

Multi actor culinary breeding methodologies:  
from theory to practical example in Europe  
Case studies in France

A photograph of a field of amaranth plants, showing their characteristic dense, upright growth and reddish-purple flowers. The image is slightly blurred and has a soft, warm color palette.

**Amaranthus,  
Camille Vindras Fouillet**

# Why breeding on culinary criteria ?

- **Improve quality product**

if heritable traits

if correlated with good performance



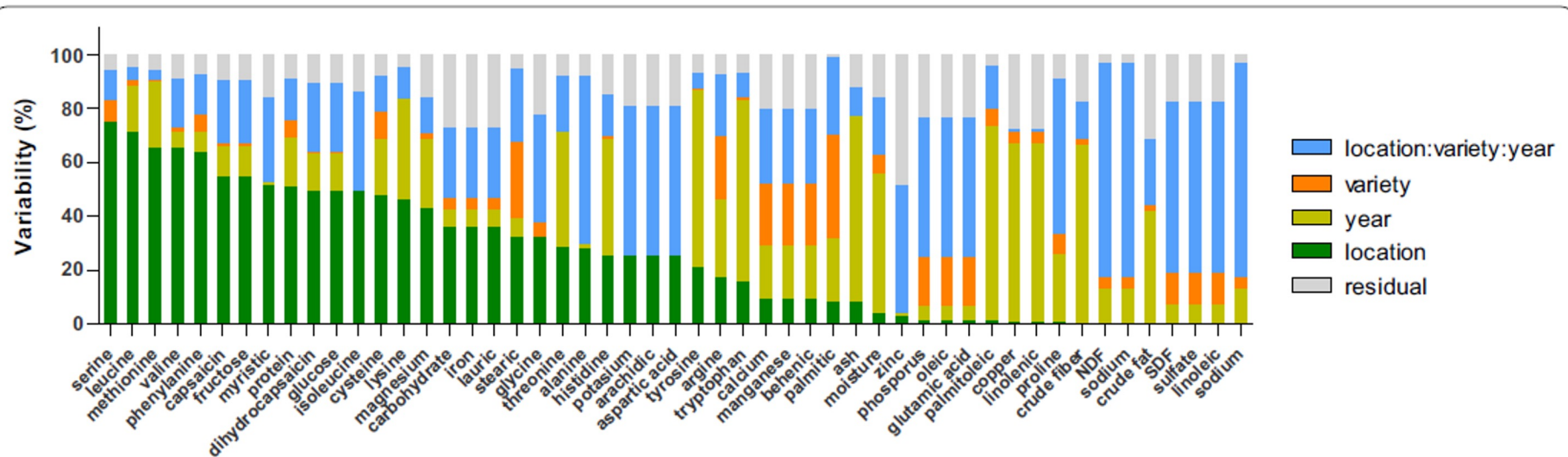
- **Diversify and adapt crop to different consumers, process**

⇒ To better promote/valorize product?

⇒ to better feed people? (tasty, diversified)

- **Animate a multi-actor network along the Farm to Fork stream**

# Importance of bibliography



**Fig. 1** Variability proportion affecting on natural variation in analytes. Variability of each analyte explained by the location effect was used to order analytes on the X-axis (from the highest to the lowest)

A comparison of the nutrient composition and statistical profile in red pepper fruits (*Capsicum annuum* L.) based on genetic and environmental factors. Kim et al. *Appl Biol Chem* (2019) 62:48.

