

# Evaluation of processing aids for olive oil extraction and quality improvement

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Development Corporation**

Pablo Canamasas & Leandro Ravetti

Boundary Bend Estate Processors Pty Ltd





# Processing aids & techniques

## Traditional aids

Talc powder

Enzymes

Water

## New aids

Microtalc powder

Common salt

Calcium carbonate

Enzymes with side activities

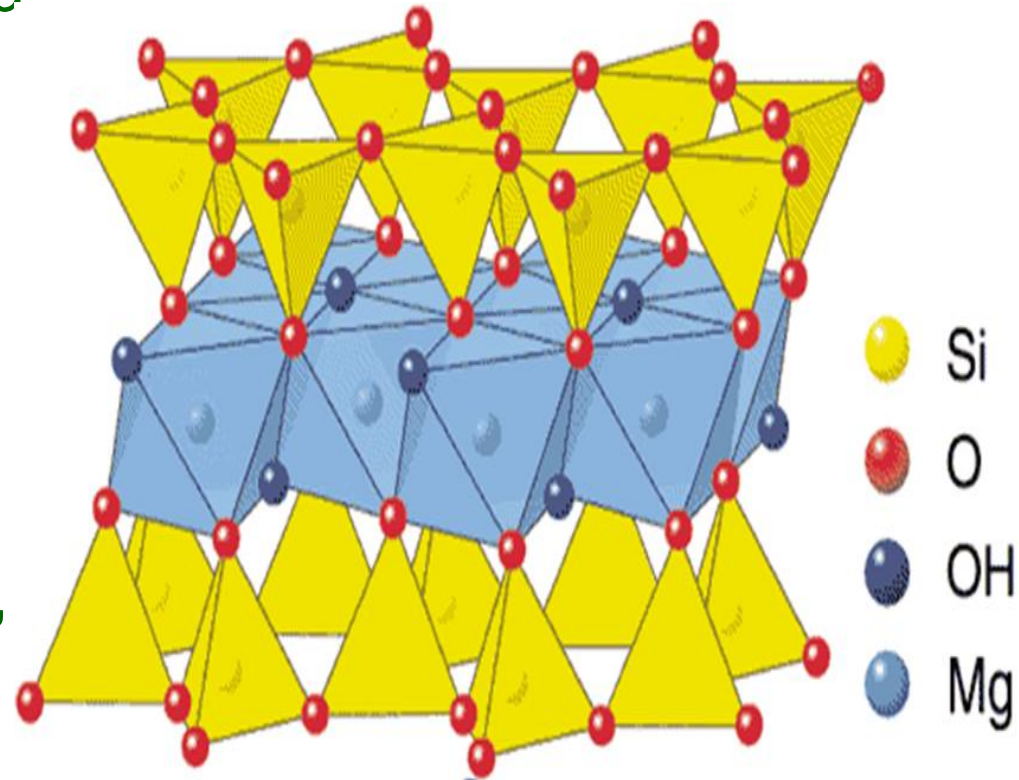
Warm water dipping

Ultrasound



# Talc & microtalc powder

- Natural mineral (hydrated magnesium silicate) of laminar structure
- Provokes aggregation of particles and provides structure to the olive paste in the malaxer
- Essential with high moisture fruit or “difficult” pastes





# Talc & microtalc powder

## Talc powder

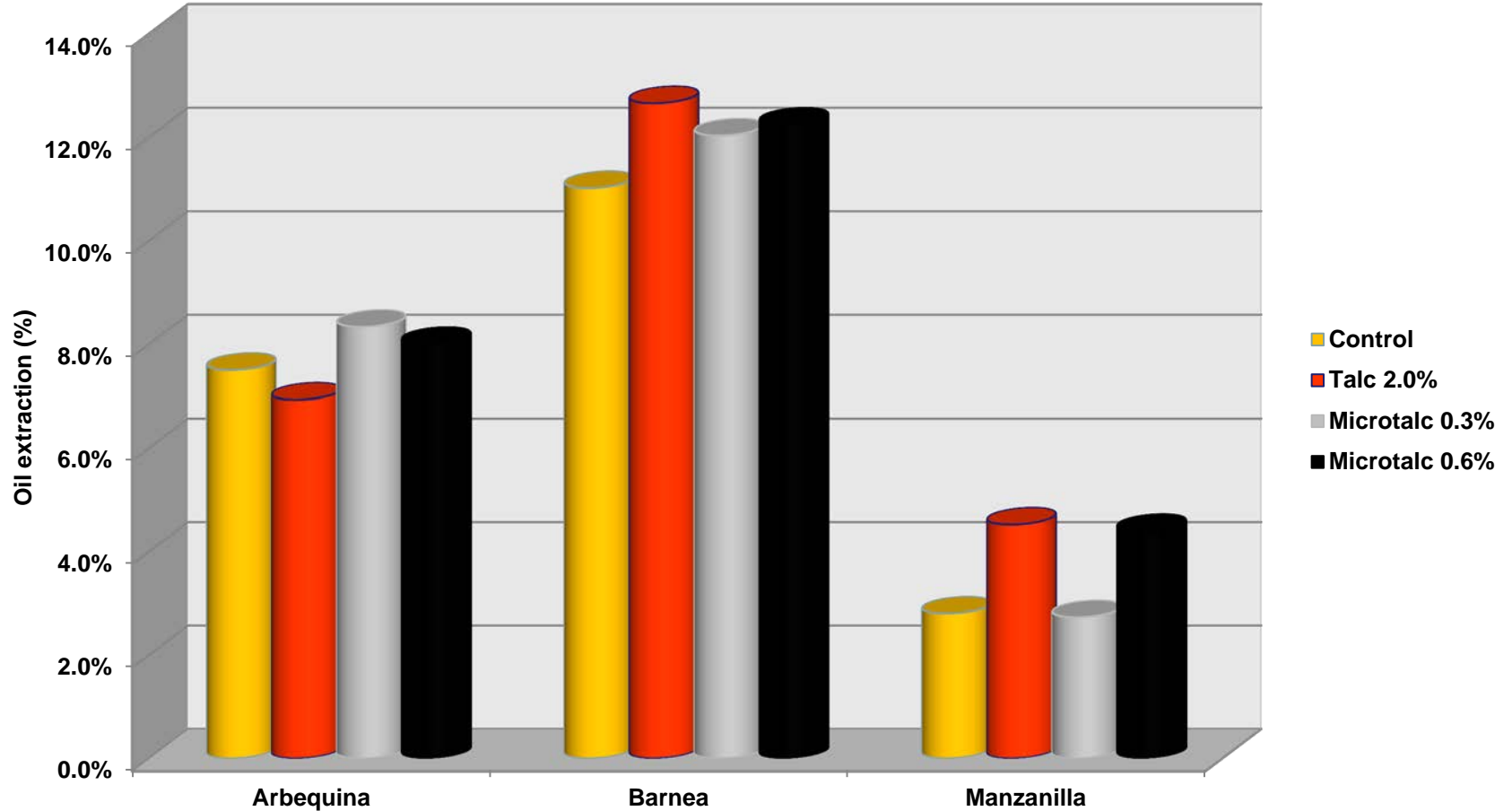
- Oldest powder used in the industry
- Magnesium silicate with high adsorption surface
- $d_{50\%} = 8\mu\text{m}$
- Specific surface area =  $3.6 \text{ m}^2/\text{gr}$
- Dose = 0.5-3%

