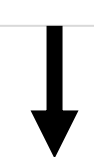


PLAN P – sPectraL tools and digitalization for the development of sustAinable structured food with plaNt Proteins



Summary

Screening of various **plant ingredients** and determination of their **functional** and **Physico-chemical** properties



Clustering of these plant ingredients based on their **foaming** or **emulsifying** capacities and their protein content → Selection of one ingredient per cluster

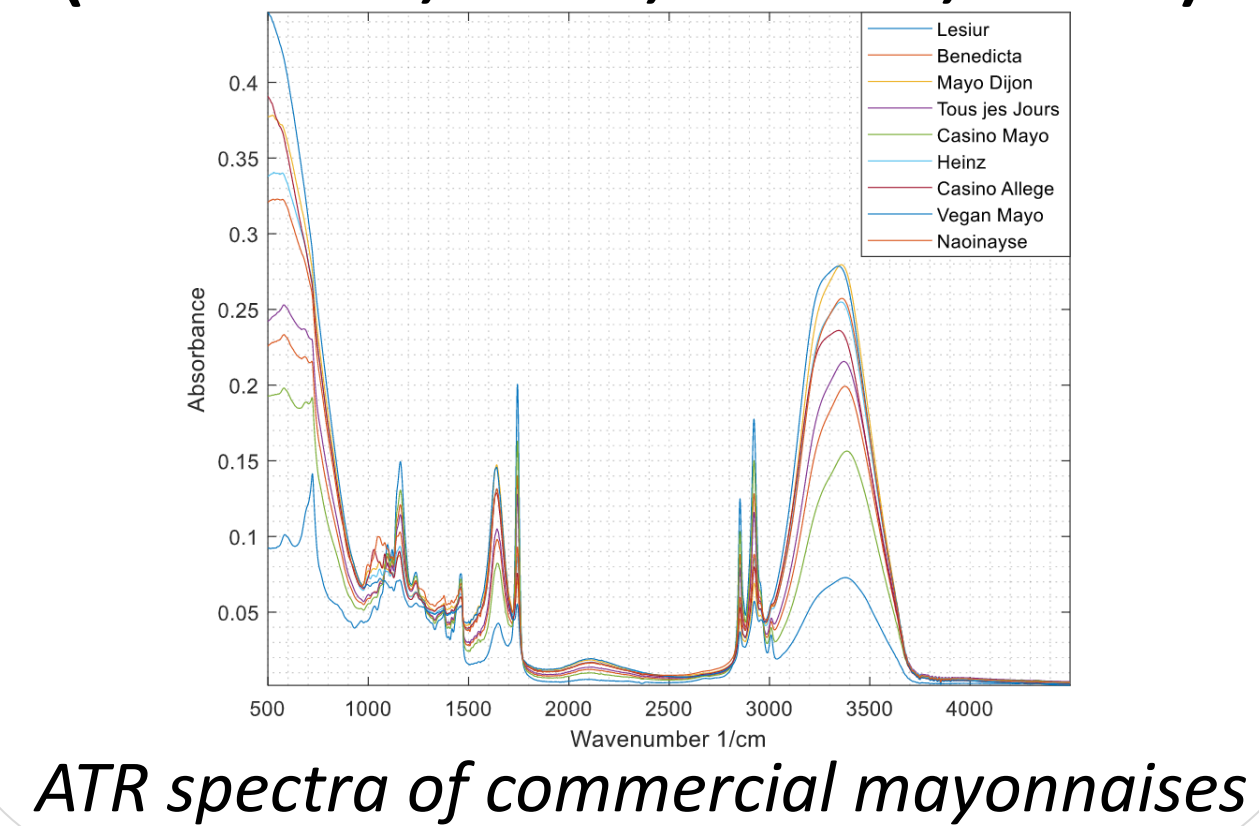


Production of matrices (emulsions and foams) with various textural properties by modifying process and formulation variables based on a **robust experimental design**

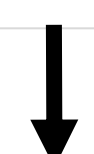
Physico-chemical characterization of the matrices (texture, viscosity, stability...)



