

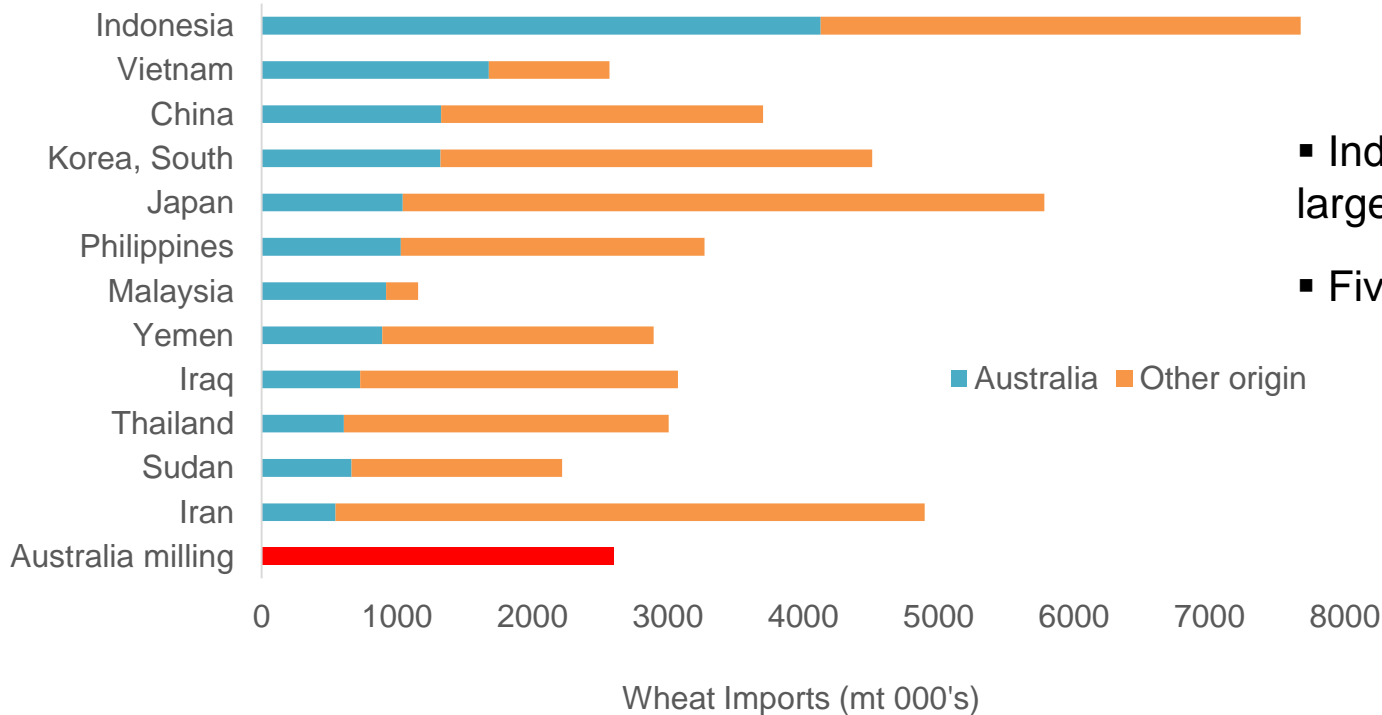
# Sponge & Dough: baking with Australian wheat

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# Australian Wheat in SEA

Australian wheat exports  
(2011/12 - 2016/17)



- Indonesia is Australia's largest wheat market

- Five SEA markets in top 12

# Australian Wheat in SEA

- SEA – largest & fastest growing region for Australian Wheat
- Total wheat imports around 42.6mmt (5 yr average, ABS 2016)
- Baking methods and practices differ between the SEA countries
  - Industrial scale (S&D)
  - SME (NtD)
  - High sugar / high fat formulations