## Microtalc powder

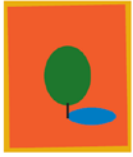
- New product in the industry
- Same as talc powder, but finer particle size
- $d_{50\%} = 2\mu\text{m}$
- Specific surface area =  $7.0 \text{ m}^2/\text{gr}$
- Dose = 0.3-1%



# Talc & microtalc powder



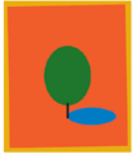




# Talc & microtalc powder

- Beneficial impact on FFA, PV, K232, K270 &  $\Delta K$  in Arbequina, Barnea & Manzanilla
- Higher PPH content in Barnea & Manzanilla
- No impact on taste or colour
- Microtalc powder is more cost effective than talc due to less product transport, handling & storage





# Common Salt (NaCl)

- High solubility in water. It does not make the oil “salty”
- Action: It changes the density of the water stretching out the gap of water:oil densities
- Greener oils as it increases chlorophyll solubility
- Dose = 1-3%
- Significantly cheaper than talc & microtalc powder





# Calcium carbonate

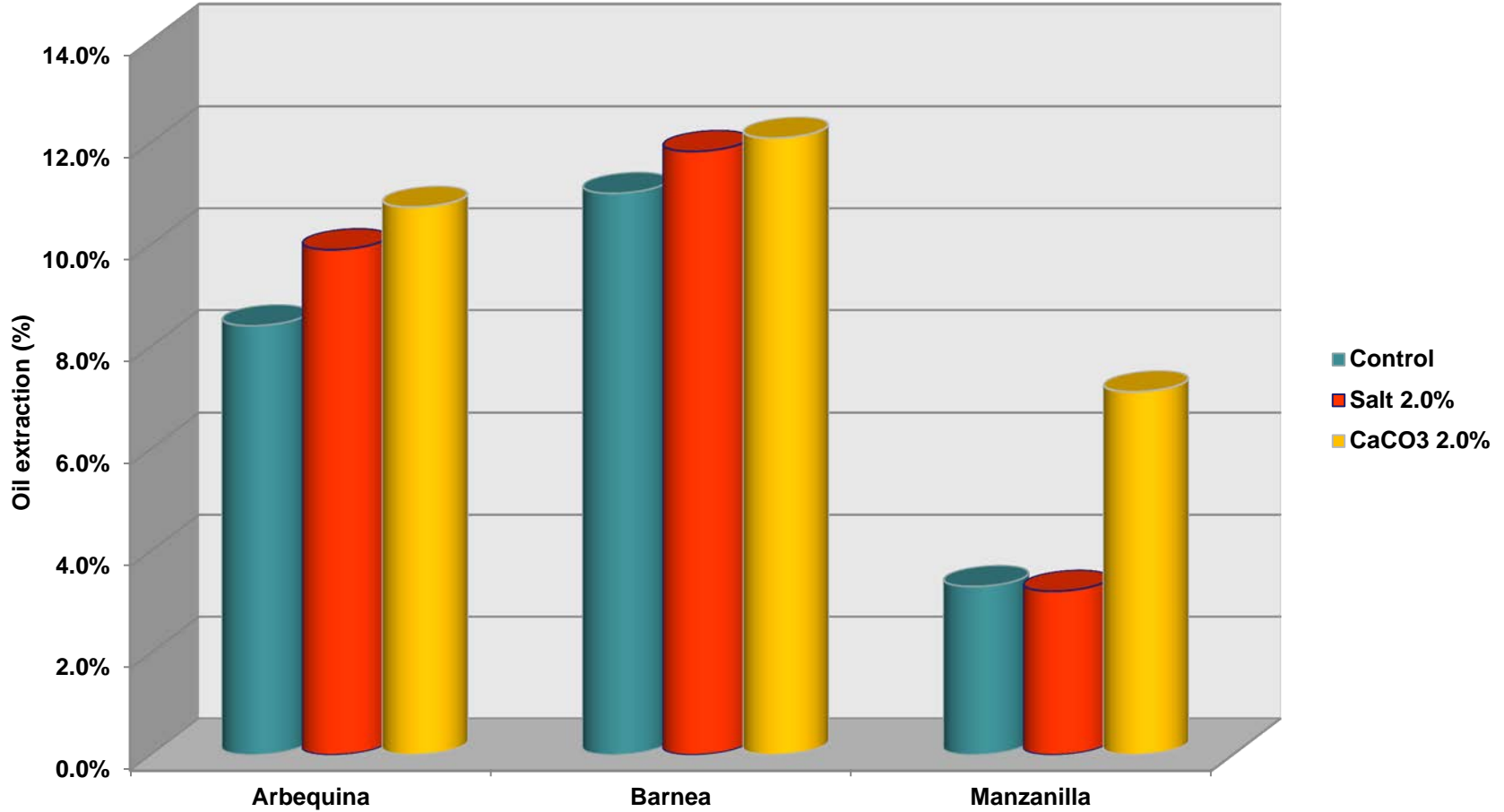
- Natural mineral with crystalline structure (calcite)
- It facilitates flocks agglomeration by adsorption (similar action to Talc powder)
- $d_{50\%} = 2.8\mu\text{m}$
- Density = 2.7 gr/ml
- Dose = 1-2%
- Cheaper than Talc powder
- Used in Spain with excellent extraction efficiency results

