

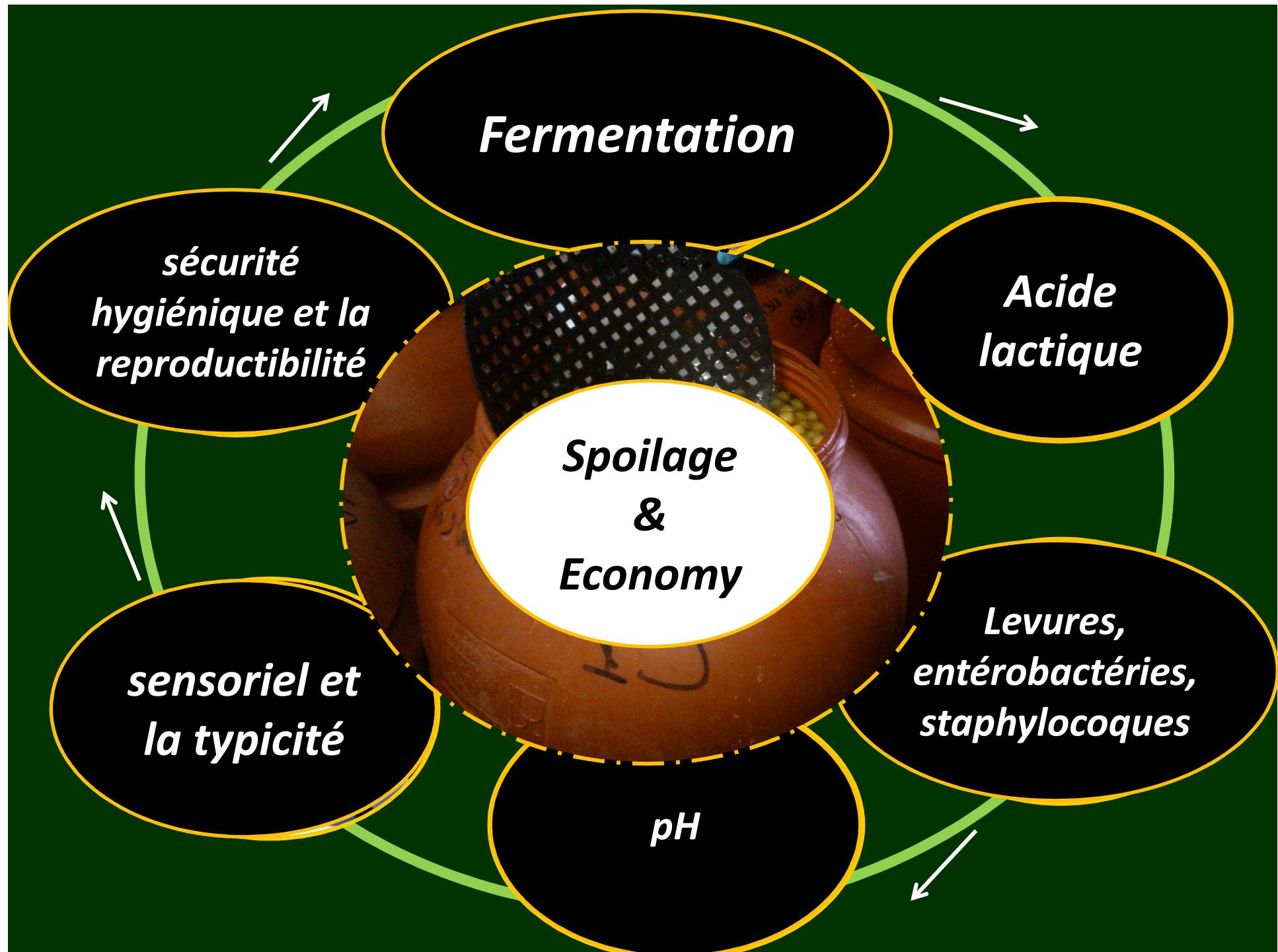
*Microbiologie*

*Olive divisé*

*e n*

*Tecnologie*

*deux parties*



# *Les olives de table & la production mondiale*

**2.550 MILLIONS ton  
per year**

*(IOOC, 2014/15 estimated data)*

**34%**  
**Spain-Greek-Italy**

**Spain 515000 ton**

**Greek 235000 ton**

**Italy 79500 ton**

**Portugal 16800 ton**

**French 1100 ton**





Les olives market





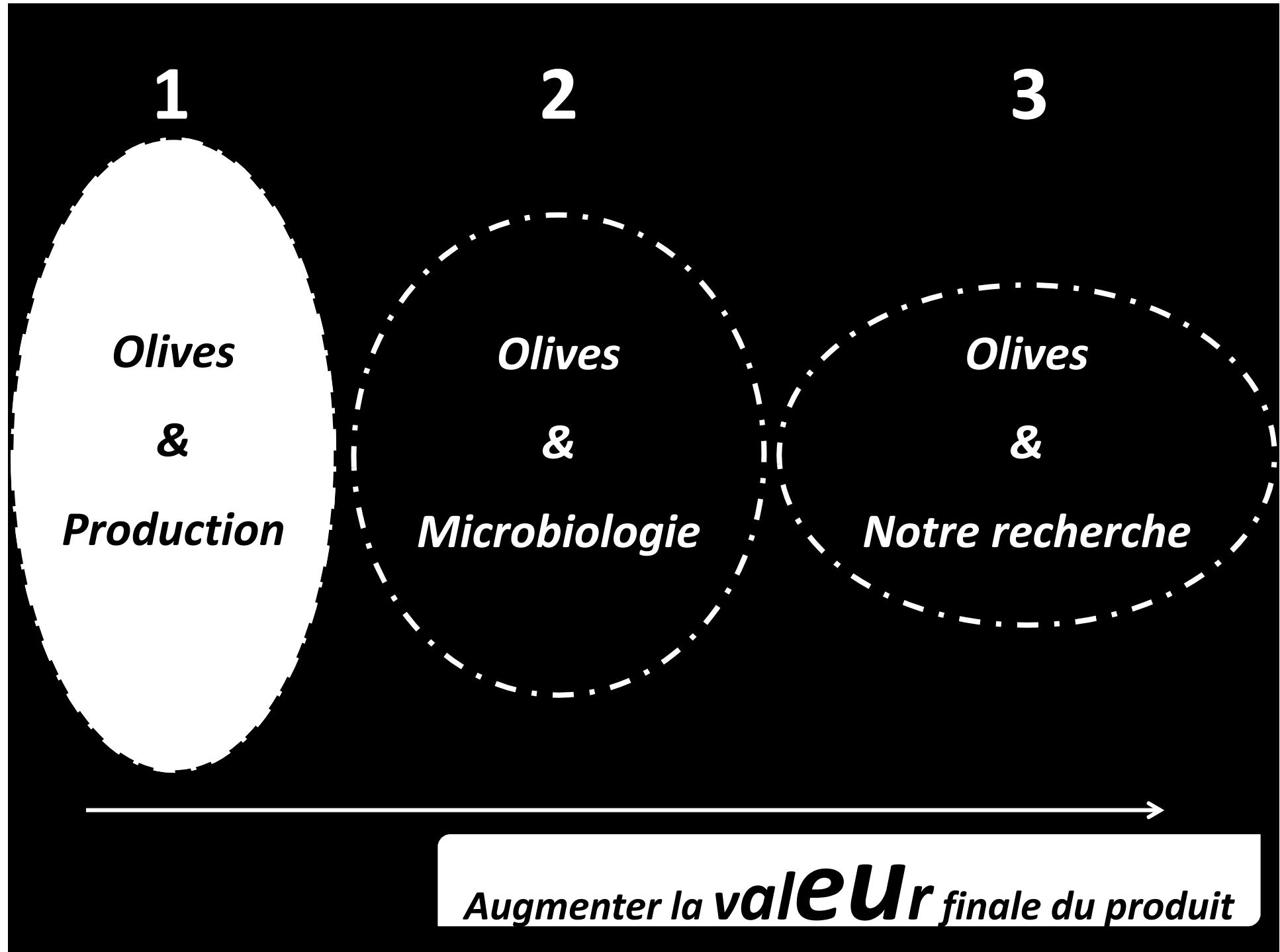
UNIVERSITÀ  
DEGLI STUDI  
DI PALERMO

# Microbiologie des olives de table fermentées: élection et application d'une nouvelle souche de bactérie lactique



*Departement of Agricultural and Forest Science, Palermo, ITALY*

Nicola Francesca, Alessandra Martorana, Luca Settanni, Tiziano caruso, Giancarlo Moschetti\*



*Recolte*



## *Olives & Production*

*Selection*



*calibration*



# *Style espagnol*

Hydroxyde de sodium  
(1.8-3.5%)  
(5-12h)

Lavage à l'eau  
(1-3 days-water)

Saumure  
(10-12% NaCl)

Fermentation + acides organiques  
(+/-months)

## *Style de production*

Gluconate ferrique  
Ajouter de l'air  
Hydroxyde de sodium (dilué)

# *Style californien*

# *Style grec*

Brining  
(10-12% NaCl)

Fermentation  
(+++mois)