# Market Bread Preferences

- Flour protein 12.5-15% db%
- Wet gluten > 32% db%
- High WAbs (%) > 64%+
- Good stability & tolerance to mixing
- High bread volume





# Outlining potential ‘problems’

# Baking in SEA

## *Example / Market 1:*

Ingredients	%
Flour	100
Water	<b>FWabs %</b>
Yeast	1 (instant)
Salt	2
Sugar	<b>6</b>
MSNF	2
Shortening	4

## *Example / Market 2:*

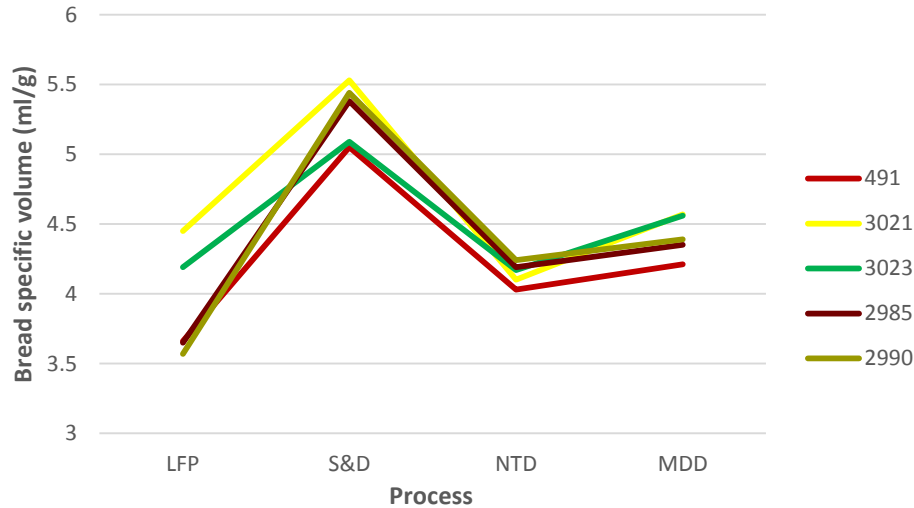
Ingredients	%
Flour	100
Water	<b>48</b>
Yeast	1 (instant)
Salt	1.7
Sugar	<b>15</b>
Shortening	5



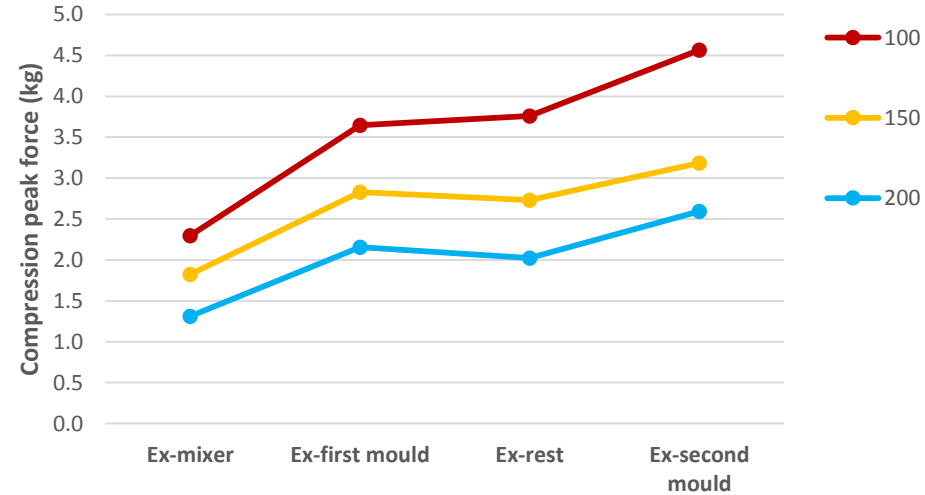
Process!

