FEEDING INFLUENCE ON ROYAL JELLY ANALYTICAL COMPOSITION

Casabianca H. ; Daniele, G. ; Wytrychowski, M.

Institut des Sciences Analytiques - UMR 5280 du CNRS
Département Service Central d'Analyse
Echangeur de Solaize - Chemin du Canal - 69360 Solaize - FRANCE

www.cnrs.fr

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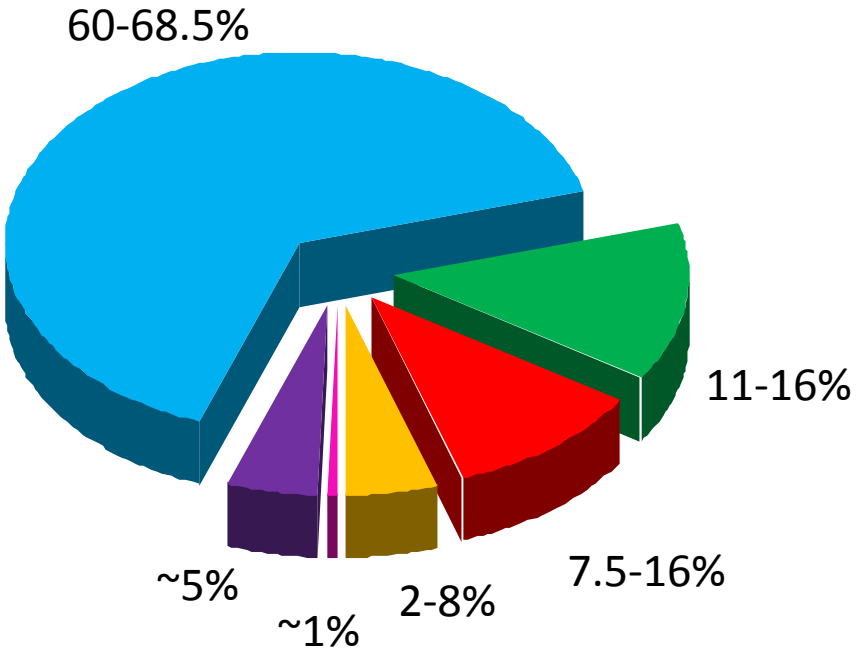
Aim of the study

Characterize the chemical composition of Royal Jelly produced in France on a broad number of samples in order

- to create a data base that reflect the wide variability of this natural compound
- to study the influence of beekeepers practices on its composition
- to compare with worldwide commercial products (purchased in France)

Chemical characterization



- water ➡ Karl Fischer
- proteins ➡ Elemental analysis : % of nitrogen
- sugars ➡ GC-FID
- lipids ➡ HPLC-UV
  acide trans 10-hydroxy-2-décénoïque (10-HDA)
- free amino acids ➡ HPLC - FLD
- B3 and B5 vitamins ➡ HPLC - FLD

Isotopic ratios $^{13}C/^{12}C$ and $^{15}N/^{14}N$ ➡ EA/IRMS (Elemental Analyzer/Isotopic Ratio Mass Spectrometry)

Royal Jellies analysed

- 500 RJs produced in France by beekeepers belonging to the GPGR
  (RJ Producer Group responsible for more than 80% of French production)

  ↳ *Respect of a quality convention concerning the production, harvest, conservation and trade of RJ*

  ↳ No feeding except honey if necessary

- 50 RJs produced in Italy

- 130 commercial RJs
  as representative materials available on French market

- 135 RJs from feeding experiments with artificial sugars and/or exogeneous proteins

Database and compliance intervals

99 % recovery of samples (gauss curve)
[mean ± 3 x standard deviation]

Constituent	Minimum	Maximum
Water (%)	60.2	70.4
Proteins (%)	11.3	16.5
10-HDA (%)	1.1	3.4
δ13C/12C (‰)	-28.60	-21.46
δ15N/14N (‰)	-2.26	7.08
Total amino acids (%)	0.4	1.0
Total sugars (%)	8.0	18.4
Fructose (%)	2.1	7.6
Glucose (%)	3.1	7.9
Erlose (%)	0.0	0.4
Saccharose (%)	0.0	2.0
Maltose (%)	0.0	1.2
Maltotriose (%)	0.0	0.2
Gluconic acid (%)	0.3	3.6

