



Australian Export Grains Innovation Centre

# How to condition and mill current-season Australian wheat

Mathew Rees

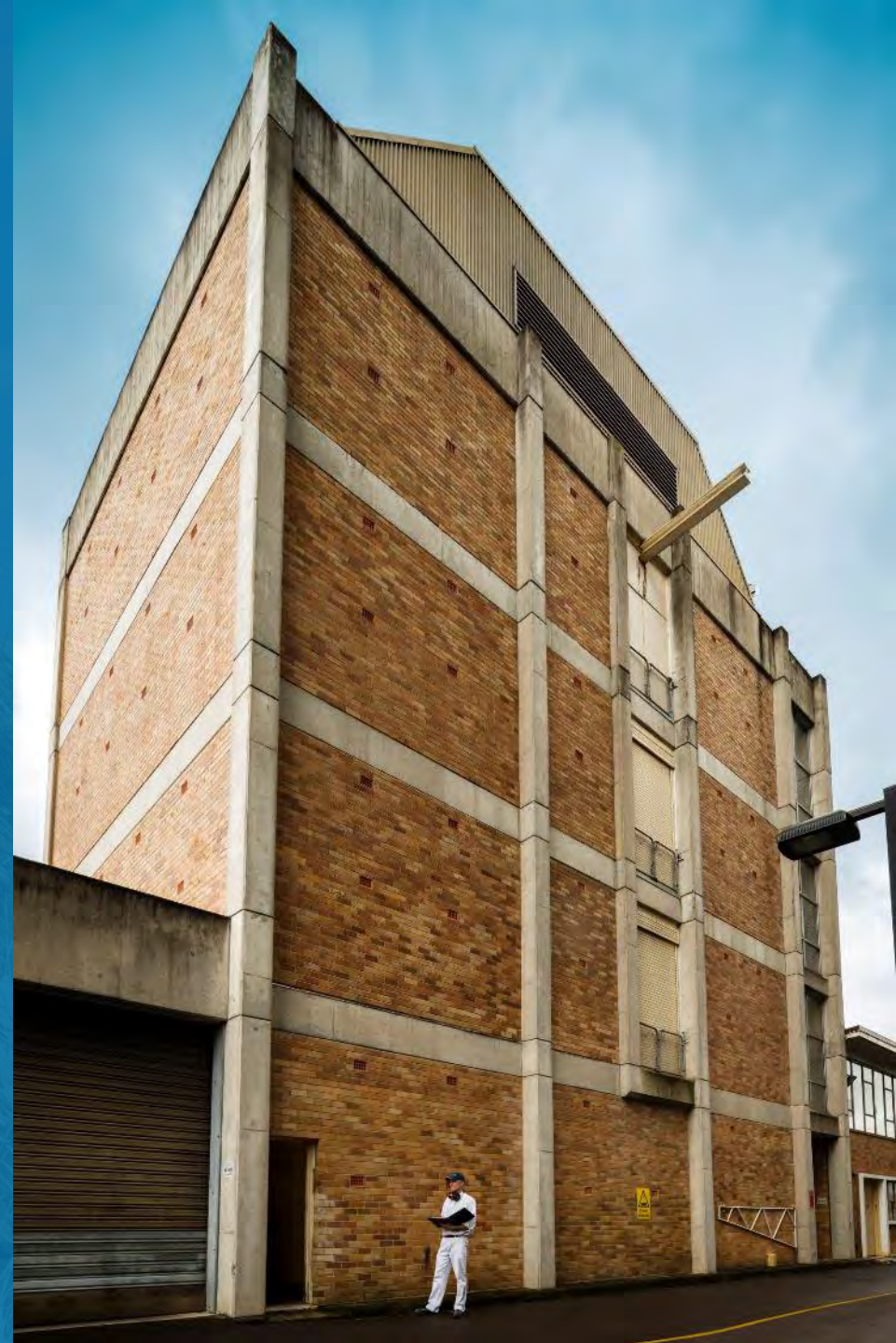


Department of  
Primary Industries and  
Regional Development



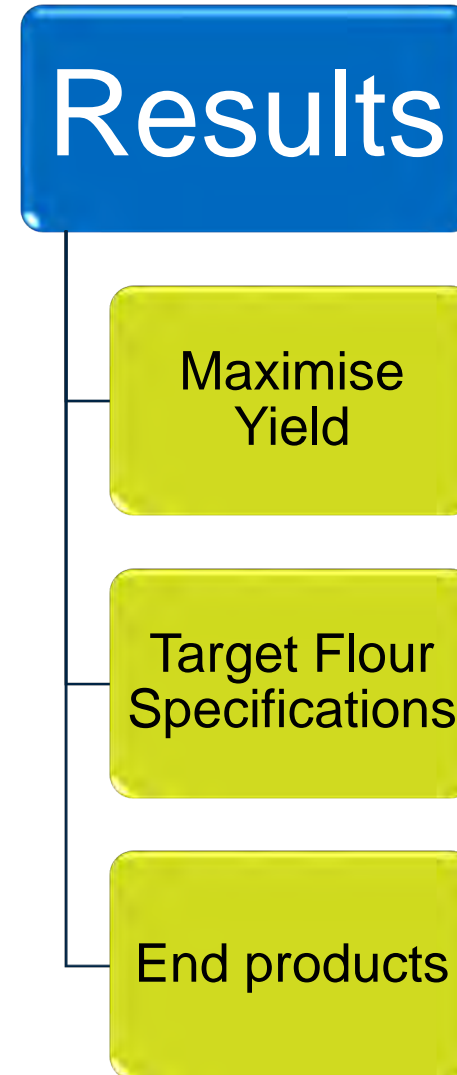
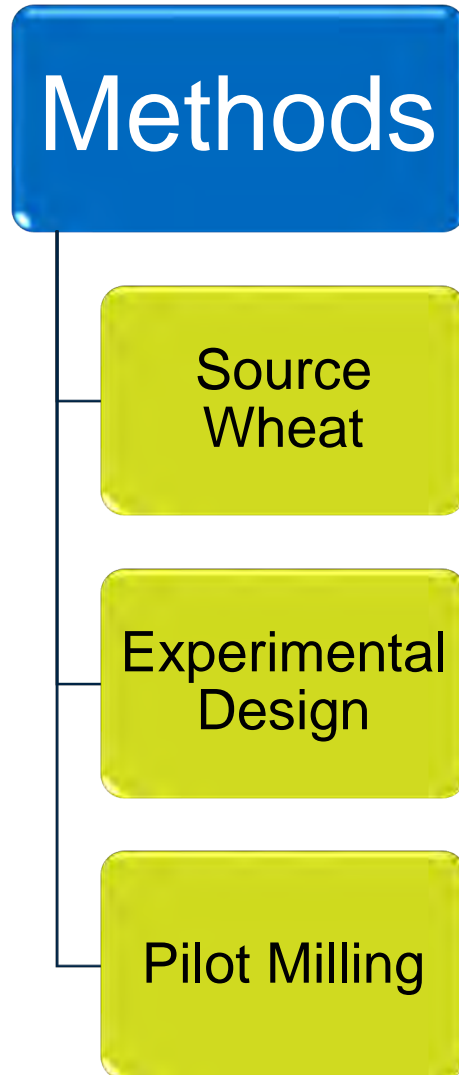
**GRDC**  
GRAINS RESEARCH  
& DEVELOPMENT  
CORPORATION