SANS FERMENTATION

*Style  
espagnol*

*Style  
grec*

Hydroxyde  
de sodium

*Objectifs ?*

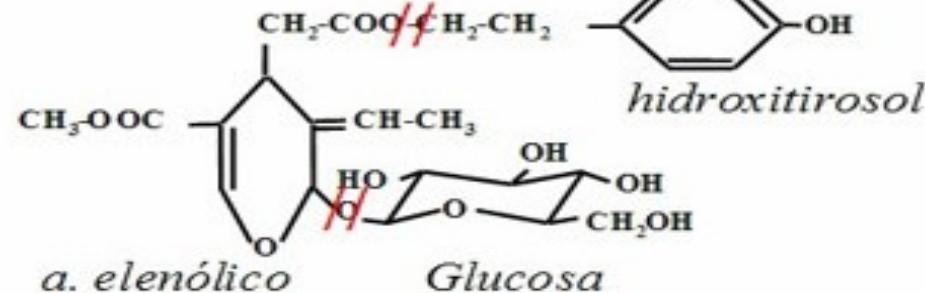
microorganismes

microorganismes

Hydroxyde  
de sodium

*Style  
californien*

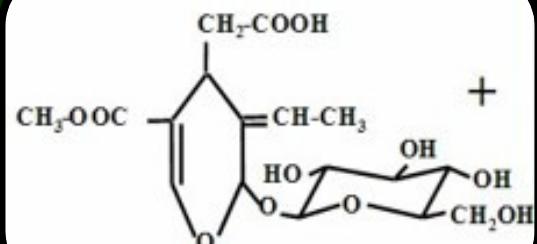
## Oleuropeine



Glucose, elenolic acid and *o*-diphenol hydroxytyrosol compounds

## Désamérisation

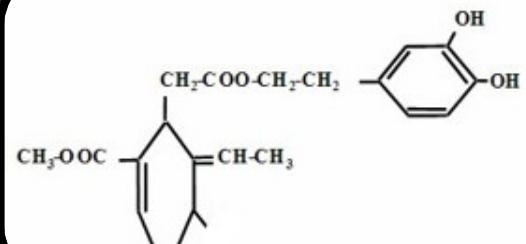
### Hydroxyde de sodium



+

Hydroxytirosol

### Fermentation



+

Glucose

## *Cuves en fibre de verre pour la fermentation des olives*



*Style  
Espagnol/Grec*

## *Cuves en fibre de verre pour la fermentation des olives*



*Style  
Espagnol/Grec*

## *Cuves à la fermentation des olives*



*Style  
Espagnol/Grec*

## *Cuves à la fermentation des olives*



*Style  
Espagnol/Grec*

## *Transfert des olives des cuves fermentation*



*Style  
Espagnol/Grec*

## *Transfert des olives après fermentation*



*Style  
Espagnol/Grec*

## *Transfert des olives après fermentation*



*Style  
Espagnol/Grec*

*calibrage du la taille des olives déjà fermenté*



*Style  
Espagnol/Grec*

*Variétés d'olives fermentées  
«Nocellara del Belice»*



*Olives fermentées distribués dans des  
fûts pour le transport et la vente*



*Style  
Espagnol/Grec*

## *Olives fermentées vert*



*Style*

*Espagnol/Grec*

## *Olives noires fermentées*



*Style  
Espagnol/Grec*

## *L'addition des substances alcalines et des sels de fer*



*Style  
californien*

## *Réservoir pour l'oxydation des olives*

*Style  
californien*

## *Réservoir pour l'oxydation des olives*



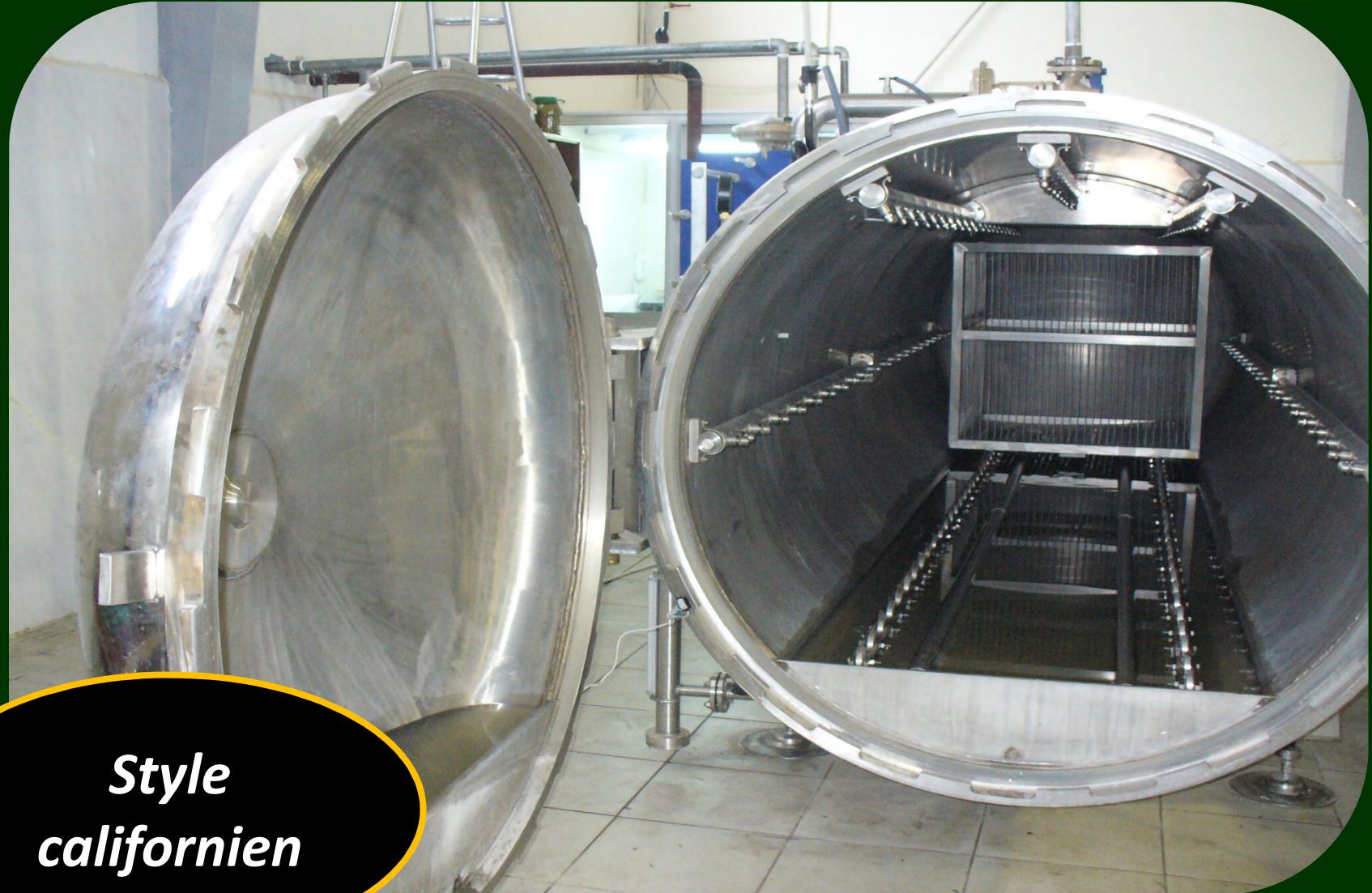
*Style  
californien*

## *Stérilisation*



*Style  
californien*

## *Stérilisation*

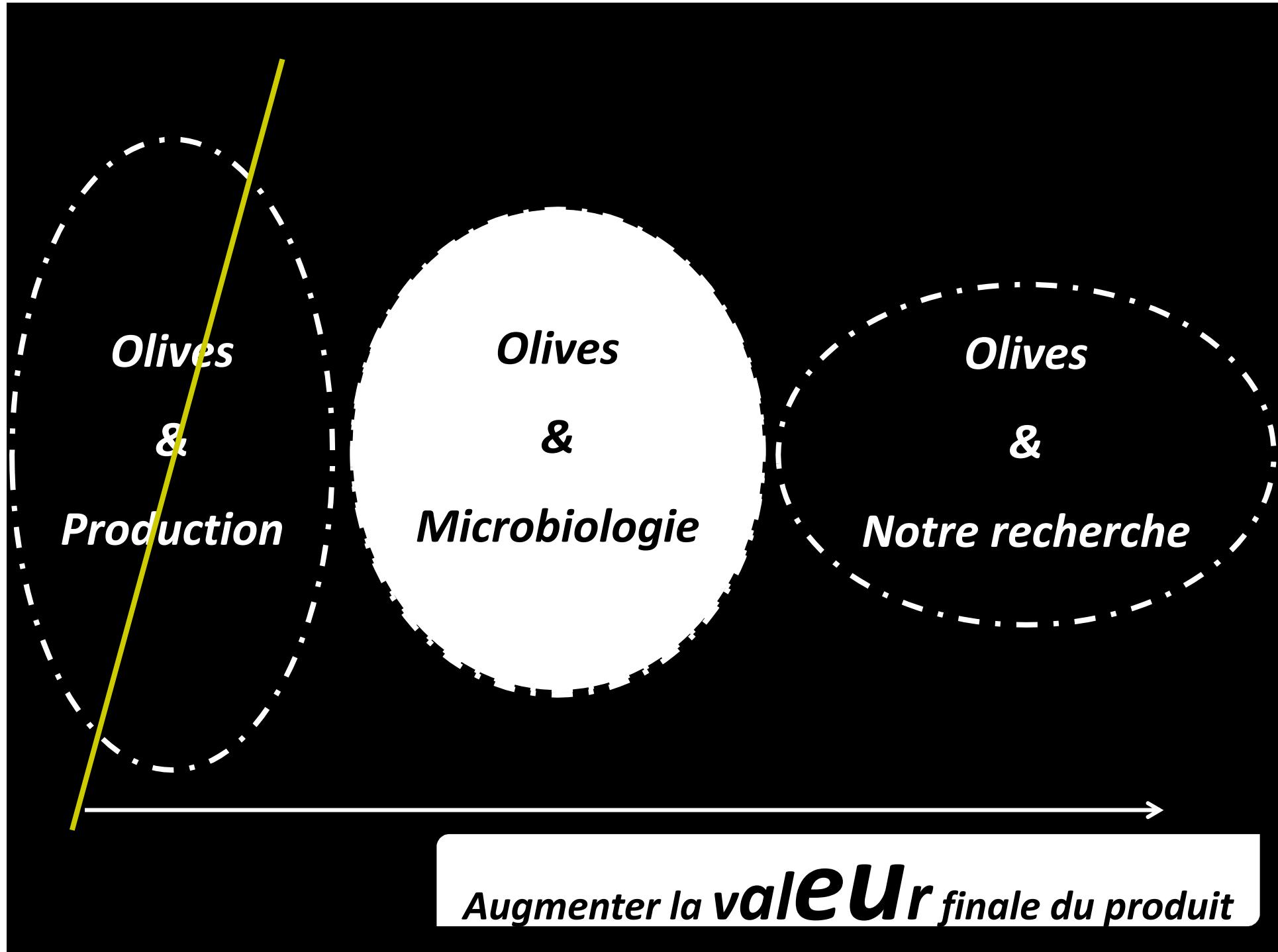


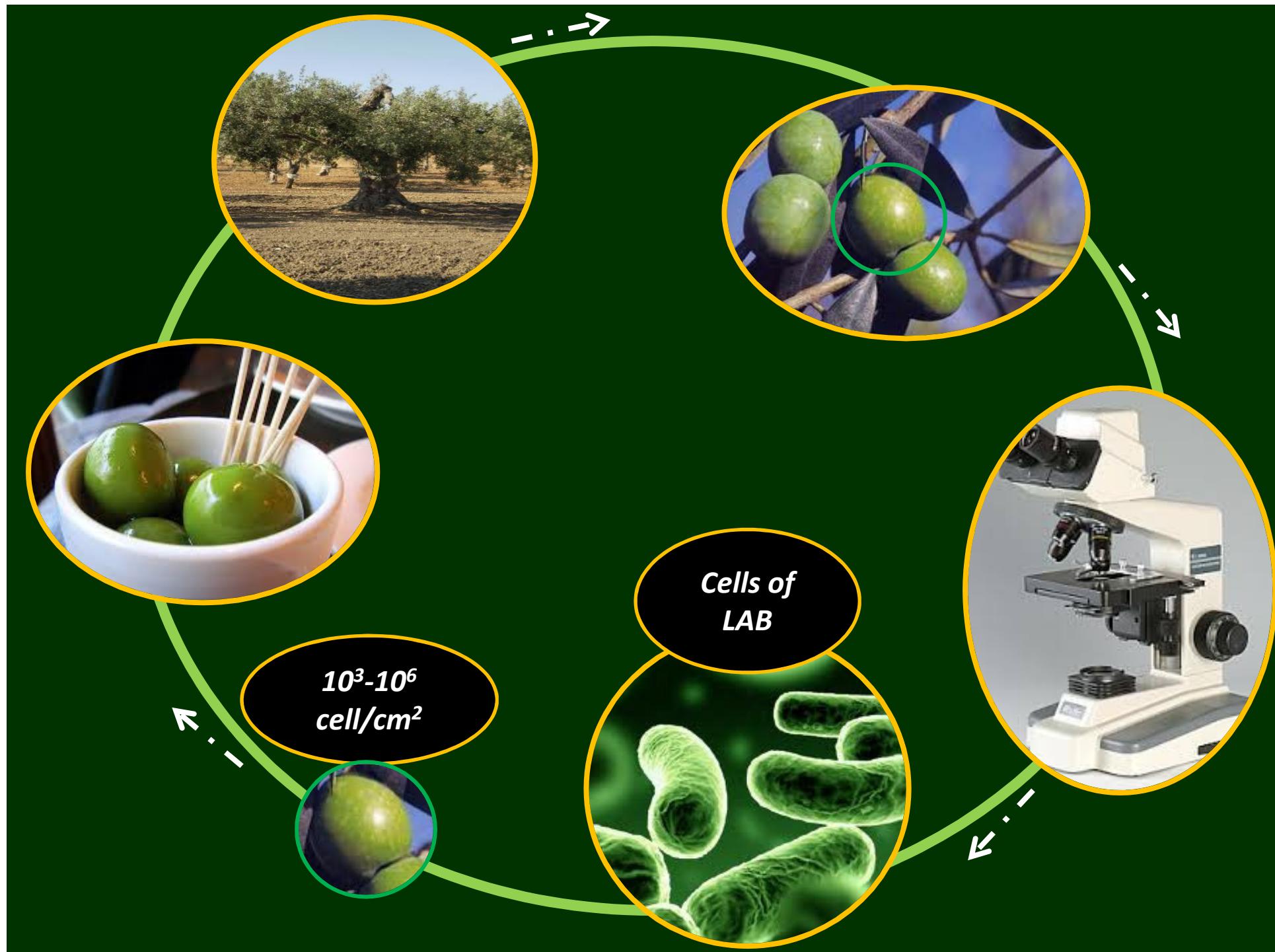
*Style  
californien*

## *Pasteurisation*



*Style  
californien*





# *Microorganismes*



## BACTÉRIES LACTIQUES

## LEVURE

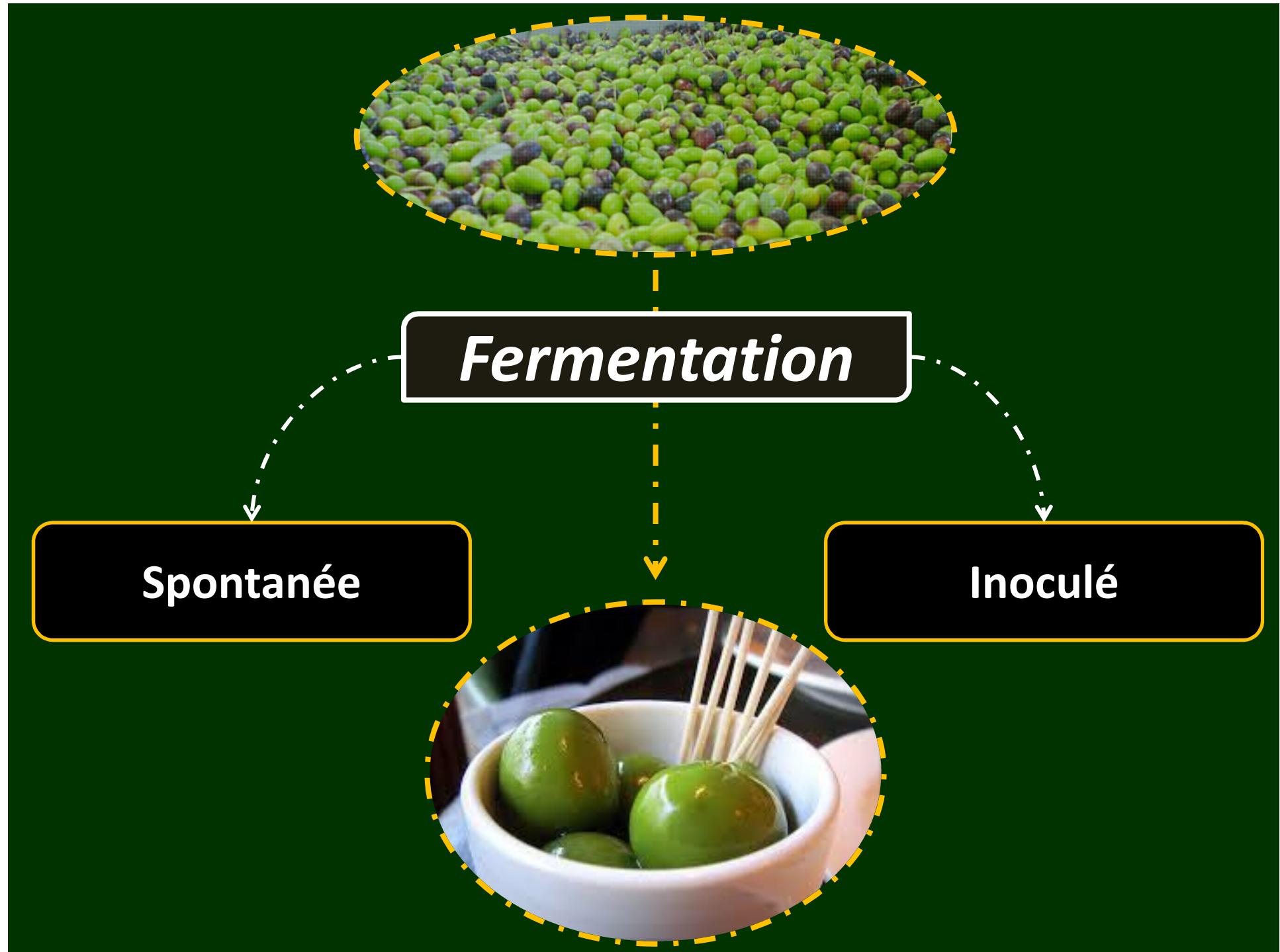
## BACTÉRIES *d'alteration*

*Lactobacillus* spp.  
*Enterococcus* spp.  
*Pediococcus* spp.  
*Leuconostoc* spp.

*Saccharomyces* spp.  
*Pichia* spp.  
*Rhodotorula* spp.

*Pseudomonas* spp.  
*Staphylococcus* spp.  
*Enterobacteriaceae*  
*Bacillus* spp.

## *UTILES*



# Fermentation spontanée

diversité microbienne élevée

complexité sensorielle élevée

Style Espagnol

*Lb. pentosus, Lb. plantarum*  
*Leuconostoc mesenteroides*

Style grec

*C. boidinii, C. diddensiae,*  
*C. membranaefaciens,*  
*Kluyveromyces lactis,*  
*Pichia kluyveri,*  
*Pichia membranaefaciens ,*  
*Rhodotolura glutinis*

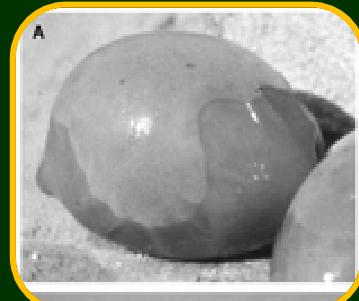


processus imprévisible

- ZAPATERA (propionic acid)
- SOFTENING (*B. pumilus*, high pH)
- ABNORMAL FERMENTATION, OFF-FLAVOUR
- FISH-EYES (o GAS POCKET)
- ALAMBRADO (slit inside olive)

altération

dommages économiques (30%)



# *Fermentation spontanée*

## *Répartition des principaux groupes microbiens*

pH: 8.5-7.0  
Augmentation de la concentration en  
*Enterobacteriaceae*

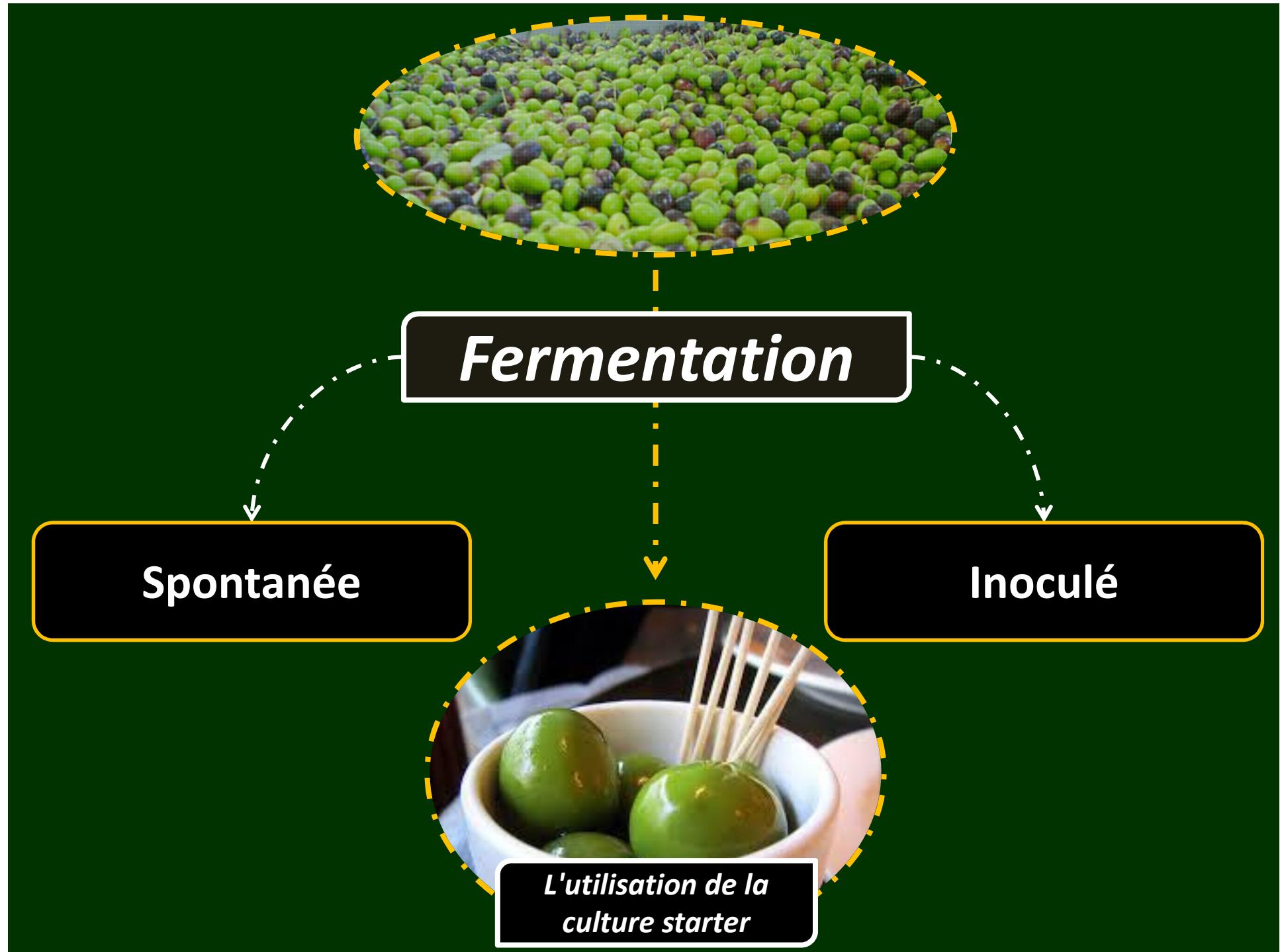
pH: 6.0-5.0  
Augmentation de la concentration en  
bactéries lactiques