Spectral characterization of the matrices (Raman, NIR, NMR, ATR)



Data analysis for the **development of a predictive model** based on artificial intelligence



Elaboration of a sensor to analyze and predict the quality of plant ingredient-based food **during production**

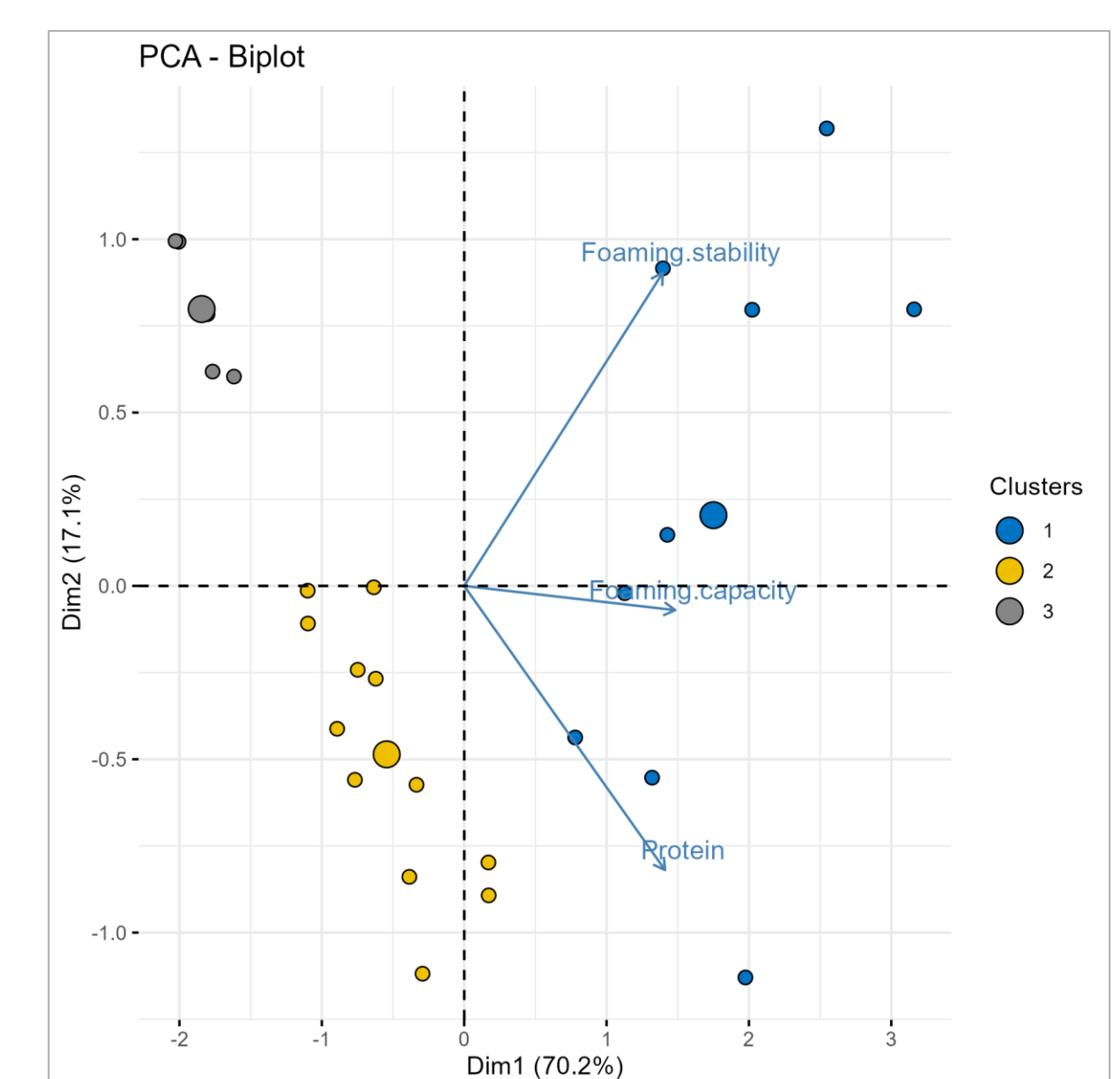
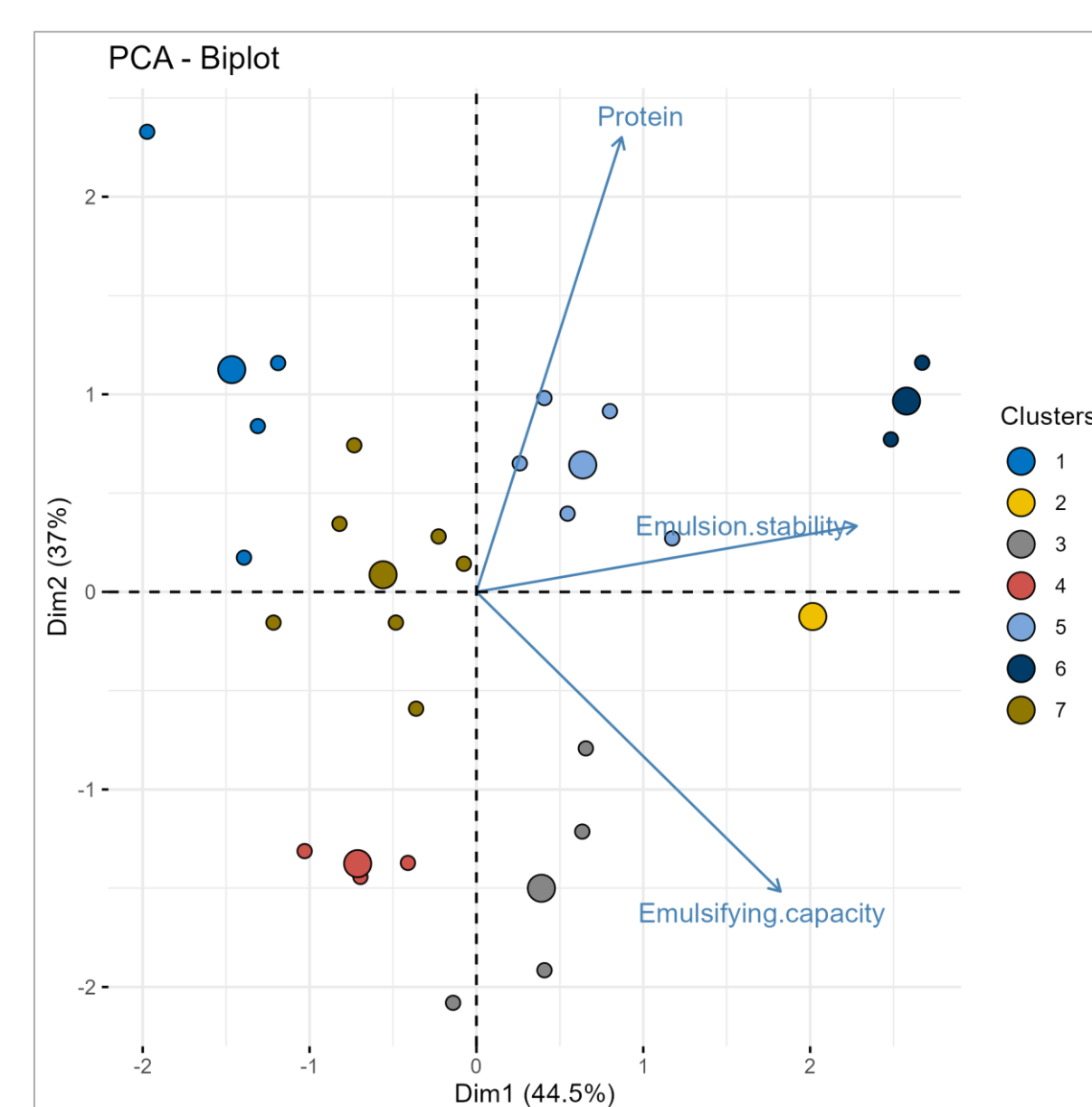