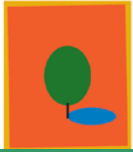






# Salt & Calcium carbonate





# Salt & Calcium carbonate

## Salt (NaCl)

- Improves extractability
- No impact on taste
- Slightly greener oils
- Higher PPH content in oil and slightly higher stability
- Environmental concerns over CE and Na content of pomace

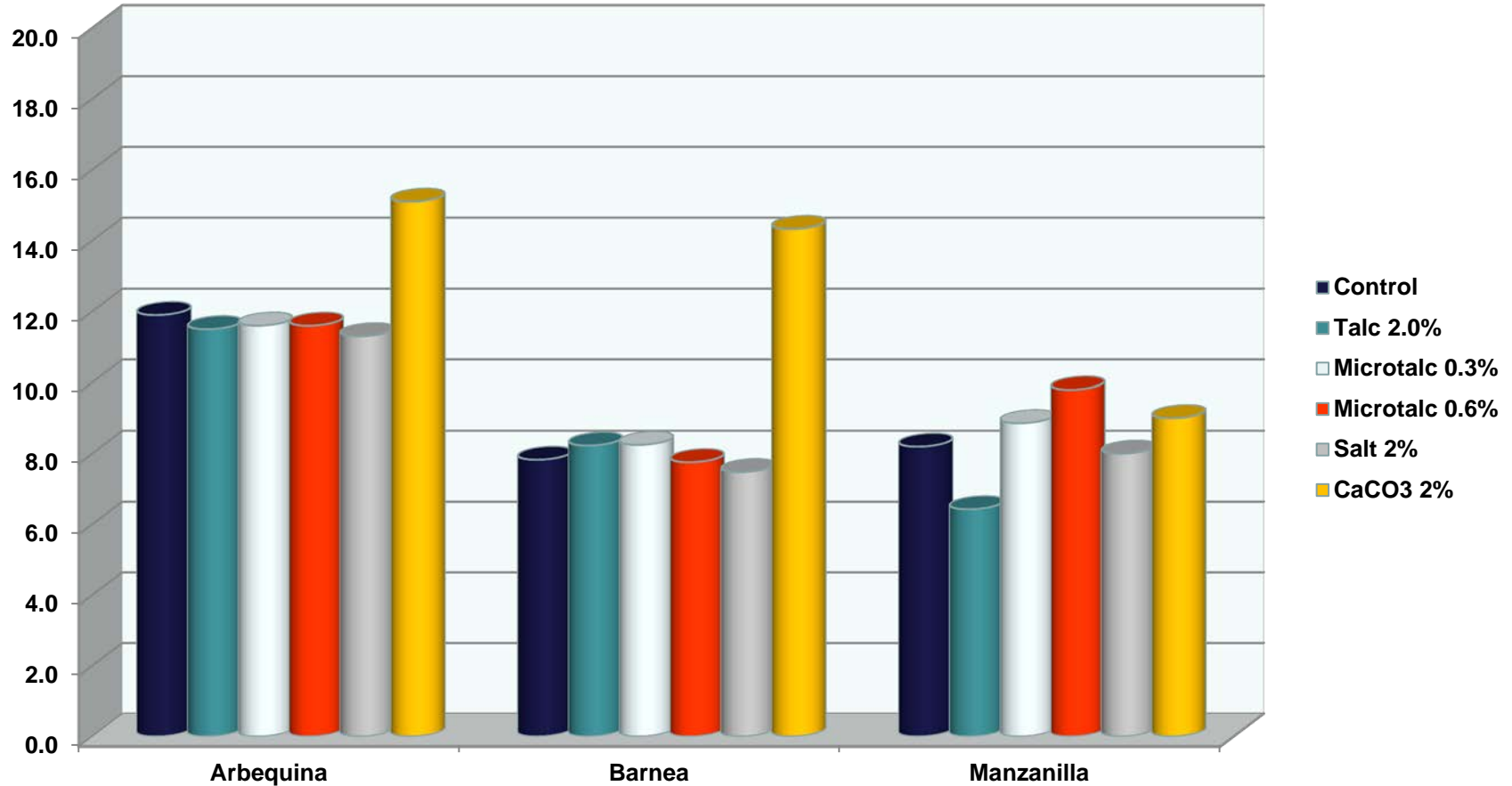
## Calcium carbonate

- Aggressive on paste
- Very high extractability
- Reduces FFA
- Oxidative action (PV, UV)
- ↓↓ PPH, stability & bitterness
- Very green oils
- Changes in taste



