Reduction Intensity			1	2	3
		A-Reduction Roll	µm	0	50	100
		B-Reduction Roll	µm	0	25	50
		C-Reduction Roll	µm	0	25	50

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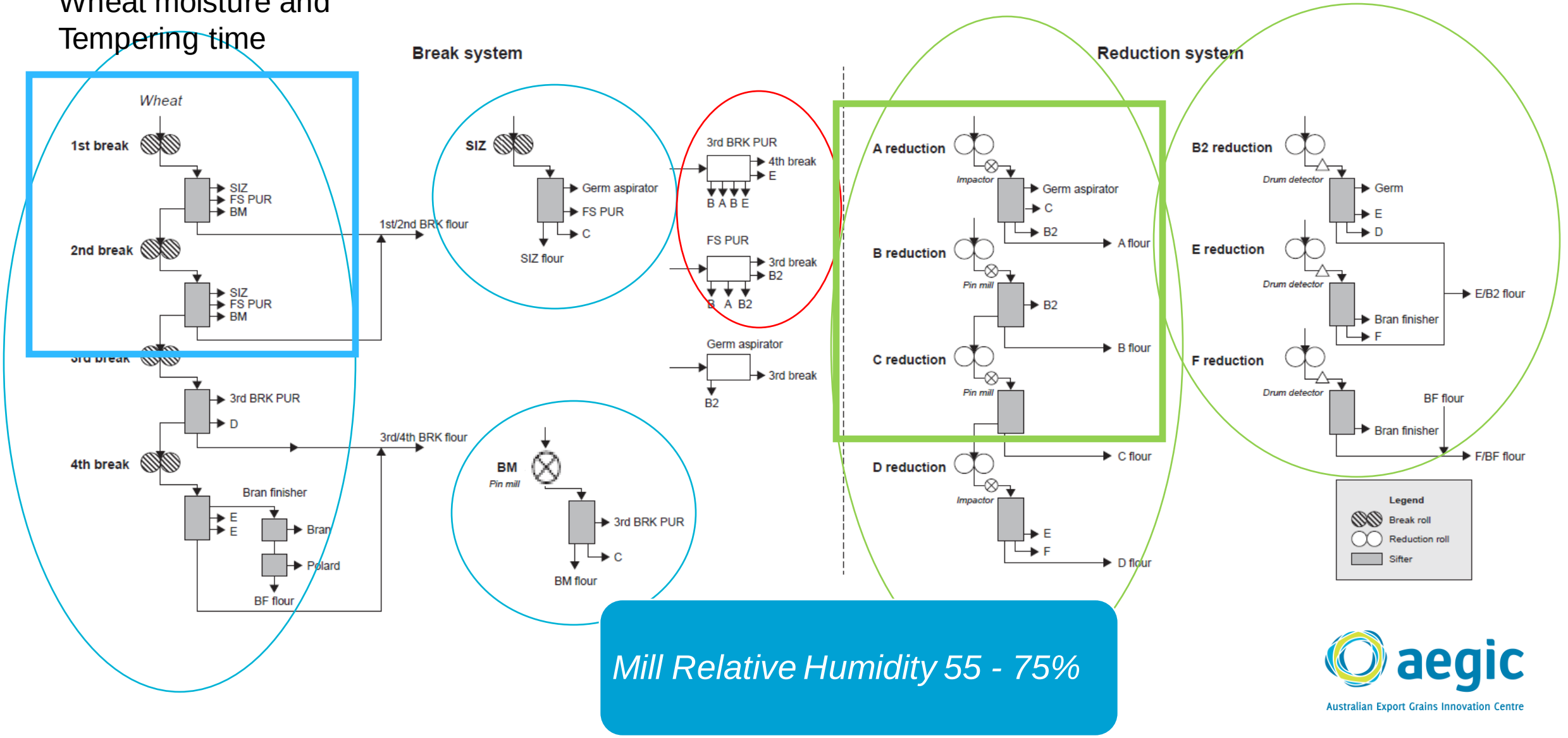
Methods

Wheat moisture and Tempering time



Mill Relative Humidity 55 - 75%

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Methods

Outputs SR Flour + Flour Streams

- Processing targets
- Flour parameters
  - Protein Content
  - Moisture Content
  - Ash Content
  - Starch Damage
  - Water Absorption
  - Wet Gluten
- Food parameters

Yield

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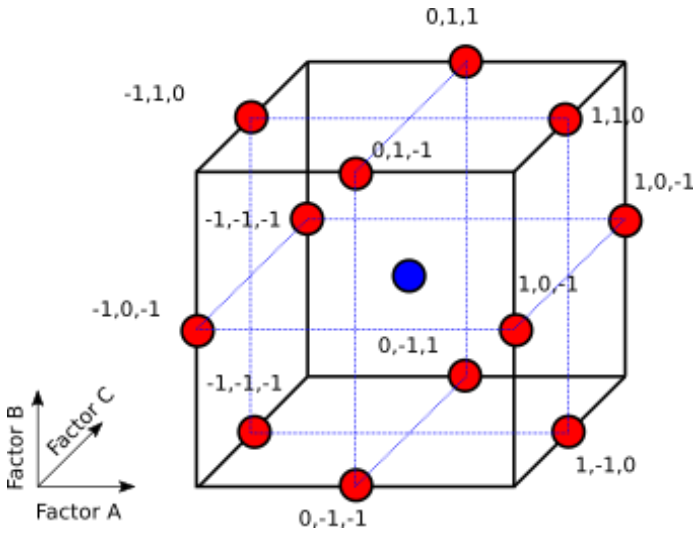
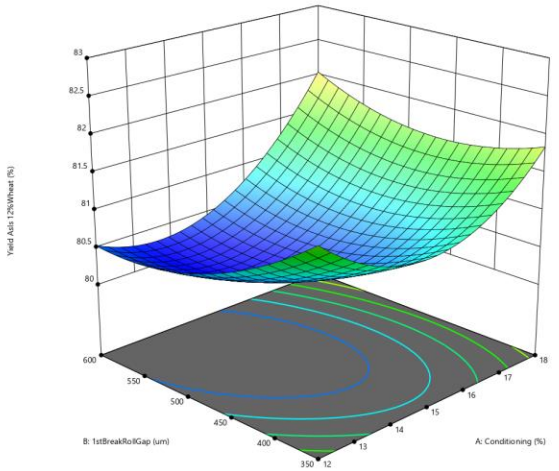
Methods

- Four-Dimensional experimental design.
- Evaluated using Response Surface Methodology (RSM).