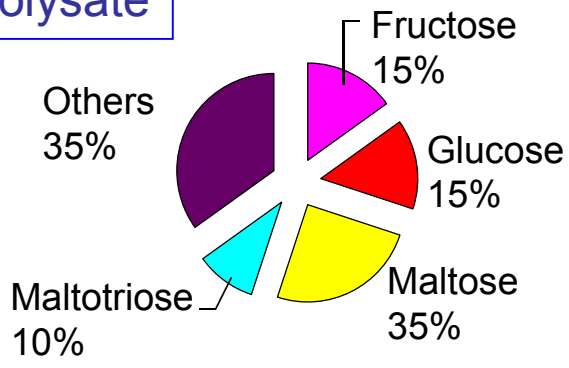
Feeding experiments

3 modes of feeding:

- ✓ **sugars :** Fructoplus, Agenabon, organic sugar cane, Apistar

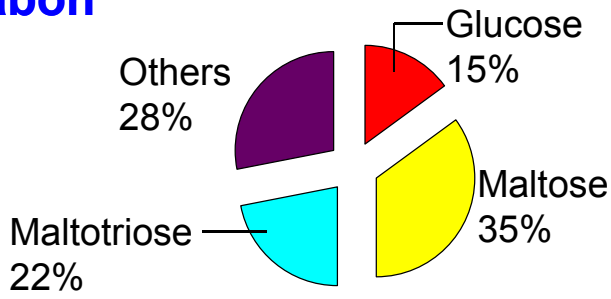
Starch hydrolysate

Fructoplus

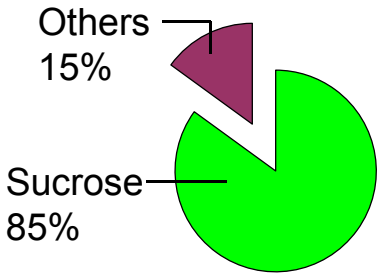


Maize hydrolysate

Agenabon

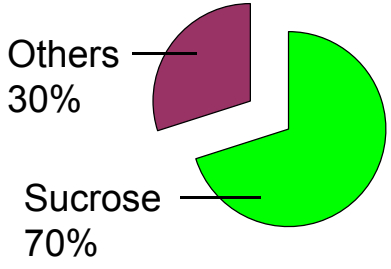


Organic sugar cane



Inverted sugar

Apistar



Feeding experiments

3 modes of feeding:

- ✓ **sugars :** Fructoplus, Agénabon, organic sugar cane, Apistar

  5 colonies (1 reference hive)

- ✓ **proteins :** yeast powder and soy yeast

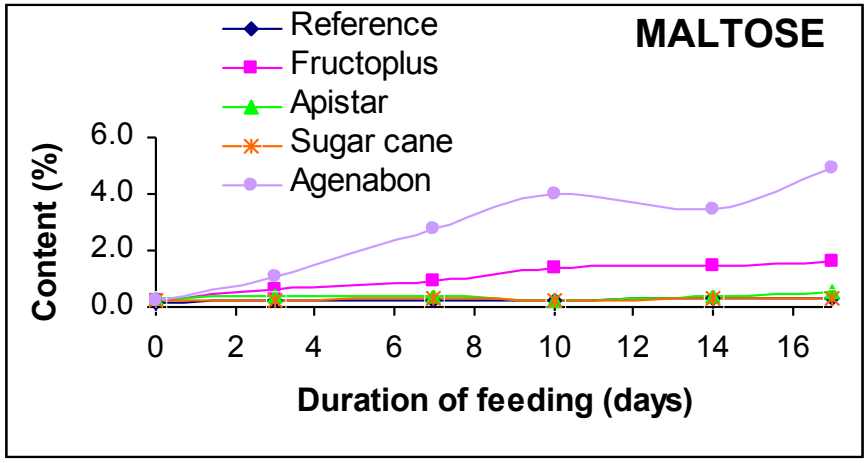
  3 colonies (1 reference hive)