# Salt & Calcium carbonate

## Peroxide value





# Enzymes

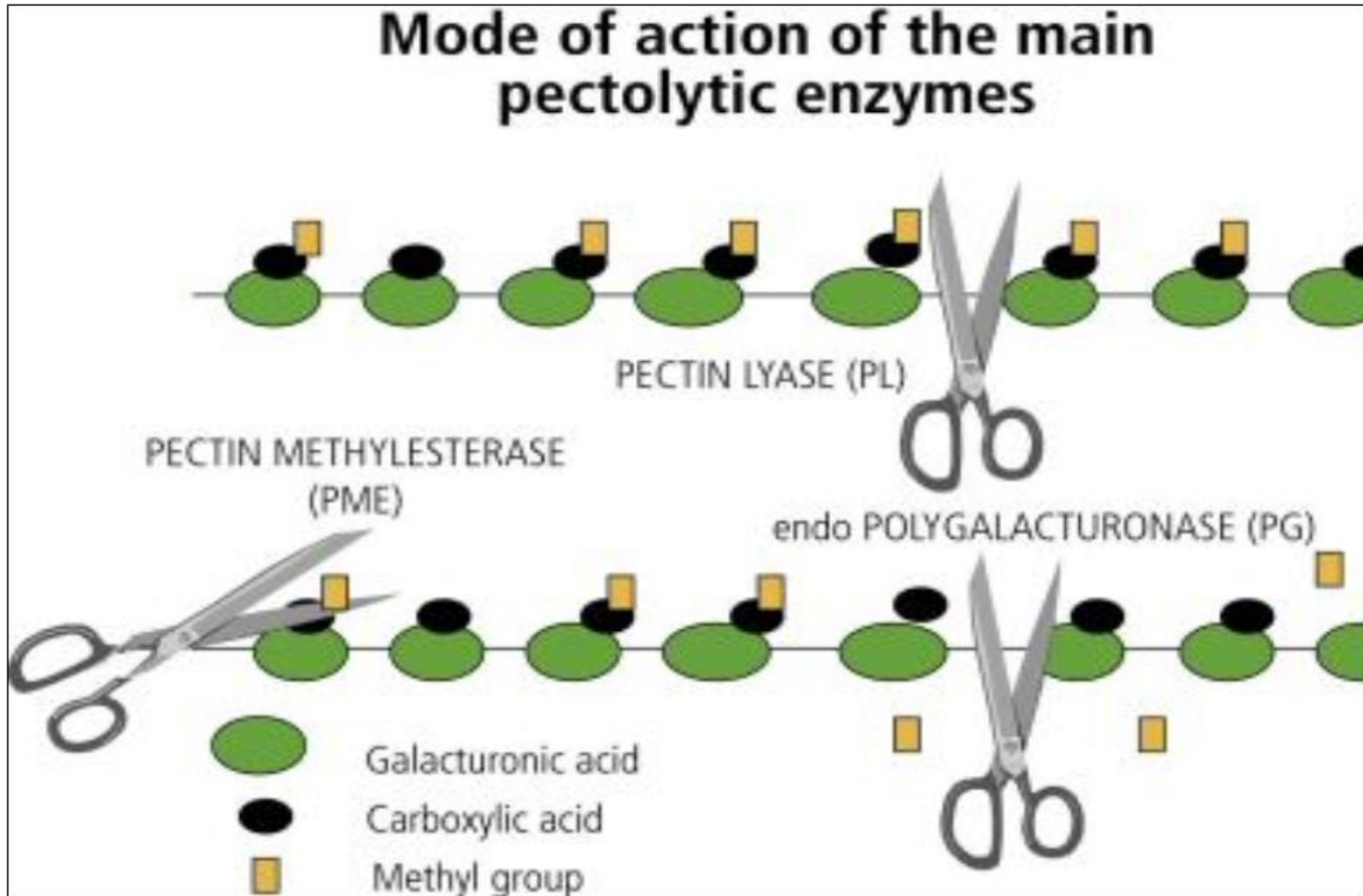
- Very effective in improving the paste extractability
- Biologically active protein substances that help in degrading the pectin & cellulose of the cell walls & vacuoles
- Same enzymes that the fruit has in its tissues
- Endogenous enzyme system depends on the season, variety & maturity and is inactivated by polyphenols
- Dose = Variable (200-500ml/tn). Higher in dry years
- Water soluble and easily removed by centrifugation
- Absolutely essential when dealing with low maturity fruit