# Example 1 – baking process, temperature & mixing speed

## Bread specific volume

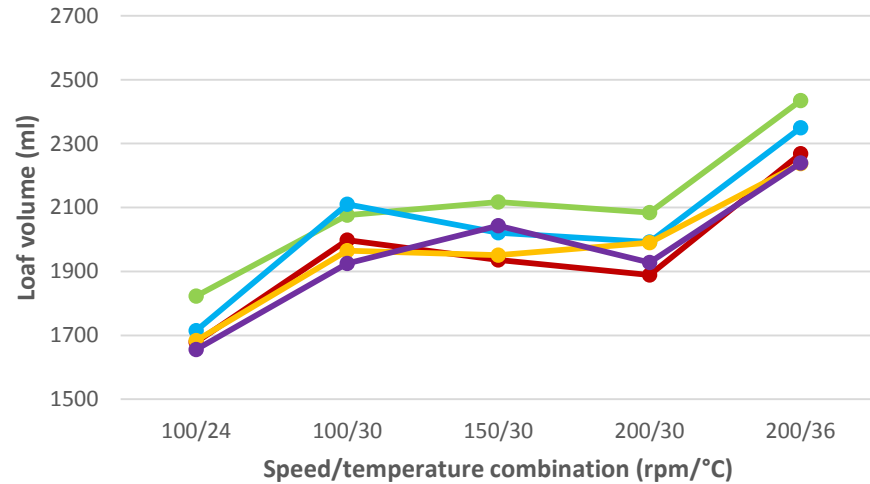


## Effect of mixing speed @ 30°C dough consistency

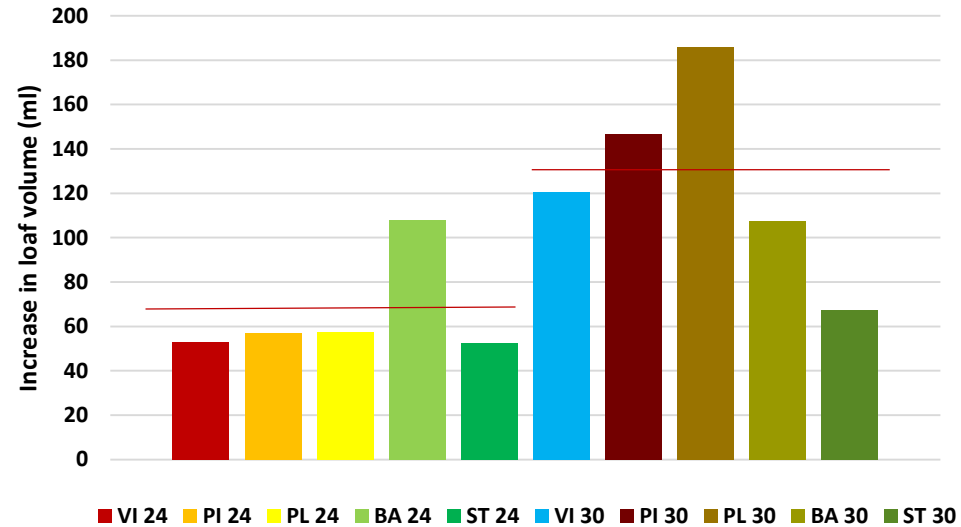