# For what purpose ?

- **Understanding**

- Studying the G\*E interaction to adapt crops to environment
- Identification of heritable traits

- **Breeding for heritable traits**

- **Characterizing**

- The typicality of a product (genotype\*environment)
- The diversity

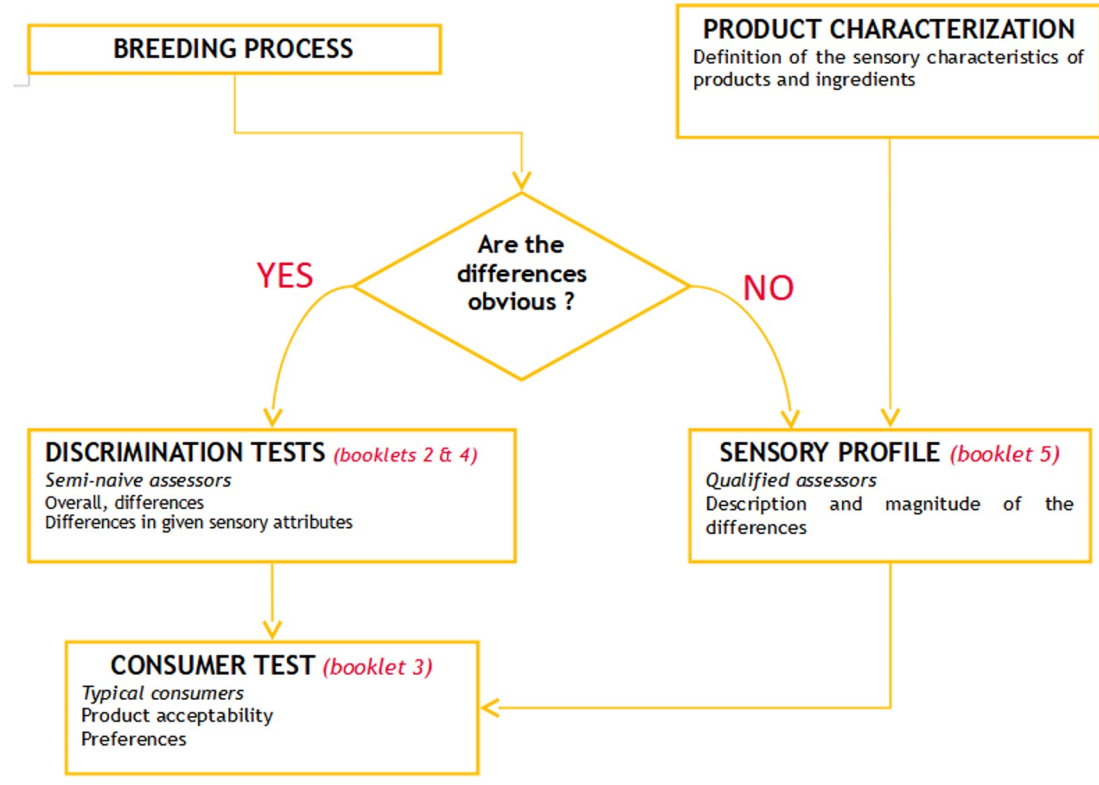
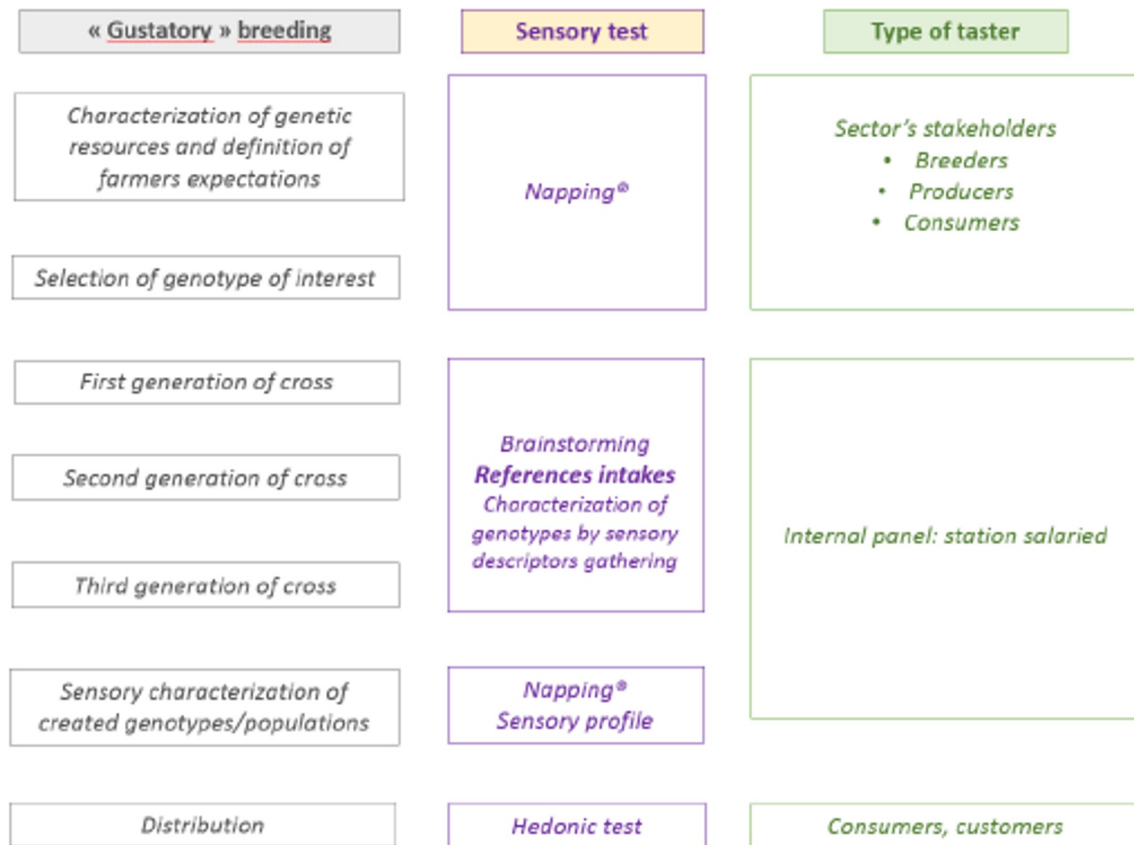