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Results

Maximise Yield

Target Flour Specification

Food products

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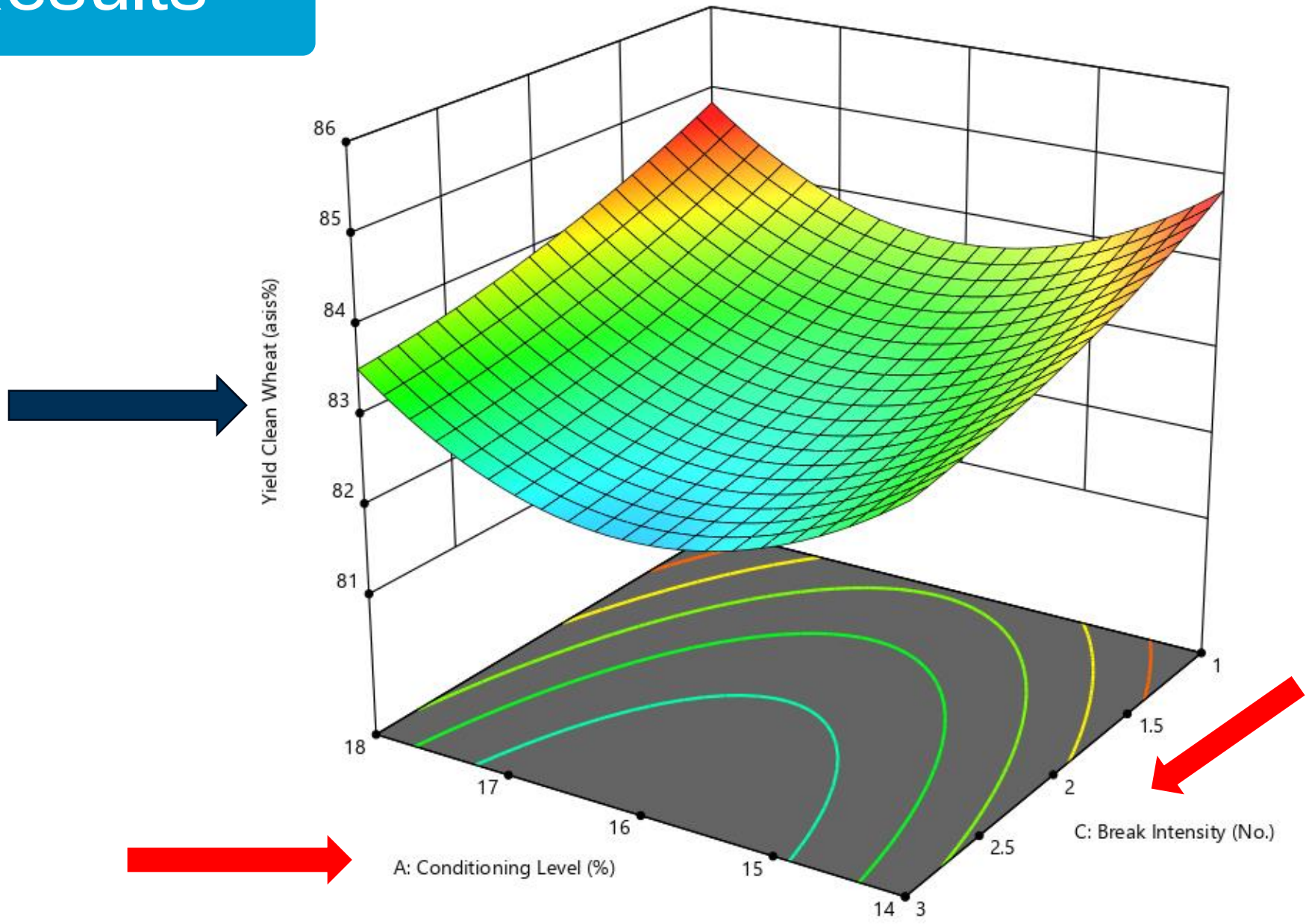
Results



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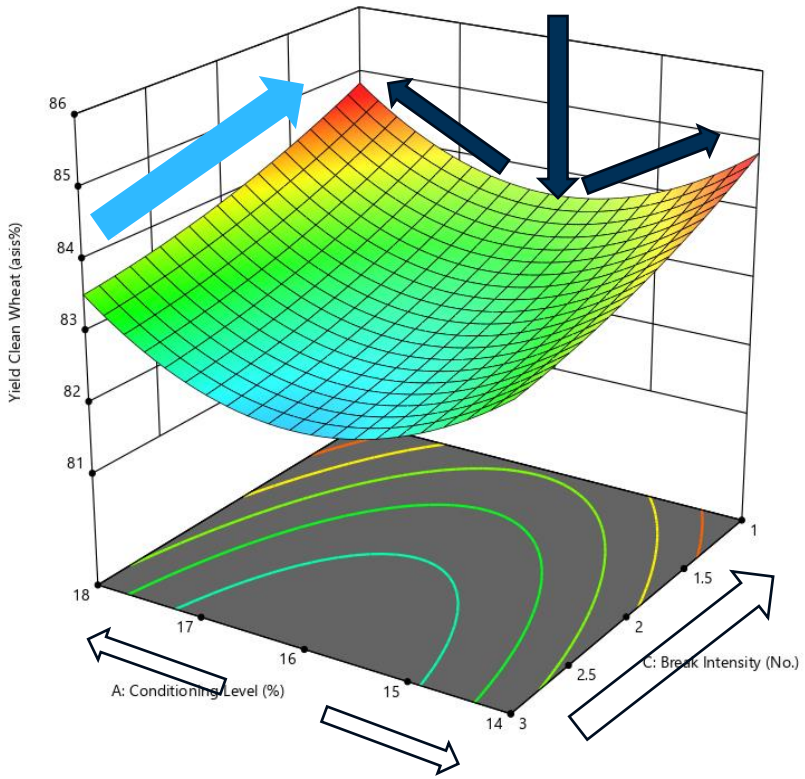
Results

Yield



AH_NSW (2022-23)

Optimised break intensity – >1% ⇧ Yield

Optimised Conditioning – >1% ⇧ Yield

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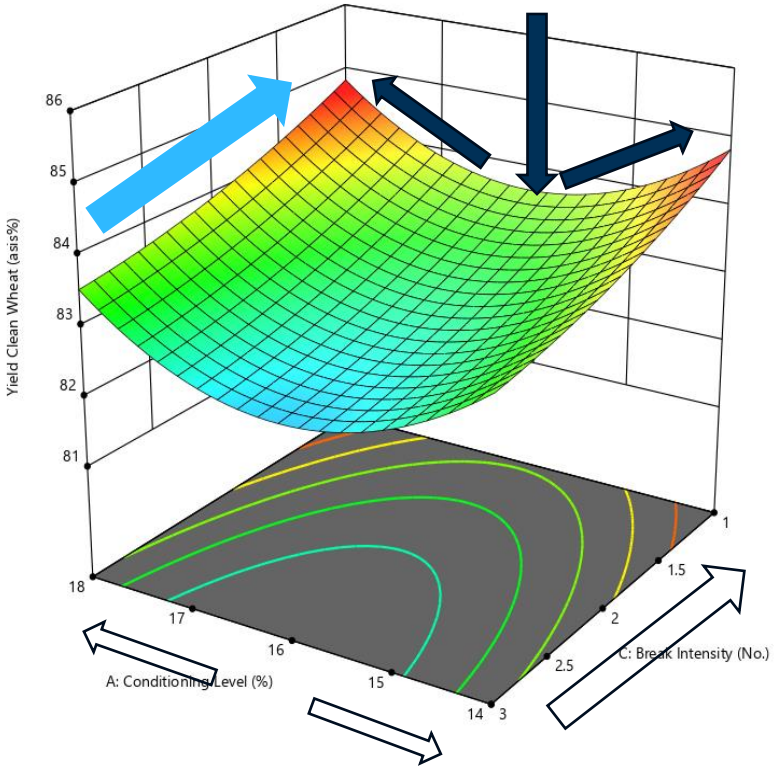
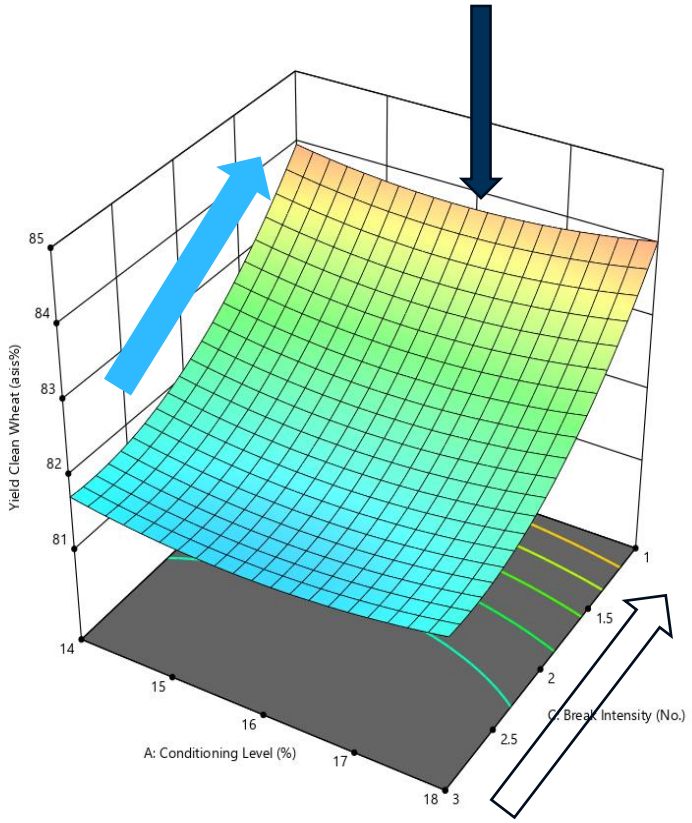
Results