# Example 2 – dough temperature & AA

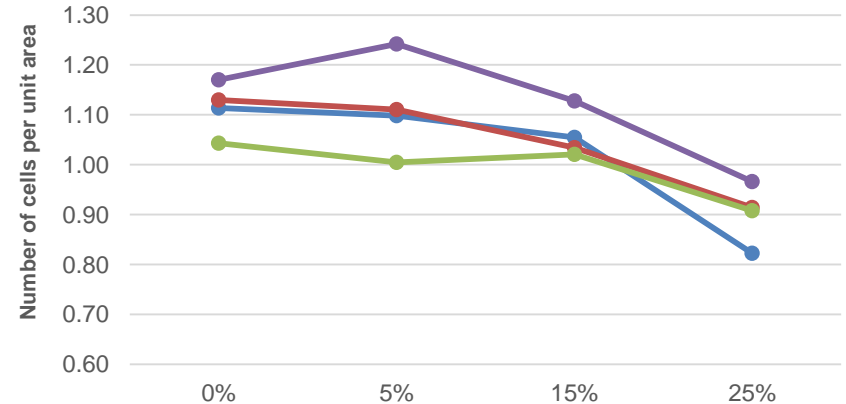
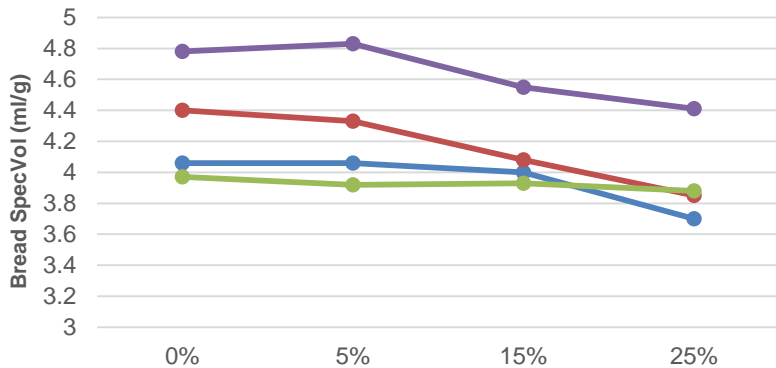
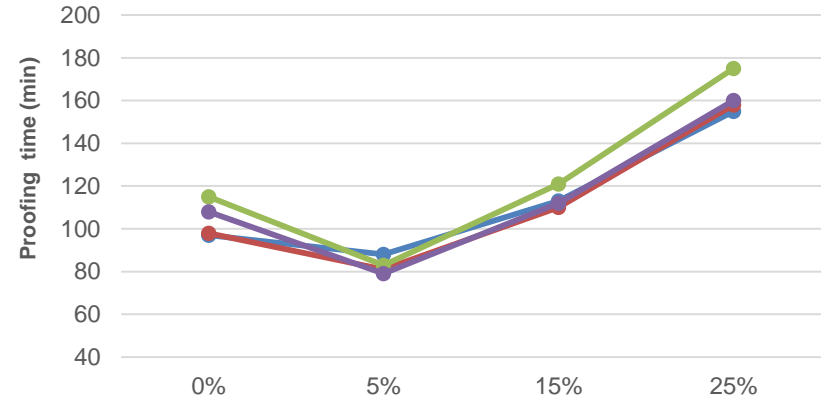
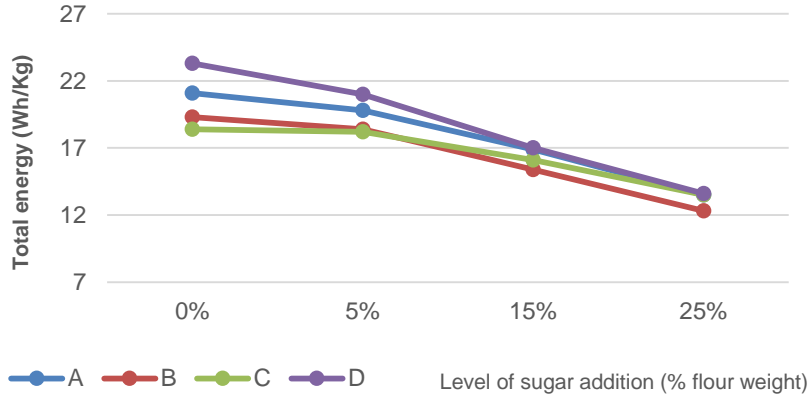
Flour + AA



