

A photograph showing a collection of chestnuts and their spiky, brown husks scattered on a ground covered with dry, brown leaves and twigs. The chestnuts are dark brown and glossy, while the husks are covered in sharp, yellowish-brown spines. The background is a dense layer of fallen leaves and twigs, creating a textured, natural setting.

**DISINFESTATION OF CHESTNUTS WITHOUT  
THE USE OF METHYL BROMIDE**



# Production

- **25000 ha of orchards for fruit production from 600m to 900m**
- **85% in Trás-os-Montes**
- **Principle varieties: Judia and Longal (more than a dozen in total)**





35000 tonnes of chestnuts

About 13,000 tonnes exported:

- 10,000tons of fresh fruits and
- 3,000 tonnes of frozen fruit
- This corresponds to about half of the production





# Shipments and exports

<b>Country of destination</b>	<b>1992</b>	<b>2002</b>
Spain	1,439	3,609
France	2,308	2,173
Italy	424	1,390
Other countries	465	678
<b>Sub-Total</b>	<b>4,635</b>	<b>7,850</b>
Brazil	1,554	1,435
USA	14	124
Canada	8	95
Venezuela	35	
Other countries		53
<b>Sub-Total</b>	<b>1,611</b>	<b>1,707</b>
<b>Total</b>	<b>6,247</b>	<b>9,557</b>

# Major pests and diseases

- In the culture: Ink disease and chestnut blight
- In the fruits:
- *Cydia splendana* Hubner
- *Balaninus* (Curculio) *elephas* Gyll





- Others tortrix:
- *Pammene fasciana* L.
- *Cydia fagiglandana* (Zell)
- Fungus:
- *Fusarium roseum*
- *Botrytis cinerea*
- *Phoma endogena*

Total losses: 6 -15%





# Methyl bromide treatment

- 48-50g/m<sup>3</sup> for 24 hours at ambient temperature
- In Trás-os-Montes we have cold winters with frost (from minimum of 0°C or below zero to maxima of 10°C to 16°C) and a dry summers
- Fumigation in concrete chambers, or under plastic film



# Trials in Japan from 1999 to 2003

No.	Methyl bromide alternative	Technology summary and key results	Technical reason for not being feasible
1	Methyl iodide fumigation	Fumigation with 30-50g/m <sup>3</sup> for 2-4 hours at 15°C/or room temperature. Complete kill was observed in 40g/m <sup>3</sup> -4hours and 50gr/m <sup>3</sup> -3 hours	Equal efficacy as MB. Toxicity and phytotoxicity assessment is required because it is unregistered
2	Sulfuryl fluoride fumigation	Fumigation with 30-40gr/m <sup>3</sup> for 2-4 hours, 15-25°C. Incomplete kill in spite of 40gr/m <sup>3</sup> for 4hours. The effect to eggs is small.	Toxicity and phytotoxicity assessment is required because it is unregistered
3	High pressure carbon dioxide	CO <sub>2</sub> pressure treatment for 10-30min.at 2.5Mpa or 3.0Mpa. Complete kill in both pressure for 30min. Equal efficacy as MB.	Equipment of high-pressure resistant facilities costs a lot and a large amount of chestnuts cannot be treated.
4	Phosphine fumigation	Fumigation with 1.5 and 2g/m <sup>3</sup> , for 24-48 hours, at 15-25°C.90-95% mortalities were obtained in 2gr/m <sup>3</sup> at 25°C.	Inferior efficacy compared to MB. Chemical injury occurs.
5	Aluminum phosphide fumigation	Fumigation with 5-10gr/m <sup>3</sup> , for 2-28 hours at room temperature. Insecticidal effect is small.	Inferior efficacy to MB. Severe chemical injury occur.
6	Carbon dioxide under low temperature	CO <sub>2</sub> fumigation: concentration 67-89, temp. 0 to -2.5°C, for 4-16 days. All tested plots cannot obtain complete mortality.	Practical use is difficult because insecticidal effect is small.
7	Carbon dioxide	CO <sub>2</sub> fumigation: 100% concentration of CO <sub>2</sub> , 1-8 days. Only 88,9% mortality was obtained for 8 days.	Insecticidal effect is small. And chemical injury occurs with fermentation.
8	Allyl isothiocyanate	Treatment: 1000, 3000 ppm, for 3-24 hours at room temperature.3000 ppm for 24 hours provide 96,8% mortality.	Inferior efficacy compared with MB. Chemical injury occur (deterioration of fruit pulp and mustard odour).
9	Dried heat	Temperature 40-90°C.More than 70°C provide 100% mortality.	Practical use is difficult because deterioration of quality occur.
10	Hot water	Treatment:40-60°C of hot water, for 30-120 minute. Complete kill was obtained above 50°C.	Practical use is difficult. Deterioration of quality occur (discoloration and strong odour).
11	Water immersion	Water immersion for 3-14 days.3days show 90%and 7 days show 90% and 50% survival rate respectively. Only 14 days show 100% mortality	Practical use is difficult. Deteriorations of quality occur.
12	Spray control	400 litters of spray of 1,500 time solution of Pyrethroid to trees in an 10a area. No effect on eggs and larvae.	Practical use is difficult because insecticidal effect is small.