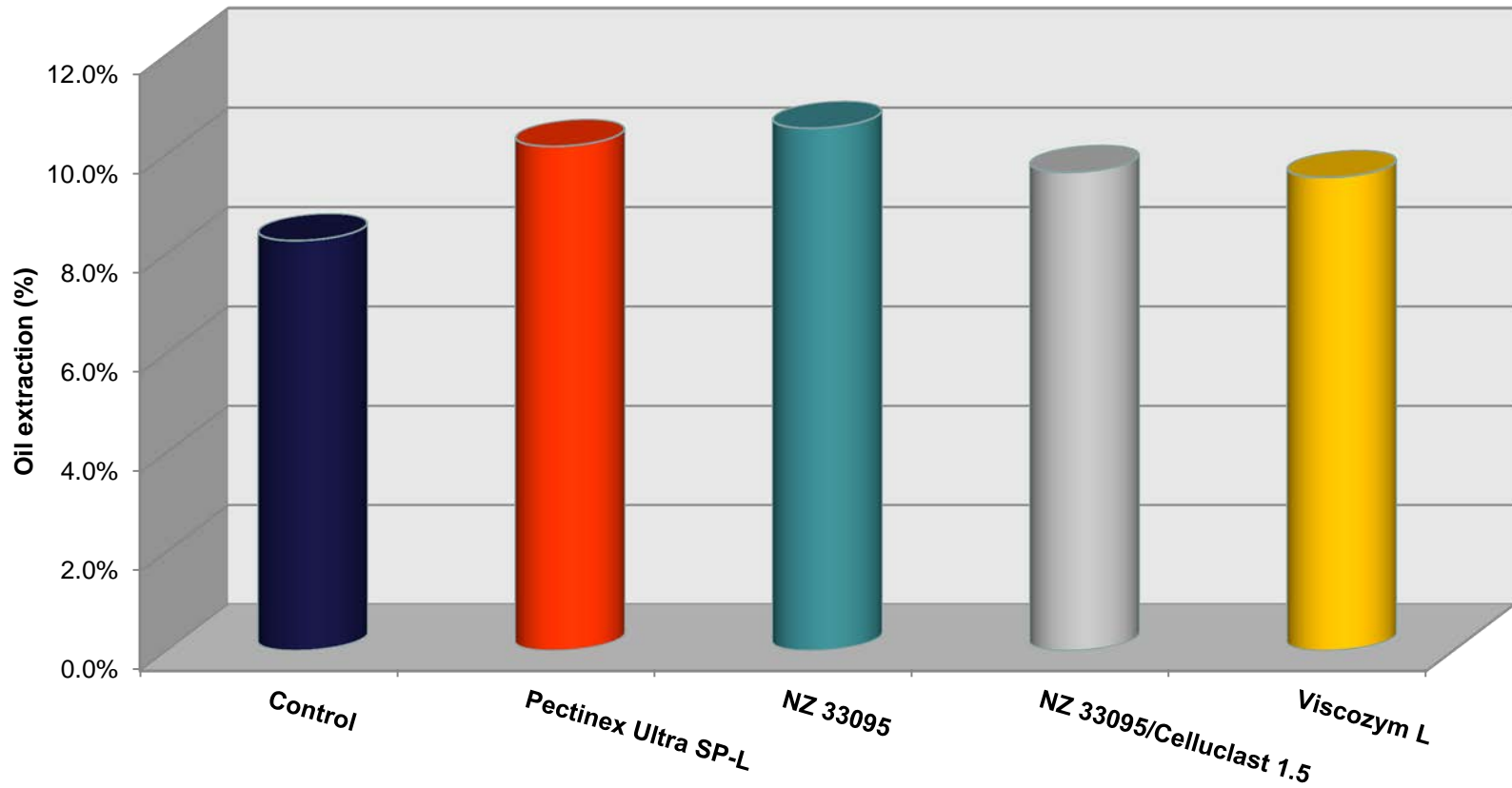
# Enzymes





# Enzymes

## Arbequina





# Enzymes

- Very good results in Arbequina. It was not a solution for high moisture Manzanilla without talc powder
- No alteration of oil quality for better or worse
- No changes in taste and colour
- Best performing enzymes: NZ 33095 & Pectinex Ultra
- The key seems to be: High PG/PE/PL activity with average side activities
- Field trials better than laboratory trials. Abencor limitations





# Warm water dipping

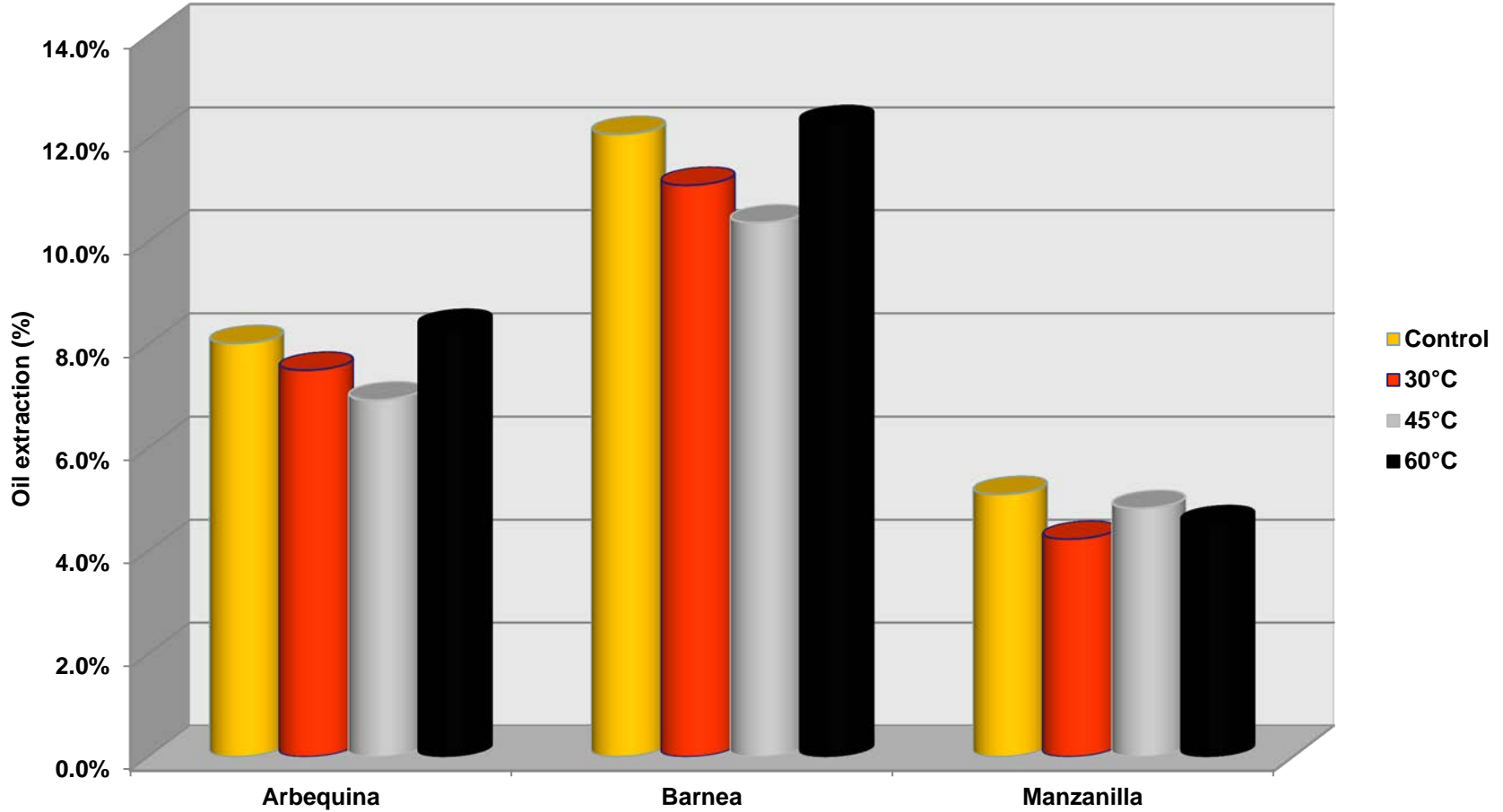
- It consists of pre-heating olives before crushing to achieve a higher temperature at beginning of malaxing
- Technique: Immersion of olives for 3 minutes in warm water at 30-45-60°C
- Research works in Spain indicate that dipping:
  1. Increases paste extractability
  2. Reduces bitterness
  3. Inhibits LOX enzyme → Delays oil oxidation
  4. Increases chlorophyll content → Greener oils
  5. No changes in taste