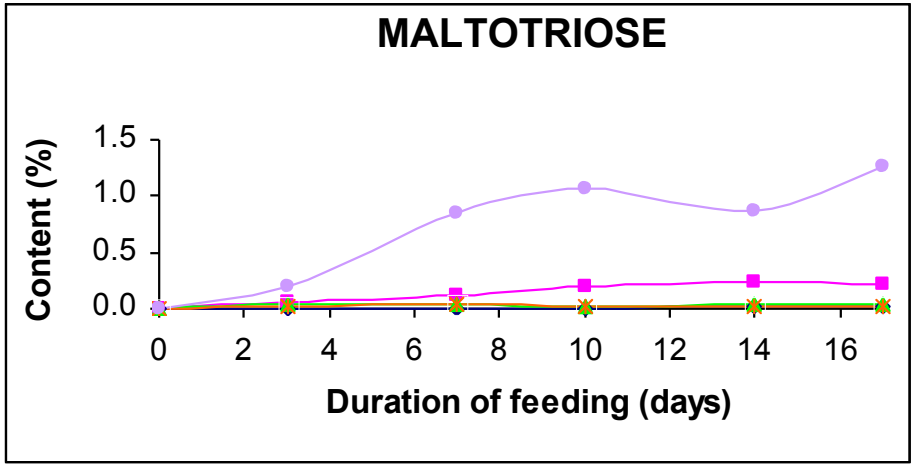
- ✓ **combination of sugars and proteins**

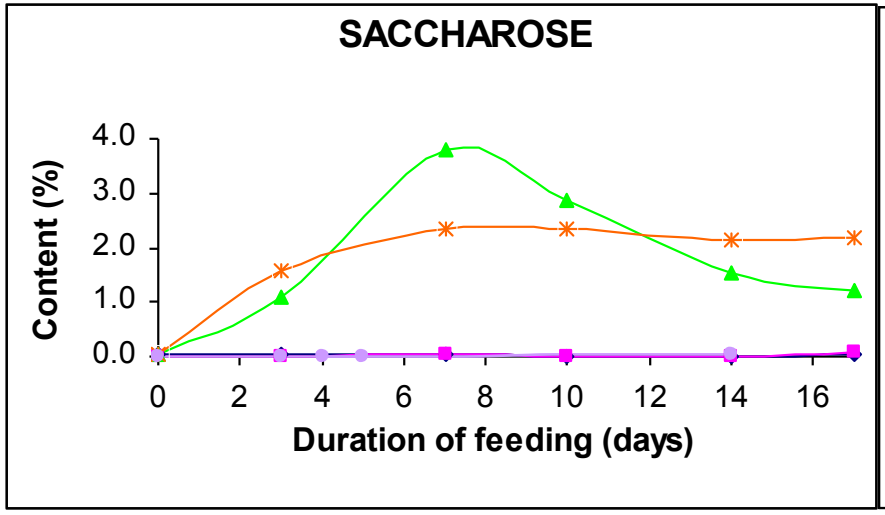
  9 colonies (1 reference hive)