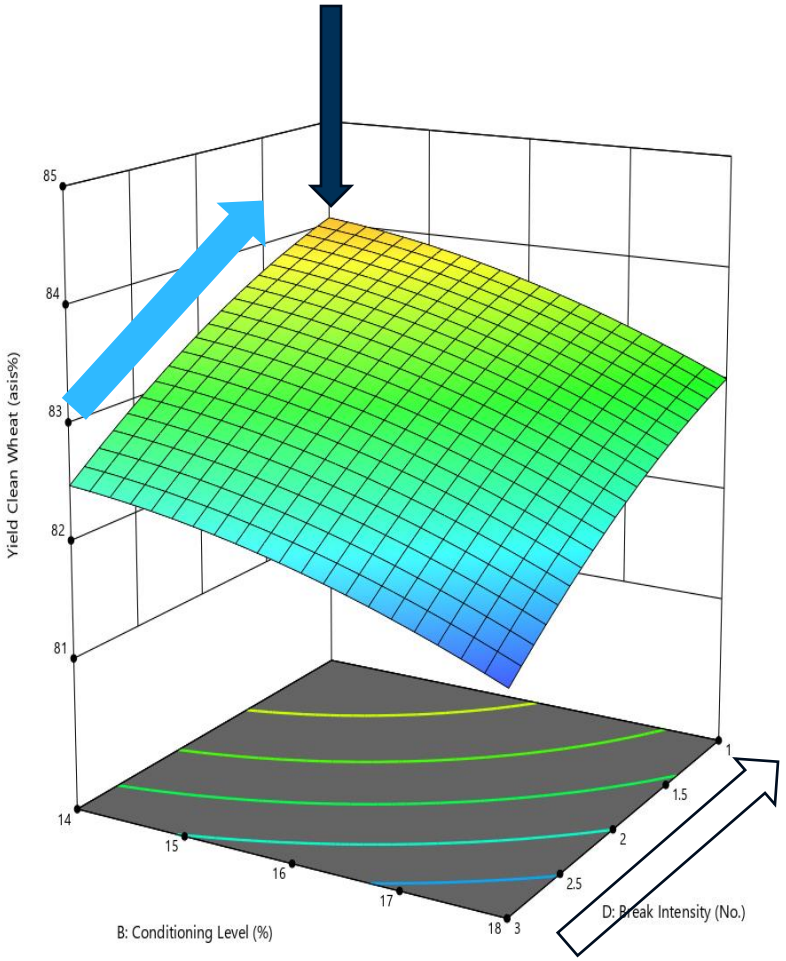
Yield



AH_NSW (2022-23)



ASW_WA (2022-23)



AH_VIC (2023-24)

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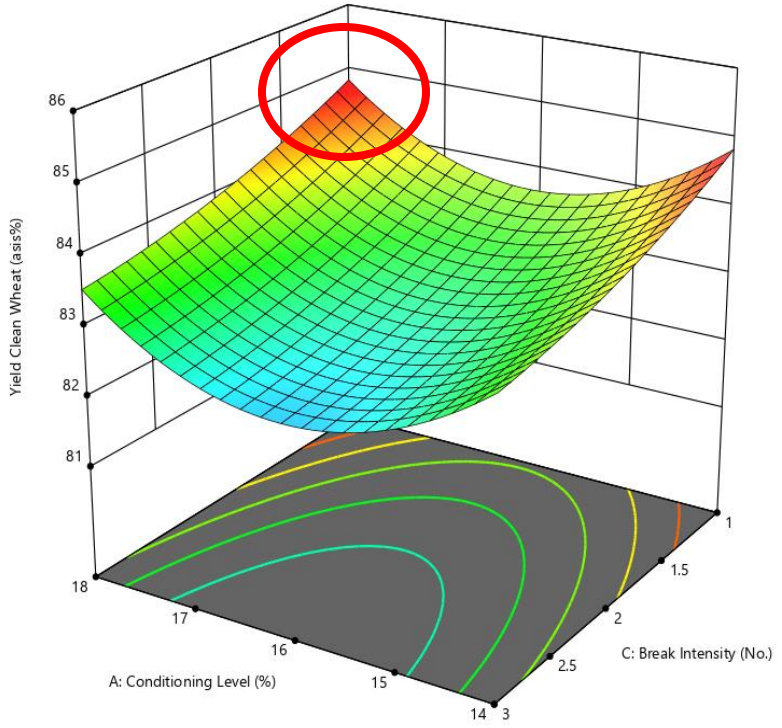
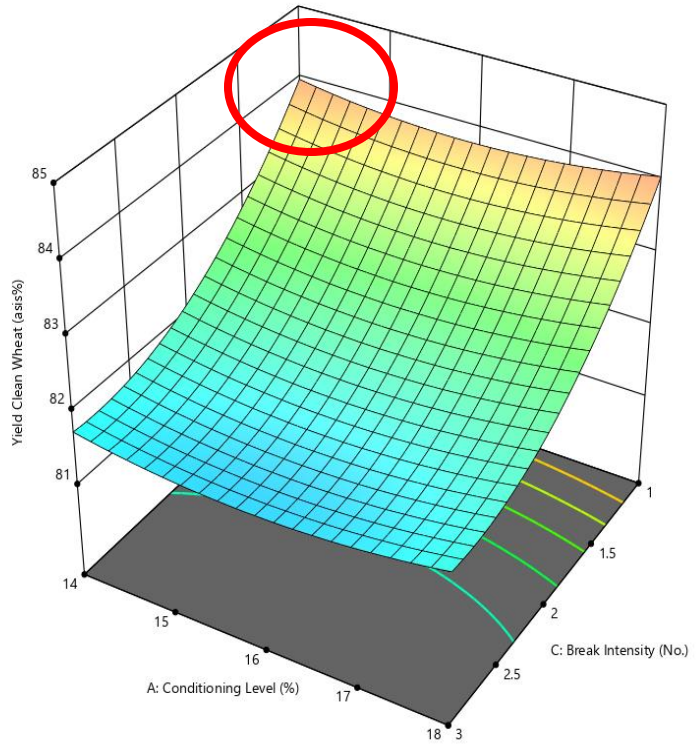
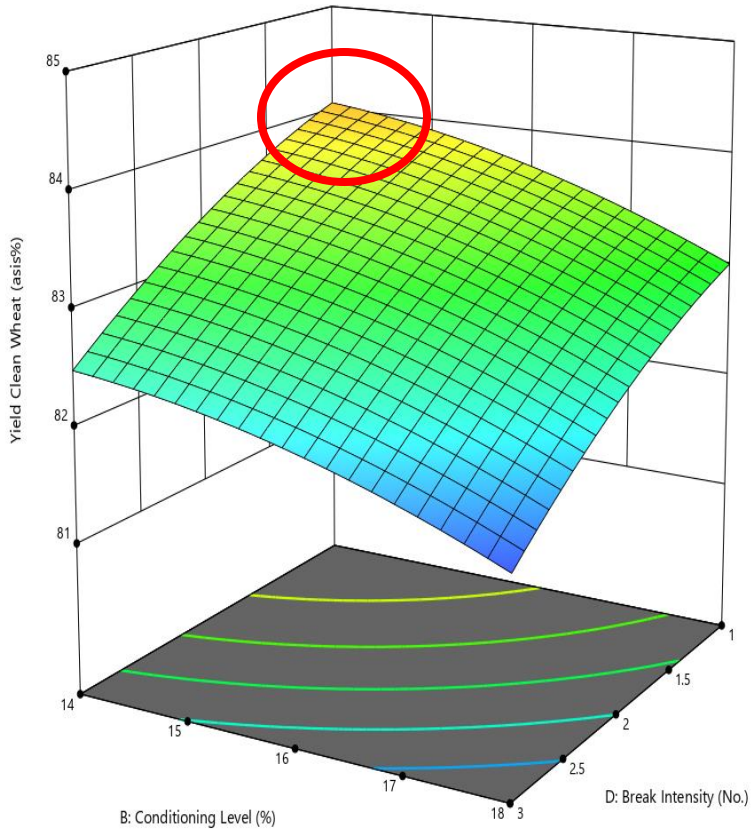
Results