AEGIC is an initiative of the Western Australian State Government and Australia's Grains Research and Development Corporation





# Overview



# Methods

Sourced wheat from  
around Australia

Experimental  
Design

Mill Trials In AEGIC  
Pilot Mill

# Methods

Sourced wheat from  
around Australia

Experimental  
Design

Mill Trials In AEGIC  
Pilot Mill

# Methods

Three main wheat classes:

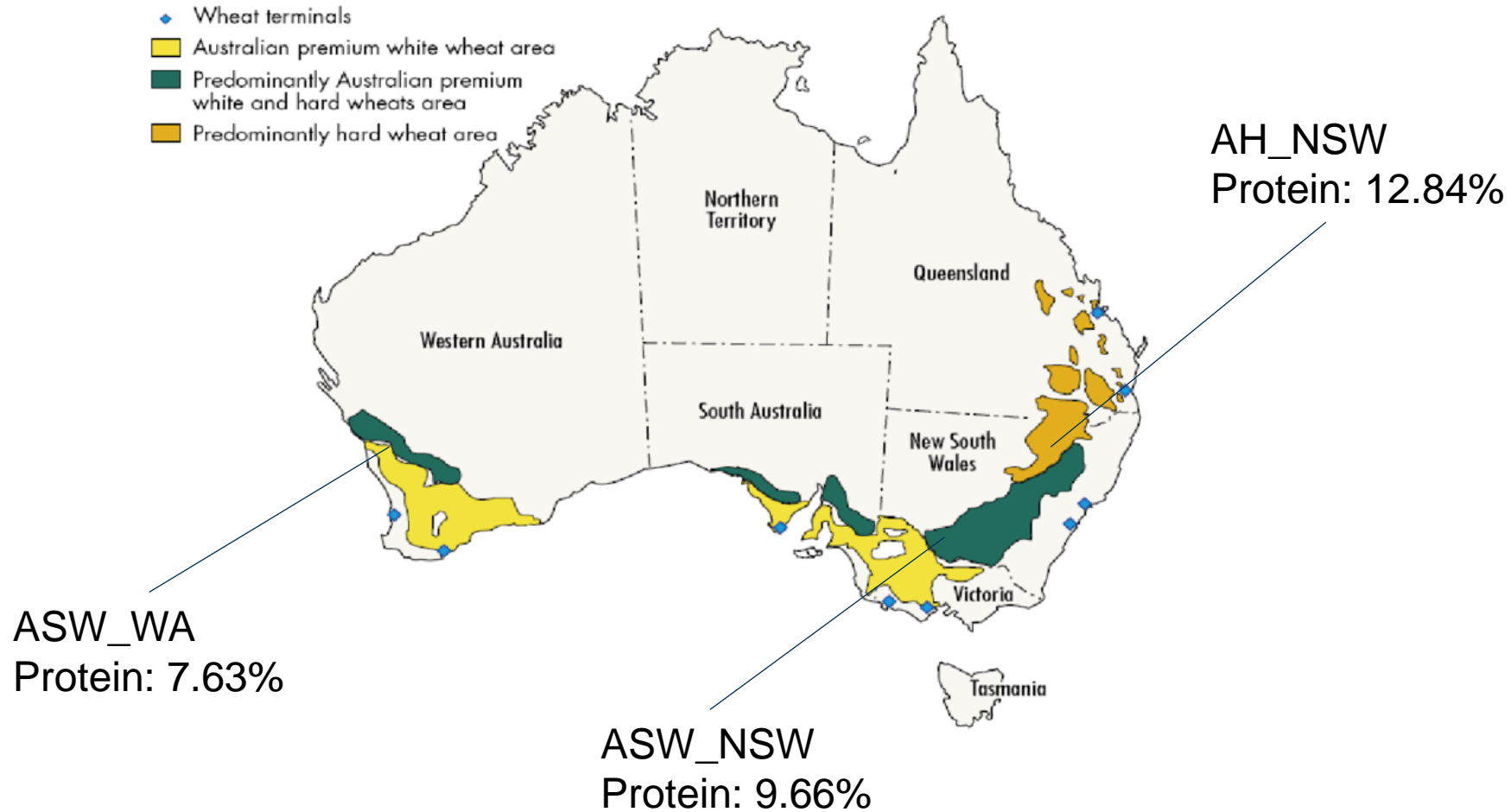
**APW** (Australian Premium White) wheat (30-40% of Australian wheat crop)