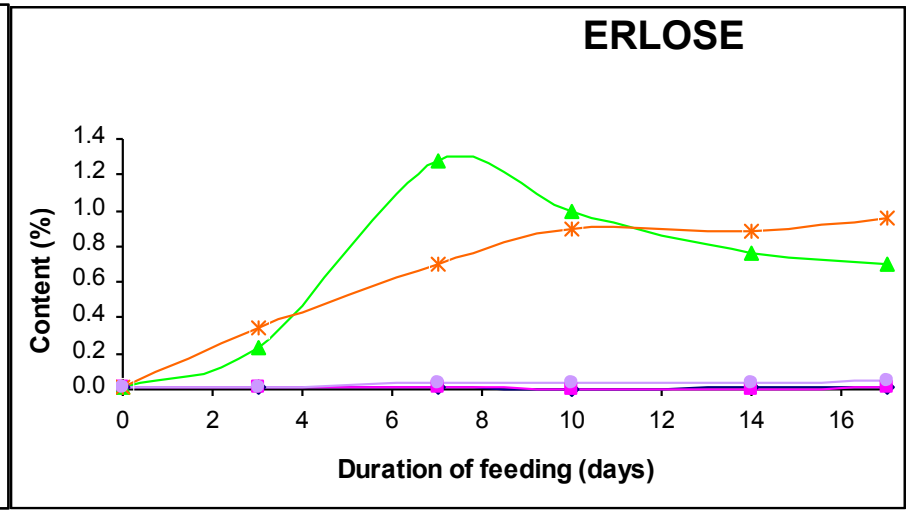
6 consecutive harvests every 3 days

Feeding experiments



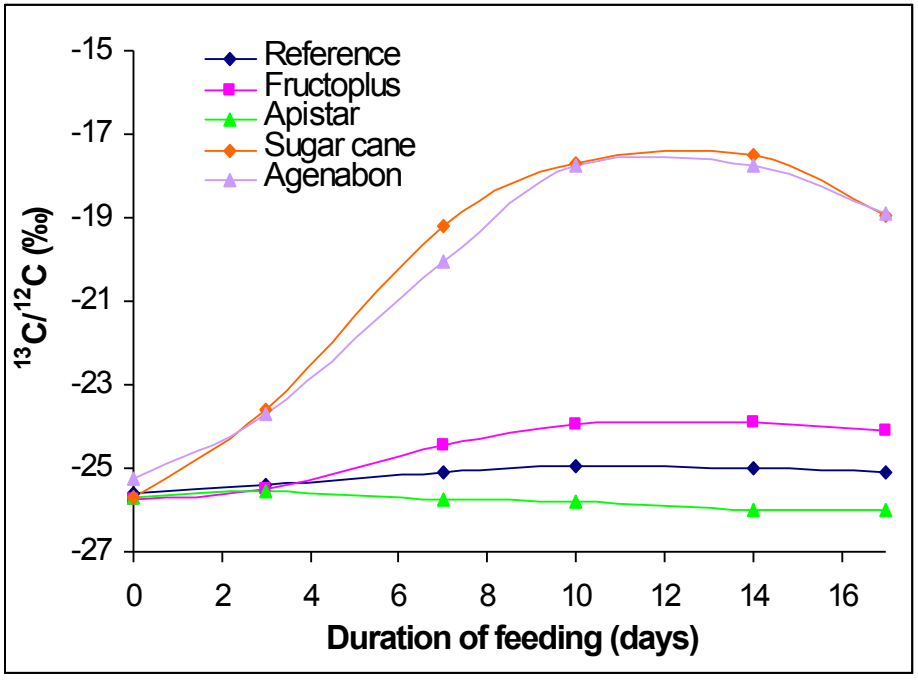


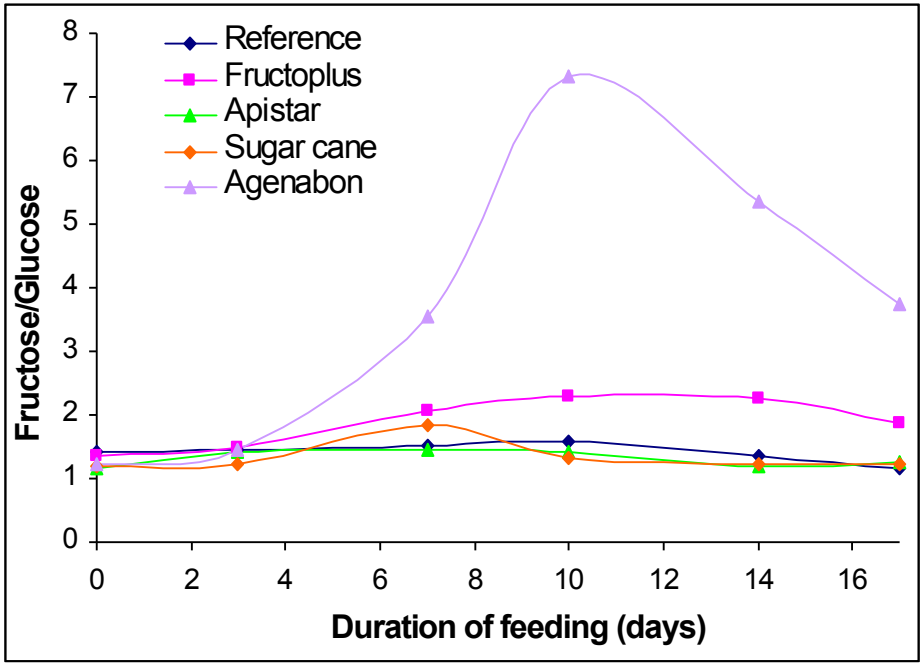




➡ maltose, maltotriose, sucrose and erlose contents are the most important parameters for variations of levels