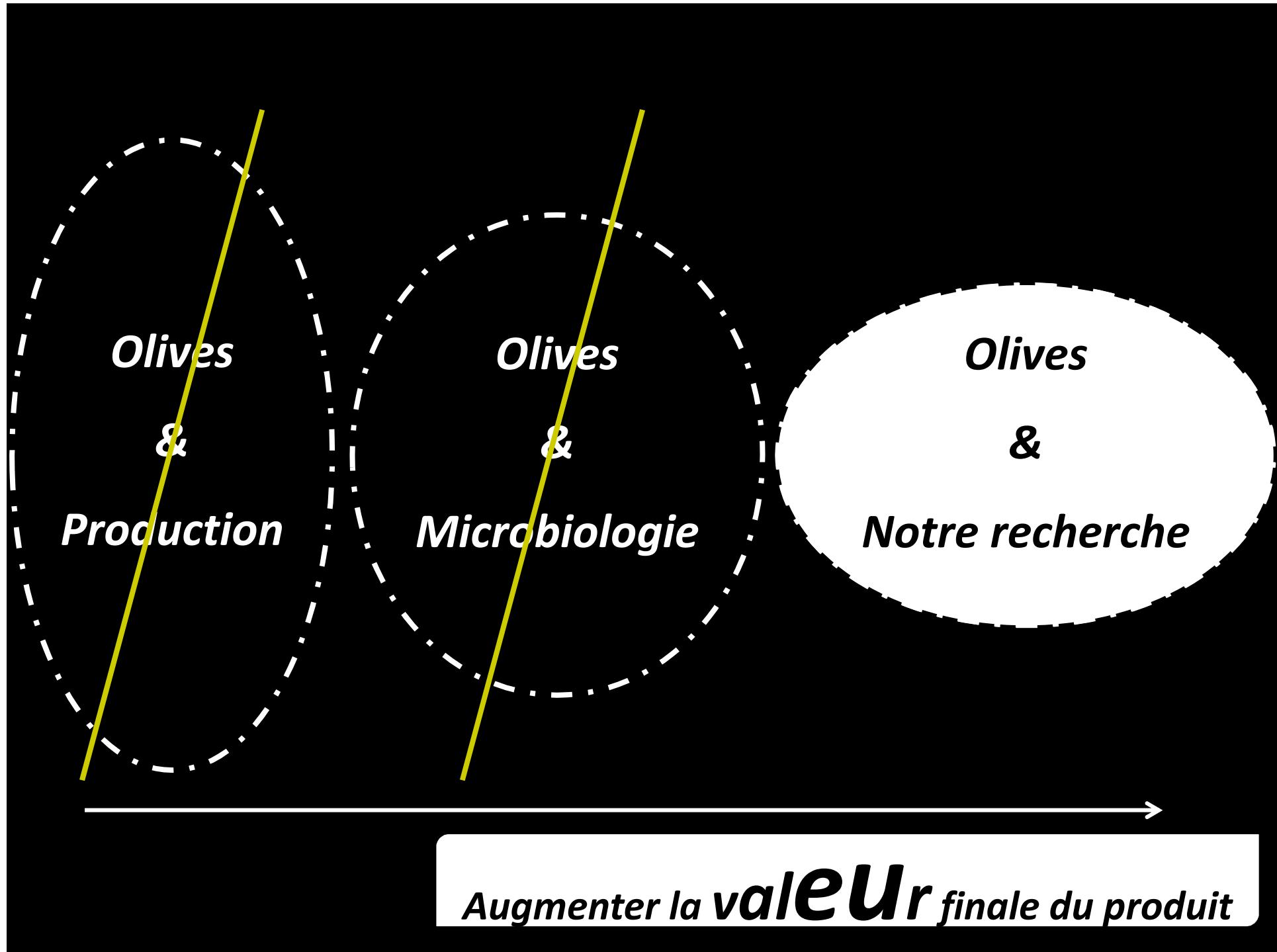
pH: 5.0-4.0 and T°<15  
Augmentation de la concentration en  
bactéries lactiques et et des levures