Response to AA at 2 dough temperatures



# Example 3 – Sugar

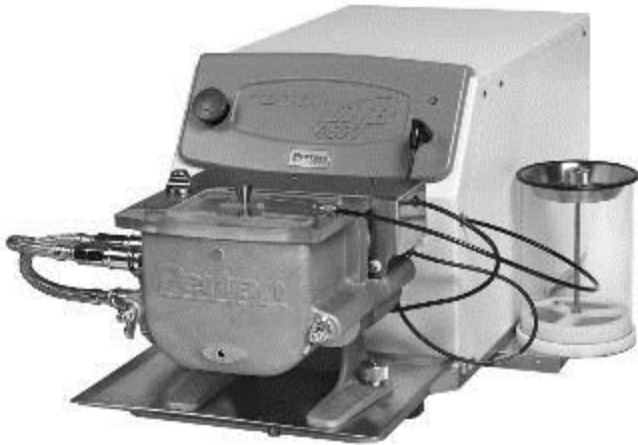




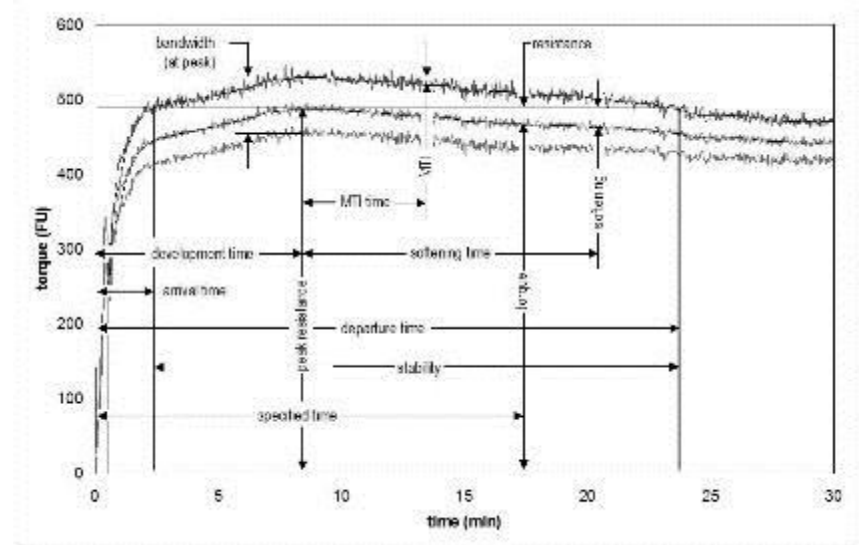
**Few examples of our approach**

# Mixing – DoughLab

- Established mixing methods using DoughLab



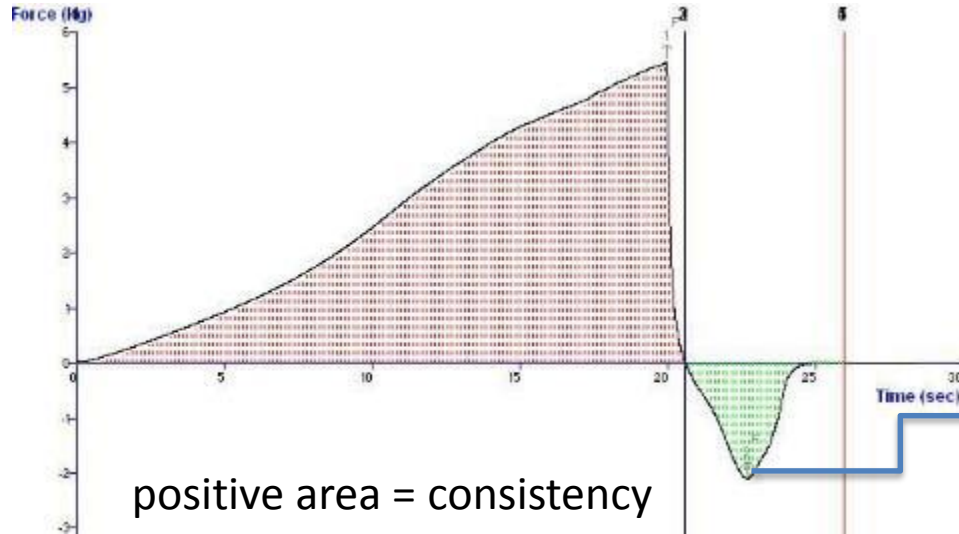
- Controlled mixing speed / Energy input
- Controlled dough Temperature