Yield







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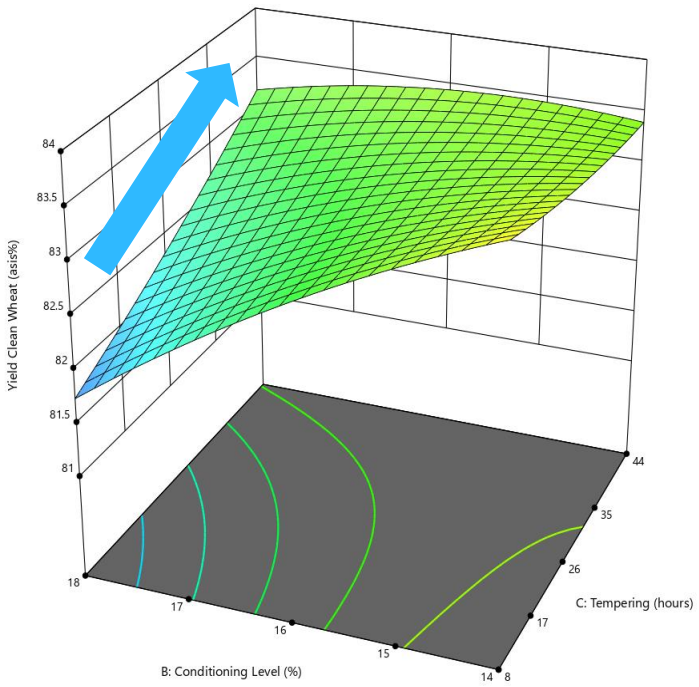
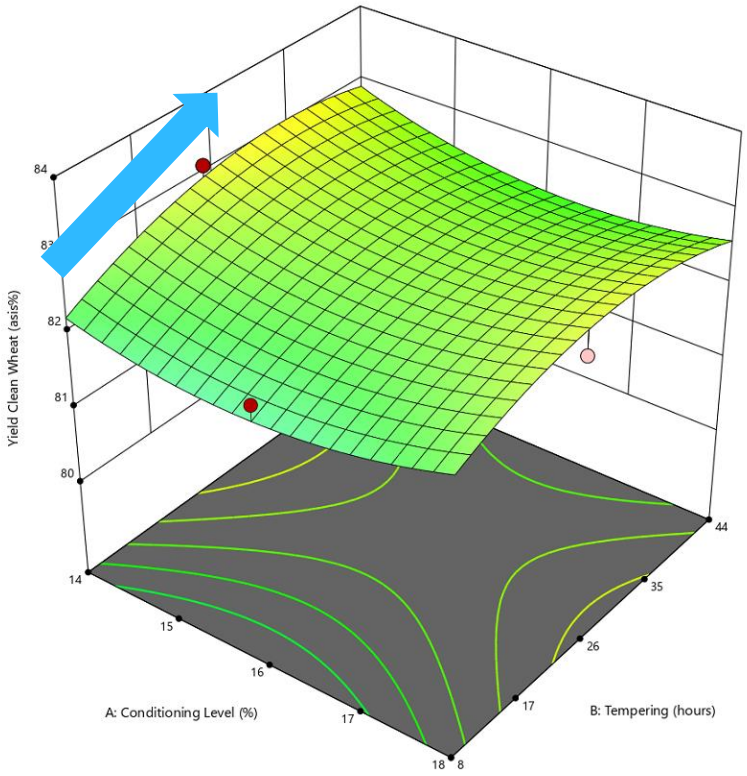
Results

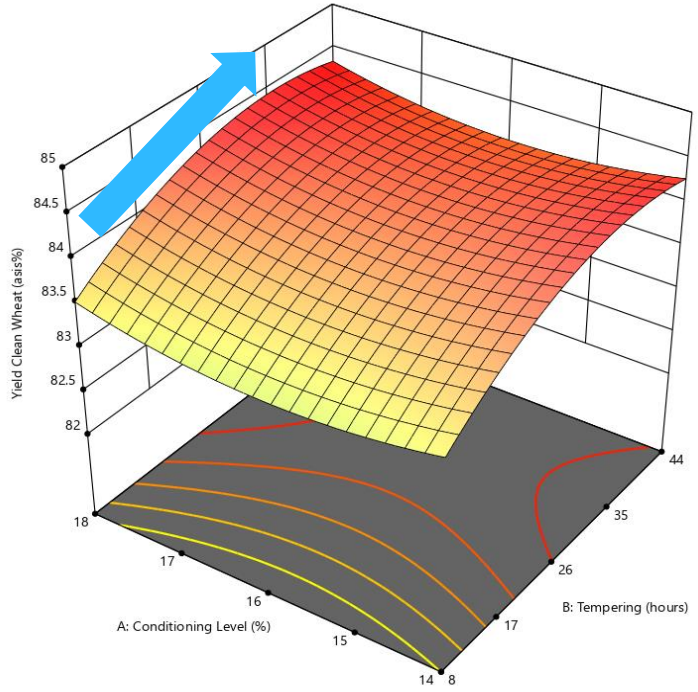
Tempering & yield



AH_VIC (23-24)



ASW_NSW (22-23)



ASW-WA (22-23)

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Results

Maximise Yield

Target Flour Specification

Food products

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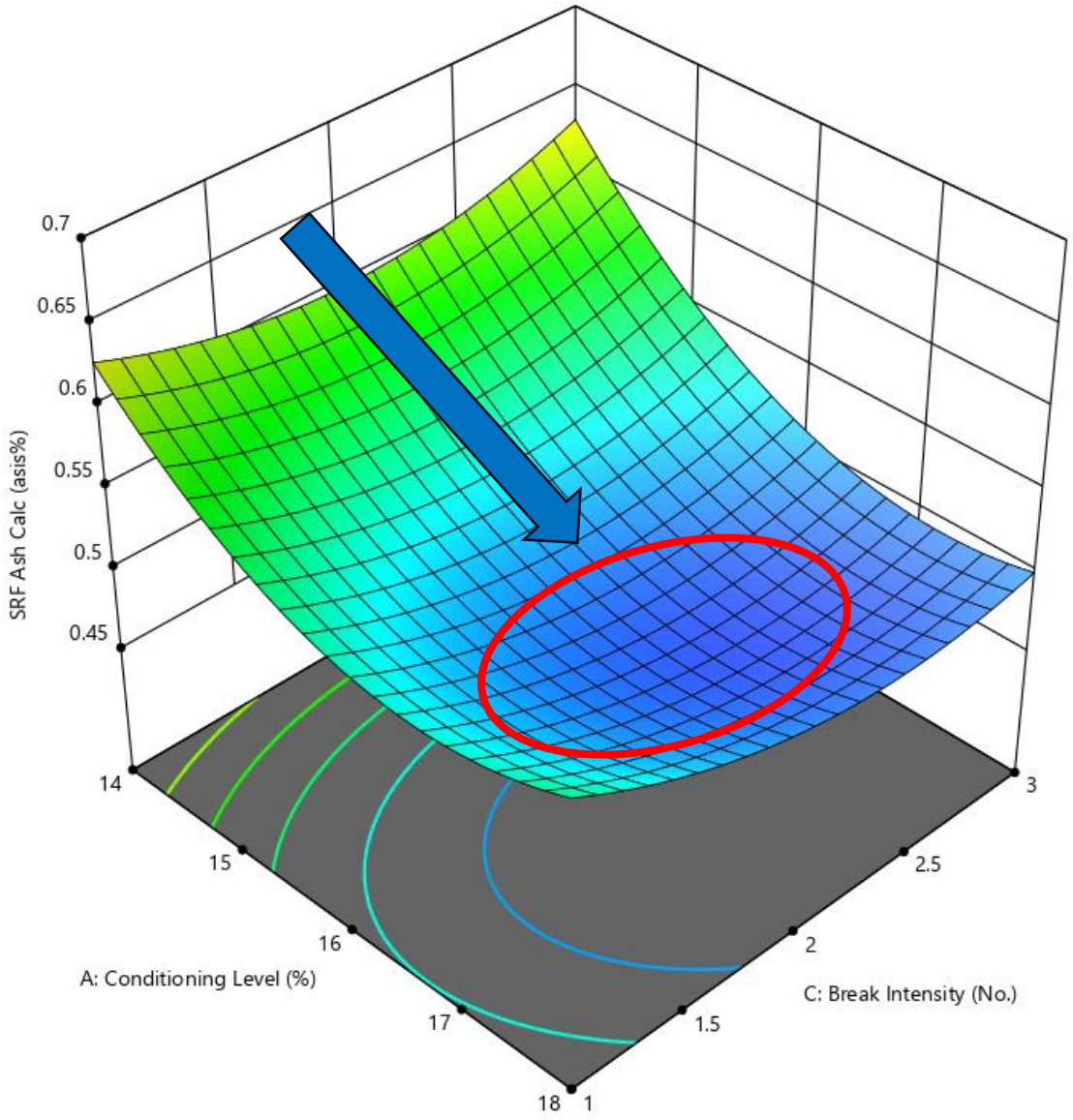
Results