1<sup>st</sup>

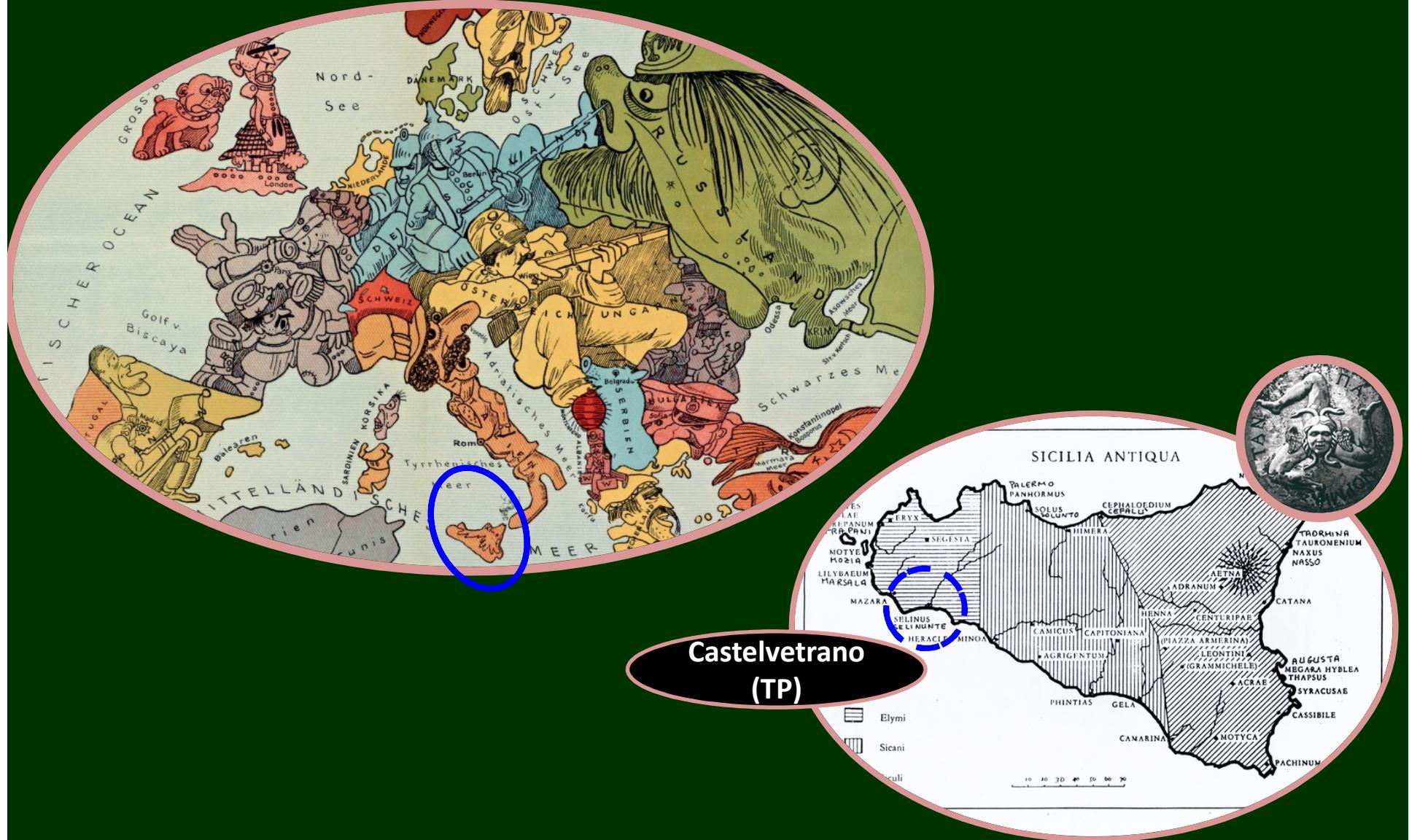
2<sup>st</sup>

3<sup>st</sup>





# Sicile, les olives et la recherche



# *Sicile & la perception esthétique*



# *Sicile & la perception esthétique*



## *Sicile & la perception esthétique*



# *Sicile & la perception esthétique*



# *Sicile & la perception esthétique*



# *Sicile & la perception esthétique*



# *Sicile & la perception esthétique*



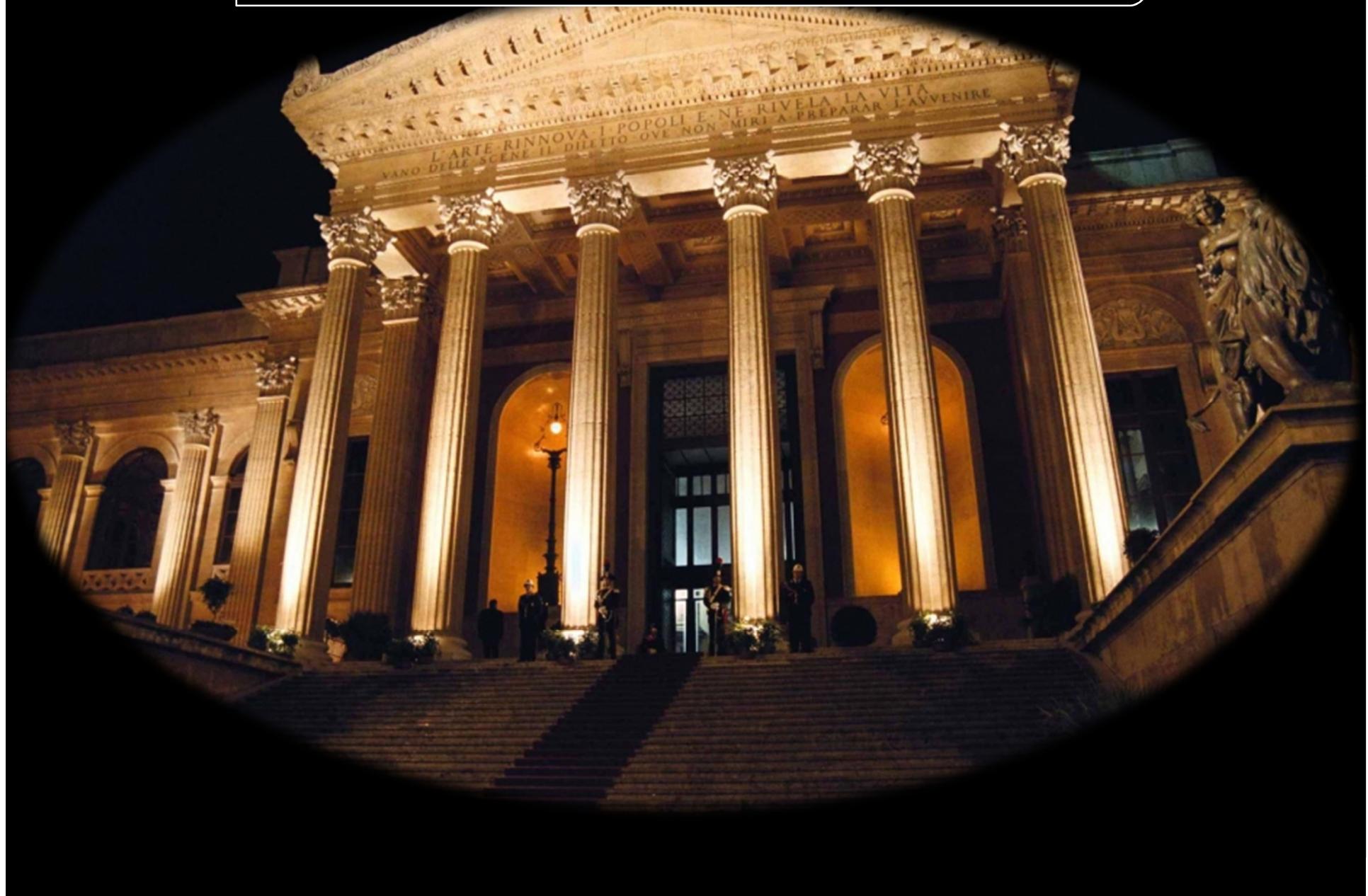
# *Sicile & la perception esthétique*



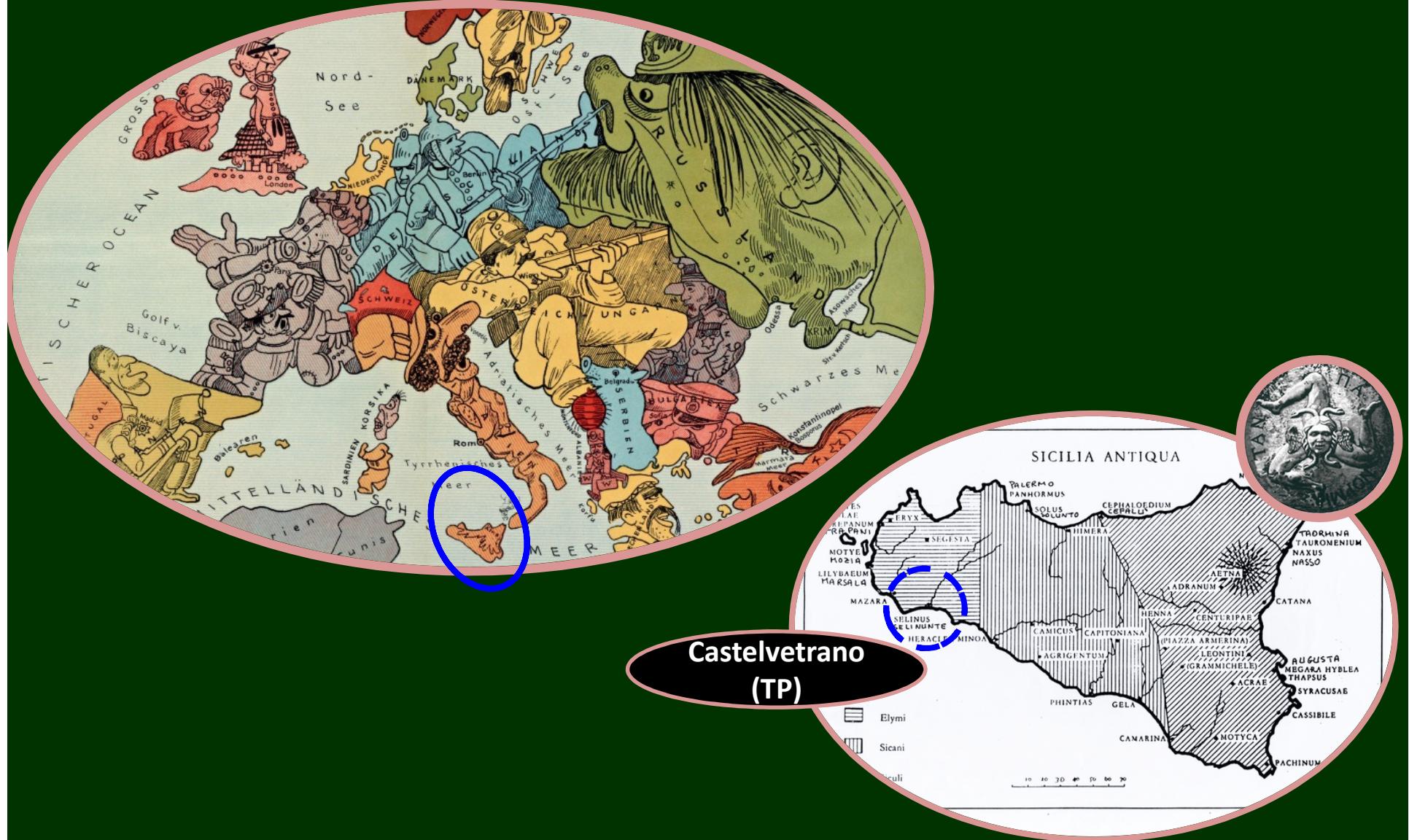
# *Sicile & la perception esthétique*



# *Sicile & la perception esthétique*



# Sicile, les olives et la recherche



**1  
olive**

2007

2008

2009

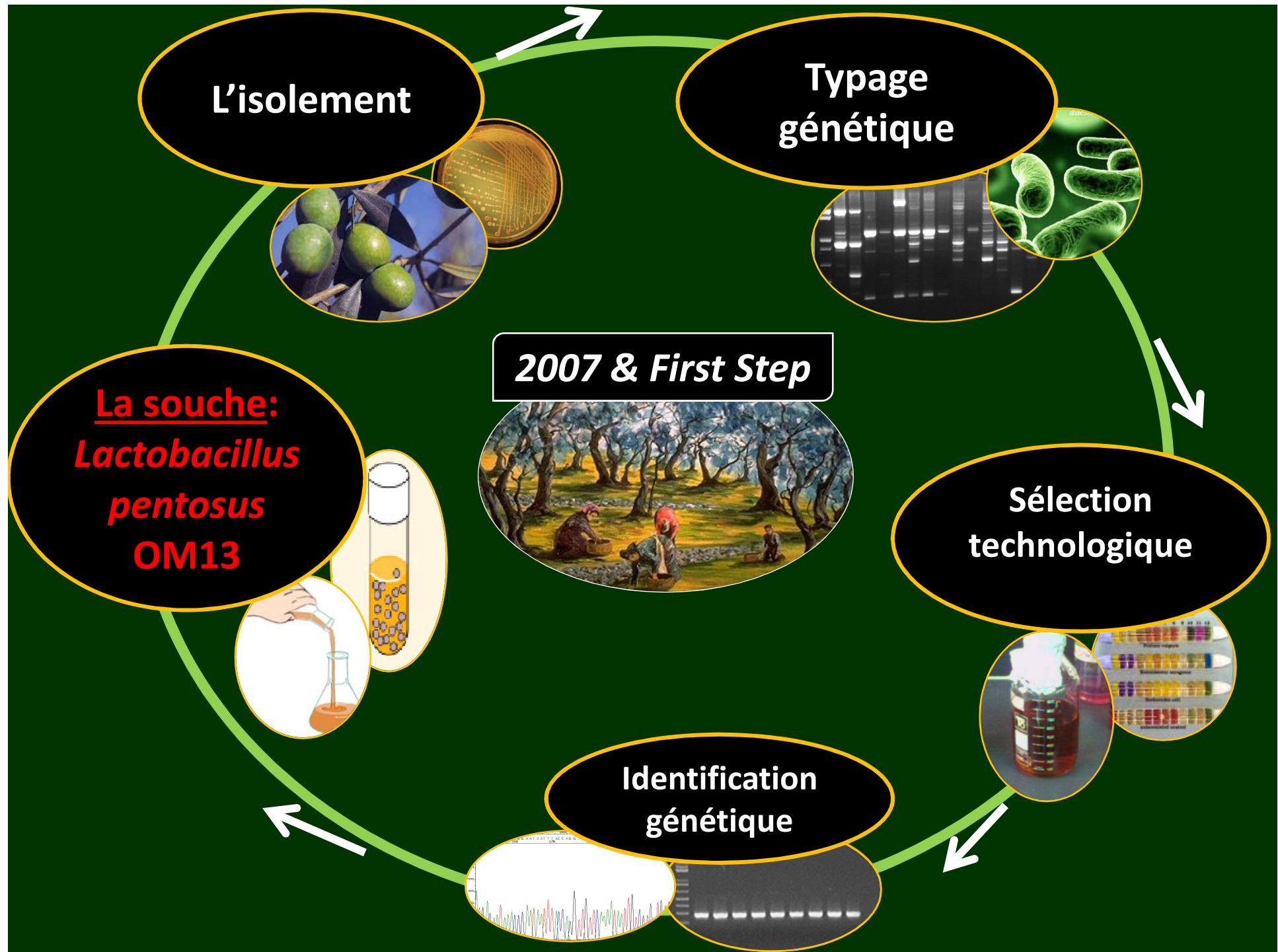
2010

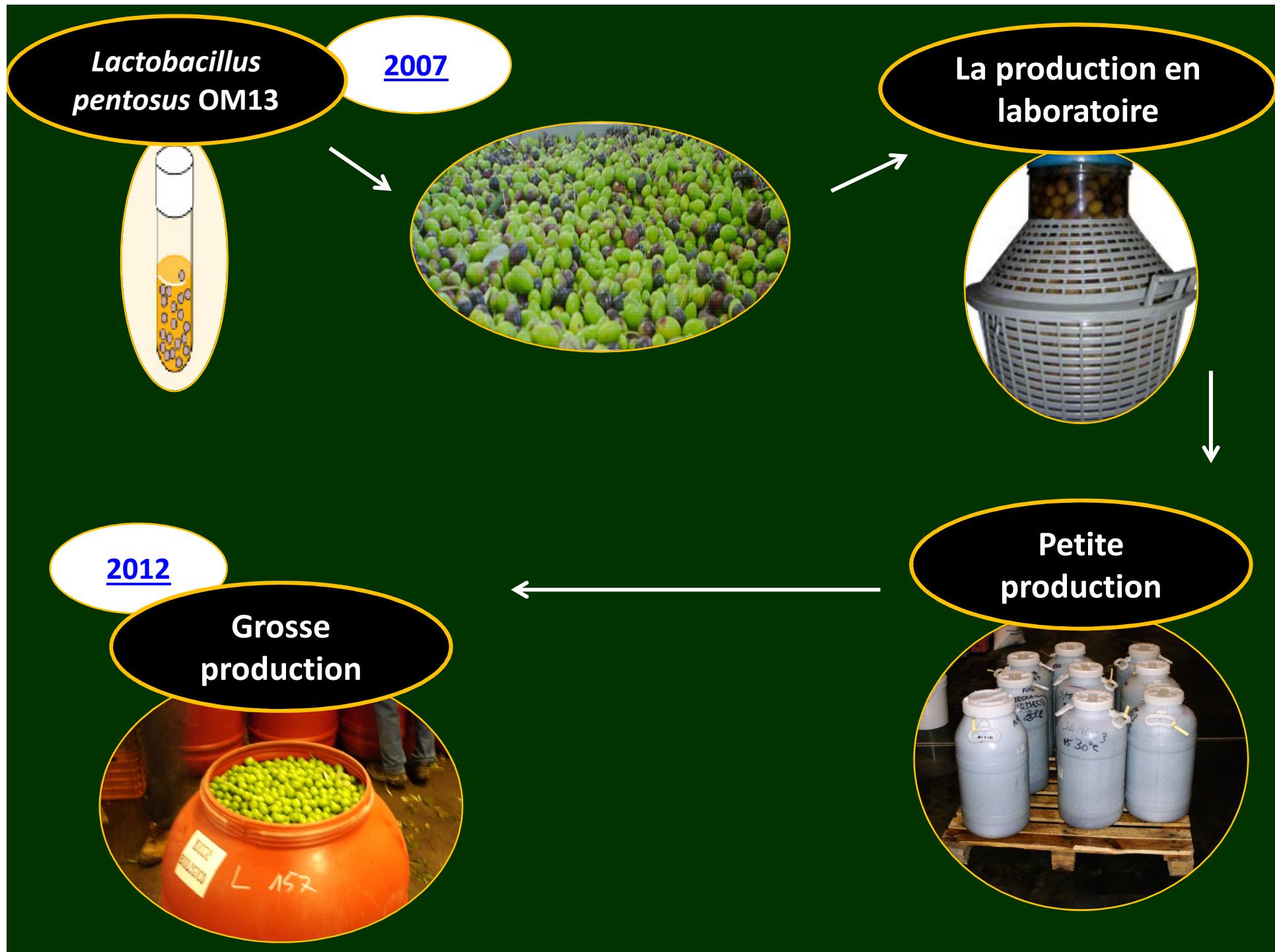
2012

2013

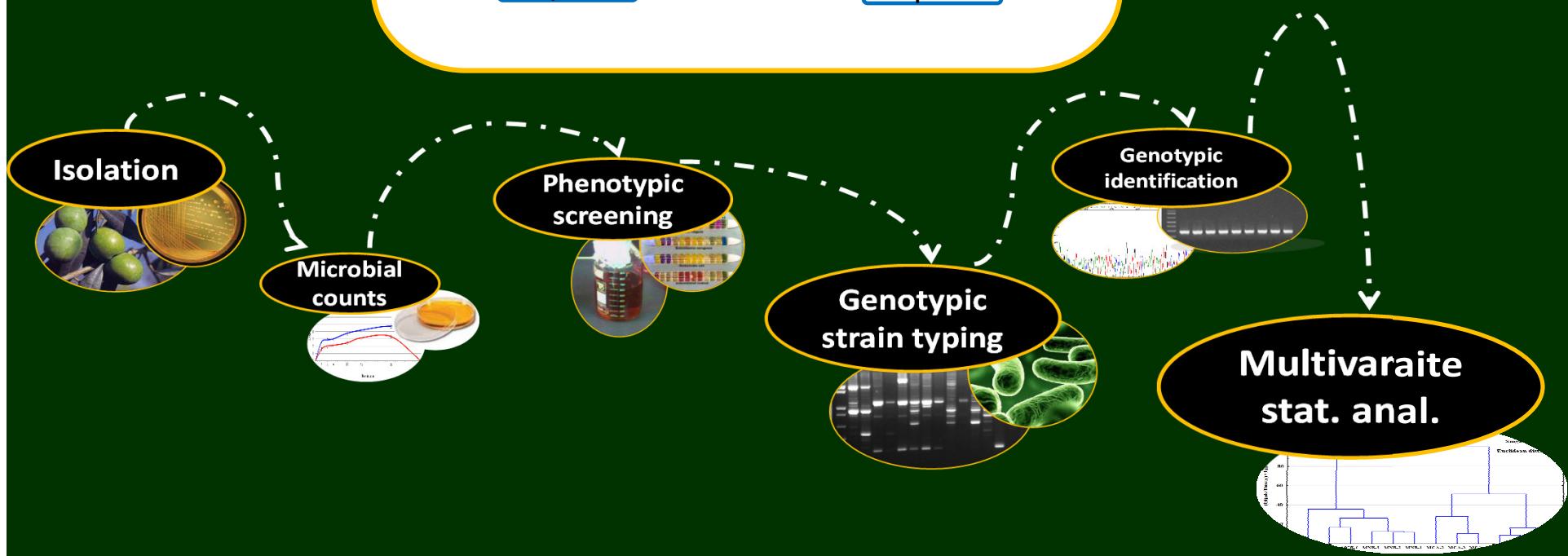
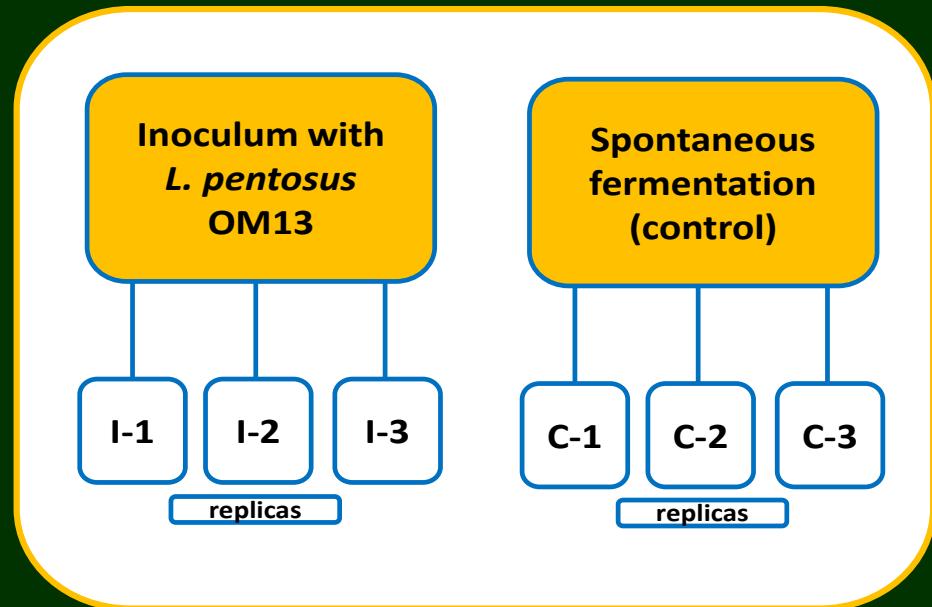
2014

**100 millions  
d'olives**



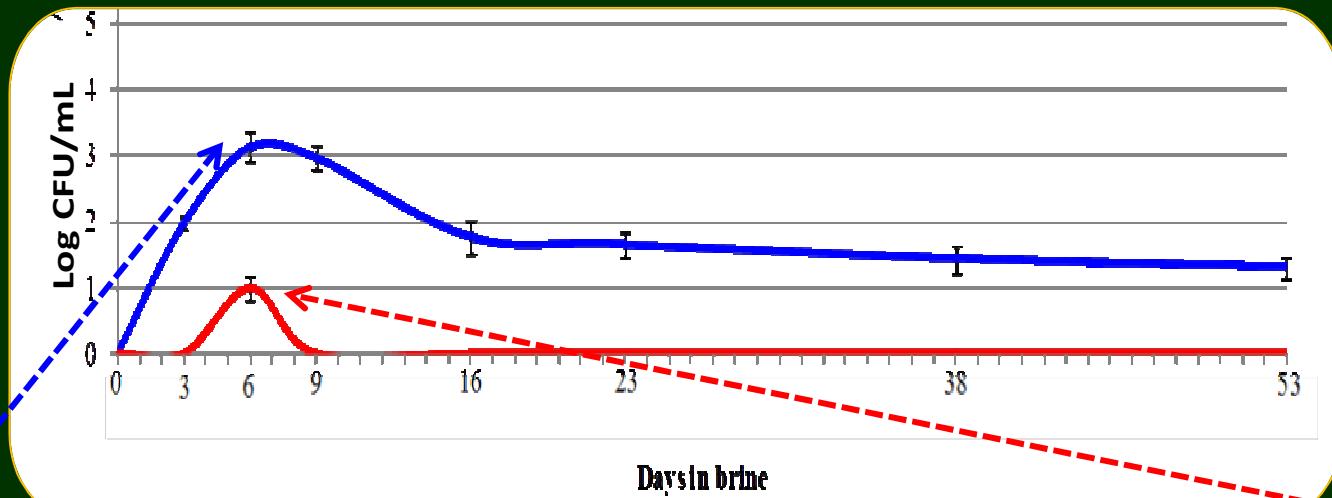


# *La conception et les méthodes expérimentales*



# Résultats des années «2007-2012» d'expérimentation

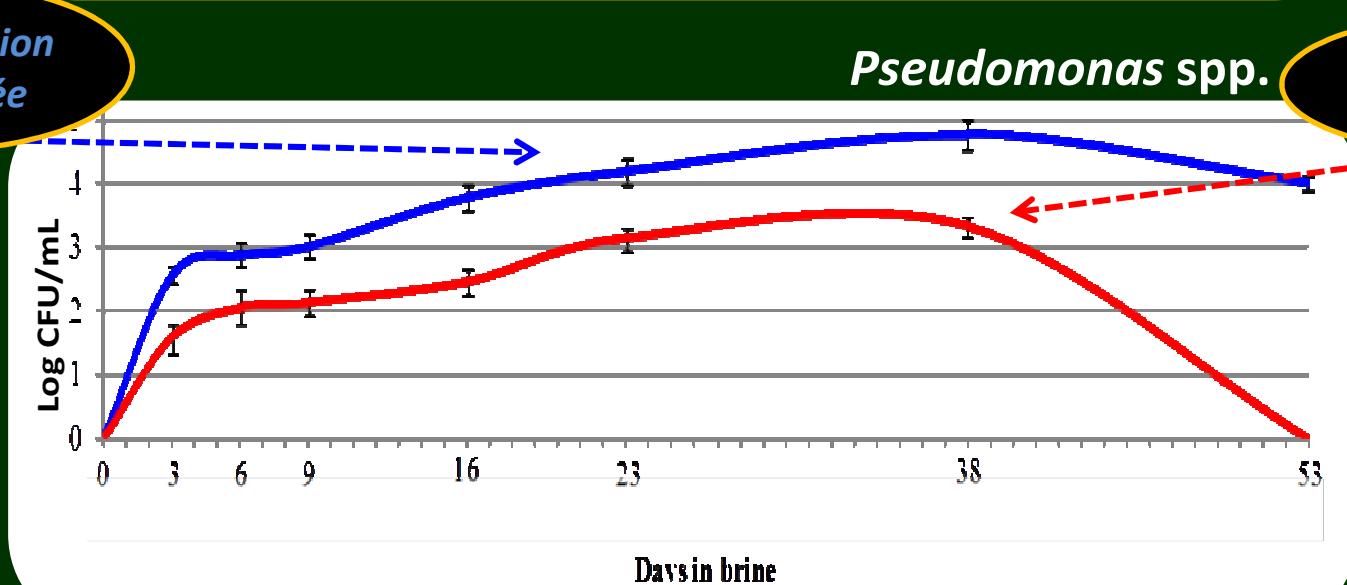
*Enterobacteriaceae*



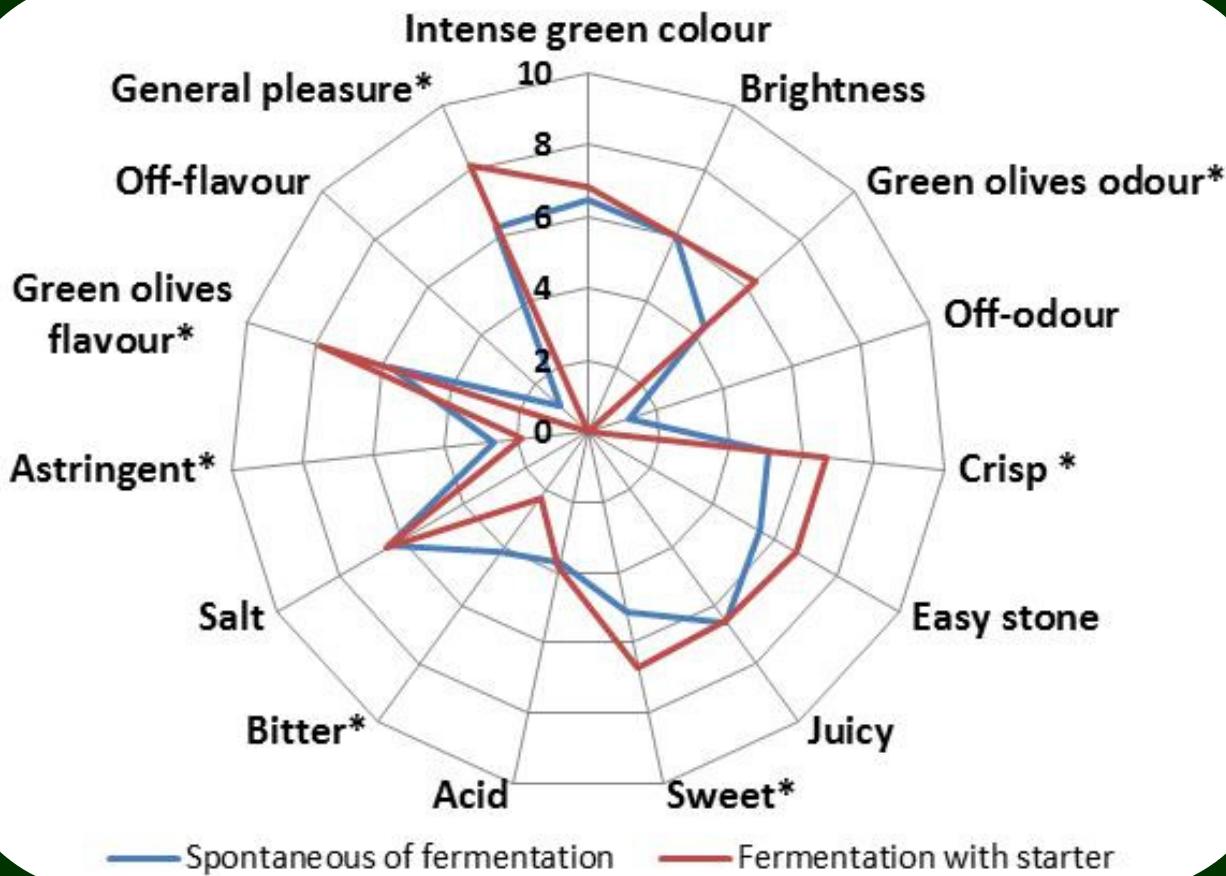
Fermentation  
spontanée

*Pseudomonas* spp.