Main objective/ research question

- PLAN P aims to develop a **smart and innovative system** in order to design sustainable food and **control quality online** during the production and shelf life.
- The project goal is to facilitate the protein transition using **spectral methods** and **predictive models**

Preliminary results

- **26 plant ingredients** were characterized and grouped into **7 clusters** based on **emulsifying capacity** and **3 clusters** based on **foaming capacity**
- An **experimental plan** was designed to produce 3 different kinds of emulsions (high energy, low energy, spreadable) and a foam with **various textural qualities**.
- Production of matrices and their **physico-chemical characterization** has begun.
- Simultaneously, commercial emulsions (mayonnaises) have been characterized in terms of **texture** and **spectral signature**.
- Initial AI pipelines based on currently provided results have been setup.



PCA (biplot representations) of the 26 plant proteins, explaining the clustering for emulsions (left) and foams (right)

Preliminary conclusions/ potential impact

- Preliminary results on commercial products have shown a **correlation between Physico-chemical quality** and **spectral signature**, which confirms the relevance of this approach.
- The clustering of the plant ingredients could facilitate the **screening of novel ingredients** → **Prediction of the techno-functional characteristics** based on **machine-learning**.
- The project should make it possible to anticipate quality problems directly on the production lines → **process optimization** and **waste reduction**

Future research activities

- Production of the matrices (emulsions and foams) and Physico-chemical & spectral characterization of these products
- Development of predictive models based on these results
- Development and testing of a platform of adapted sensors coupled to predictive models.