Figure 1: Selection criteria to choose suitable tests

(«De la perception à la mesure sensorielle», Fortin J. et Durand, N., Ed. La Fondation des gouverneurs, 2004)

# When in the breeding process ?



# Who ?

The type of panels impact the choice of the sensory test

## Naïve assessors

*Consumers...*

## Semi-naïve assessors

*farmers, bakers...*

## Qualified assessors

*trained panel, chief...*

Sensory test	Type of quality	Type of data	Min. nb of tasters	Max. nb of products	Taster's expertise	Estimated time	Disadvantages
Ranking test	Sensory	Rank sums	12	6	No trained	1h	No more than 3 descriptors
Hedonic test	Hedonic	Ranks or quantitative	60	7	No trained	7h	Need for many taster
Sensory brainstorming	Sensory	Qualitative	10	-	No trained but expert <sup>1</sup>	2/3h	Only qualitative data
Sensory profile	Sensory	Quantitative	10	6/sessions	Trained	1h (+7h training session)	Time and money consuming
Napping	Sensory	Sensory distance + qualitative	10	12	No trained but expert	1h	No possibility to compare between sessions

# Where ?

Specificity of sensory analysis in **participatory and frugal** research on **fresh product**

## Quantitative descriptive analysis

- Panelists develop a predefined terminology beforehand
- Panelists evaluate samples in separate booths
- Panelists are discouraged from discussing results afterwards
- Scoring is by a predefined scale
- The results are analysed using statistical methods
- Can lead to inconsistency of results



Too expensive in time and money (panel remuneration, panel training, laboratory...)