*L. pentosus*  
OM13



# *Résultats des années «2007-2012» d'expérimentation*



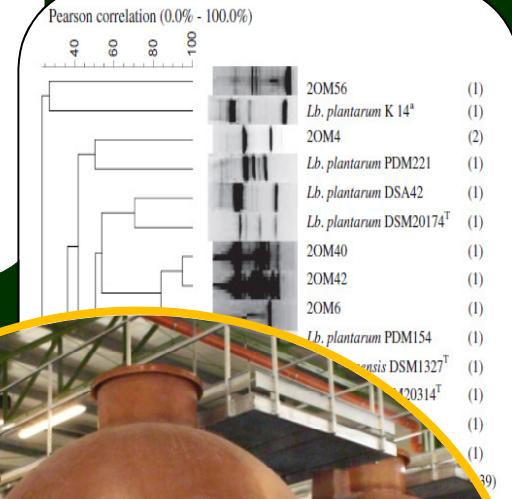
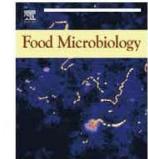
\*  $p \leq 0.05$

# Résultats des années «2007-2012» d'expérimentation



Food Microbiology 27 (2010) 162–170  
Contents lists available at ScienceDirect  
**Food Microbiology**  
journal homepage: [www.elsevier.com/locate/fm](http://www.elsevier.com/locate/fm)

Study of green Sicilian *trappista* cheese: microbiological, chemical and sensory analysis  
Maria Aponte<sup>a</sup>, Valeria Vento<sup>a</sup>, Giuseppe Avellone<sup>c</sup>, Carmela Farina<sup>b</sup>,



**1 x 10<sup>10</sup> cells/gr**

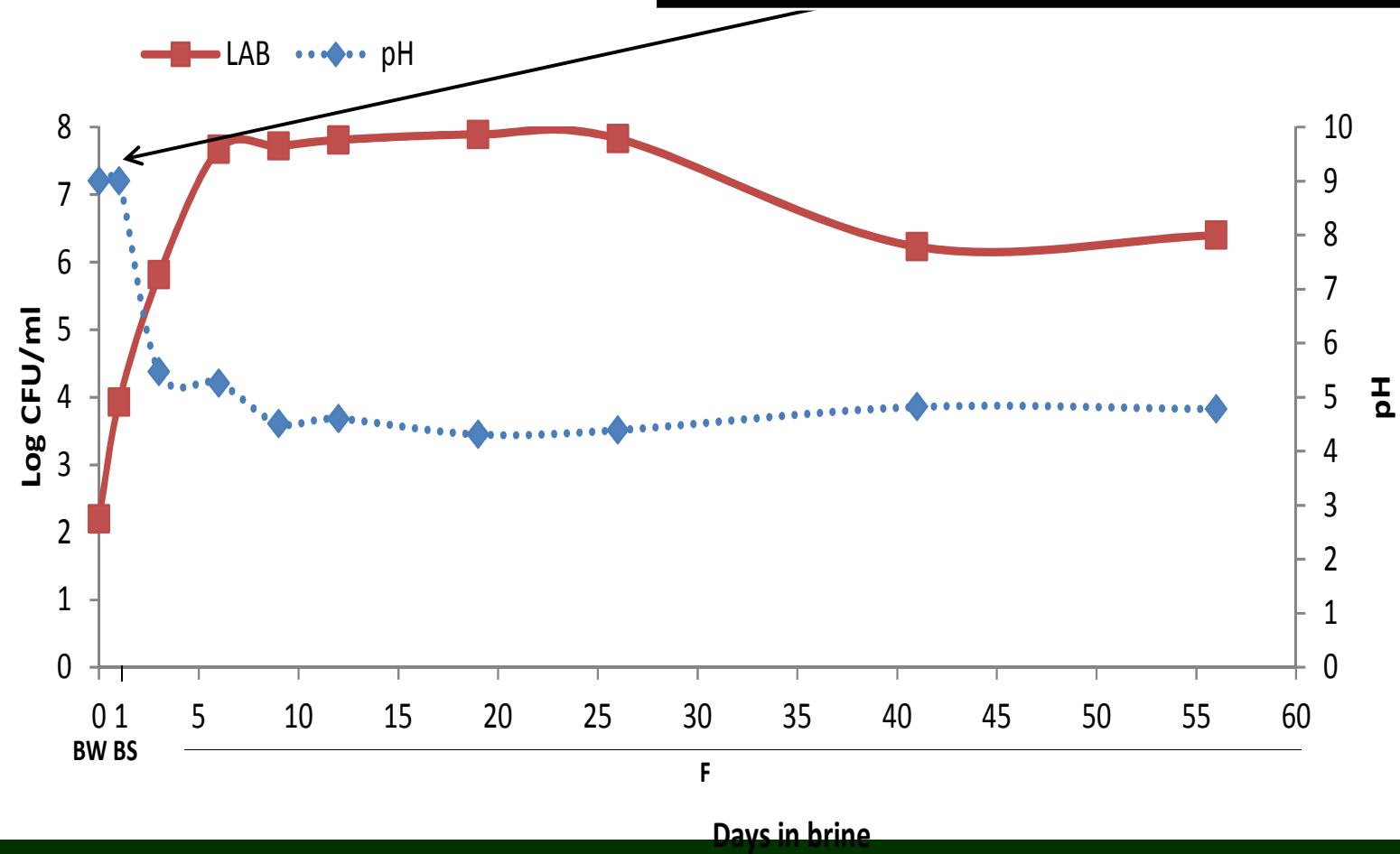
Food Microbiology  
journal homepage: [www.elsevier.com/locate/fm](http://www.elsevier.com/locate/fm)

Use of selected *Lb. plantarum* strains in the production of Sicilian trappista cheese  
2013 & Lallemand



# 2013 & Lallemand

*Inoculum Lb. pentosus OM13*



*Fermentation spontanée*

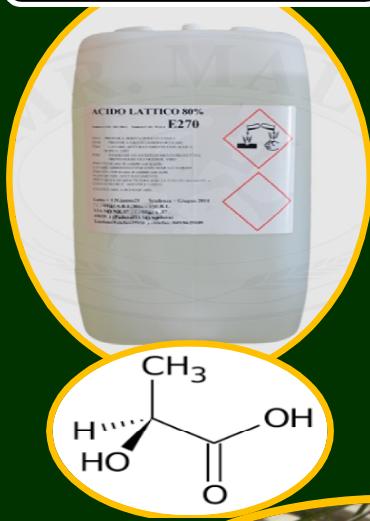


# 2014 - Lallemand

*L. pentosus OM13*



*Lactic acid*



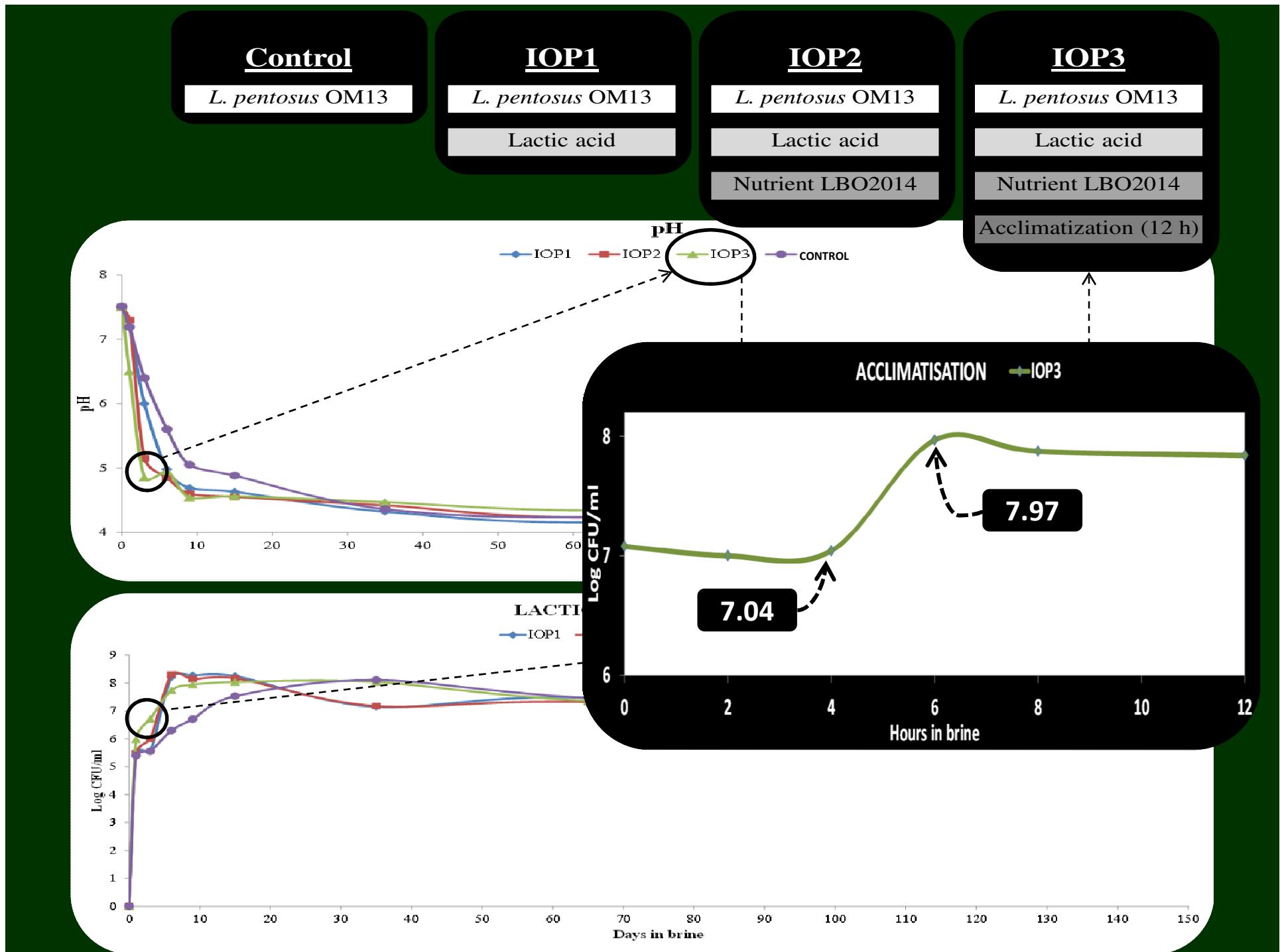
*Nutrient LPO2014*



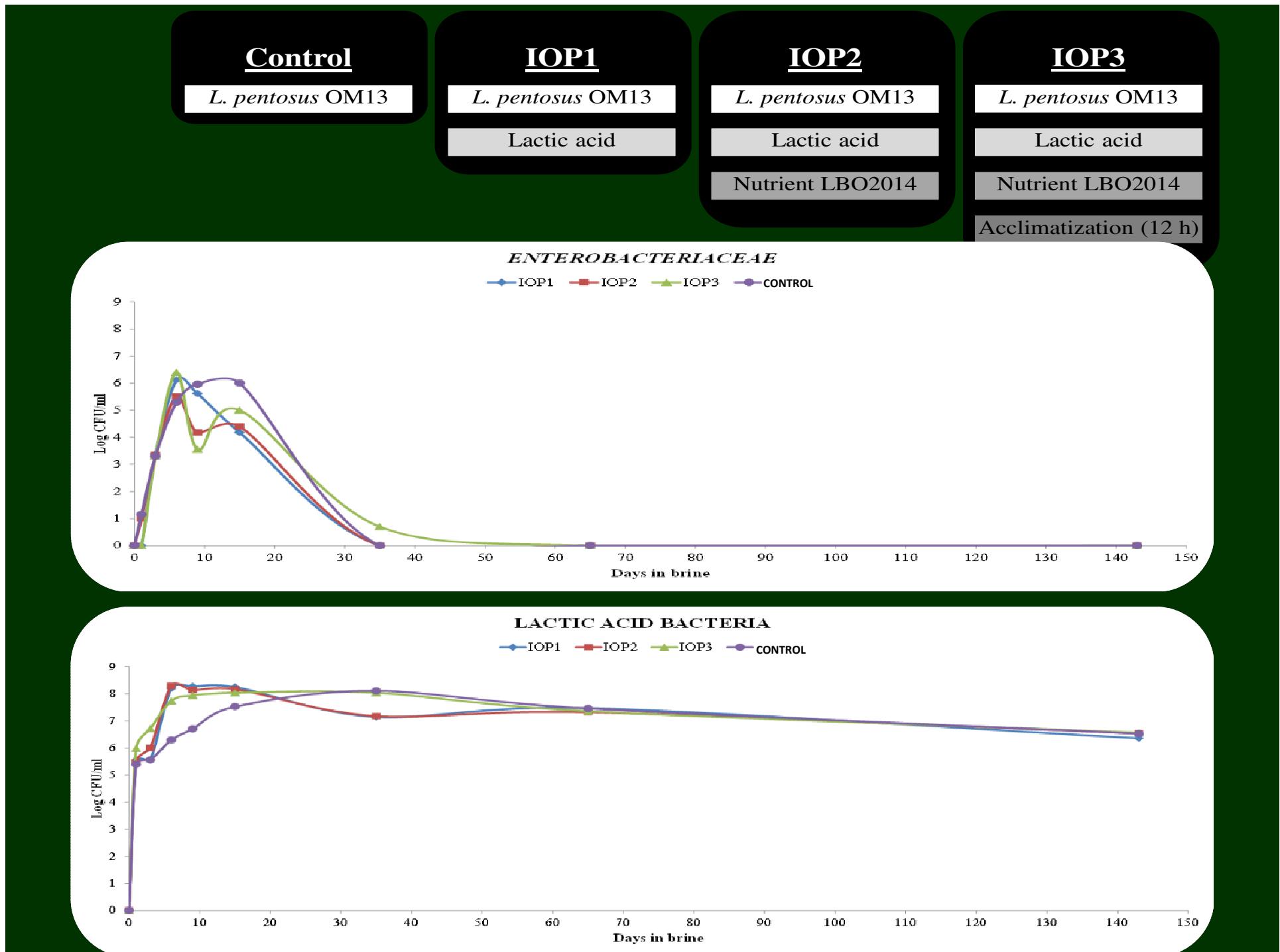
Acclimatisation



L'objectif:  
optimiser le protocole à utiliser  
pour inoculer les bactéries et  
réduire le temps de production