**ASW** (Australian Standard White) wheat (20-25% of Australian wheat crop)

**AH** (Australian Hard) wheat (15-20% of Australian wheat crop)

These three Australian wheat classes are made up of **hard white wheat** varieties. At grain receipt they are segregated according to protein content, amongst other parameters

# Methods



# Methods

Sourced wheat from  
around Australia

Experimental Design

Mill Trials In AEGIC  
Pilot Mill



# Methods

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

# Methods

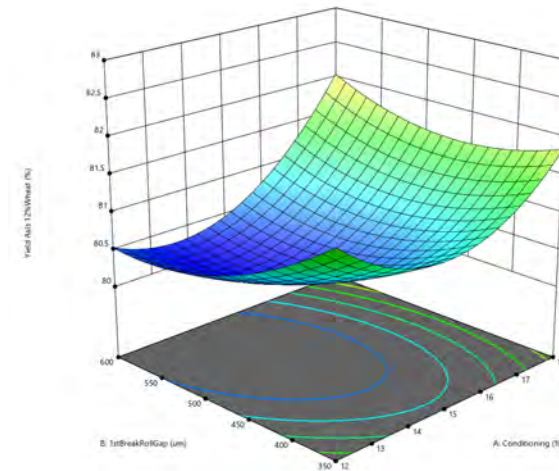
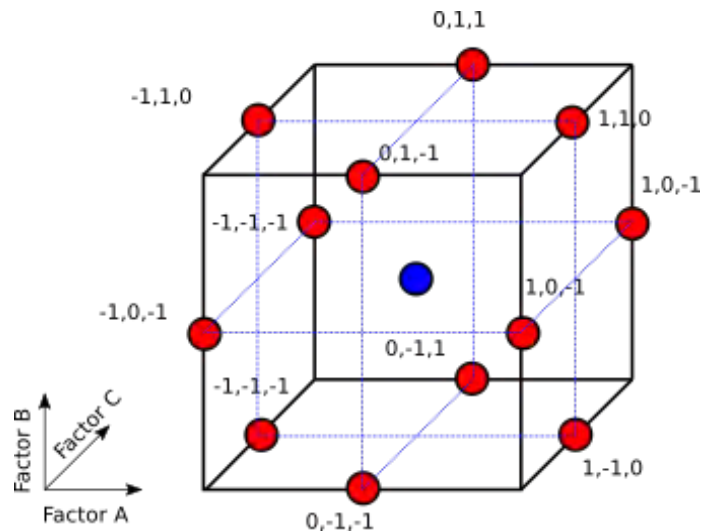
1. Yield
2. Flour Constituents:
  - a. Protein Content
  - b. Moisture Content
  - c. Ash Content
3. Flour Properties:
  - a. Starch Damage
  - b. Water Absorption
  - c. Wet Gluten
4. Flour Streams
  - a. Flow rate
  - b. Flour constituents
  - c. Flour properties

$$\text{Flour yield (\%)} = \frac{\text{Flour weight (as is MB)}}{\text{Clean wheat weight (as is MB)}}$$



# Methods

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



# Methods

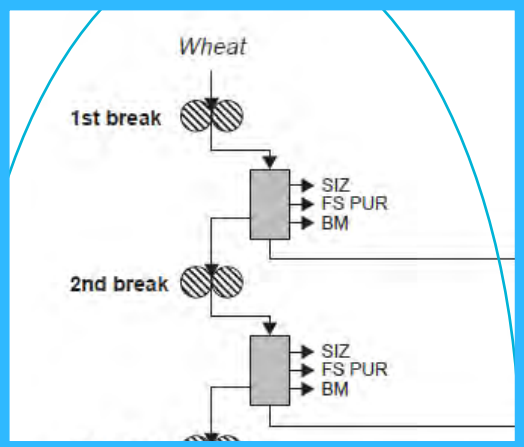
Sourced wheat from  
around Australia

Experimental Design

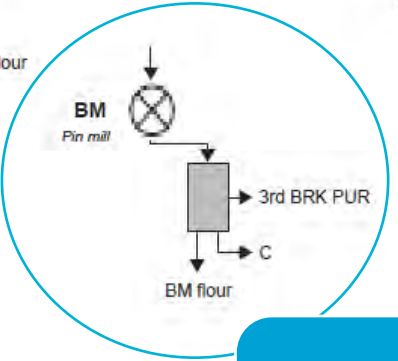
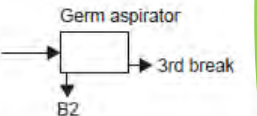
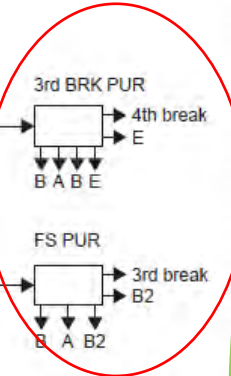
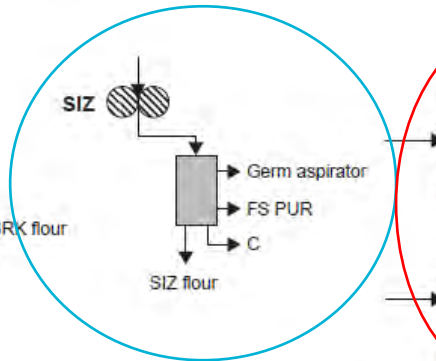
Mill Trials In AEGIC  
Pilot Mill