⇒ **alternative methodologies less expensive but reliable**



Heterogeneity and seasonality of product

⇒ **representativity and homogeneity of sample**

**On-field sensory analyses**

New sensory methodologies based on **spontaneity** and **panel expertise**

Napping

CATA

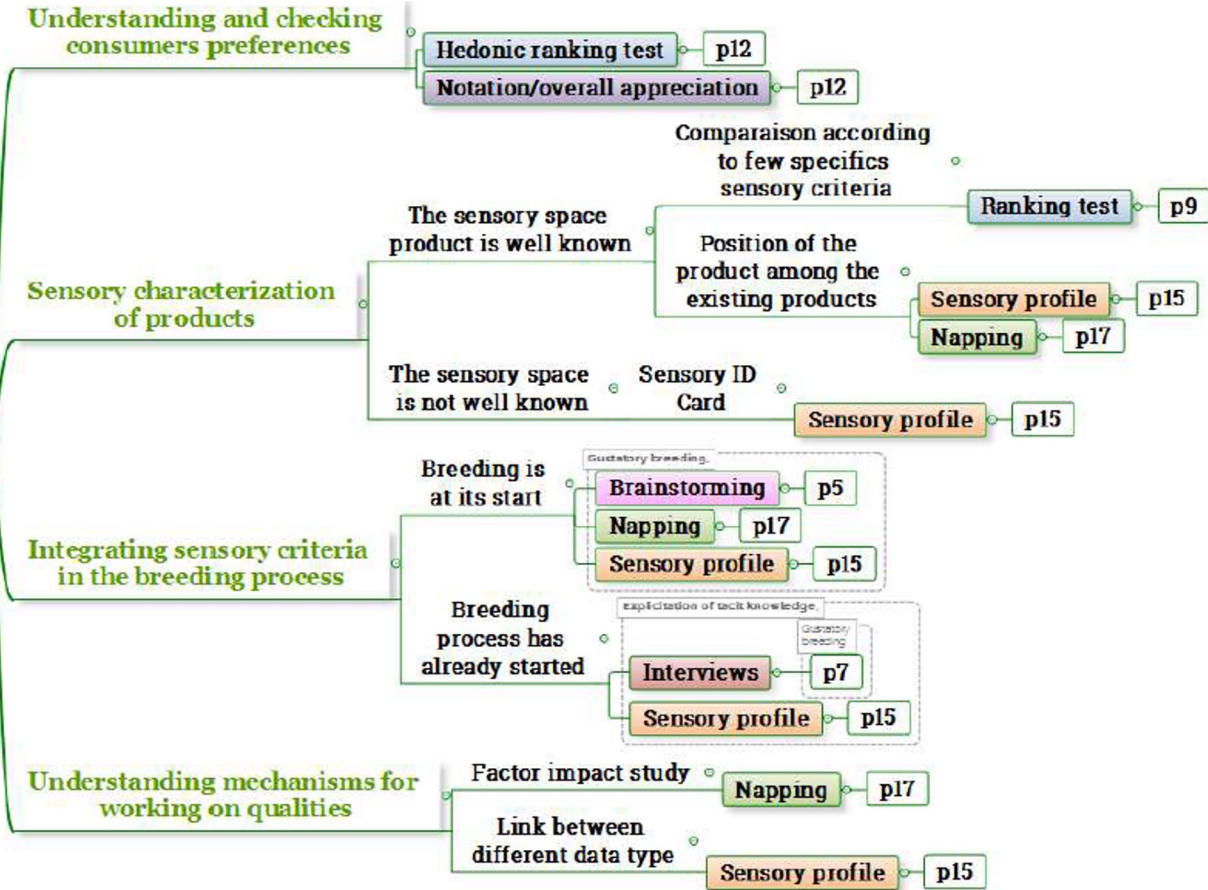
verbalisation task

# How ?

The choice of the sensory test depends on :