Assessing dough strength  
(development)

# Dough Stickiness – Warburtons rig

- Established dough rheology testing methods – DoughLab and Warburtons stickiness test

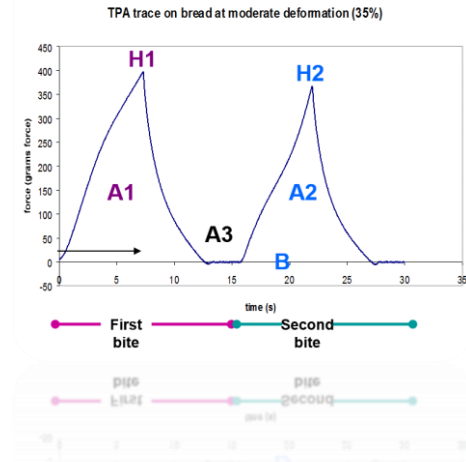
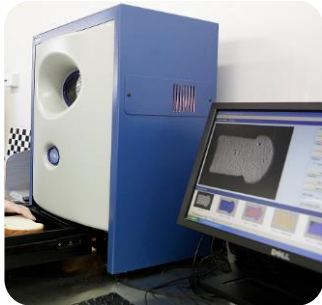


negative area on the graph = stickiness

Provides important information on the level of dough development and how it will behave during moulding

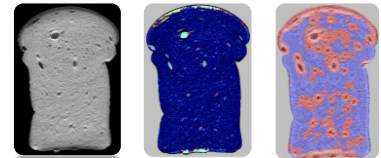
# Bread Assessment Methods

- Established product assessment methods
- Volume - BVM
- Crumb softness – Texture analyser – Texture Profile Analysis (2 'bites', 7 parameters)



48 parameters including:

- Crumb brightness
- Number of cells / unit area
- Average cell size
- Uniformity





## Results – Few Examples

# Enzymes

- The S&D standard test method was used for the evaluations
  - 4 hrs sponge fermentation
- ‘Target’ – current CONTROL baking flour used in SEA
- Preliminary experiments had established the ‘boosting’ improver formulation to be used with Australian flour samples (amounts based on flour weight)
  - 24 ppm fungal *alpha*-amylase (source Fungamyl)
  - 25 ppm xylanase (source Pentopan)
  - 60 pp glucose oxidase (source Veron 191S)

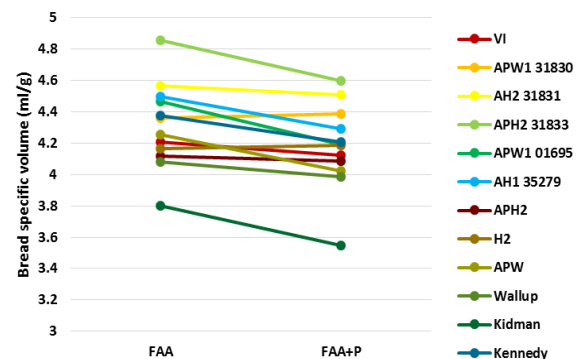
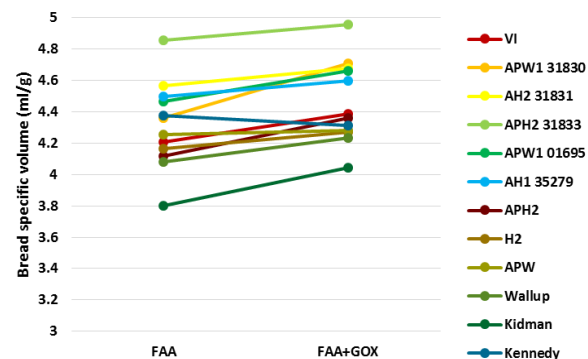
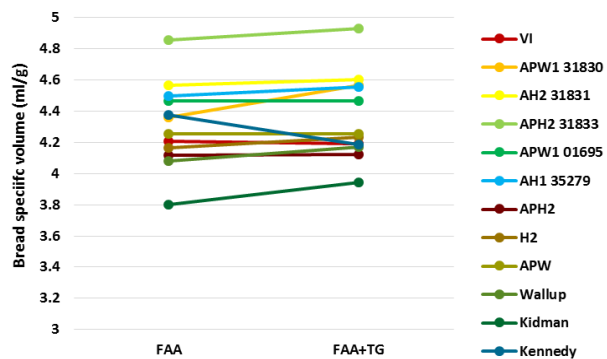
# Dough processing flow