# Methods

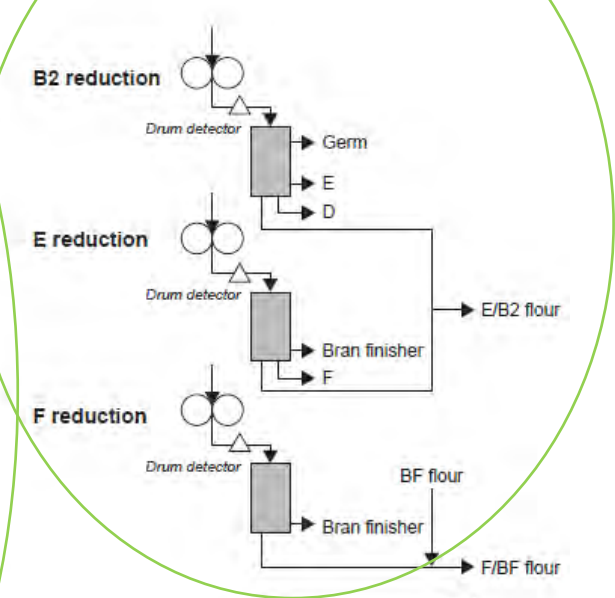
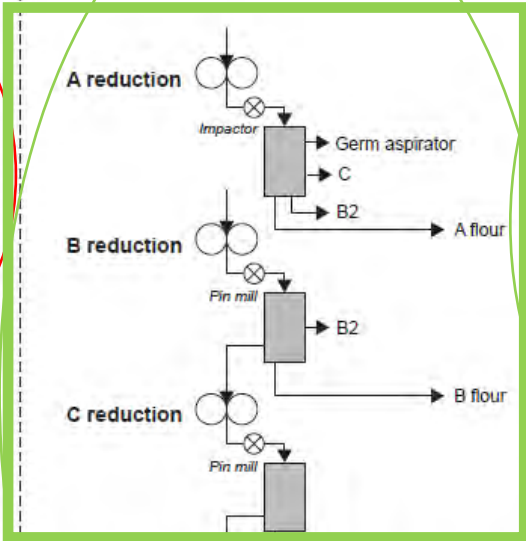
## Wheat moisture and Tempering time



### Break system



### Reduction system



*Mill controlled at relative humidity of 60%*

# Results

Maximise Yield

Target Flour  
Specification

What does this  
look like?

# Results – Maximise Yield

Maximise Yield

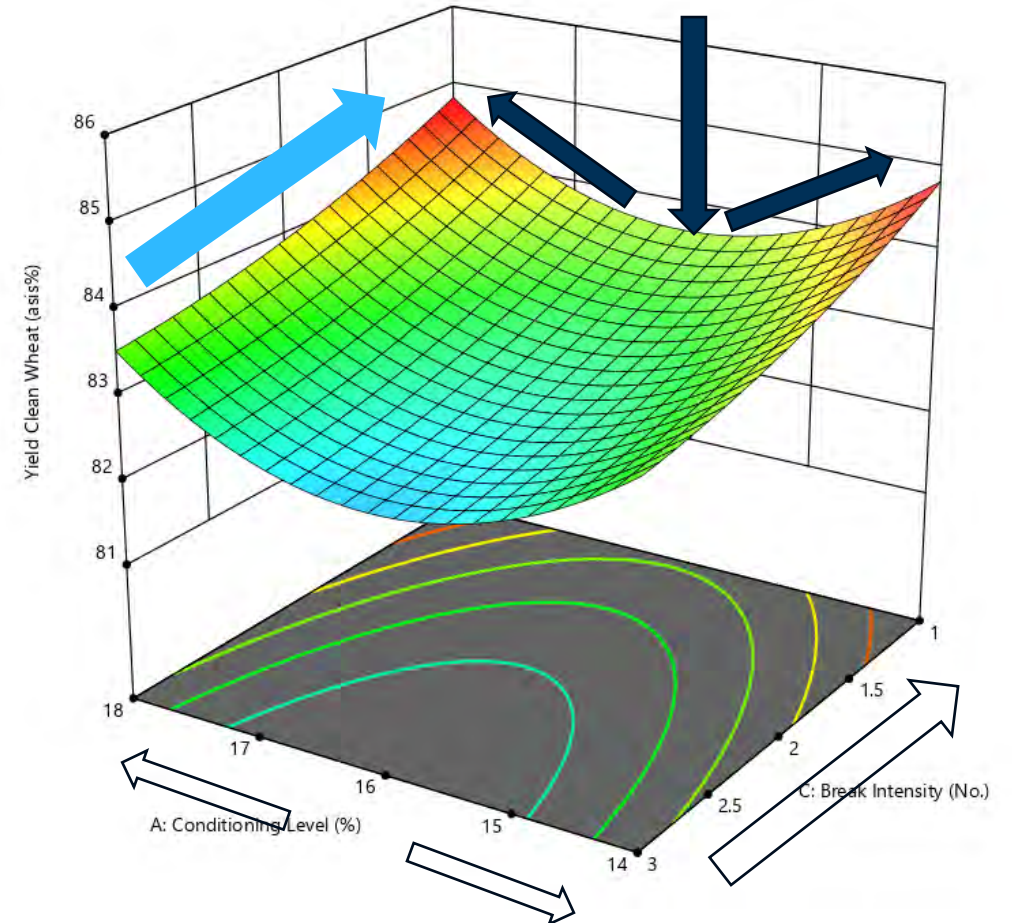
Target Flour  
Specification

What does this  
look like?