- Objective
- Panel expertise
- Product number

**SENSORY ANALYSIS**



Decisions tree proposition to choose the adequate sensory test



# TECHNICAL BOOKLET

11 FACTSHEETS

Recommended tests

How to prepare the  
samples

How to analyze the  
results



## TASTING GUIDE:

Tools to integrate organoleptic quality  
criteria into breeding programmes

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Bruno TAUPIER-LETAGE



## An online tasting guide

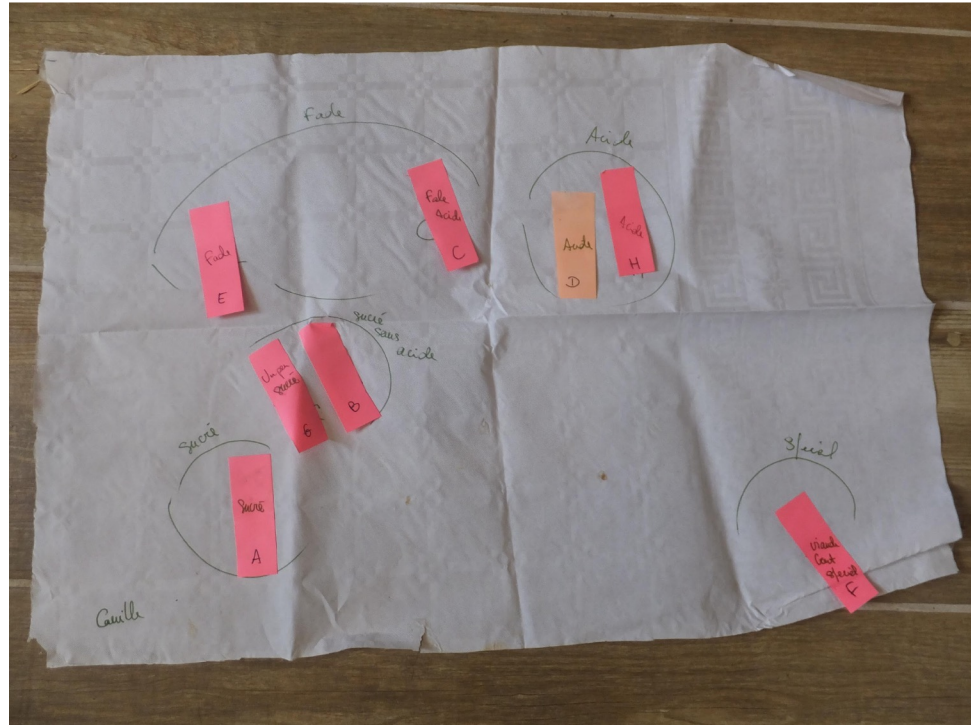
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## Example 1 : Factor impact study in legumes by Napping (1)

**The sorting task:** each taster are asked to position the whole set of products on a sheet of blank paper (a tablecloth) accordingly to their **similarity/dissimilarities**.

*two products are closed if perceived as similar or, on the contrary, are far-off one another if perceived as different. Each taster uses his/her own criteria.*

**The verbalisation task:** After performing the napping task, the panellists are asked to describe the products by writing **one or two** sensory descriptors that characterized each group of product on the map.