Flour specifications - ash



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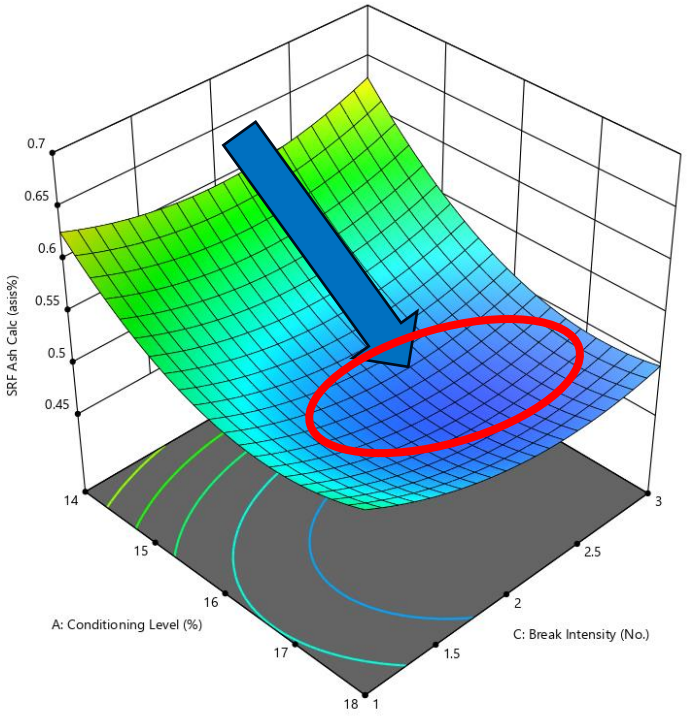
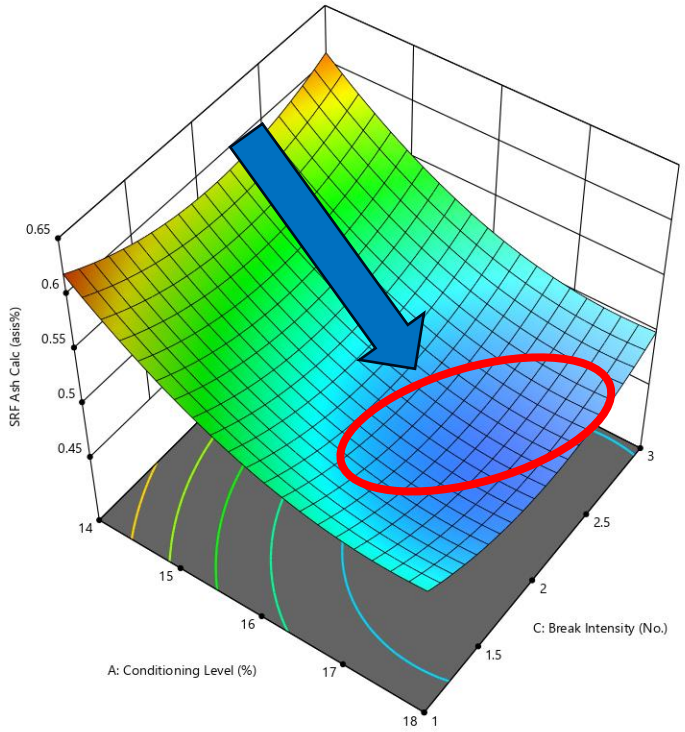
Results

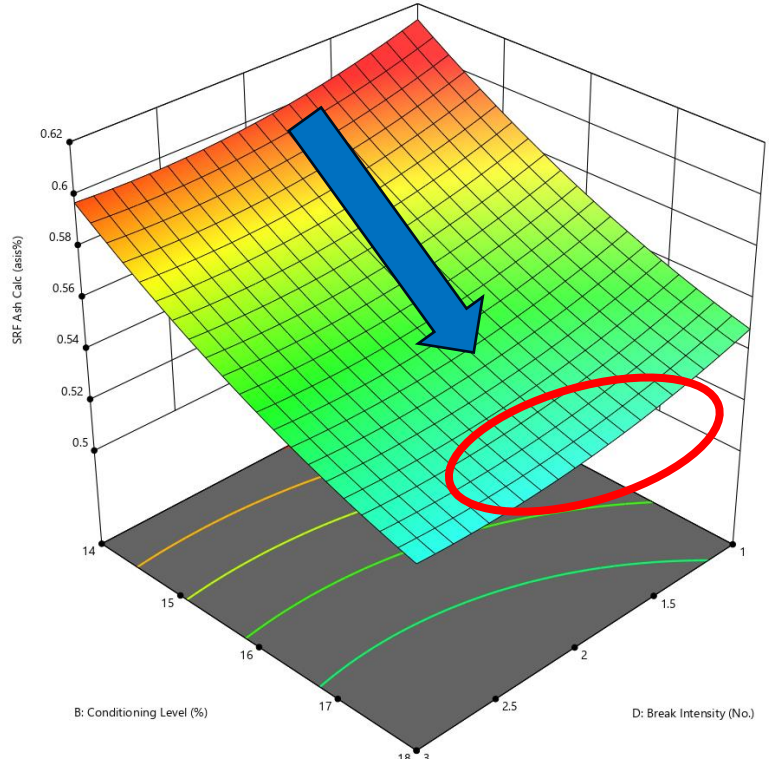
Flour specifications - ash



AH_NSW (2022-23)



ASW_WA (2022-23)



AH_VIC (2023-24)

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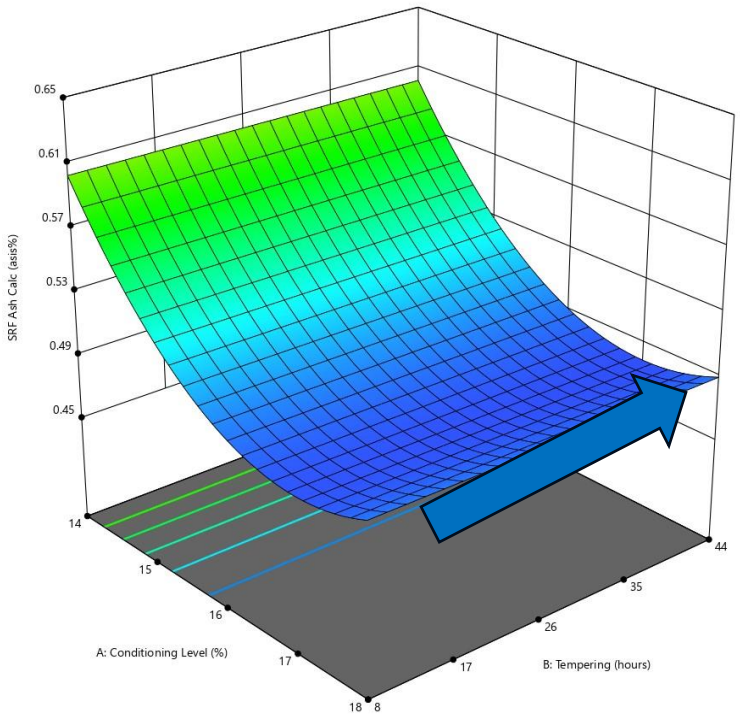
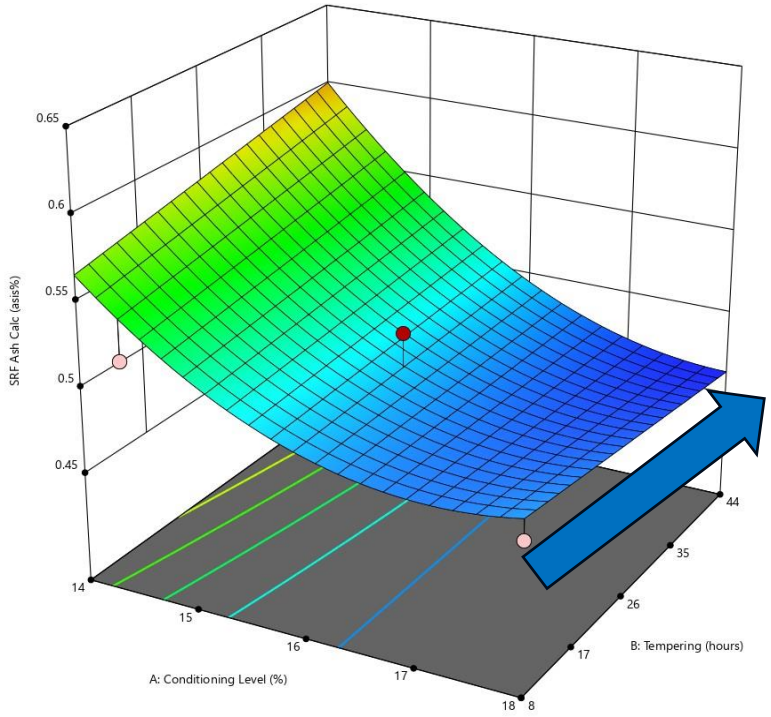
Results

