

# Impact of eCO<sub>2</sub> on Grain Quality

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# Elevated CO<sub>2</sub> affects grain quality



# Elevated CO<sub>2</sub>

- Increased grain dimension (length, width, height)
- Grain weight increased (>5g)
- Increase in hectolitre weight (2kg/hL)
- No effect on % screenings (<2mm sieve)
  - James Nuttall Heat FACE (Increase in screenings )
- Grain protein decreased (0.5-1.1%) [ $\sim$  3-8%]
- Effects on quality greater in water limited conditions (Fernando *et al* J Cereal Science)

# Despite increase in grain size-

No significant effect on:

- Grain hardness (starch granule/protein packing )
- % Flour yield
- % Flour Ash (inorganic)
- % Damaged starch granules

# Dough Rheology

- Overall decrease in dough strength
- Dough more elastic and structurally weaker
- This aligns with decrease in protein percentage
  - Fernando *etal*: decrease in N/S ratio

However:

- Glutenin/gliadin increased
- Unextractable polymeric protein decreased

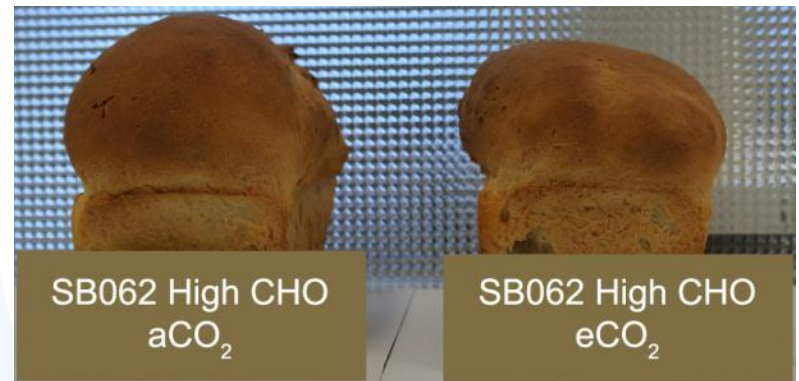
# Baking quality

Loaf volume decreased in all years in eCO<sub>2</sub> treatment

- In part due to decreased protein
  - But: not correlated with protein
- Deleterious effects were greater than would be expected from the decrease in % protein
- Loaf volume response varied between cultivars

# Baking quality

- Characteristically within  $e\text{CO}_2$  treatment collapsed structure
- Dough very sticky- moulding problems



# Asian noodles

**Market specification:** bright yellow colour and stable over 24 hour period

- Where the effects were significant
  - Noodles were brighter (CIE L\*) and more yellow (CIE b\*) in eCO<sub>2</sub> treatments
  - Increased colour stability (24 Hour)



# Concluding Observations

- Variability between cultivars in response to eCO<sub>2</sub>
- Protein composition doesn't explain baking quality
  - Collapse of bread structure unique to eCO<sub>2</sub> treatment
- Variability between years (interaction with other abiotic effects) *Fernando et al; Nuttall et al*

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# More information

## Publications

Fernando, N, Panozzo, JF, Tausz, M, Norton, R, Fitzgerald G and Seneweera, S. (2012) Rising atmospheric carbon dioxide affects mineral nutrient and protein concentration of wheat grain. *Food Chemistry* 133 1307-1311

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