

Pellet Freezing Milk



Transport and storage challenges:

- Growth over the next 20 years could be spread across remote areas, and small scale farms.
- The sheep dairy industry does not have the same collection and processing infrastructure as the dairy industry.
- Makes storage and aggregation important:
 - Collecting enough milk.
 - Storing while waiting for pick-up
- How do we store milk on farm for a long period?
 - Freezing is an attractive option.
 - Already done on some farms.
- Can this process be improved?



Difficulties With Freezing Milk as a Bulk.

- Freeze Concentration
- Protein stability/ denaturation
- Growth of large ice crystals.
- Damage to fat globules:
 - Emulsion becomes less stable.
 - Fat oxidation can occur, more rancid flavours.
- Not too bad if you're making yogurt or cheese.
- Not good for fresh milk products, or milk powder products.
- Storage requires manual labour and chiller space



Our Idea

- Create a milk “hail”.
 - Frozen droplets 2-3 mm in diameter.
- Freeze milk very rapidly.
 - Smaller ice crystals.
 - Faster transition to storage temperatures.
 - Less damage to milk structure.
 - Thaws very rapidly.
- Benefits:
 - Continual processing.
 - Lower labour requirements.
 - Maintain stability.
 - Ease of storage and bulk handling.

Milk frozen as a bulk:



Milk frozen as a “hail”:



Liquid Nitrogen: Great in the lab, But not on farm.



On-farm equipment.

- A freezer for on-farm use should ideally be:
 - Inexpensive to buy and run.
 - Robust.
 - Reliable.
 - Compact.
 - Easy to clean and maintain.

Project Milestones

- Year 1:
 - Benchtop scale prototype.
 - 100L/H scale prototype under construction.
 - Freezing profiles investigated
 - Investigating the effects on quality.
- Year 2:
 - On farm prototype under construction.
 - Farm tests begin.
 - Modelling the freezing process.
 - Investigating the changes occurring during the freezing process and storage
- Year 3:
 - Seeking partners for commercial manufacturing.
 - In depth understanding of phenomena occurring and the effects on quality.



Food Industry Enabling Technologies

Project 2 - Droplet Freezer