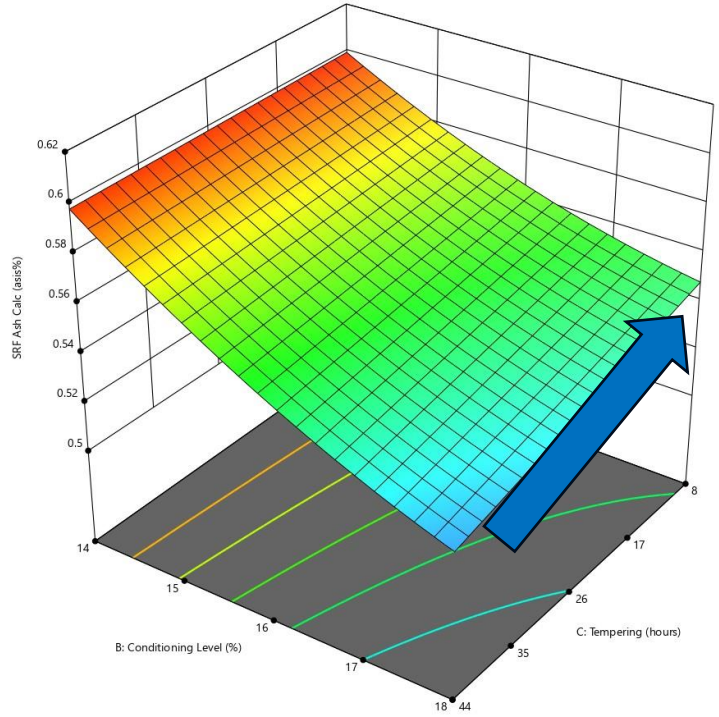
Flour specifications - ash



AH_NSW (2022-23)



ASW_WA (2022-23)



AH_VIC (2023-24)

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Results summary

Settings	Break gap	Reduction gap	Conditioning moisture	Tempering time
Flour yield	**		**	*
Ash	**		**	

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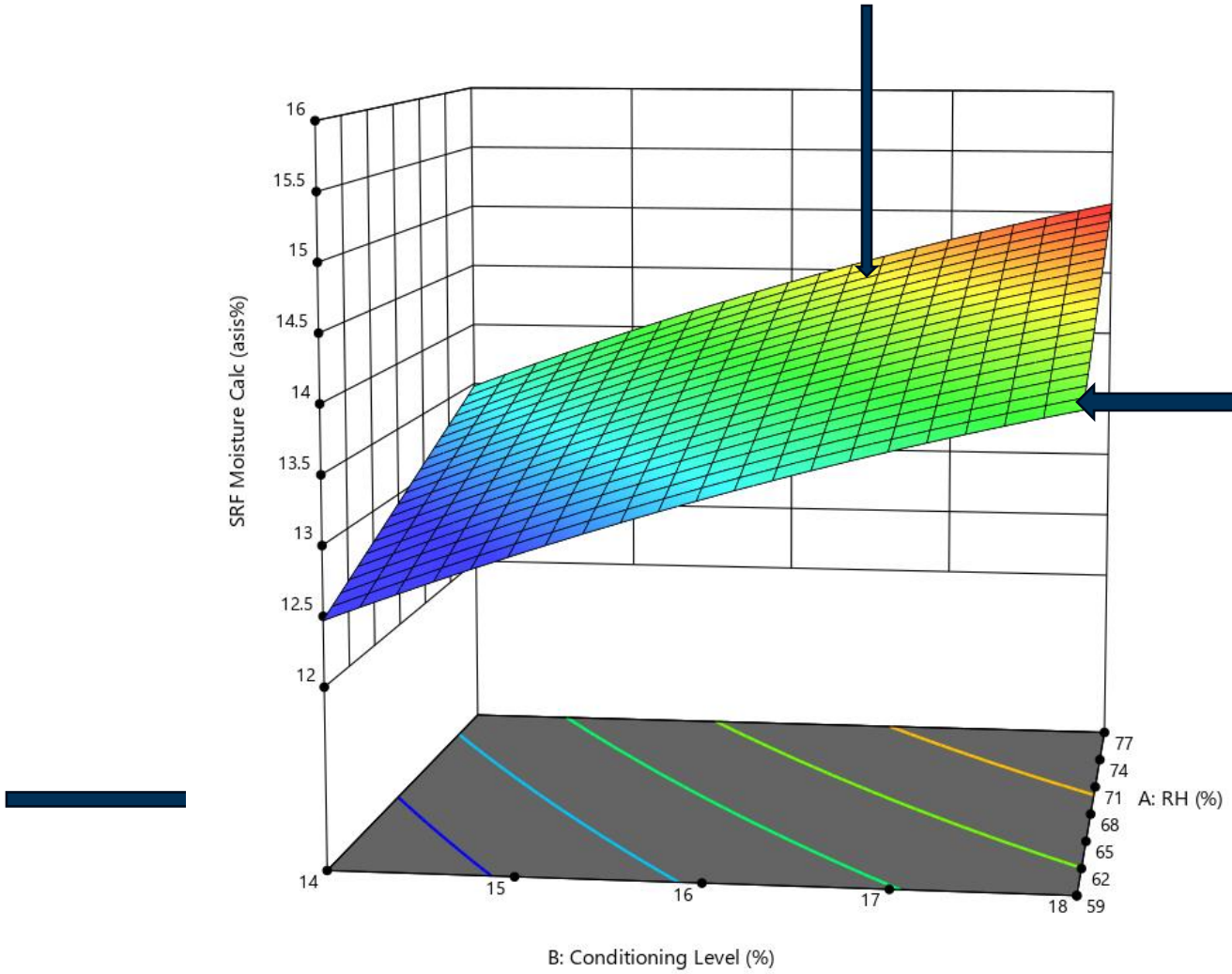
Results