# Warm water dipping

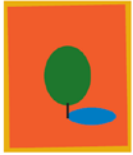




# Warm water dipping

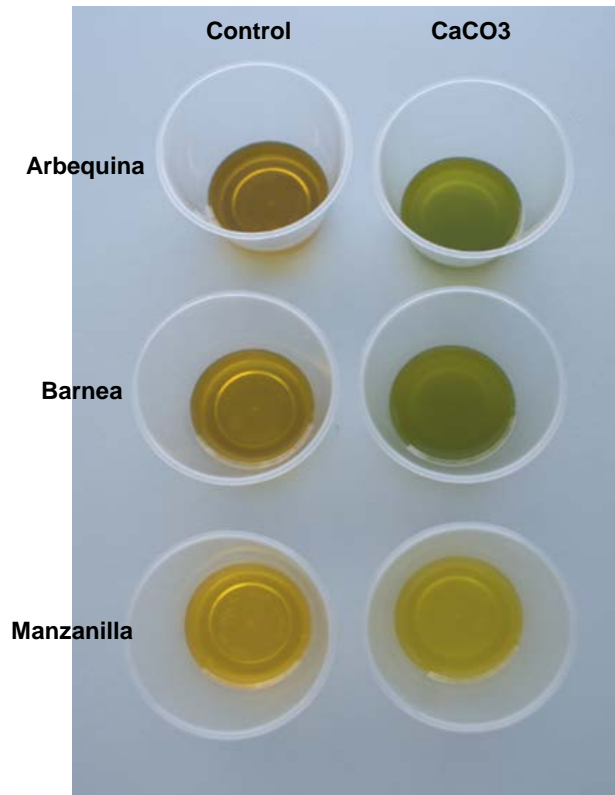
- Simple to implement in small Plants working in “batching” modality. **More complicated for larger Plants**
- Paste extractability showed slight improvements only at 60°C
- **Increase in the moisture content of the fruit, making the extraction process more difficult**
- Combined with talc could be interesting
- Oils are greener, **but there is a change in taste too**
- There is a clear reduction of the bitterness
- **There is a reduction of the oxidative stability**



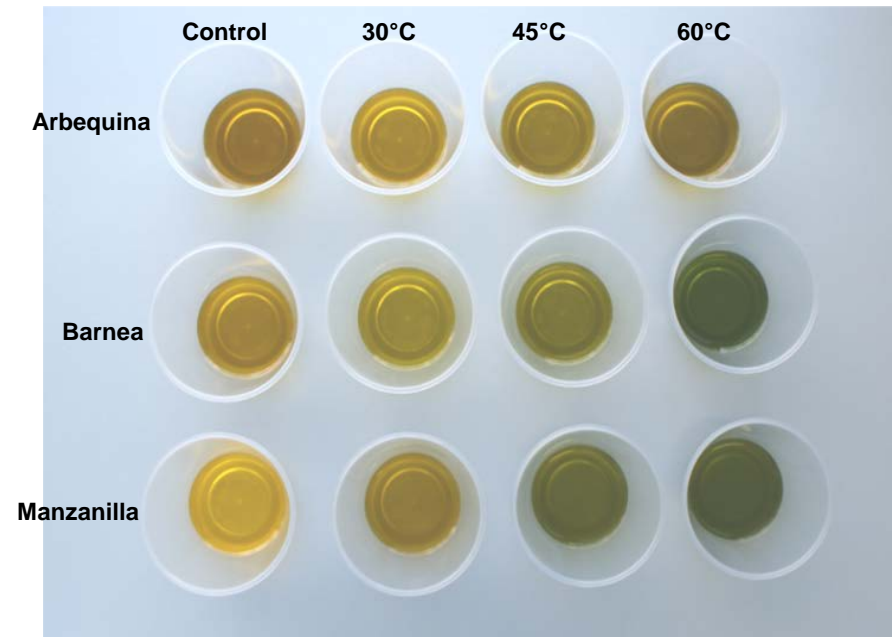


# Colour changes

## Calcium carbonate



## Warm water dipping





# Ultrasound

## *Enhancing Olive Oil Processing Efficiency and Competitiveness Using UltraSound Technology*

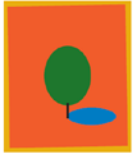
**Research project funded by HAL**

**John Allison<sup>1</sup>, Leandro Ravetti<sup>2</sup>, Claudia Guillaume<sup>2</sup>, Pablo Canamasas<sup>3</sup>,  
Kamalijt Vilku<sup>4</sup>, Piotr Sweirgon<sup>4</sup> and Lloyd Simons<sup>4</sup>**