# Maximise Yield – AH\_NSW

Optimised break intensity –  $>1\%$  ↑ Yield

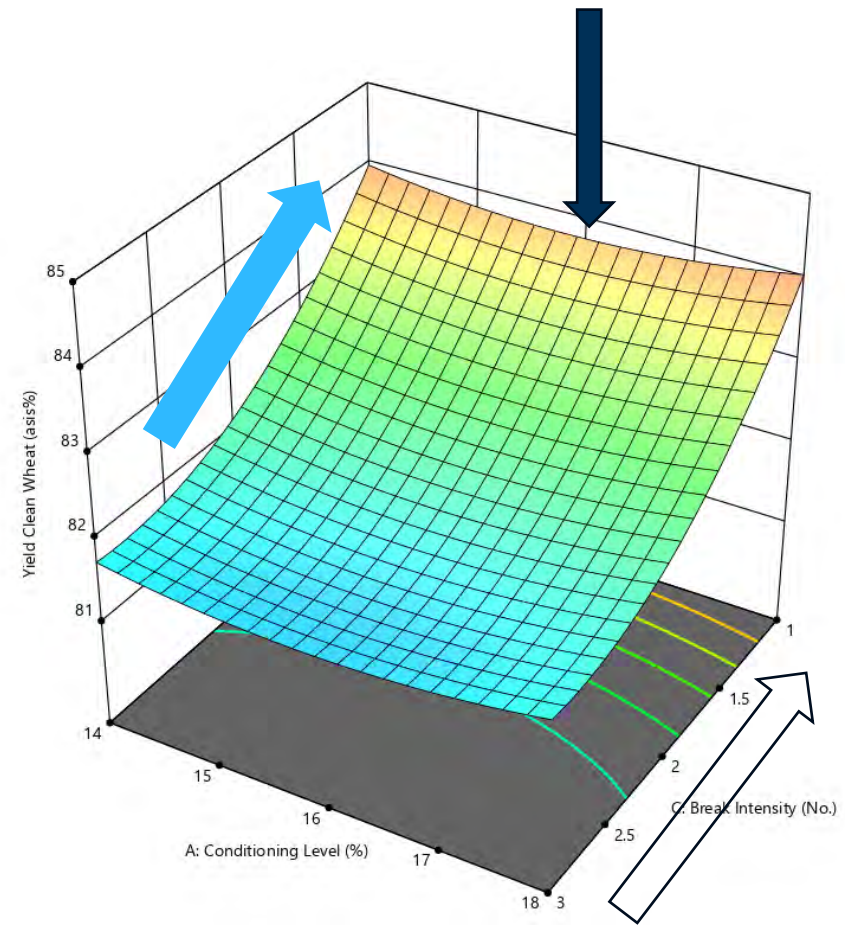
Optimised Conditioning –  $>1\%$  ↑ Yield





# Maximise Yield – ASW\_WA

1. Break roll intensity decrease - yield increases
2. Parabolic shape in yield with respect to condition moisture

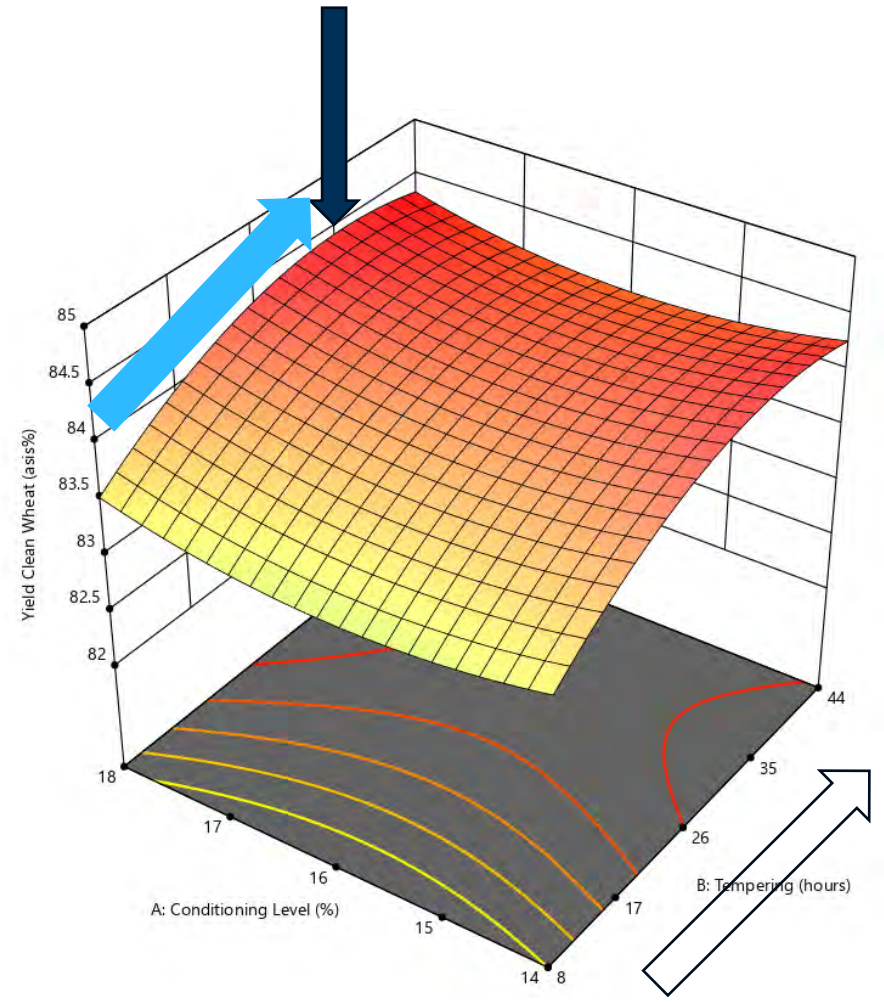


Optimised break intensity – >2% ↑ Yield

Optimised Conditioning – 0.25% ↑ Yield

# Maximise Yield – ASW\_WA

In this slide we explore the impact of tempering or conditioning time on the yield  
As tempering time increases the yield increases.  
Optimum Yield at about 35 hour tempering time