## Results

Flour comparison in the standard recipe  
Dough rheology ex-mixer

- The recipe water level is based on the value indicated from the Farinograph test method (-4% to allow for the dough softening effects of the recipe sugar and fat)
- Using the WST the compression area (derived from the downward movement of the blade) is the dough property most closely related to dough 'consistency' at a defined moment in processing
- The WST was carried using full recipe doughs which have been mixed under significantly different conditions to that pertaining in the Farinograph, compression area values for the different flours are not simply a reflection of differences in water absorption values

# TransGlutaminase (TnG), GlucoseOxidase (GLO), Protease (PR)



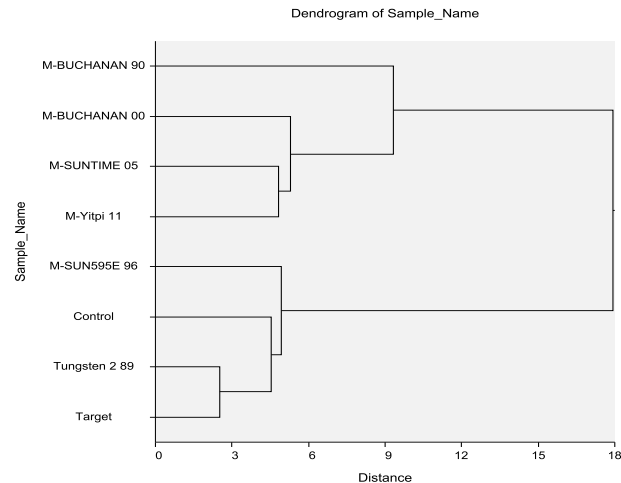
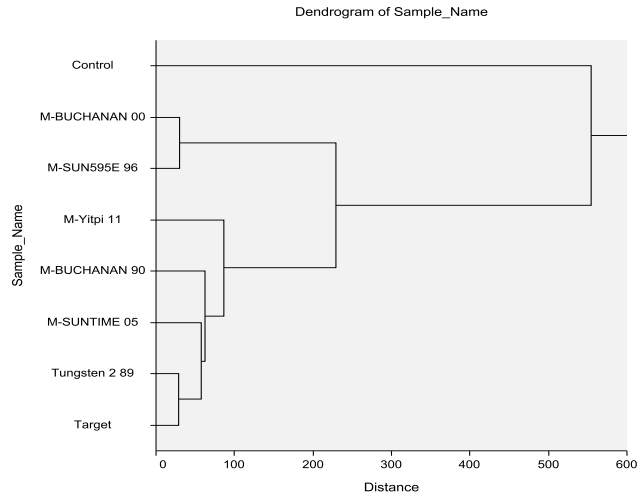
- The addition of TG had no effect on bread specific volume with any of the flours tested

- With the exception of **Kennedy**, bread specific volume increased with the addition of GOX and crumb softness decreased with most flour samples (not illustrated)