Feeding experiments

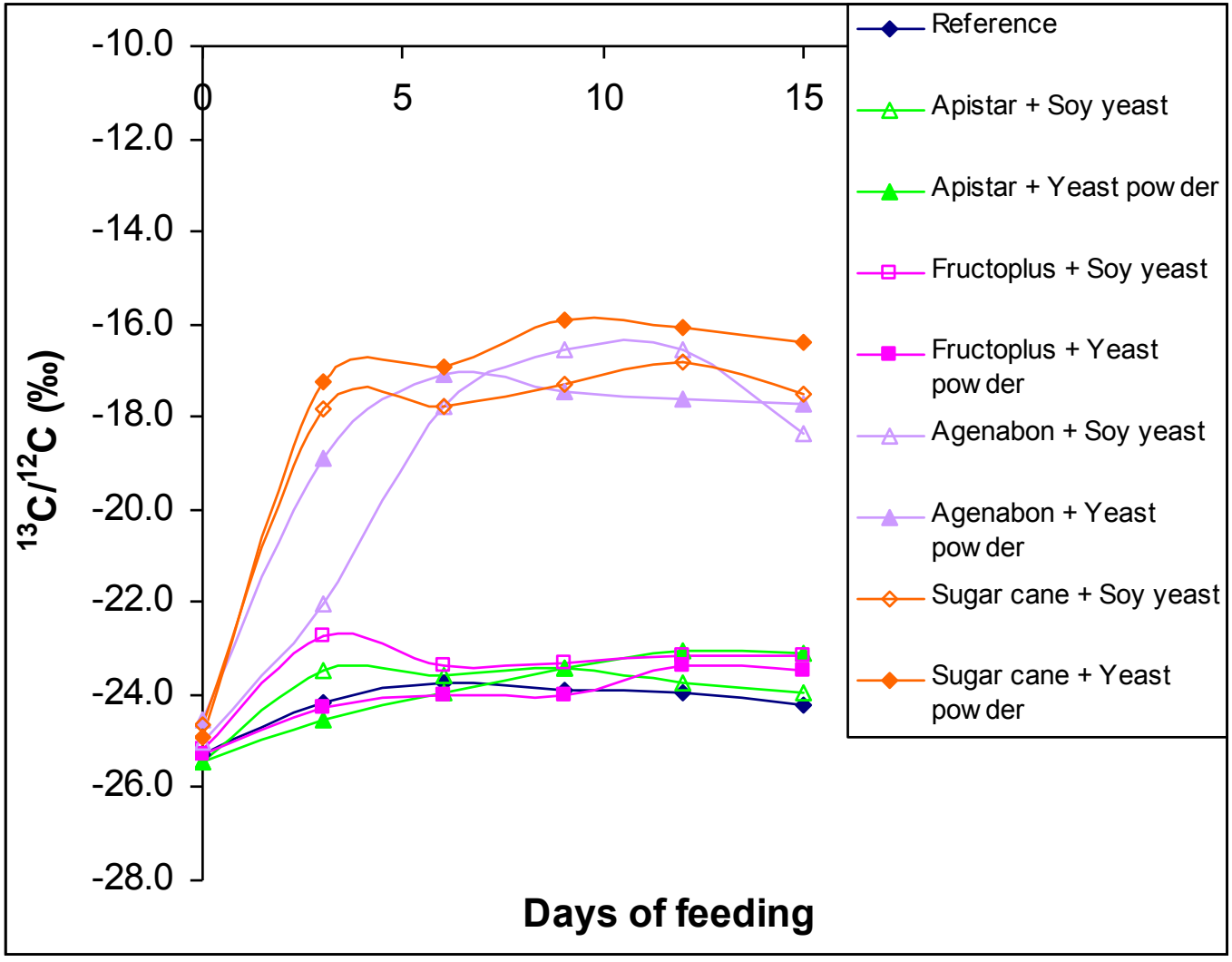




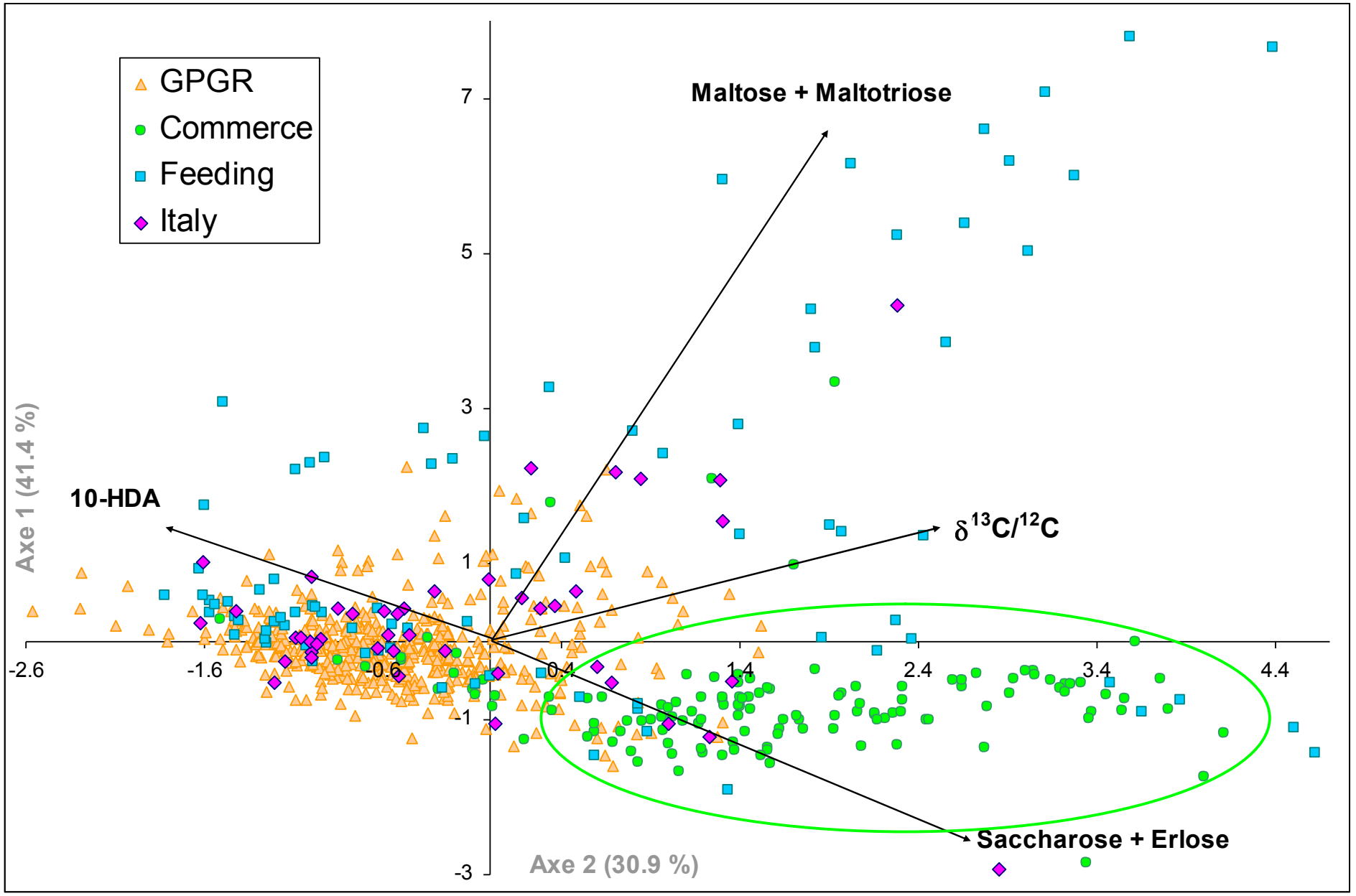
➡ Isotopic ratio and glucose/fructose ratio allow detection of sugars feeding

Feeding experiments

Combination of sugars and proteins



Principal Component Analysis



Conclusions

A quite complete and original survey for such high number and diversity of the RJ samples :

France (500 samples)
Italy (50 samples)
Commerce (130 samples)
Feeding experiments (135 samples)

An efficient differentiation of feeding practises

- sugars contents (saccharose, erlose, maltose, maltotriose)
- isotopic determination of the ratio $^{13}C/^{12}C$

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