Optimised Tempering Time – 1% ↑ Yield

# Results – Target Flour Specifications

Maximise Yield

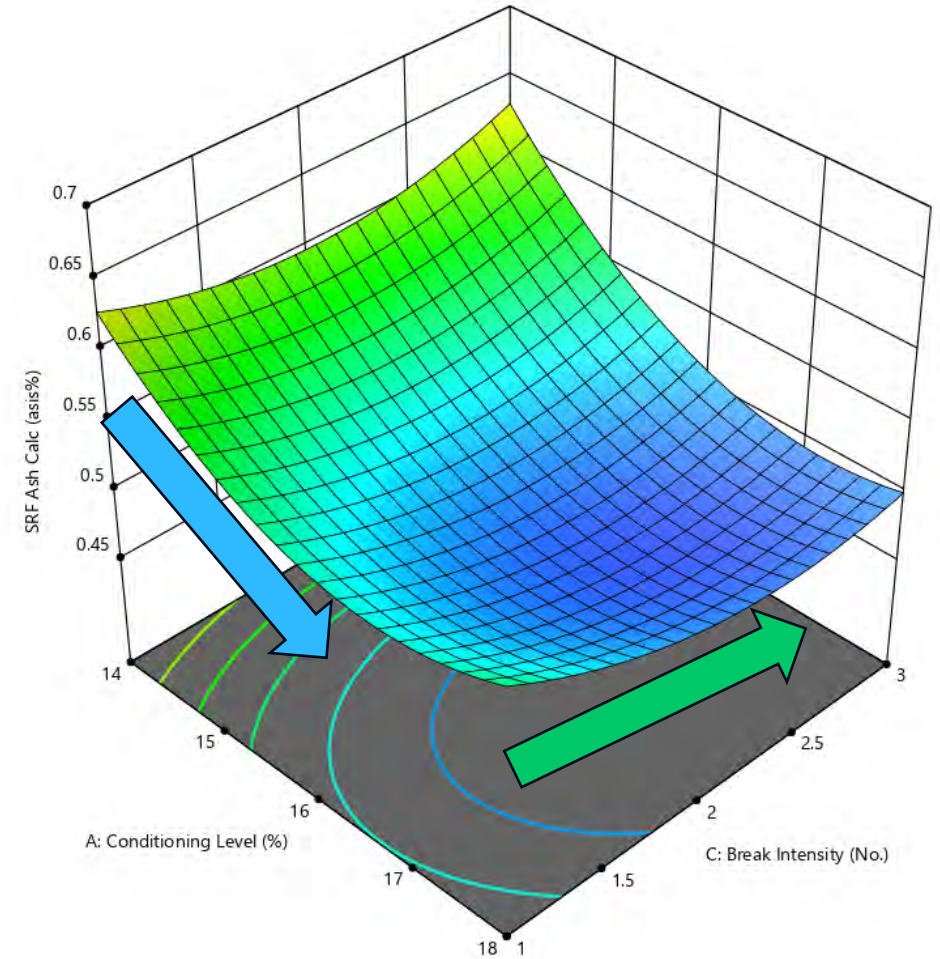
Target Flour  
Specification

What does this  
look like?

# Conditioning on Ash Content – AH\_NSW

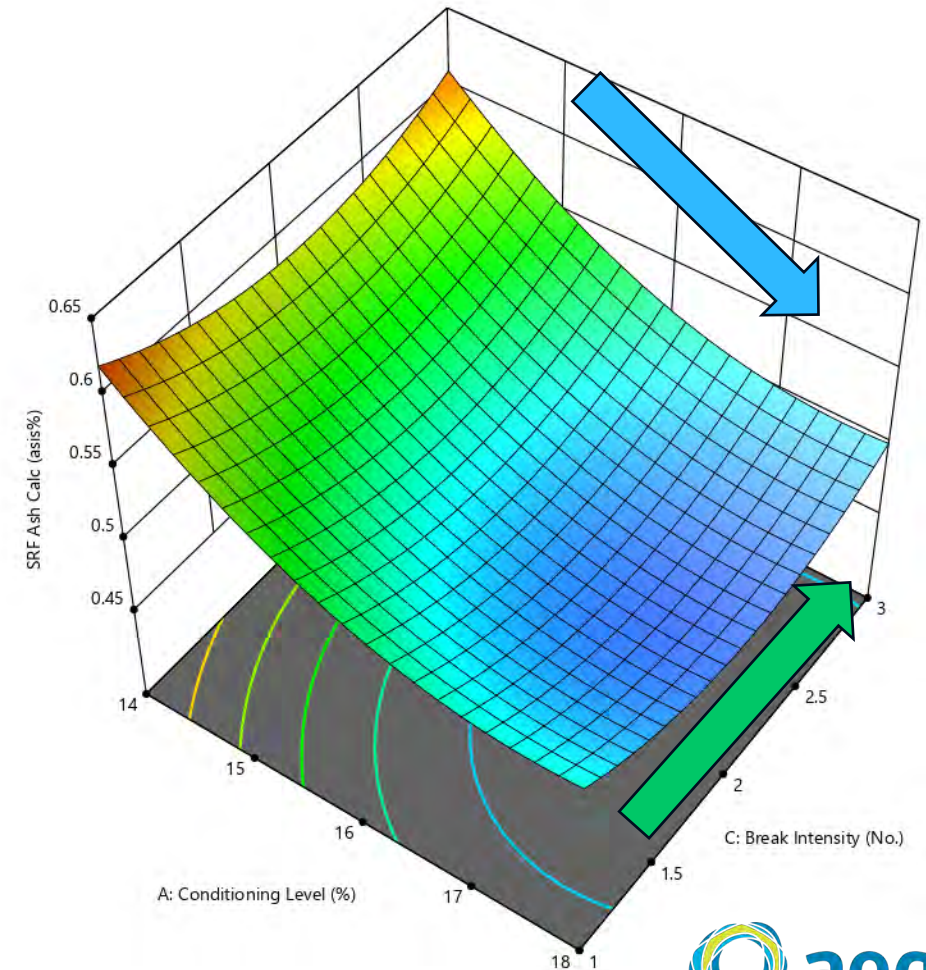
Higher Conditioning Moisture - Lower Ash content