- With moist flours, there was a small loss of bread specific volume with protease addition

# Preliminary Screening

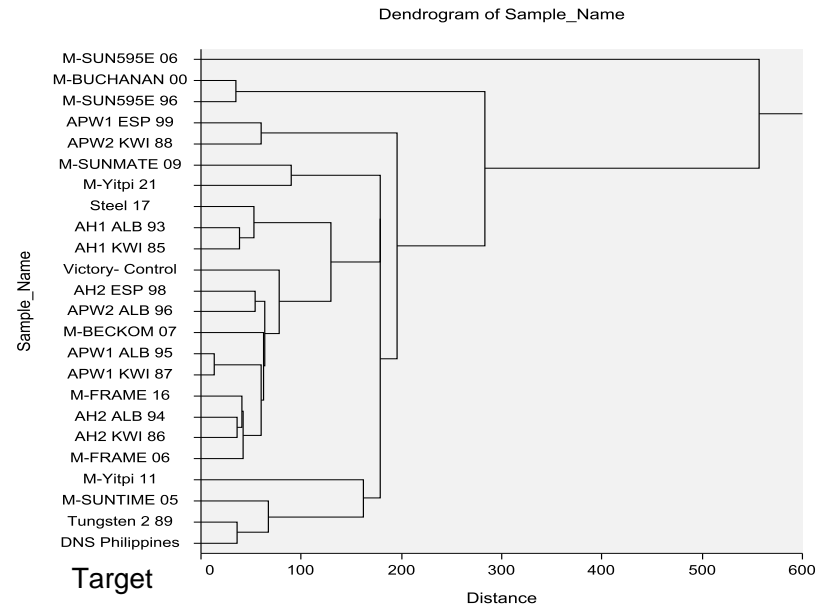
- The selected parameters were subjected to Hierarchical Cluster analysis and visualised as Dendrograms to identify those Australian flour samples which most closely resembles the ‘Target’
- The further to the right (greater distance) the horizontal lines join the less similar the sample results are
- Samples with relatively good matches to the target appear at the bottom each of the diagrams



# Preliminary Screening

- The dominance of bread quality data in deriving the dendrograms was confirmed by running the bread quality only data which yielded the same pattern of dendrogram

- Samples at the top of the dendrogram mainly cluster away from the target because they have greater bread volume than the target, or some other improved bread property



# Preliminary Screening

- The trials have shown that it is possible to yield dough and bread using Australian wheat flour and a composite improver that have similar characteristics to the 'Target'
- The data from bread quality dominate the discrimination between samples
- Some combinations of Australian flour and composite improver yielded greater bread volume than the 'Target' - though the data should be treated with caution as the test samples are for single results

# Summary

The actions of enzymes are substrate specific and their effects of dough and bread qualities depend on a number of key factors including:

- Availability of substrate
  - Concentration of the enzyme addition
  - Environment temperature
  - Environment pH
  - Length of potential reaction time
- 
- In a fixed test baking method in which the nature of the flour is varied, it is only the first two factors that can be considered to be critical
- 
- The prime output from this study is related to the inputs derived from the different wheat flour samples

# Summary

- FAA for bread volume improvement and reduction in crumb hardness (the effects on crumb softness over-life have not been evaluated)
- Transglutaminase had limited impact in this system on bread quality
- GOX delivered some benefits in bread volume and reduction in crumb hardness
- Protease has major effects on dough rheology, with negative effects on bread volume and crumb cells structure. While the tests showed that its addition did reduce crumb hardness, the negative effects on other bread attributes outweigh this positive result

# Next Steps

- To develop a sub-set of Australian wheat flours for optimisation of the composite improver formulation, with particular reference to bread volume
- Such trials will include a reference point using fungal *alpha*-amylase only (as was the case with the target) in order to establish the baseline for improver composition adjustment

Title

## Acknowledgments...

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- Collaborators in the market

