# Can the quality of chilled-aged-frozen meat be improved to increase its value?

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**AgResearch MIRINZ Meat Industry Workshop Tuesday 20th October 2009**

**AgResearch Ruakura, Hamilton**

# Chilled vs AC&A frozen meat

Chilled meat (compared to AC&A frozen meat):

- Looks better on retail display
- Has higher water holding capacity
- Is perceived by consumers to be superior in eating quality
- Typically attracts twice the price of AC&A in export markets

Questions?:

- Can this quality difference be reduced or eliminated by extended ageing prior to freezing
- If yes, would the resultant product be viable for export

# Chilled-never-frozen *vs* Chilled-aged-frozen-thawed: Meat Colour

| Hue angle (°) in bloomed samples after 9 wk storage | | | |
|---|---|---|---|
| **Specie** | **Chilled** | **Aged-frozen*** | **Statistical Significance** |
| **Lamb LD** | 23.3 | 23.5 | NS |
| **Beef SM** | 20.7 | 20.7 | NS |
| **Beef LD** | 21.1 | 20.1 | NS |
| **Venison LD** | 21.9 | 21.5 | NS |

*Extended ageing periods was 21 days

# Chilled-never-frozen *vs* Chilled-aged-frozen-thawed: Water Holding Capacity

| Total moisture loss (purge + drip) % after 9 wk storage | | | |
|---|---|---|---|
| **Specie** | **Chilled** | **Aged-frozen*** | **Statistical Significance** |
| **Lamb LD** | 6.5 | 6.2 | NS |
| **Beef SM** | 7.2 | 11.3 | 0.01 |
| **Beef LD** | 2.7 | 7.7 | 0.01 |
| **Venison LD** | 4.8 | 4.6 | NS |

* Extended ageing periods was 21 days

# Chilled-never-frozen *vs* Chilled-aged-frozen-thawed: Overall Consumer Acceptability

| Overall acceptability of cooked meat after 9 wk storage | | | | |
|---|---|---|---|---|
| **Specie** | | **Chilled** | **Aged-frozen*** | **Statistical Significance** |
| **Lamb** | **LD** | 51% | 49% | NS |
| **Beef** | **SM** | 7.1 | 7.3 | NS |
| **Beef** | **LD** | 7.8 | 7.1 | NS |
| **Venison** | **LD** | 9.7 | 9.6 | NS |

For lamb: The percentage of consumers preferring one product over the other
For beef & venison: Unstructured continuous line scale with 0= dislike extremely and 15 = like extremely was used for consumer sensory evaluation

* Extended ageing periods was 21 days

# Recommended ageing times for different species:

## to optimise final colour stability, drip loss, WHC and shear force

| Optimal ageing period prior to freezing | | |
|---|---|---|
| **Specie** | **Ageing Period** | **Reference** |
| **Lamb** | 2-3 weeks | A |
| **Beef** | 4-10 weeks* | B, C, D |
| **Venison** | 1-2 weeks | B, C, D |


**A:** Wiklund, E., Farouk, M.M., Stuart, A., Cartwright, S., Penney, N. and Rosenvold, K. (2009) Quality of chilled-never-frozen versus chilled-frozen-thawed lamb. Proceedings of the New Zealand Society of Animal Production 69, 108-111.

**B:** Farouk, M.M., Wiklund, E., Stuart, A. and Dobbie P. (2009) Ageing prior to freezing improves water holding capacity in beef and venison. The 55th International Congress of Meat Science and Technology (ICoMST), Copenhagen, Denmark, 781-785.

**C:** Farouk, M.M., Wiklund, E., Stuart, A. and Dobbie P. (2009) Ageing prior to freezing improves the colour of frozen-thawed beef and venison. The 55th International Congress of Meat Science and Technology (ICoMST), Copenhagen, Denmark, 787-790.