**<sup>1</sup>Boundary Bend Ltd; <sup>2</sup>Modern Olives; <sup>3</sup>Boundary Bend Estate Processors Pty  
Ltd; <sup>4</sup>Food Science Australia**







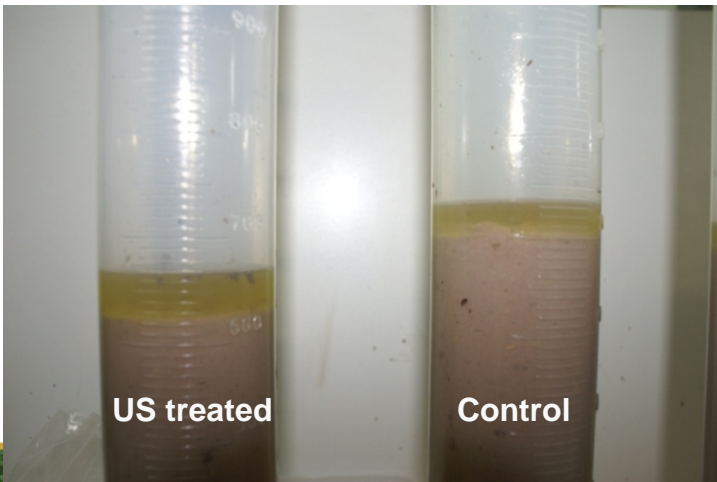
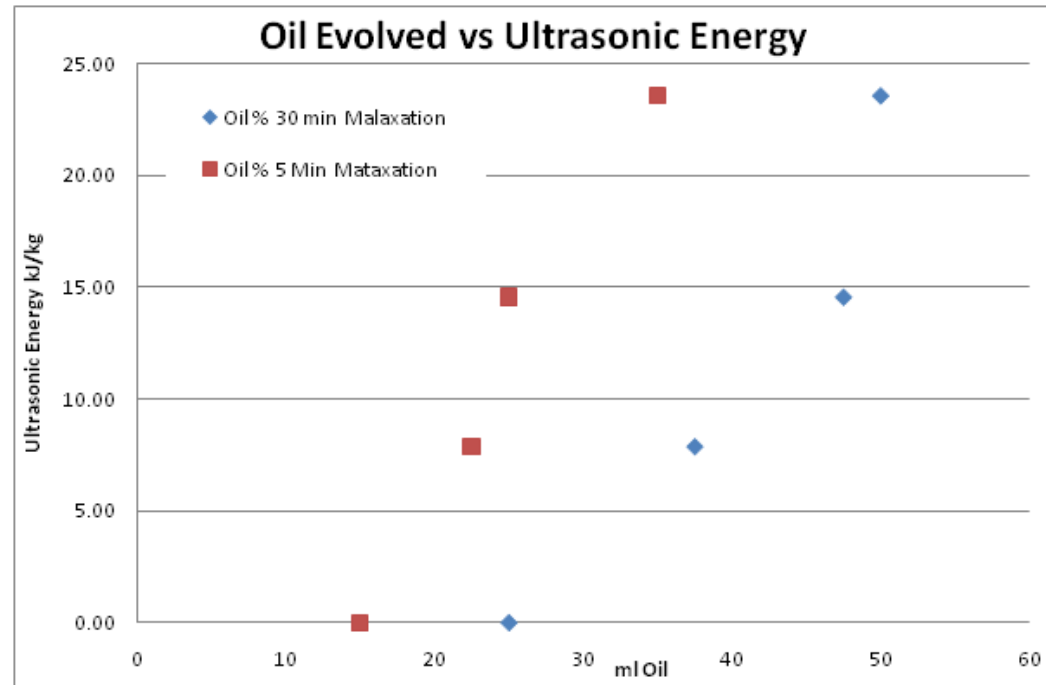
# Ultrasound

- Research in very early stages
- Olive paste is supplied with ultrasound energy in order to break down wall cell and release the oil
- There is a beneficial increase in the paste temperature
- It seems to be more effective on green fruit
- Lab trials showed very good results on paste extractability
- Field trials with variable results. More work to be done here
- No apparent impact on oil quality