Flour specifications - moisture



Measure
Understand
Control

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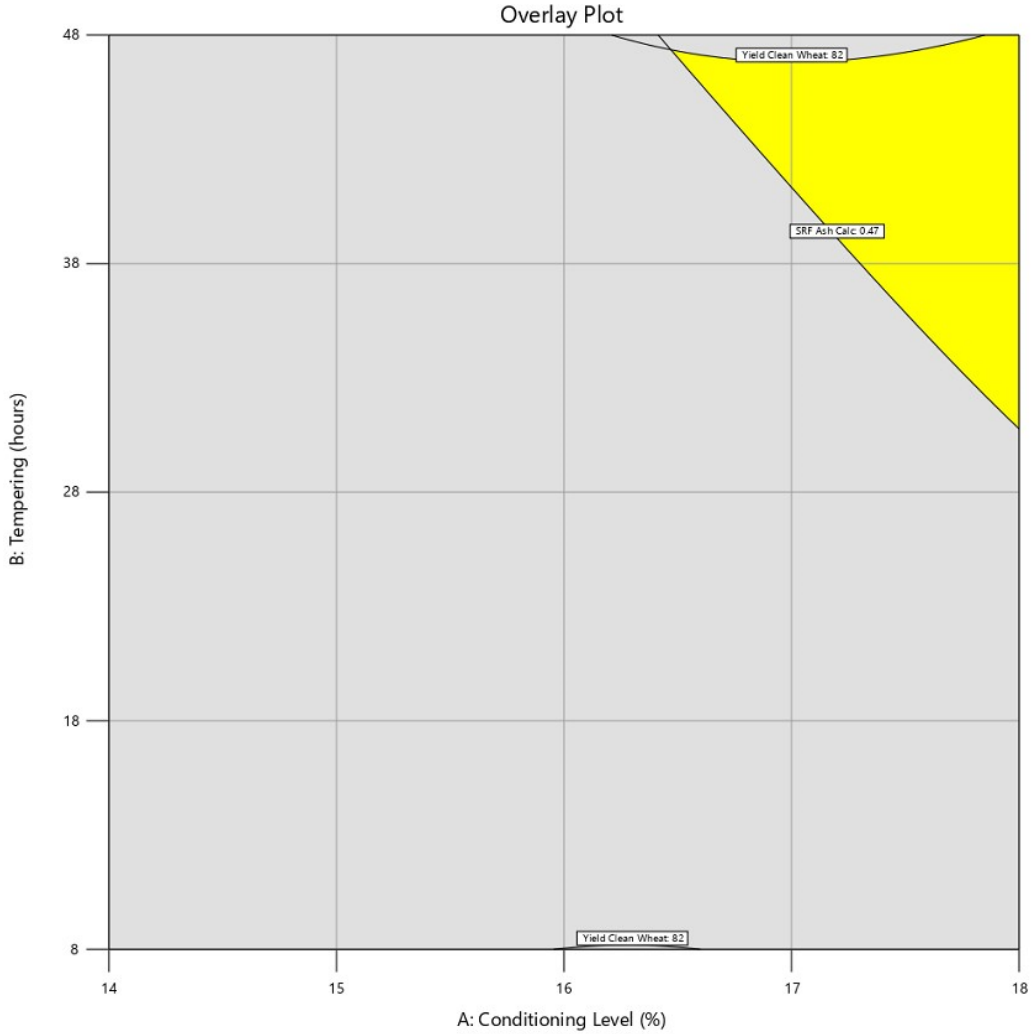
Results

Yield & ash



Flour Ash Content: **<0.47%**

Clean Wheat Yield: **>82.0%**

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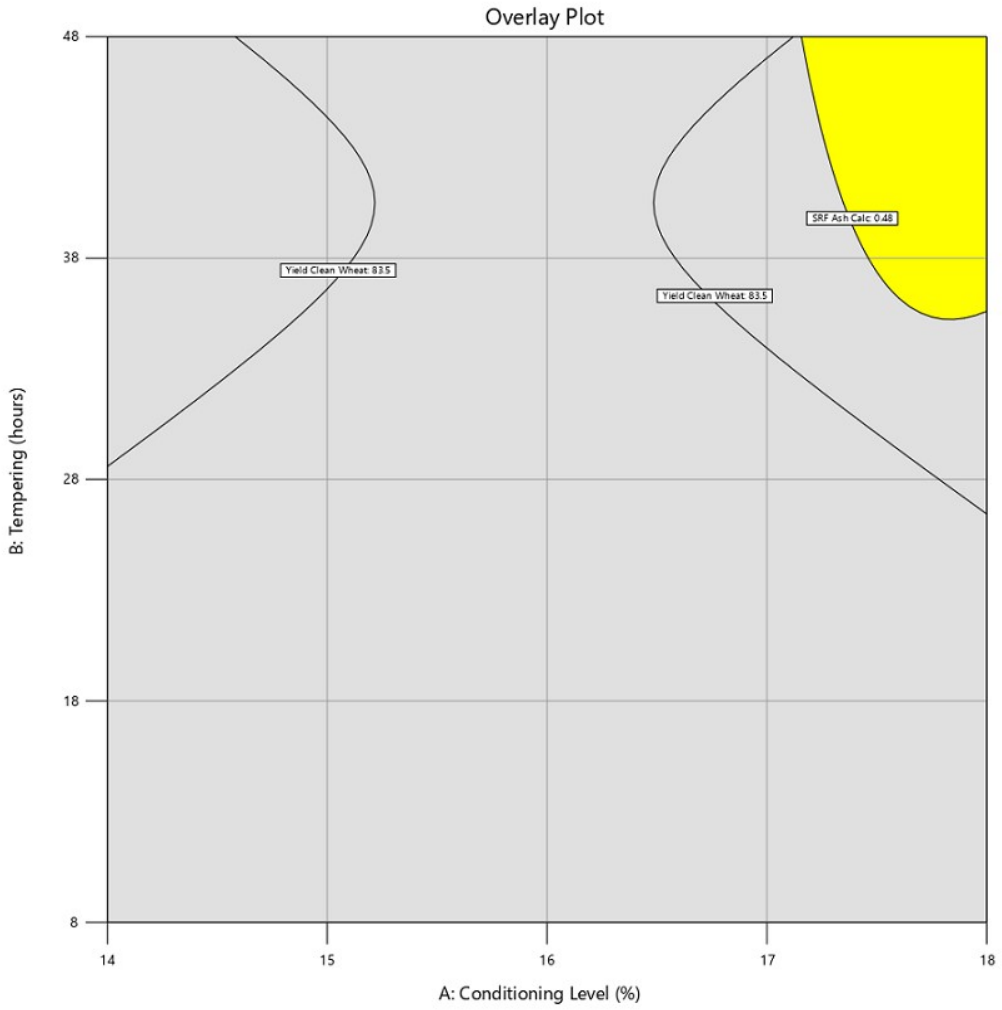
Results

Yield & ash & moisture



Targets:

Flour Ash Content: **<0.48%**

Clean Wheat Yield: **>83.5%**

Moisture content: **<14.5%**

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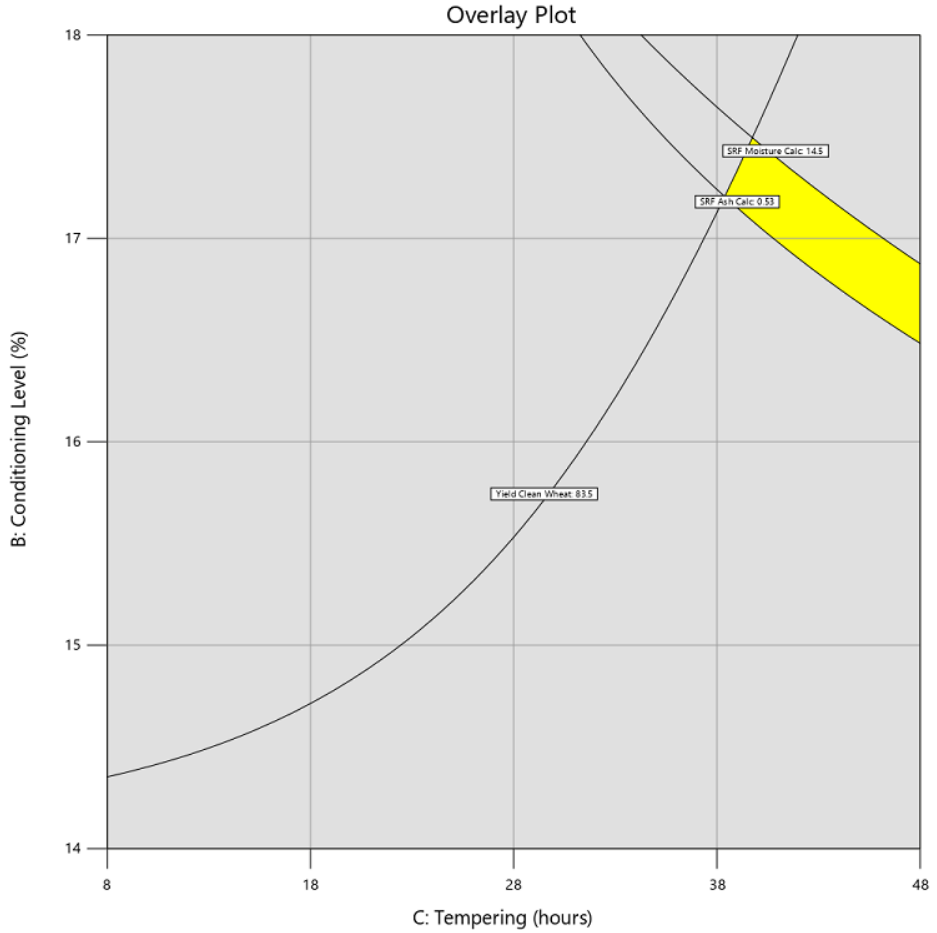
Results

Yield & Ash & Moisture & RH



Flour Ash Content: **<0.53%**

Clean Wheat Yield: **>83.5%**

Moisture content: **<14.5%**

Relative Humidity: **62%**

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Results

Maximise Yield

Target Flour Specification

End products?