## Example 1 : Factor impact study in legumes by Napping (2)



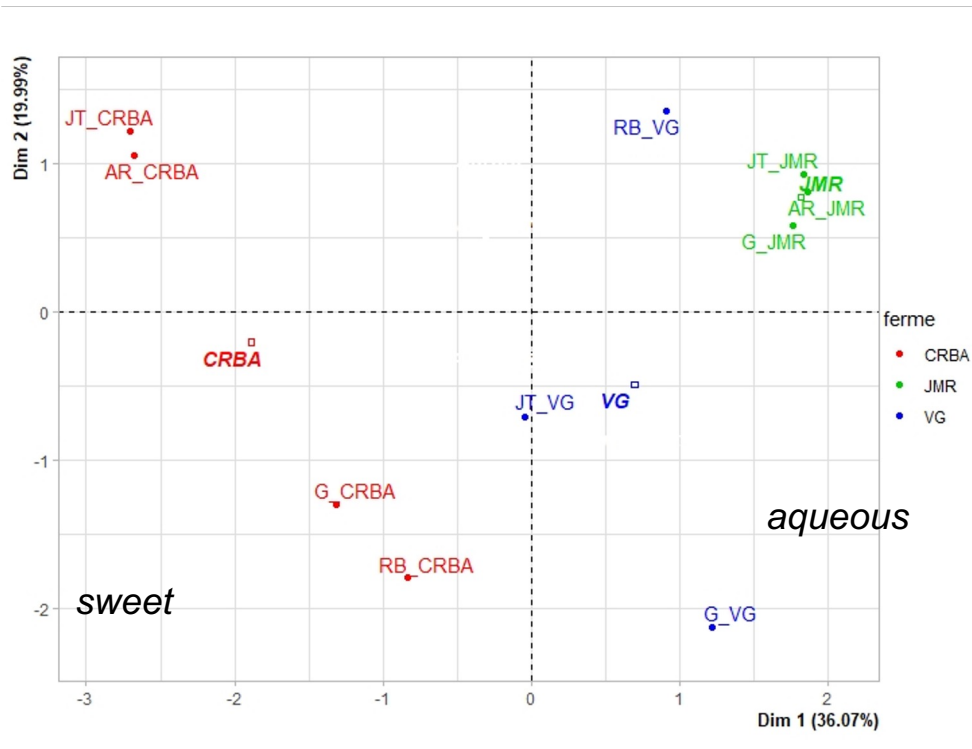
Napping on field, CRBA

# Example 1 : Factor impact study in legumes by Napping (3)

Impact of environment factor on global quality of tomatoes

Groups of tomatoes from the same environment

*7 tasters, used to eat tomatoes*





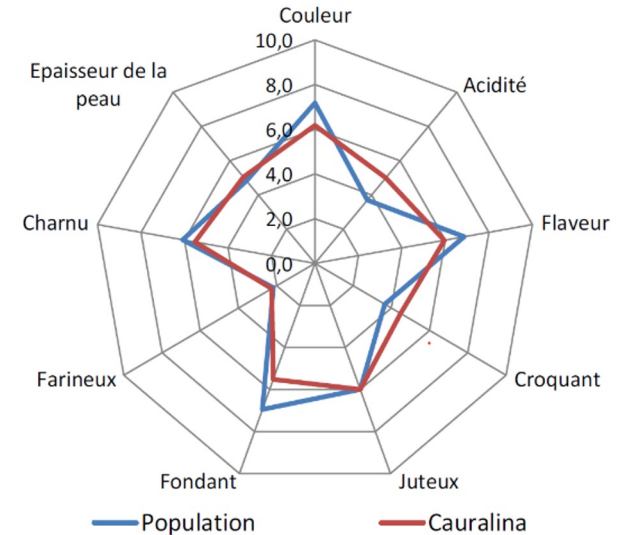
## Example 2 : Selecting precise ideotype by discrimination test (1)

### Breeding for a identified ideotype of tomatoes (cauralina)

⇒ Ranking test on selected traits :

- Juiciness
- Sucrosity
- Farinosity

Profil sensoriel comparé Cauralina F1, Cauralina population



- **Cauralina** : La variété est jugée assez colorée, acide avec une flaveur assez développée. Elle est décrite comme plutôt croquante, juteuse et fondante. Le fruit est charnu et peu farineux.