# Conclusions by Japan

**Methyl iodide fumigation most promising**

- Further research will be necessary on the toxicology and the quality of the chestnuts

**Most promising alternative on physical methods:**

- Hot steam/water



# Portugal hot steam/water treatment

- Used by «Sortegel» since 1992
- Technology based on a French and Italian methods
- Used Italian equipment in Portugal
- The final price is about 20% more than the MB treatment



# Sortegel





Boiler – 30-45 minutes at 48-50°C





# Cooling/selection water tank



Reject chestnuts  
float and are  
discarded



Drier - 30 minutes at ambient temperature



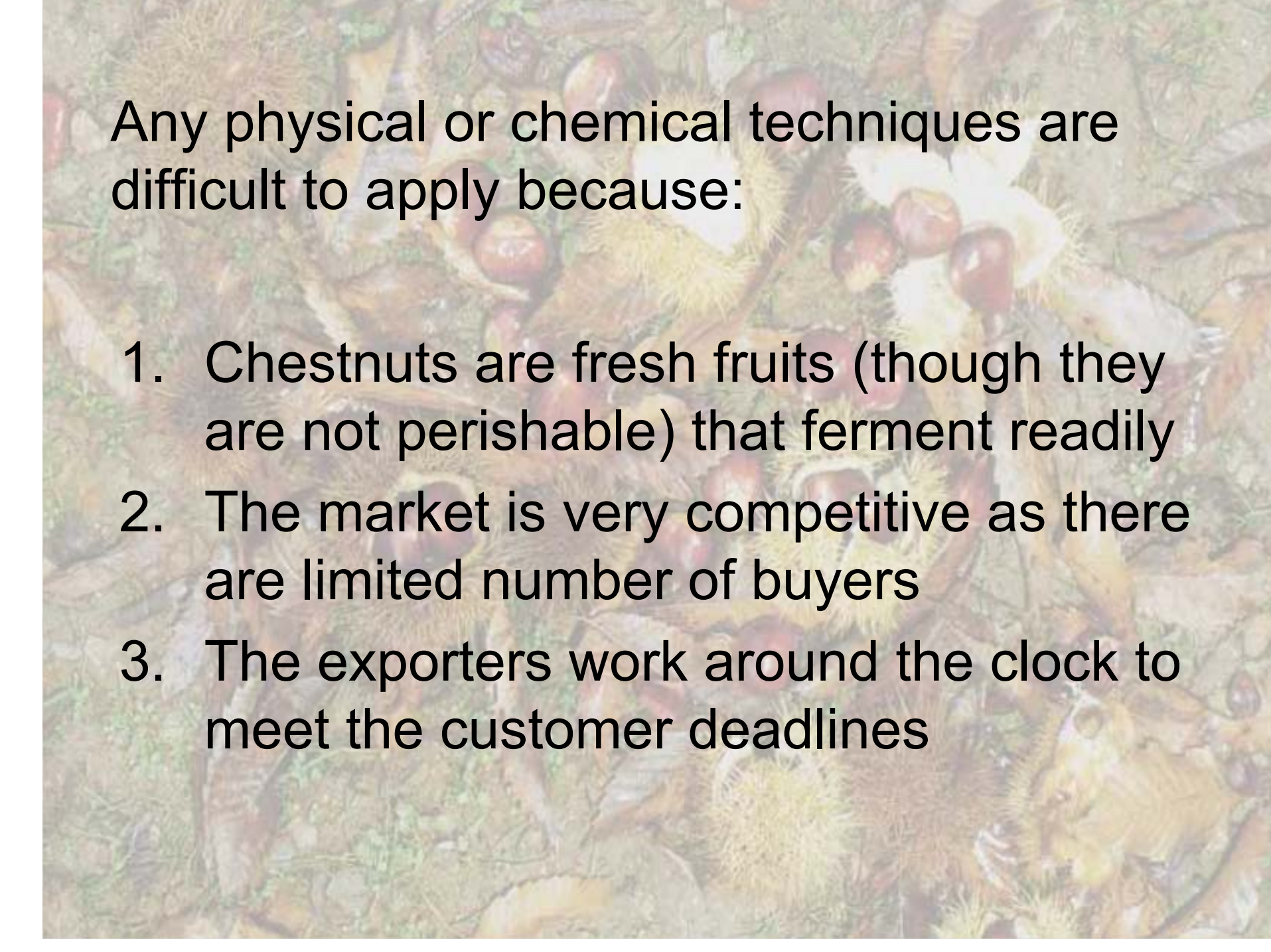
Spin dry to  
eliminate water



# Temperature controller







Any physical or chemical techniques are difficult to apply because:

1. Chestnuts are fresh fruits (though they are not perishable) that ferment readily
2. The market is very competitive as there are limited number of buyers
3. The exporters work around the clock to meet the customer deadlines



# Summary

- Exports of fresh chestnuts important for Trás-os-Montes
- MB is being used for disinfestation
- Steam treatment is being used commercially and its use might increase