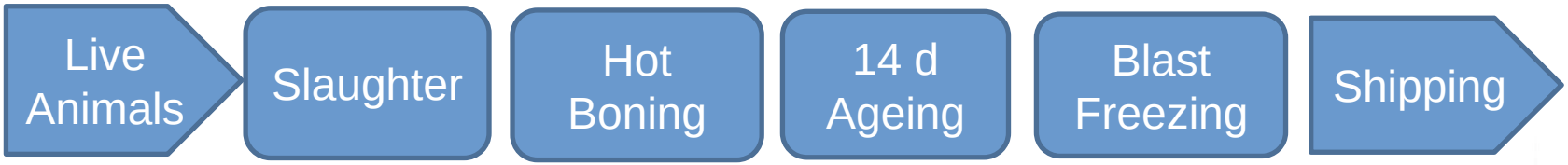
**D:** Wiklund, E., Farouk, M.M., Stuart, A. and Dobbie P. (2009) Consumer evaluation of chilled-never-frozen versus chilled-frozen-thawed beef and venison. The 55th International Congress of Meat Science and Technology (ICoMST), Copenhagen, Denmark, 1206-1209.


*** For beef: drip loss, WHC and shear force may continue to improve beyond 10 weeks of ageing prior to freezing**

# Example of Cost Benefit Analysis - BEEF

- Partial Budget Approach
- Comparison between current situation and proposed change

Current chill-aged-frozen beef process




Improved chill-aged-frozen beef process

# Additional Costs

| | | Total per kg (NZ$) | Industry Total (NZ$) |
|---|---|---|---|
| **(A) Cost of chiller space for CAF while aging*** | | | |
| | **Space needed at peak ($m^2$)** | | |
| **Frozen Mfg** | 0.00 | **Cost** $0.0000 | **Cost** $0.00 |
| **CAF** | 53.41 | $0.0508 | $313,236.70 |
| **Difference** | | **$0.0508** | **$313,236.70** |
| **(B) Inventory cost*** | | | |
| | **Average Daily Inventory Value (NZ$)** | | |
| **Frozen Mfg** | $13,937.26 | **Cost** $0.0054 | **Cost** $33,557.06 |
| **CAF** | $76,872.09 | $0.0300 | $185,086.67 |
| **Difference** | | **$0.0246** | **$151,529.61** |
| **(C) Packaging cost** | | | |
| | **Cartons** | **Cost** | **Cost** |
| **Frozen Mfg** | 224859 | $0.0442 | $272,079.10 |
| **CAF** | 286564 | $0.0907 | $558,800.16 |
| **Difference** | | **$0.0465** | **$286,721.06** |
| **(D) Shipping cost** | | | |
| | **TEU's** | **Cost** | **Cost** |
| **Frozen Mfg** | 351 | $0.1037 | $638,612.93 |
| **CAF** | 448 | $0.1367 | $842,230.05 |
| **Difference** | | **$0.0330** | **$203,617.12** |

# Estimated benefit of improved quality

More $, but how much more?

## Pricing Options

Estimated price relative to current chilled and frozen prime beef of $6.45 per kg

# Estimated Value to New Zealand

| | Total per kg (NZ$) | | Industry Total (NZ$) |
|---|---|---|---|
| Net Gain (Loss) | $1.32 | | $8,163,277 |

# Can NZ get more value out of improved quality chilled-aged-frozen meat?

**Yes**

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# Sensitivity Analysis

Net Gain or Loss will be sensitive to pricing level, days aged and the capital costs of chiller space.

| Days Aged | Price Level (% between FM and Chilled) | | | |
|---|---|---|---|---|
| | 25% | 50% | 75% | 100% |
| 14 | $0.40 | $0.96 | $1.51 | $2.06 |
| 21 | $0.38 | $0.93 | $1.48 | $2.04 |

| Chiller Cost (NZ$/M$^2$/year) | Price Level (% between FM and Chilled) | | | |
|---|---|---|---|---|
| | 25% | 50% | 75% | 100% |
| $600 | $0.42 | $0.97 | $1.52 | $2.07 |
| $800 | $0.40 | $0.96 | $1.51 | $2.06 |
| $1,000 | $0.39 | $0.94 | $1.50 | $2.05 |