# Example 2 : Selecting precise ideotype by discrimination test (2)

Results of the Friedman rank sum test, p-value <0.05



Selecting CdC S1 for multiplication

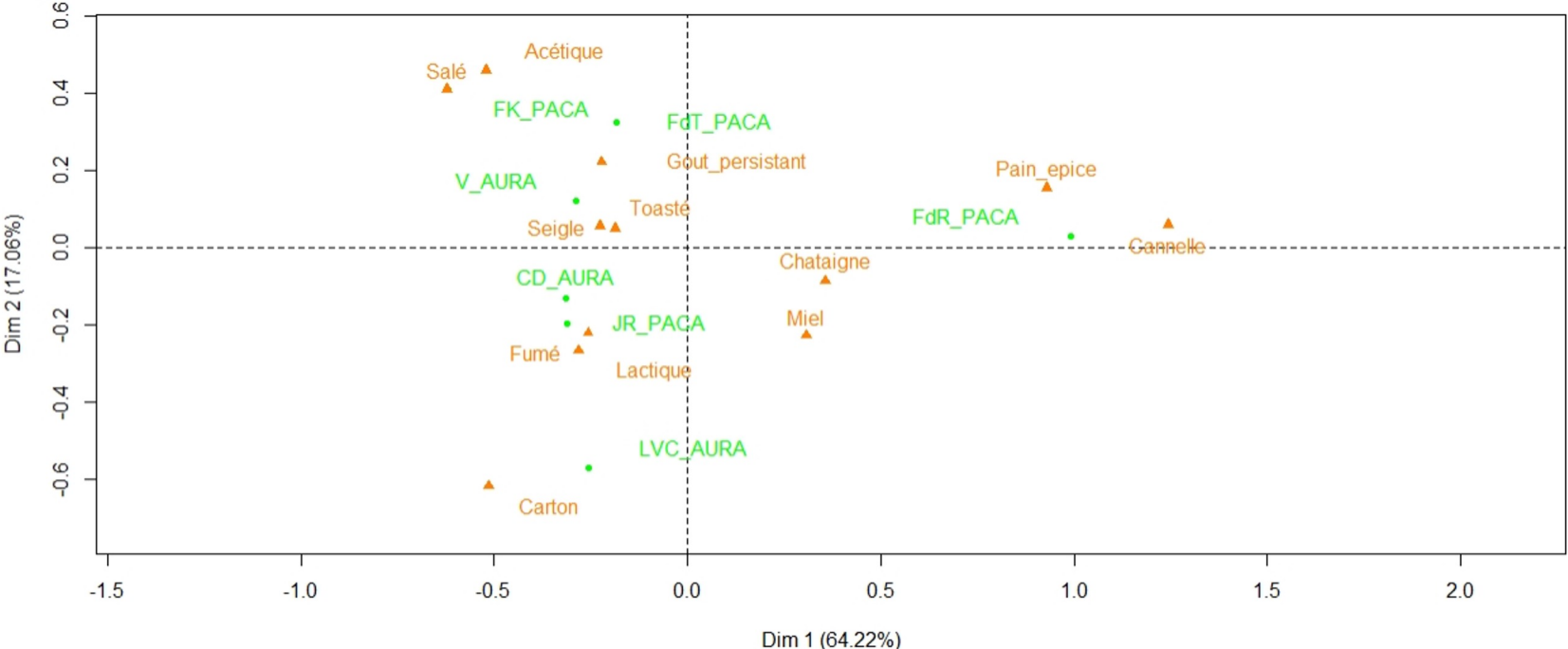
### Example 3 : Demonstrating typicity by CATA test (1)

**Each taster answer to a questionnaire where a list of sensory attributes are proposed. Taster choose the adequate sensory attributes. The order of the list is randomized.**

Cochez dans la liste suivante les attributs sensoriels qui décrivent selon vous le pain	
Code pain	
<input type="checkbox"/> pain d'épice	<input type="checkbox"/> arôme de seigle
<input type="checkbox"/> arôme fumé	<input type="checkbox"/> saveur de châtaigne
<input type="checkbox"/> saveur acétique (acide)	<input type="checkbox"/> arôme de cannelle
<input type="checkbox"/> goût salé	<input type="checkbox"/> saveur lactique (doux)
<input type="checkbox"/> goût carton	<input type="checkbox"/> goût persistant
<input type="checkbox"/> arôme de miel	<input type="checkbox"/> arôme toasté
Descripteur libre :	

# Example 3 : Demonstrating typicity by CATA (2)

7 breads  
4 from PACA Region  
3 from AURA Region  
60 naïves tasters





# Discussion

- What difficulties you encountered when breeding for quality?
- Do you use alternative sensory test
- what do you need to improve your practice of culinary breeding?