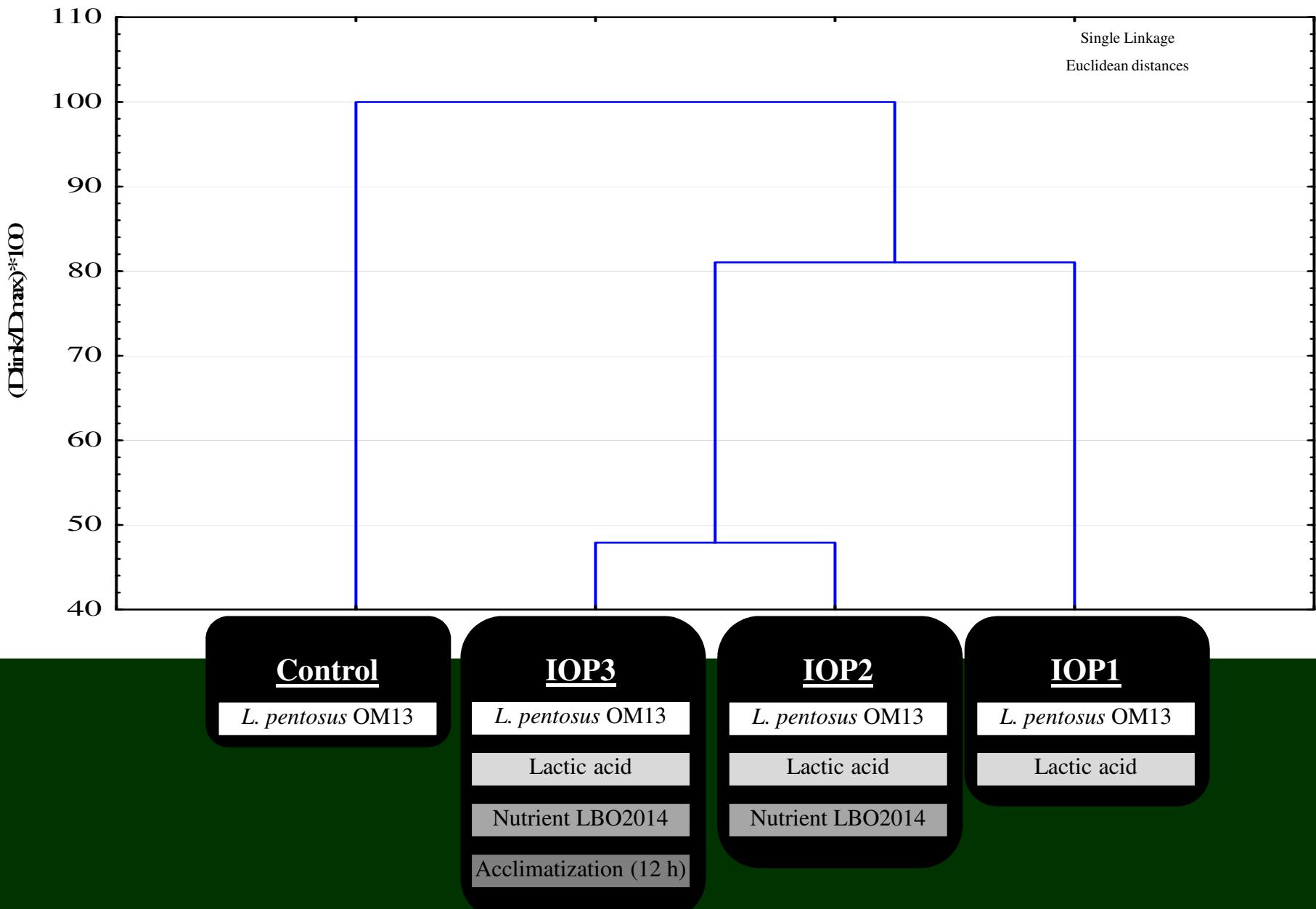






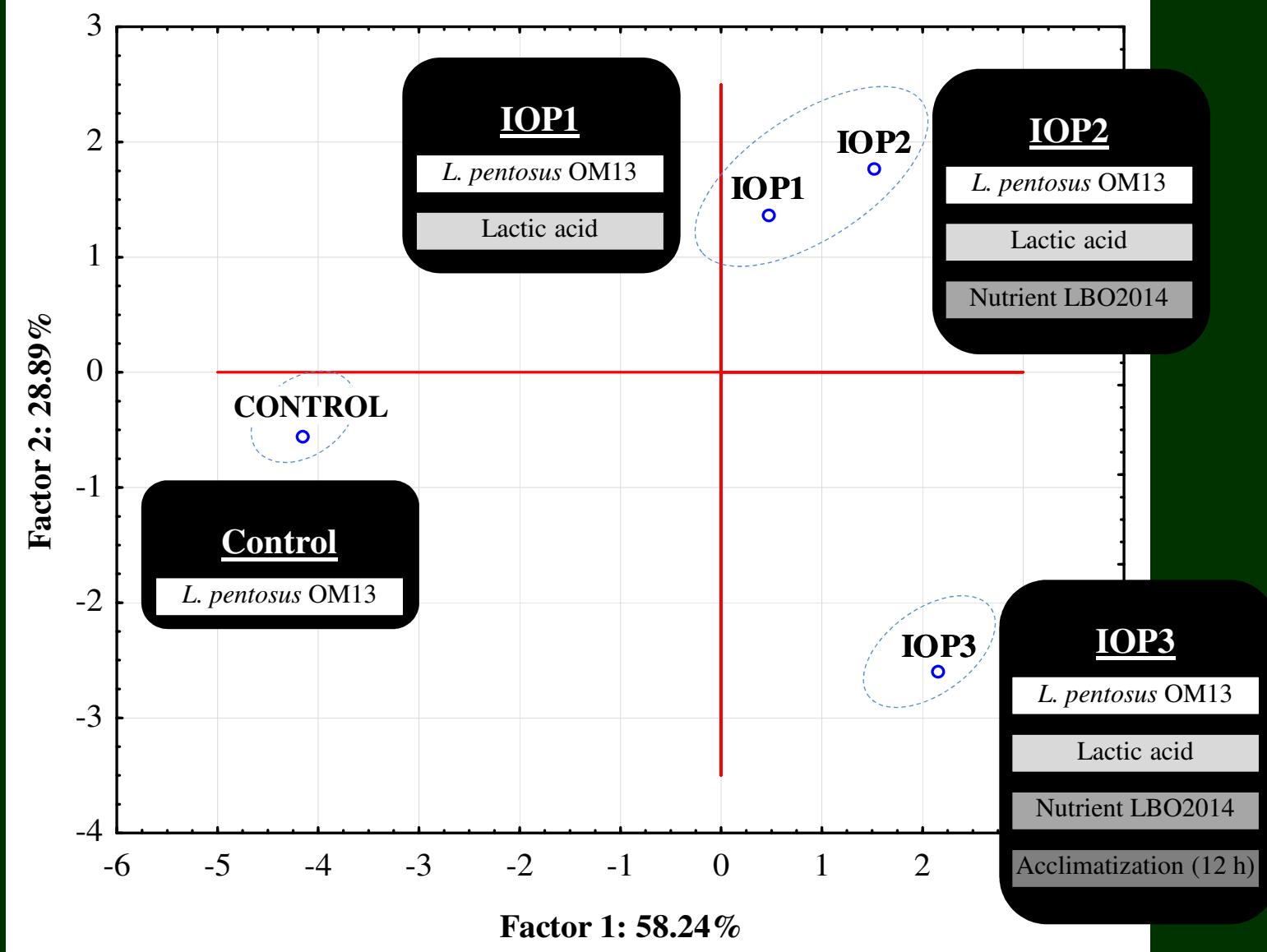
## HIERARCHICAL CLUSTER ANALYSIS

### To evaluate differences among trials



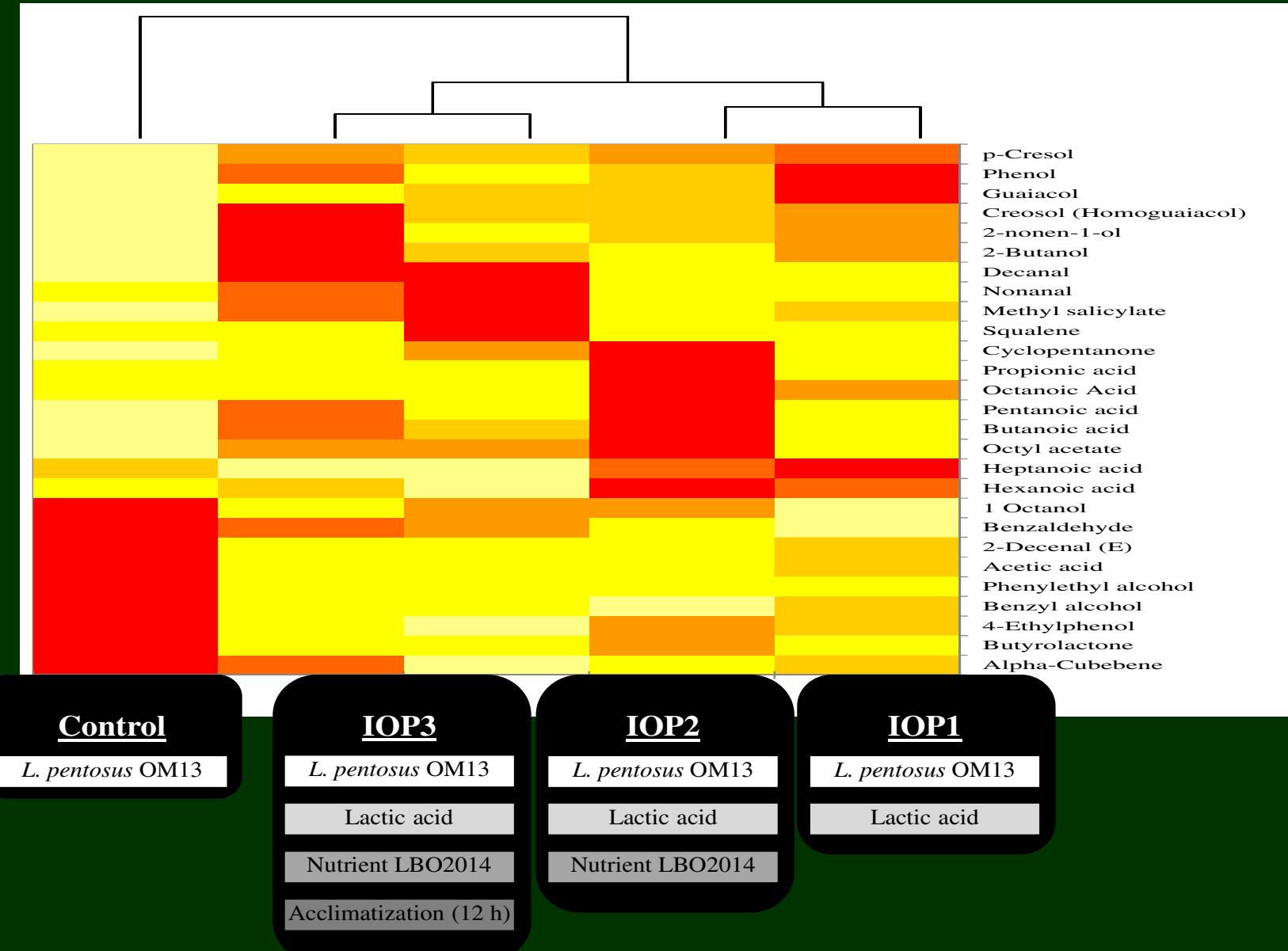
## PRINCIPAL COMPONENT ANALYSIS

### To evaluate differences among trials



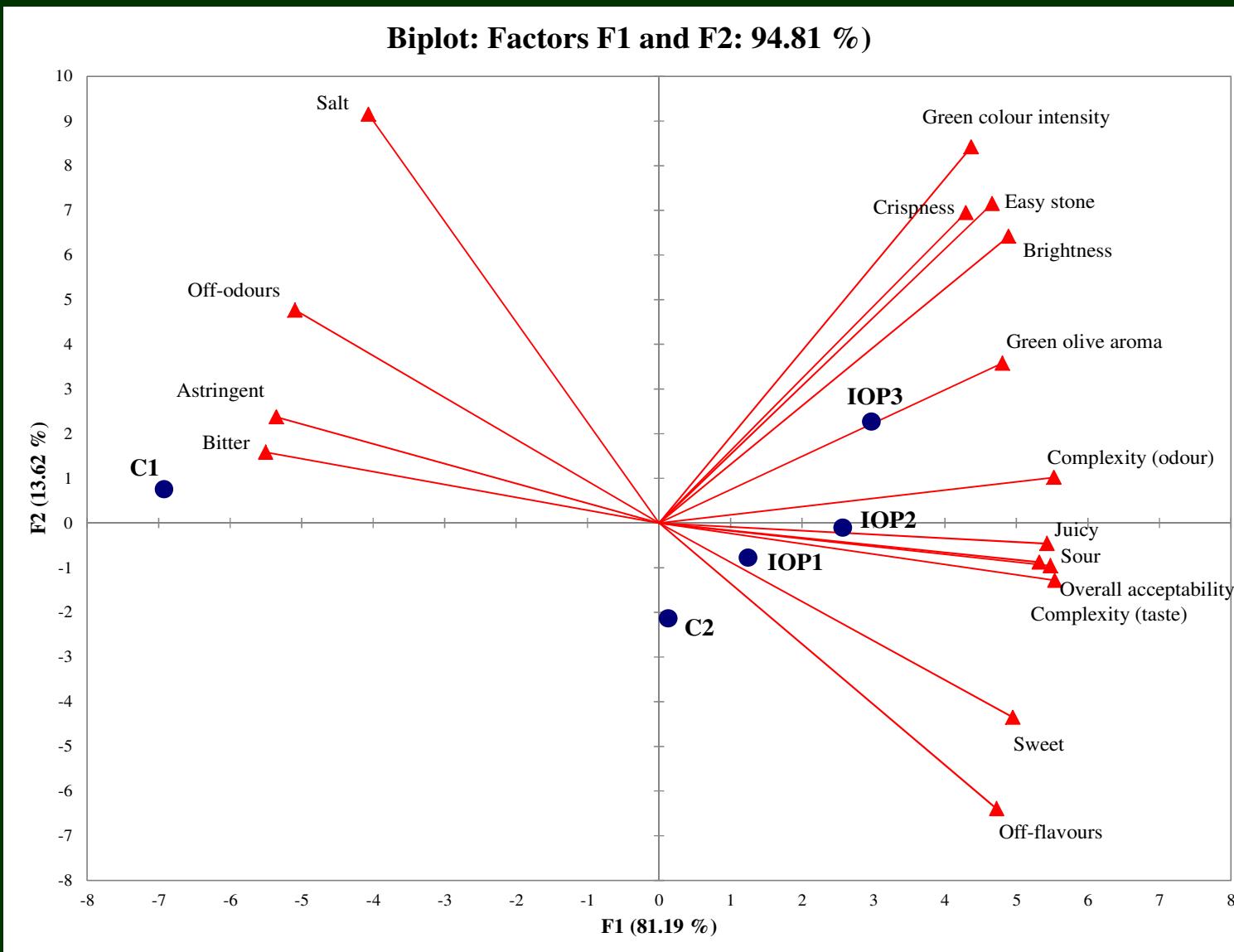
# HEAT MAP CLUSTERING ANALYSIS

## Les composés organiques volatils (arôme)



# BI PLOT GRAPH

## résultats de l'analyse sensorielle

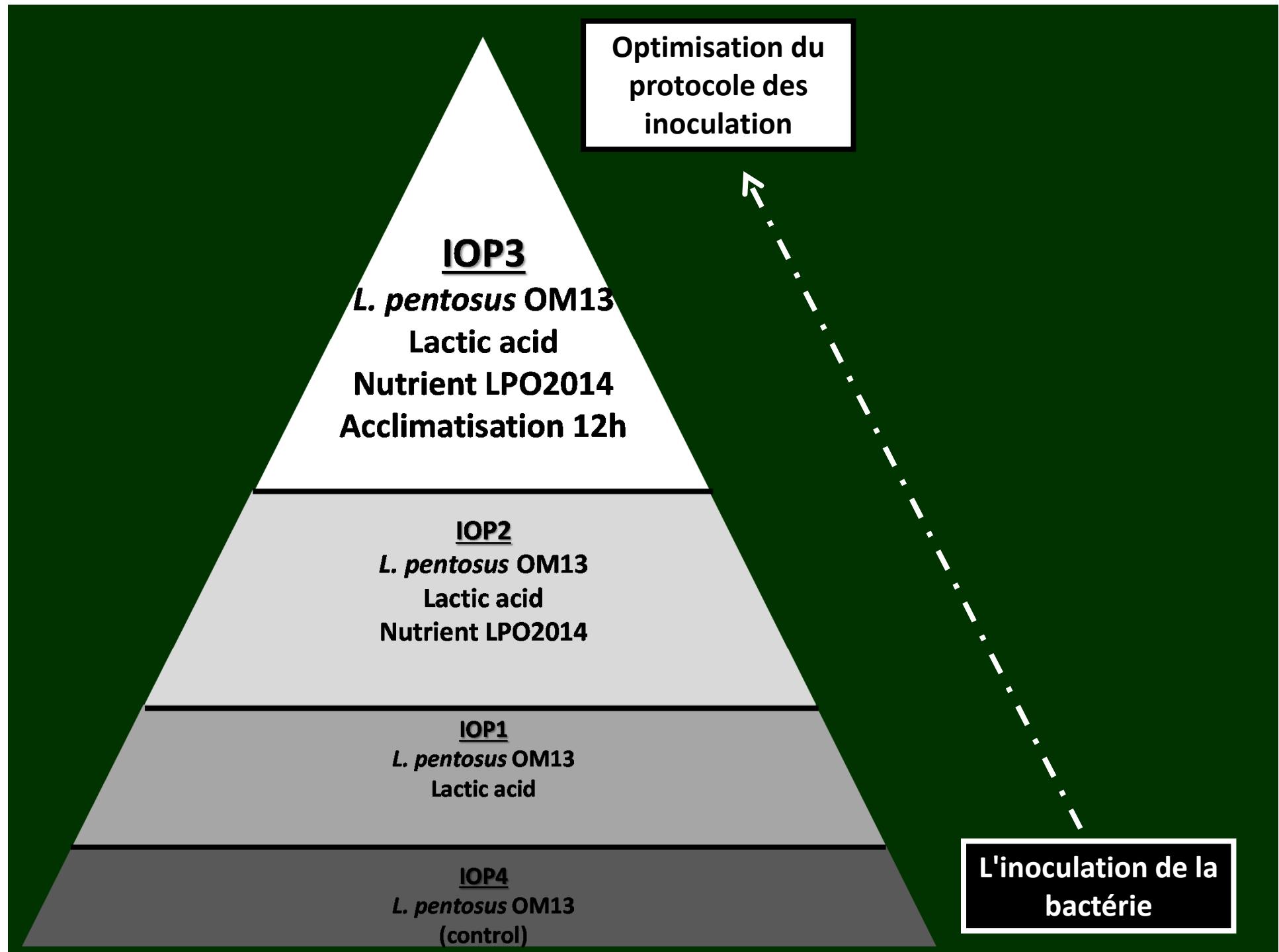


**IOP3**

- L. pentosus OM13*
- Lactic acid
- Nutrient LBO2014
- Acclimatization (12 h)