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Results

Yellow Alkaline Noodles

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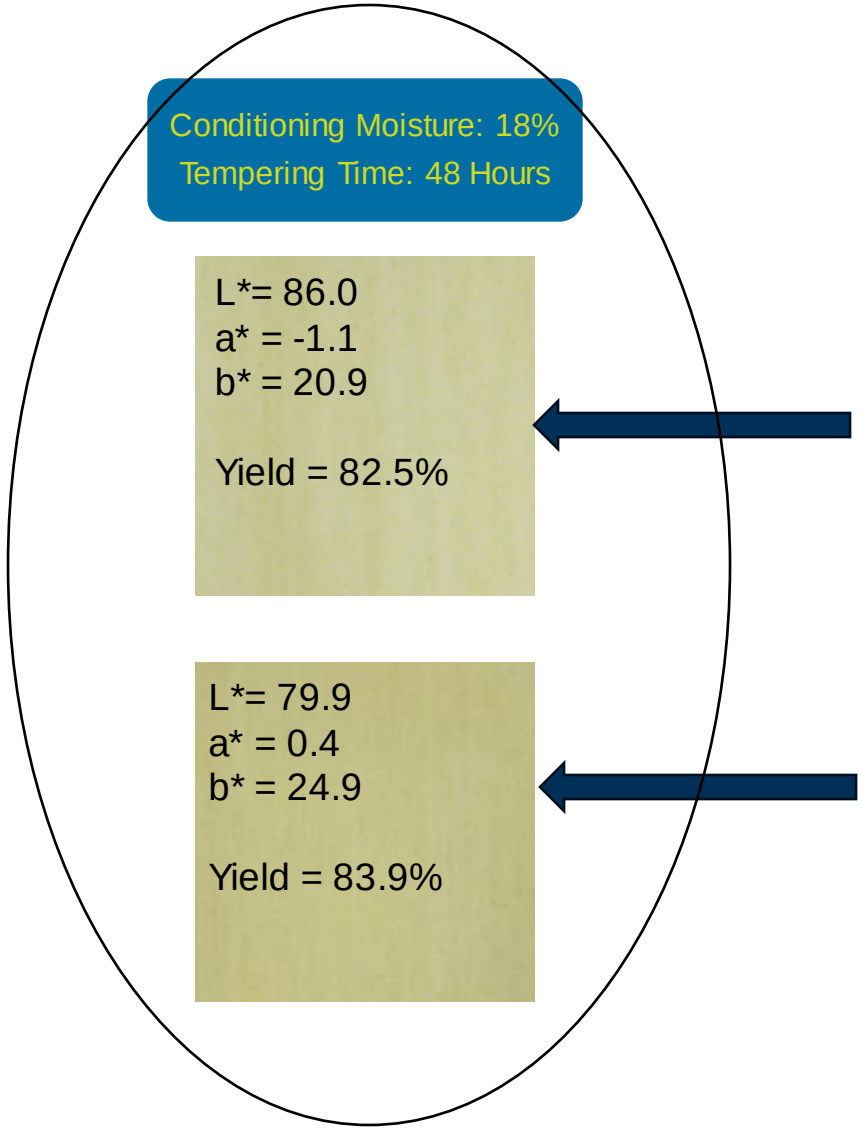
Results

Yellow Alkaline Noodles



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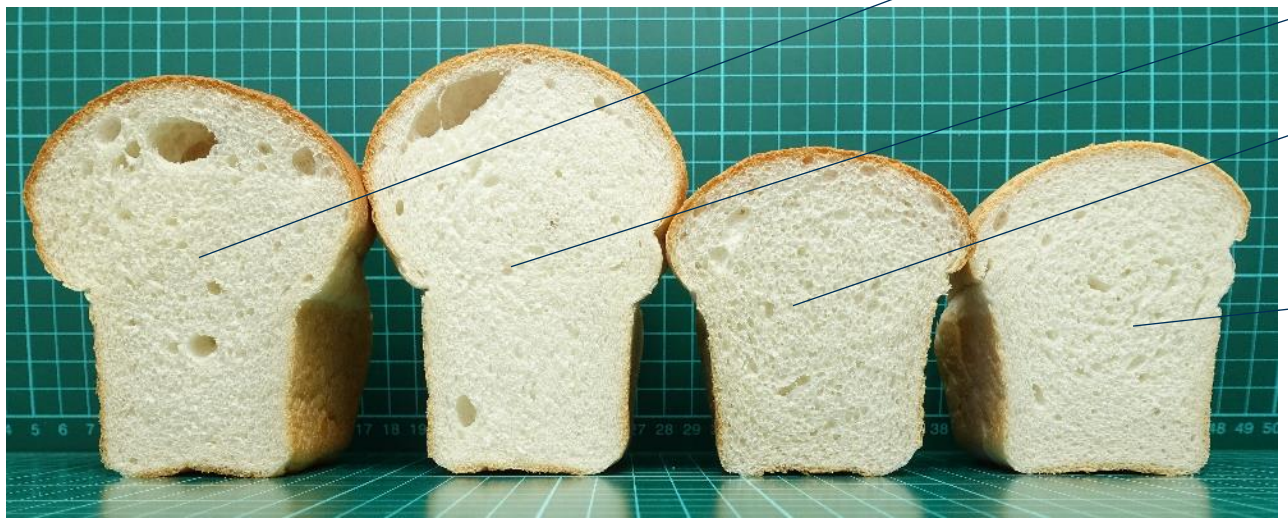
Results

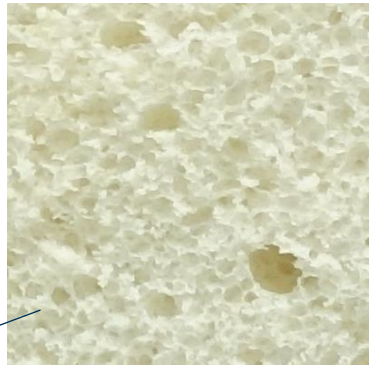
Bread

AH_NSW

ASW_WA

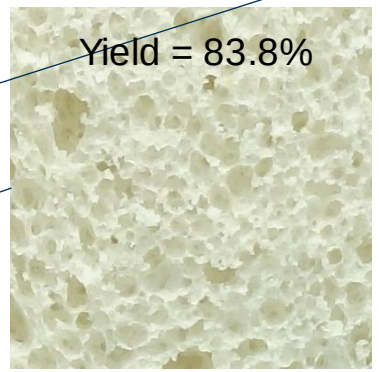


Conditioning Moisture: 14%
Tempering Time: 24 Hours



L*= 76.2

Yield = 83.8%



L*= 76.6

Yield = 83.0%

Conditioning Moisture: 18%
Tempering Time: 48 Hours

L*= 80.2

Yield = 83.9%

L*= 80.4

Yield = 82.5%

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Summary

- Broadly similar results across wheat samples.

- Optimum milling conditions for wheat tested so far:
  - Intense grinding on the break rolls
  - High Conditioning Moisture between 16.5 – 18%
  - Long tempering times 30 – 48 hours

- Contour plots and end-product results available upon request

- AEGIC Team can work with you to maximise utilisation of Australian wheat.

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What is next?

- Use models to work with millers to achieve maximum benefits from Australian wheat
- Add grades, seasons and locations
- Add milling variables
- Add financial outcomes

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Thanks!

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Department of Primary Industries and Regional Development

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