# Ultrasound – Lab trials





# Ultrasound – Field trials

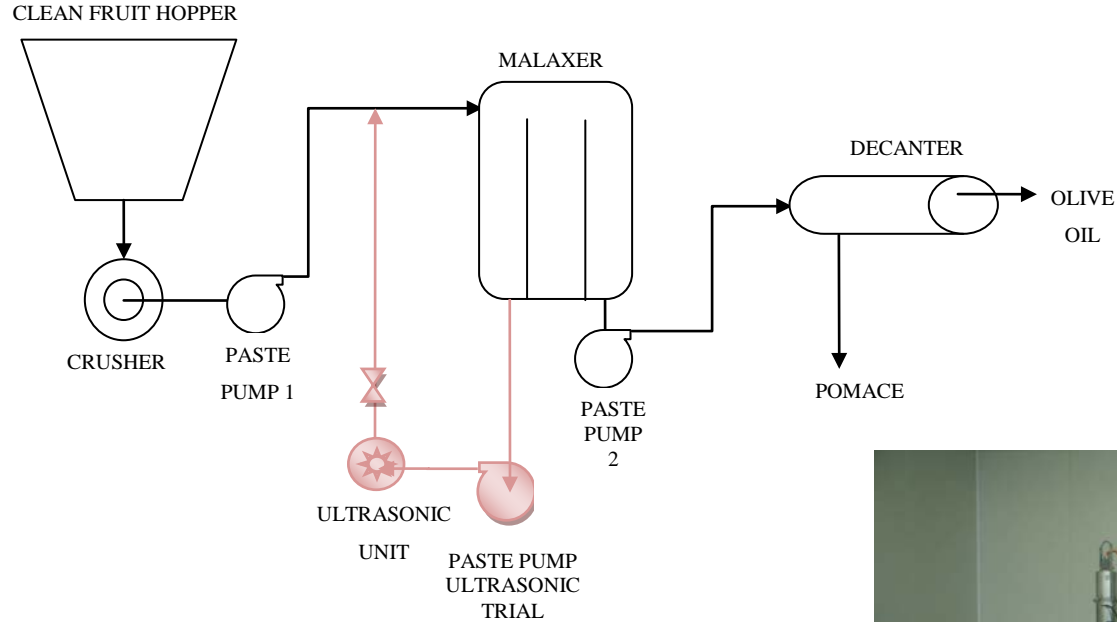
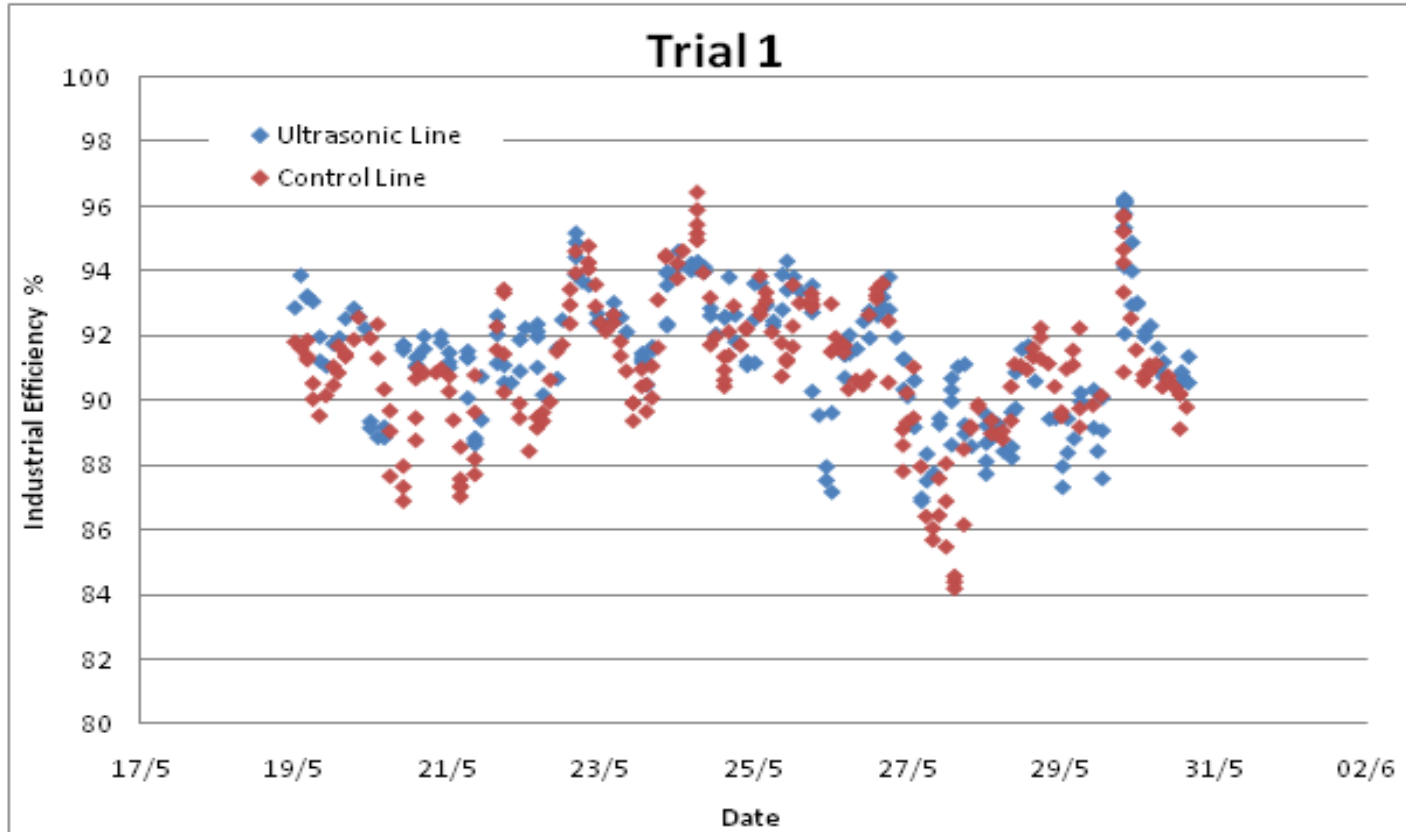


Figure 1: Process Flow Diagram

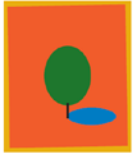




# Ultrasound – Field trials



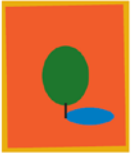




# Summary

- Talc & microtalc powder: essential with difficult pastes or high moisture fruit. No impact on oil quality
- Common salt: a cheap option. No impact on oil quality. There could be environmental issues
- Calcium carbonate: another cheap option. High paste extractability. There could be issues with oil quality
- Enzymes: Effective under most conditions. Doses depend on the year and fruit ripeness. No impact on oil quality
- Warm dipping: an option for small plants. Only effective with temperatures above 60°C. It does change the oil
- Ultrasound: Promising technology. No impact on oil quality
- Microtalc powder & enzymes could be an interesting combination





# Thank you!

## Acknowledgments

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