**IOP2**

- L. pentosus OM13*
- Lactic acid
- Nutrient LBO2014



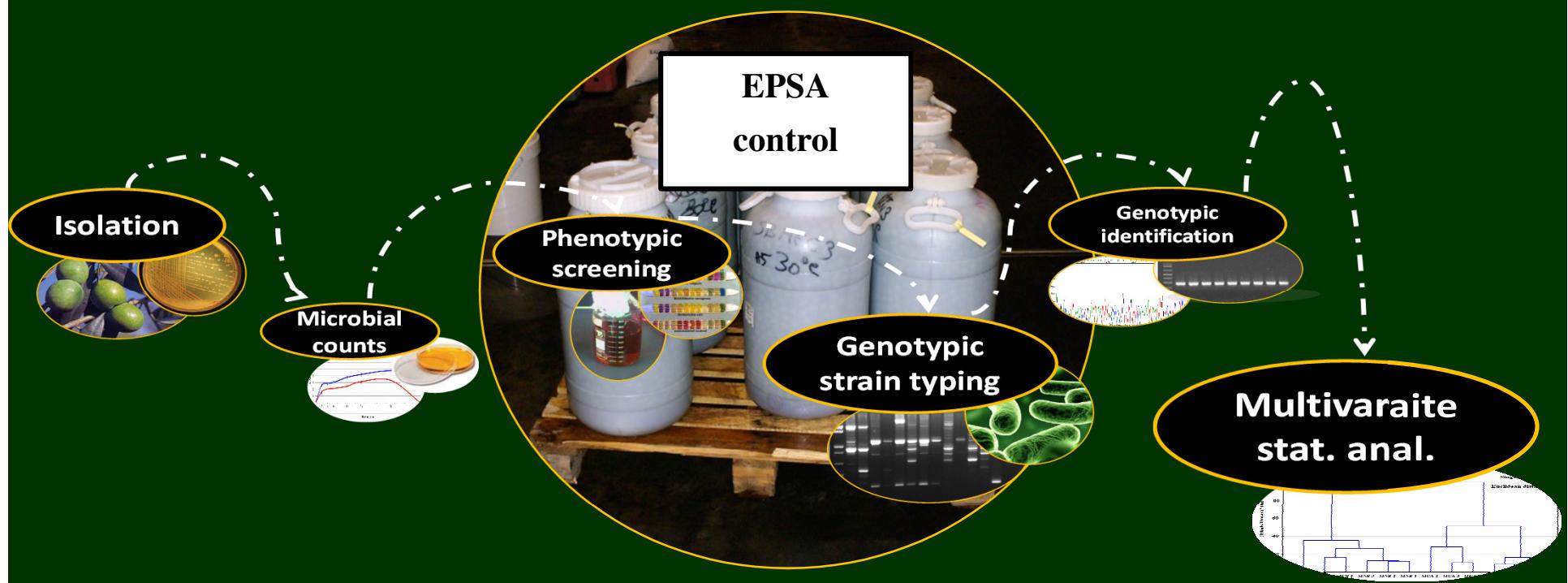


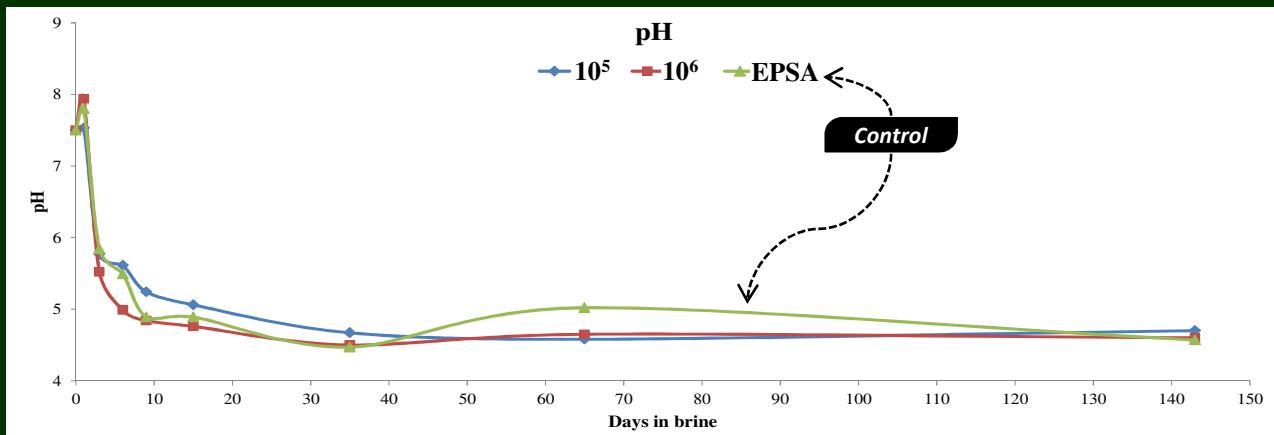
# 2014 & Lallemand

*L. pentosus* OM13

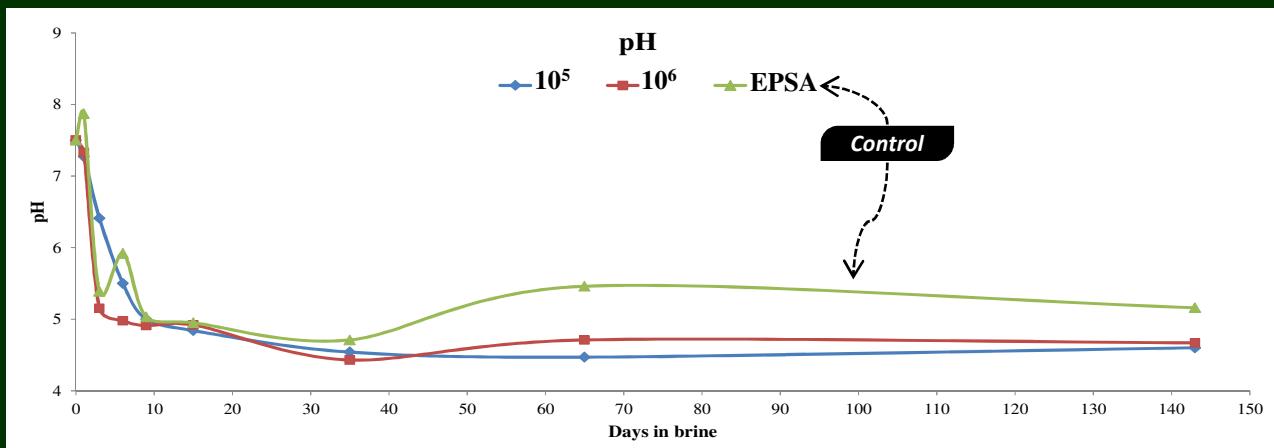
*L. pentosus* OM13  
+  
Nutrient LPO2014  
+  
Acclimatisation for 12 h

*L. pentosus* OM13  
+  
Nutrient LPO2014  
+  
Acclimatisation for 12 h  
+  
Lactic acid



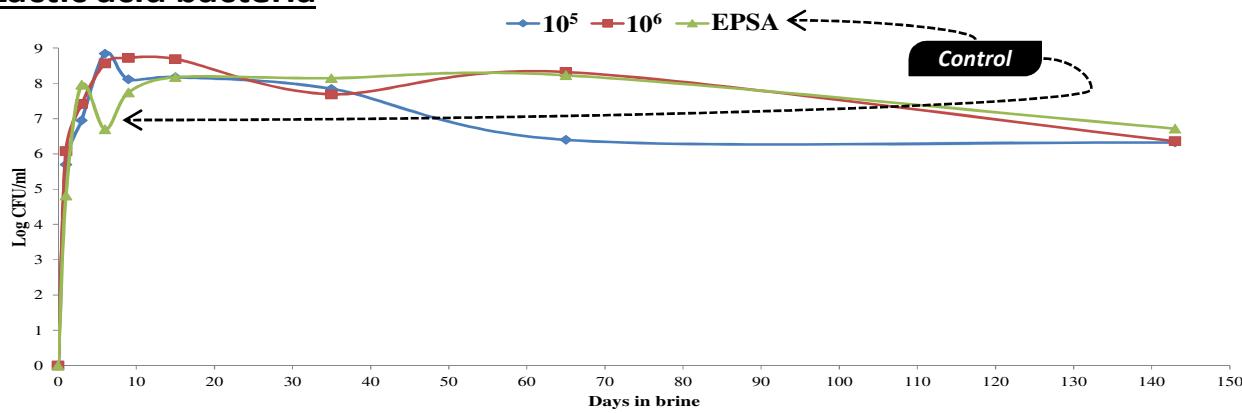


*L. pentosus* OM13  
+  
Nutrient LPO2014  
+  
Acclimatisation for 12 h



*L. pentosus* OM13  
+  
Nutrient LPO2014  
+  
Acclimatisation for 12 h  
+  
Lactic acid

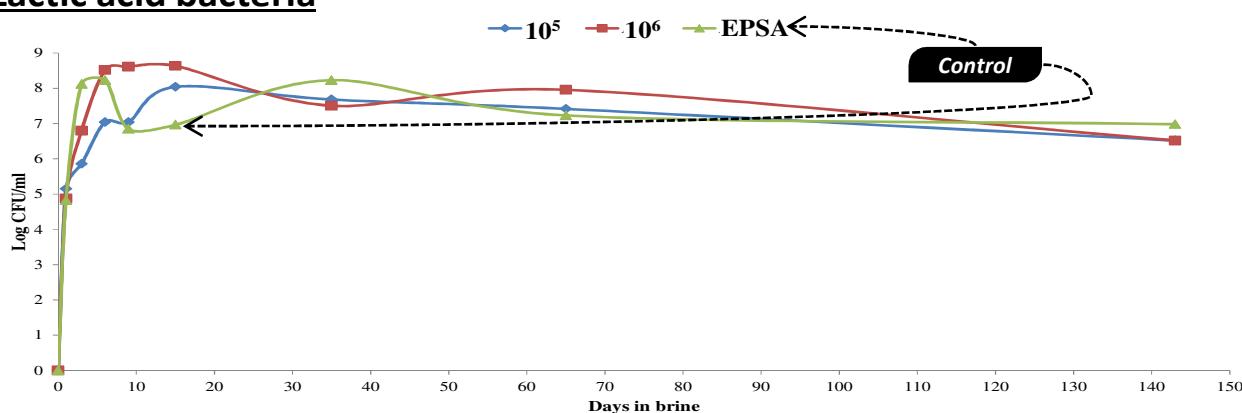
### Lactic acid bacteria



*L. pentosus* OM13  
+  
Nutrient LPO2014  
+  
Acclimatisation for 12 h

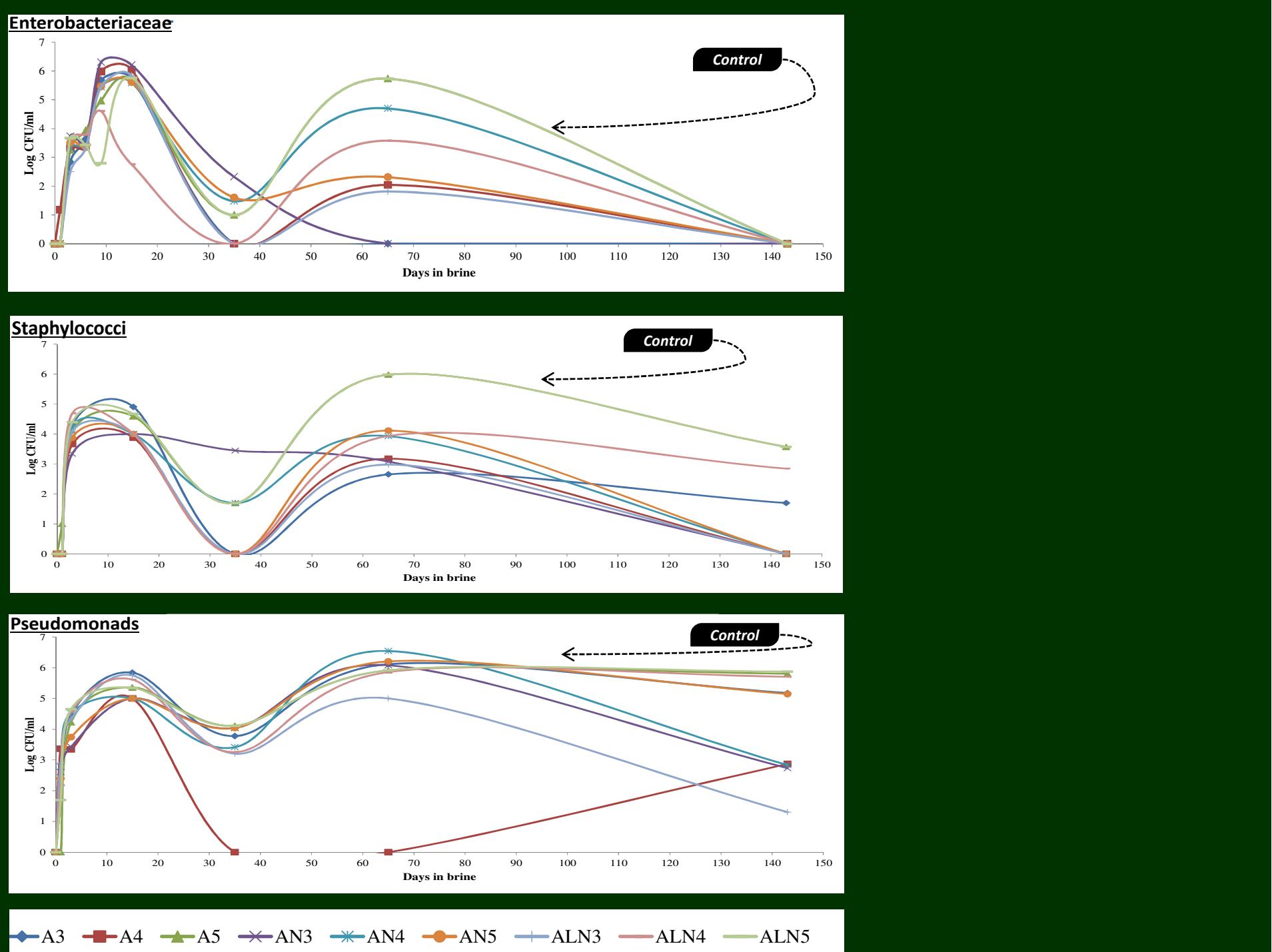


### Lactic acid bacteria



*L. pentosus* OM13  
+  
Nutrient LPO2014  
+  
Acclimatisation for 12 h  
+  
Lactic acid



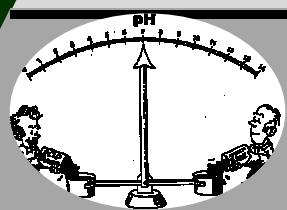




*Notre  
recherche*

## Nutraceutiques probiotiques

La saveur et  
la typicité



Pocessus  
reproductible

Sécurité  
hygiénique



*L'utilisation de la  
culture starter*

# LES MÉTHODES DE RÉCOLTE

Manuel



Mécanique



long travail

haute qualité

coûts élevés

courte période

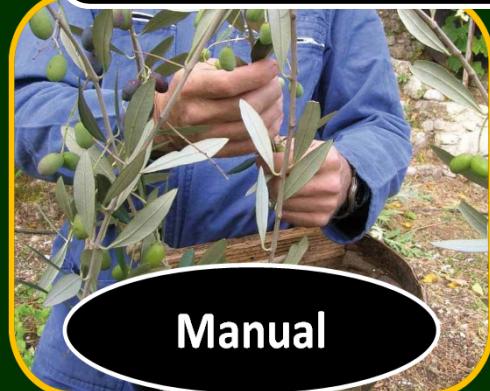
faible qualité

réduction des coûts

## EXPERIMENTATIONS

2013-2014

effets de la récolte mécanique des olives sur la qualité du produit final «cultivar Nocellara del Belice-Sicile»



