



# OATS: adding value

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# Oat production bottlenecks

- NZ limited capacity and flexibility for processing covered oats - especially in North Island
- The hull of the seed must be mechanically removed after harvest if covered oats are to be used for food
- Lack of innovation and processing capacity limits investment in the crop food chain potential for export replacement
- The insoluble fibre from oat hulls restricts use for non ruminant animals



# A Solution

- Diversify crop production - cultivate hull and hullless oats
- Hullless oats an excellent raw material for small manufacturers - expensive dehulling and sorting equipment not needed
- Hullless oat production will encourage more food chain innovation by new companies that recognise their value
- Improve networks and utilisation of existing processing equipment
- Promote discovery of new processing technologies with smaller factory footprint



# Why hullless oats?

- Harvested groats occupy less storage space ( $\text{kg/hl} \approx 65/54$ )
- The hulls are returned to the soil at harvest
- No dehulling costs
- The groats can remain on the farm, be cleaned, sieved for size if required, and stored safely until needed
- No identified intrinsically new technological or functional characteristics distinguish a **hullless** groat from a **dehulled** groat

# Advances in genetics & agronomics

- Plant genetics has overcome agronomic deficiencies of old hulless oat cultivars and genetic stocks
- Total groat yield from hull and hulless oat cultivars are similar
- Hulless oats make up 90% of commercial oat crop in China, grown for centuries for feed and food - expanding product range - oat pasta and oat noodles, rice/oat mixtures, - miscellaneous foodstuffs and beverages
- Continuous sources of adapted hulless oat genetics coming on stream



# Commercial potential

- New naked oats are progressing through the UK national list system for registration - developed through the NZ/UK shuttle oat breeding program





# The two oat types

- **Hull** - (*Avena sativa*) a covered grain where the lemma and palea (husk) is **RETAINED** with the groat at harvest
- **Hulless** - (*Avena nuda*) a naked grain where the lemma and palea is **RELEASED** at harvest





# Harvest guide for hullless oats

- Harvest crop when completely field dry to improve grain threshability.
- Slow down combine cylinder speed, narrow gap between concaves
- Reduce wind velocity to avoid loss of smaller kernels
- Better to clean grain in a seed cleaner than thresh a very clean sample from the combine





# Storing hulless oat groats

- As for all grains moisture content and temperature critical to storage of hulless grains
- Groats at 12% moisture or less store properly and germinate well.
- During storage prevent moisture rises above 12%
- Beware of transporting grain through pneumatic systems with elbows in piping at speed. Groats easily bruised and embryos damaged



# Potential oat processing technologies

- A single step milling process that combined heat treatment and milling was tested.
- Groats underwent a one step controlled thermal mechanical treatment
- Where the oat enzyme, the flavour development, and the fractioning of groat structure was completed in a single step



# A novel oat processing tested

- Custom made elements were fitted to a lab twin screw extruder barrel shaft to produce groat flour and flakes - each product the result of specific configuration of the elements
- A conceptual design was prepared for a simpler larger scale prototype for a modified single screw extrusion milling machine
- Potentially suitable for a wide range of grain crops especially with high oil content

Test1: Configuration of extruder shaft elements





# Summary

- The current milling companies will continue to process covered oats. They are equipped to do so
- Hulless oat production presents other opportunities for growers and product development by new companies
- Hulless oats do not require conventional dehulling - disposal of low value hulls after dehulling avoided
- Enable new companies to develop alternative oat processing technologies with smaller factory footprint