Lower Break Intensity - Lower Ash content

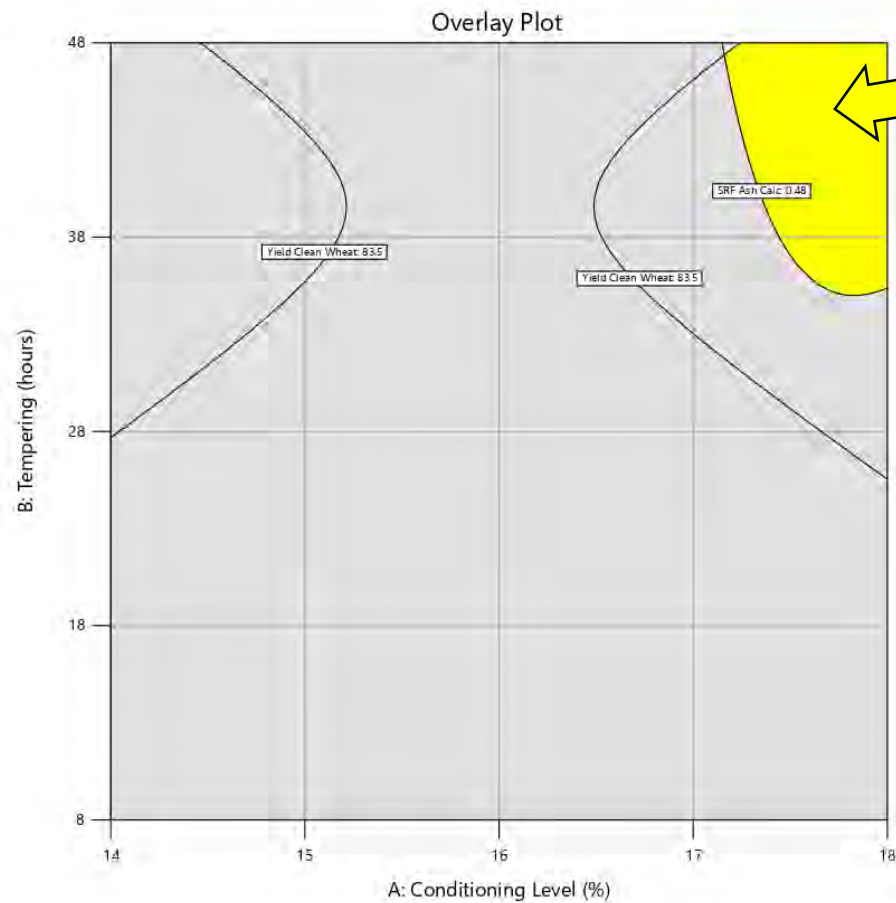


# Conditioning on Ash Content – ASW\_WA

Higher conditioning moisture and lower break roll intensity – Lower Ash content



# Yield + Ash content – ASW\_WA



Conditioning Moisture: 17.5 – 18%  
Tempering Time: 36 – 48 hours

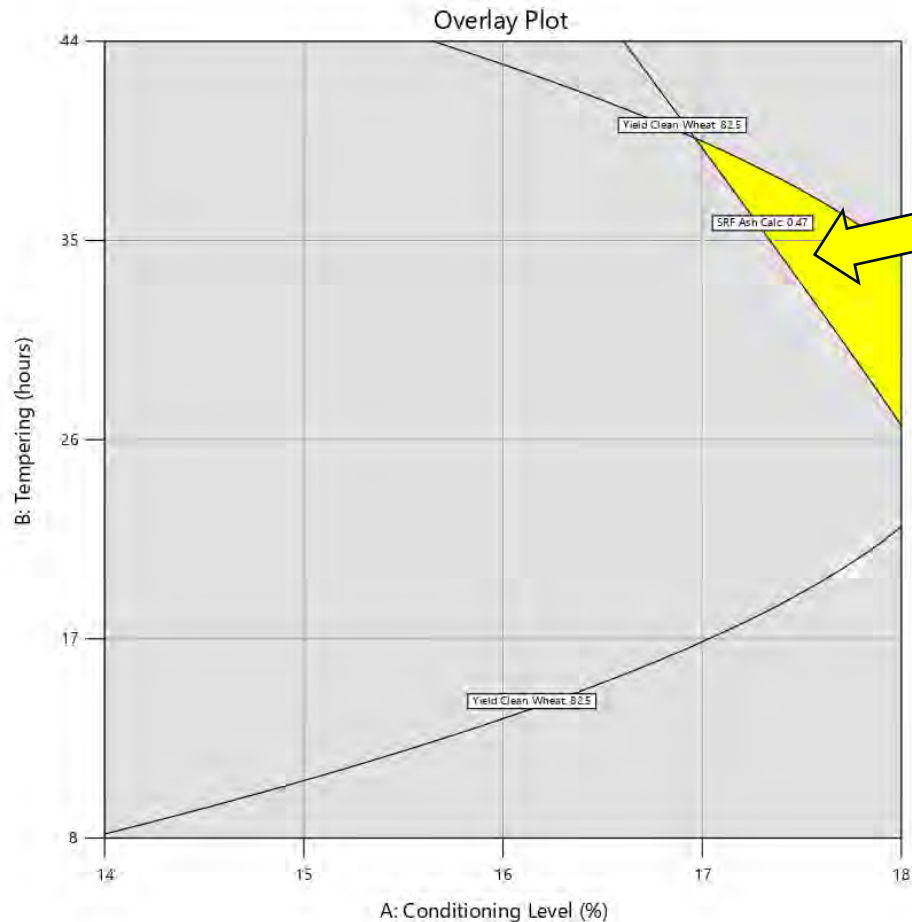
Targets:

Flour Ash Content: **<0.48%**

Clean Wheat Yield: **>83.5%**

Potential to Increase yield by relaxing  
Ash content specification

# Yield + Ash content – ASW\_NSW



Conditioning Moisture: 17.0 – 18%  
Tempering Time: 27 – 40 hours

Targets:

Flour Ash Content: **<0.47%**

Clean Wheat Yield: **>82.5%**

Potential to Increase yield by relaxing  
Ash content specification

# Results – Wheat and Milling Influence Product

Maximise Yield

Target Flour  
Specification

What does this  
look like?