Manual



Mechanical

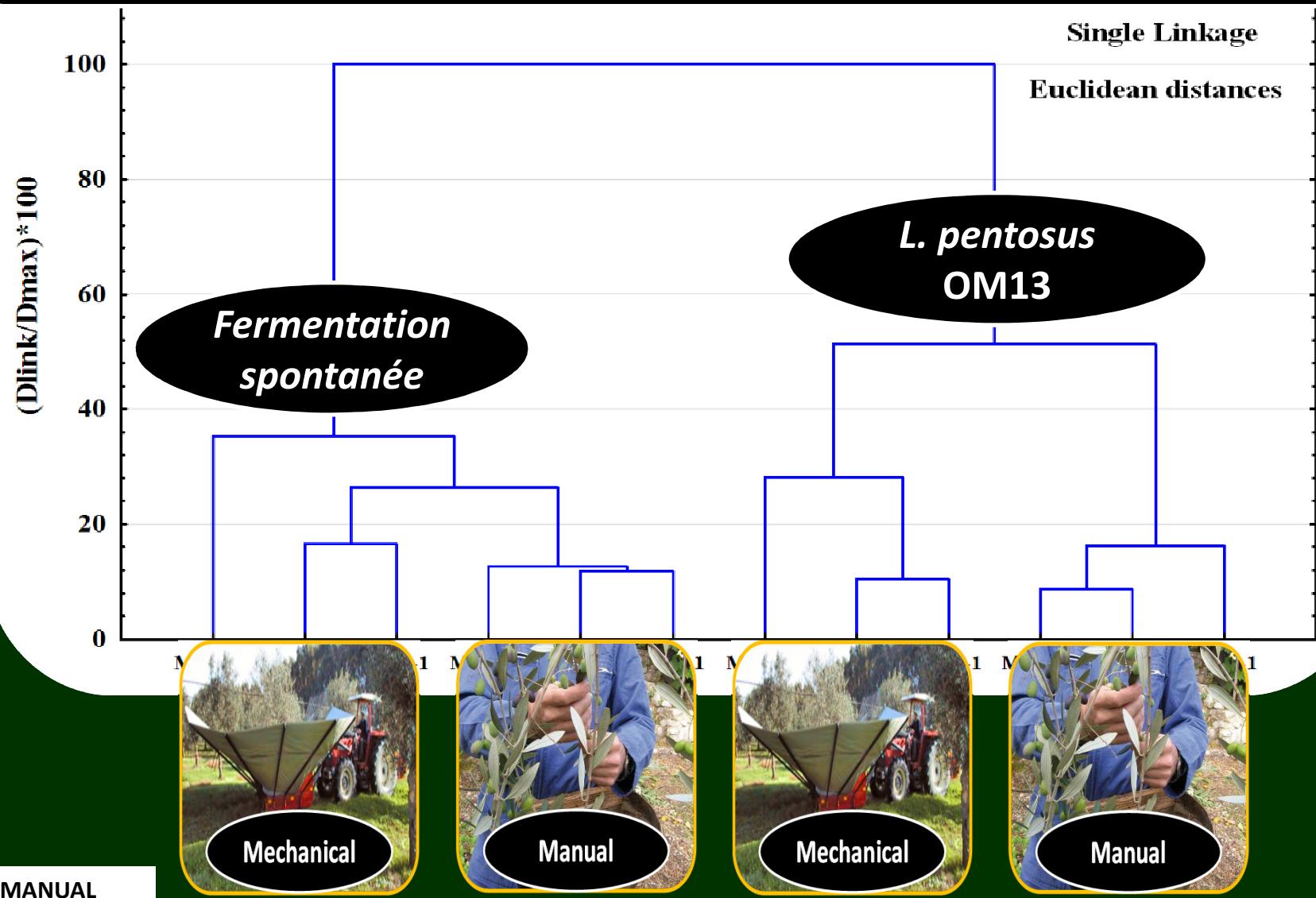
*Spontaneous  
fermentation*



*L. pentosus*  
OM13

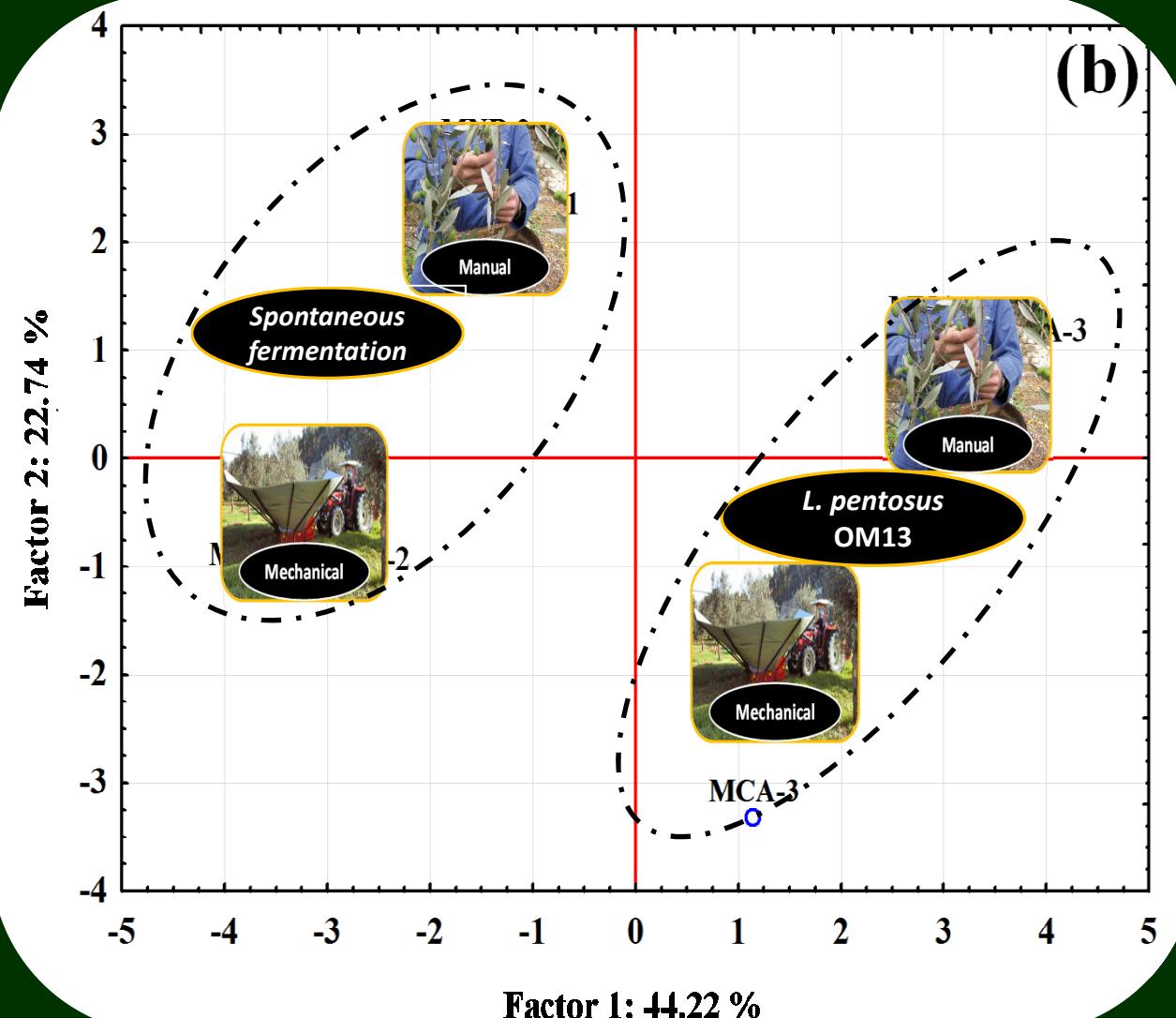
## HIERARCHICAL CLUSTER ANALYSIS

by using area under growth/decline curves of LAB, yeasts, enterobacteria,  
pseudomonads, staphylococci, CPS as well as pH values



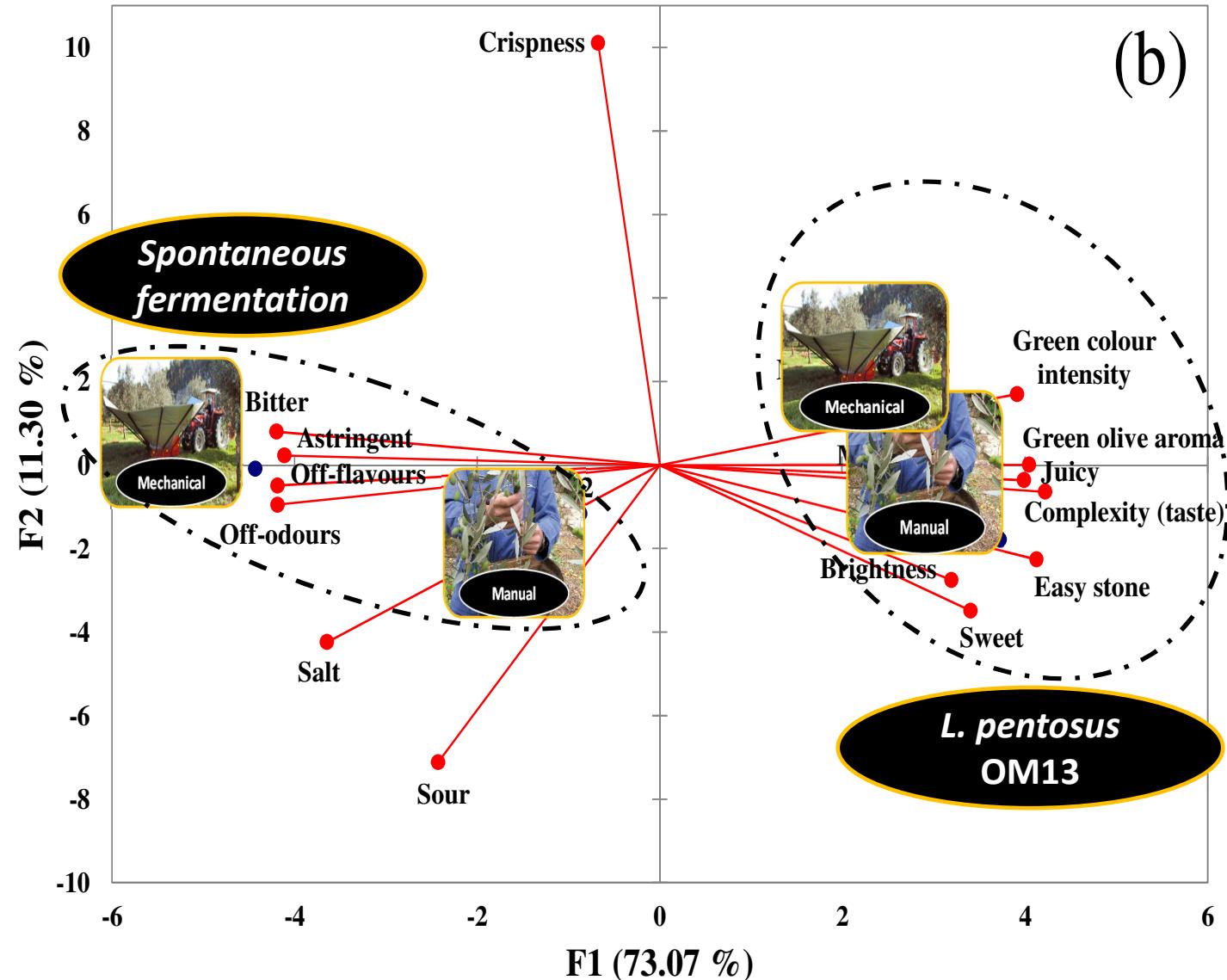
# PRINCIPAL COMPONENT ANALYSIS

données microbiologiques et pH



## BI PLOT GRAPH

### résultats de l'analyse sensorielle



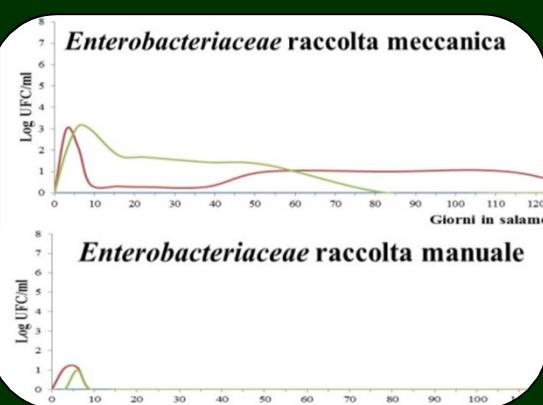
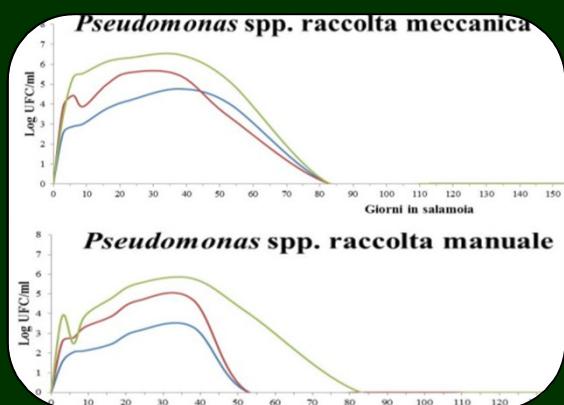
# Submitted to Food Control Journal

## **1 Effect of manual and mechanical harvesting on 2 microbiological, chemical and sensory characteristics of 3 fermented table olives (cv. Nocellara del Belice)**

5 Alessandra Martorana<sup>1</sup>, Giancarlo Moschetti<sup>1\*</sup>, Tiziano Caruso<sup>1</sup>, Onofrio Corona<sup>1</sup>, Nicola  
6 Francesca<sup>1</sup>, Luca Settanni<sup>1</sup>

7  
8 <sup>1</sup>Department of Agricultural and Forestry Science, University of Palermo, Viale delle Scienze 4,  
9 90128 Palermo, Italy

10  
11 **Correspondence:** Giancarlo Moschetti, Department of Agricultural and Forest Science, Università  
12 degli Studi di Palermo, Viale delle Scienze 4, 90128 Palermo, Italy. Tel.: +3909123896050; fax:  
13 +390916515531; e-mail address: [giancarlo.moschetti@unipa.it](mailto:giancarlo.moschetti@unipa.it)



# Submitted to *Food Microbiology Journal*

1 **Monitoring of natural fermentation of green table olives (cv.**  
2 **Nocellara del Belice) collected from trees trained into two**  
3 **different agronomic conditions: irrigation and not irrigation**

4

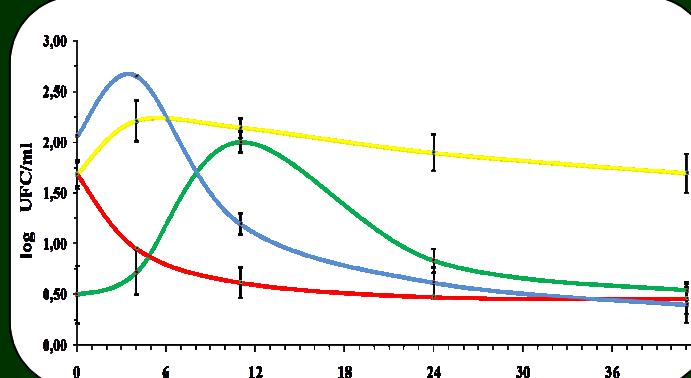
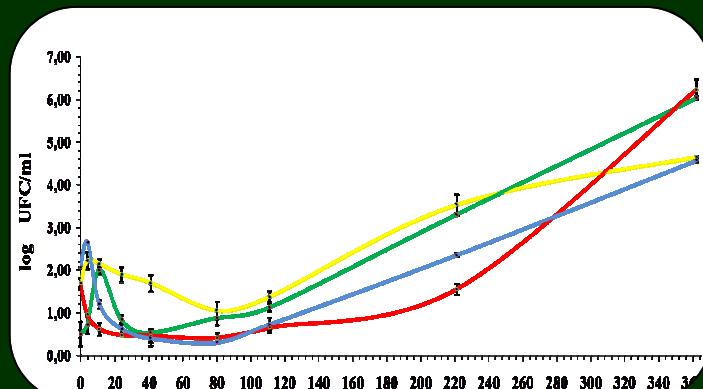
5 Giancarlo Moschetti<sup>1\*</sup>, Tiziano Caruso<sup>1</sup>, Alessandra Martorana<sup>1</sup>, Onofrio Corona<sup>1</sup>, Nicola  
6 Francesca<sup>1</sup>, Luca Settanni<sup>1</sup>

7

8 <sup>1</sup>Department of Agricultural and Forestry Science, University of Palermo, Viale delle Scienze 4,  
9 90128 Palermo, Italy

10

11 **Correspondence:** Giancarlo Moschetti, Department of Agricultural and Forest Science, Università  
12 degli Studi di Palermo, Viale delle Scienze 4, 90128 Palermo, Italy. Tel.: +3909123896050; fax:  
13 +390916515531; e-mail address: [giancarlo.moschetti@unipa.it](mailto:giancarlo.moschetti@unipa.it)





Je vous remercie !!!!!



1  
olive

2007

Je vous remercie!!!!!!

100  
millions  
d'olives

2014

*Olive*  
*e*  
*deux*

*divisé*  
*n*  
*parties*

### Control

*L. pentosus* OM13

### IOP1

*L. pentosus* OM13

Lactic acid

### IOP2

*L. pentosus* OM13

Lactic acid

Nutrient LBO2014

### IOP3

*L. pentosus* OM13

Lactic acid

Nutrient LBO2014

Acclimatization (12 h)

### Control

*L. pentosus* OM13

### IOP1

*L. pentosus* OM13

Lactic acid

### IOP2

*L. pentosus* OM13

Lactic acid

Nutrient LBO2014

### IOP3

*L. pentosus* OM13

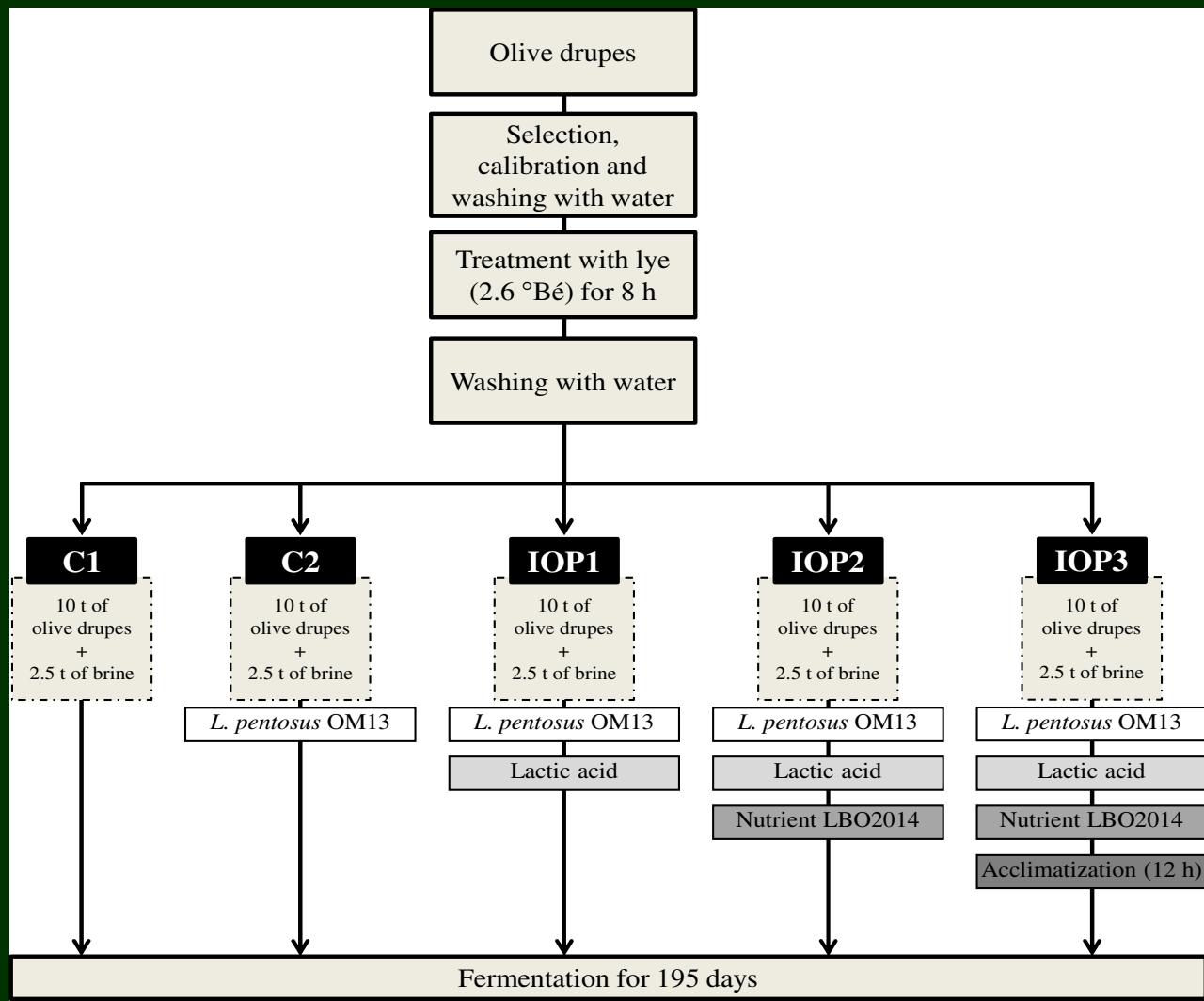
Lactic acid

Nutrient LBO2014

Acclimatization (12 h)



# Experimental design for manufacturing of green table olives.



Abbreviation: °Bé, gradi Baumé the codes C1 and C2 refer to the control trials; the codes from IOP1 to IOP3 refer to the experimental trials; *L.*, *Lactobacillus*.