# Yellow Alkaline Noodles

ASW\_WA

Conditioning Moisture: 14%  
Tempering Time: 24 Hours

$L^* = 82.9$   
 $a^* = -1.0$   
 $b^* = 25.0$

Yield = 83%

Conditioning Moisture: 18%  
Tempering Time: 48 Hours

$L^* = 86.0$   
 $a^* = -1.1$   
 $b^* = 20.9$

Yield = 82.5%

AH\_NSW

$L^* = 77.1$   
 $a^* = 0.5$   
 $b^* = 26.9$

Yield = 83.8%

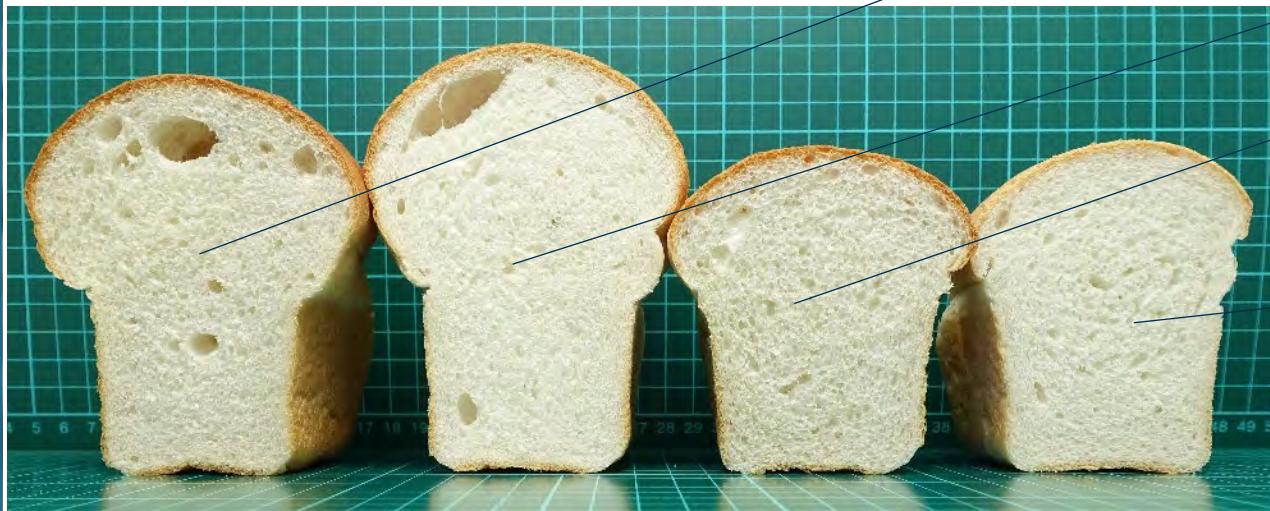
$L^* = 79.9$   
 $a^* = 0.4$   
 $b^* = 24.9$

Yield = 83.9%

# Bread

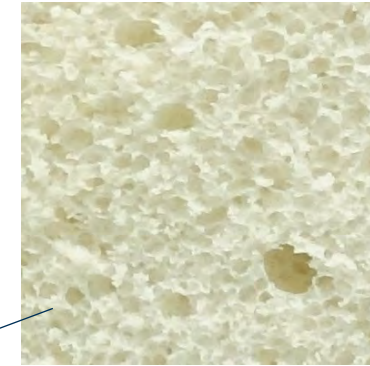
AH\_NSW

ASW\_WA



Conditioning Moisture: 14%  
Tempering Time: 24 Hours

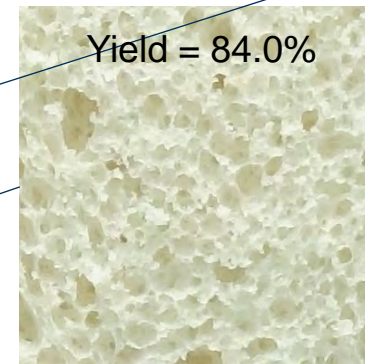
Conditioning Moisture: 18%  
Tempering Time: 48 Hours



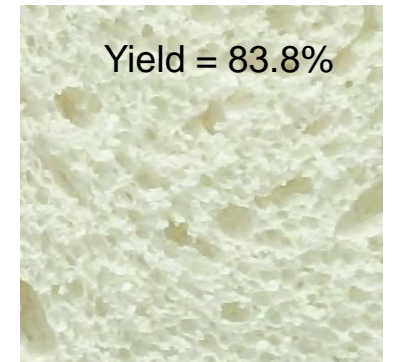
L\* = 76.2



L\* = 80.2



Yield = 84.0%



Yield = 83.8%

L\* = 76.6

L\* = 80.4

Yield = 83.0%

Yield = 82.5%

# Conclusions

- Optimum milling conditions for AH and ASW were similar
- When milling Australian Hard White Wheat
  - High Conditioning Moisture between 17 – 18%
  - Long tempering times 30 – 48 hours
- This benefits yield, flour specifications and quality of the flour
- Recognise that factors may restrict the full adoption including:
  - Environmental (e.g. high ambient relative humidity)
  - Final flour moisture
  - Physical restrictions (e.g. the size and capacity of conditioning silos)

# What is next?

- With the knowledge and models, we are uniquely positioned to assist you in developing a tailored solution to maximise the benefits from Australian wheat
- Add more seasons and grades to the models
- Expand the number of milling variables in the models



Australian Export Grains Innovation Centre



AEGIC is an initiative of the Western Australian State Government and Australia's Grains Research and Development Corporation

[aegic.org.au](http://aegic.org.au)