

From dry-fractionated pulse proteins to food matrices: understanding protein–ingredient interactions driving functionality and sensory performance



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Context & Objectives

The development of sustainable plant-based foods requires protein ingredients that combine:

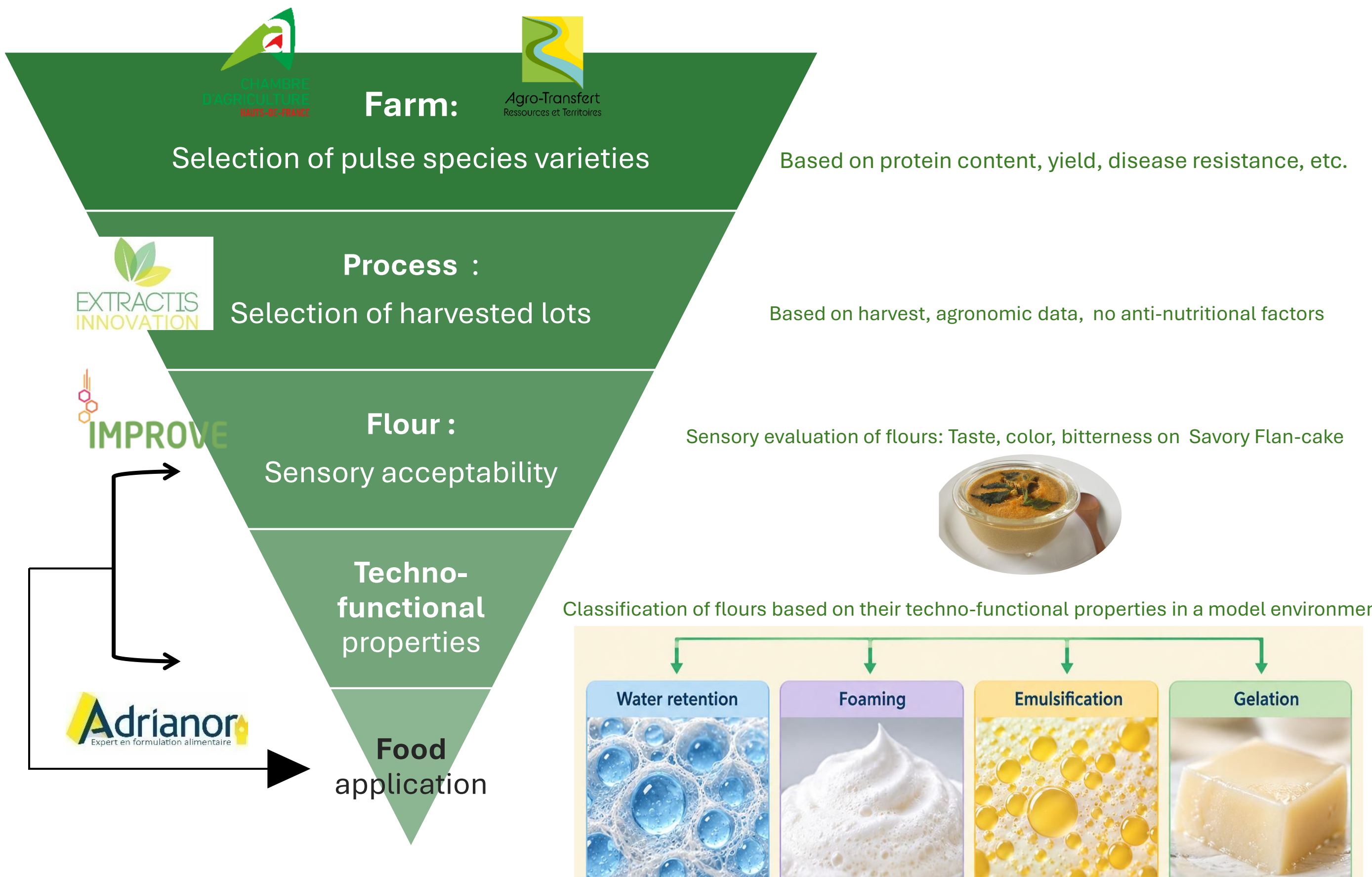
Nutritional Value Techno-functional Properties Sensory acceptability

Within the **PROFIL** project, an integrated “farm-to-food” approach was implemented to investigate the suitability of pulse crops cultivated in Northern France for food applications. Pea, faba bean, lentil and chickpea were investigated **from** variety selection and dry fractionation **to** ingredient characterization and food formulation.



Experimental Approach

From Farm To Table: Funnel Effect



Pulse proteins characterization on model and complex food systems

1. Savory Flan with 18% of vegan protein

Variety	Year	Color	Beany Flavor	Bitterness
FURIOUS	2023	Yellow		
FLOKON	2023	Yellow		
LAPONY	2023	Yellow		
RGT CASINI	2023	Beige Yellow		
ESCRIME	2023	Pale Yellow		
FOUDRE	2023	Yellow		
FURTIF	2023	Pale Yellow		
ALLISON	2023	Brown		
CALLAS	2024	Grey		
CALLAS	2024	Grey		
CALLAS	2024	Grey		
SHIVA	2024	Yellow		
SHIVA	2024	Yellow		
STELLA	2024	Grey		
SYNERGY	2023	Brown		
SYNERGY	2024	Grey		
SYNERGY	2024	Grey		
SYNERGY	2024	Yellow		
SYNERGY	2024	Yellow		
TIFFANY	2023	Brown		
TIFFANY	2024	Grey, Green		
TIFFANY	2024	Grey		
VICTUS	2023	Brown		
VICTUS	2024	Grey		
VICTUS	2024	Grey, Green		

2. Techno-functional properties in a model systems

Variety	Year	Water retention	Emulsifying capacity	Emulsion stability (+4°C)	Foaming capacity
KWS PROKLAM	2023	+++	None	+	++
AVIRON	2025	++	+	++	None
ESCRIME	2023	+++	None	+	None
FOUDRE	2023	++	None	None	None
RGT CASINI	2023	+++	+	None	+
SHERPA	2025	+++	+	++	None

Variety	Year	Water retention	Emulsifying capacity	Emulsion stability	Foaming capacity
CALLAS	2024	+++	+	++	None
KETU	2025	+	++	++	None
SHIVA	2024	+++	+	+	None
SHIVA	2025	+	++	++	None
SYNERGY	2023	+	None	+	+
SYNERGY	2024	+++	+	+	+
SYNERGY	2024	+	+	+	None
TIFFANY	2023	+++	++	+	+
TIFFANY	2024	++	++	+	None
TIFFANY	2025	++	+	++	None
VICTUS	2023	++	None	None	+
VICTUS	2024	+++	++	+	None

3. Food Applications

Target functionality: Emulsification + Foaming abilities

Target functionality: Emulsification + Emulsion stability

PEA CONCENTRATE
Dosage: 3.4%
Variety: ORCHESTRA ou KWS PROKLAM (2023)
Process: Pasteurization, Freezing
Taste: Strong Vanilla flavor and a little vegetal flavor
Color: Neutral
Texture: Creamy
Foaming ability: Good (+)

PEA CONCENTRATE
Dosage: 3.6%
Variety: RGT CASINI (2023)
Taste: No parasite taste
Emulsion stability: Stable after preparation but instable during stockage

FABA BEAN CONCENTRATE
Dosage: 3.4%
Variety: SYNERGY (2023)
Process: Pasteurization, Freezing
Taste: Little vegetal flavor
Color: Neutral
Texture: Creamy
Foaming ability: Very Good (++)

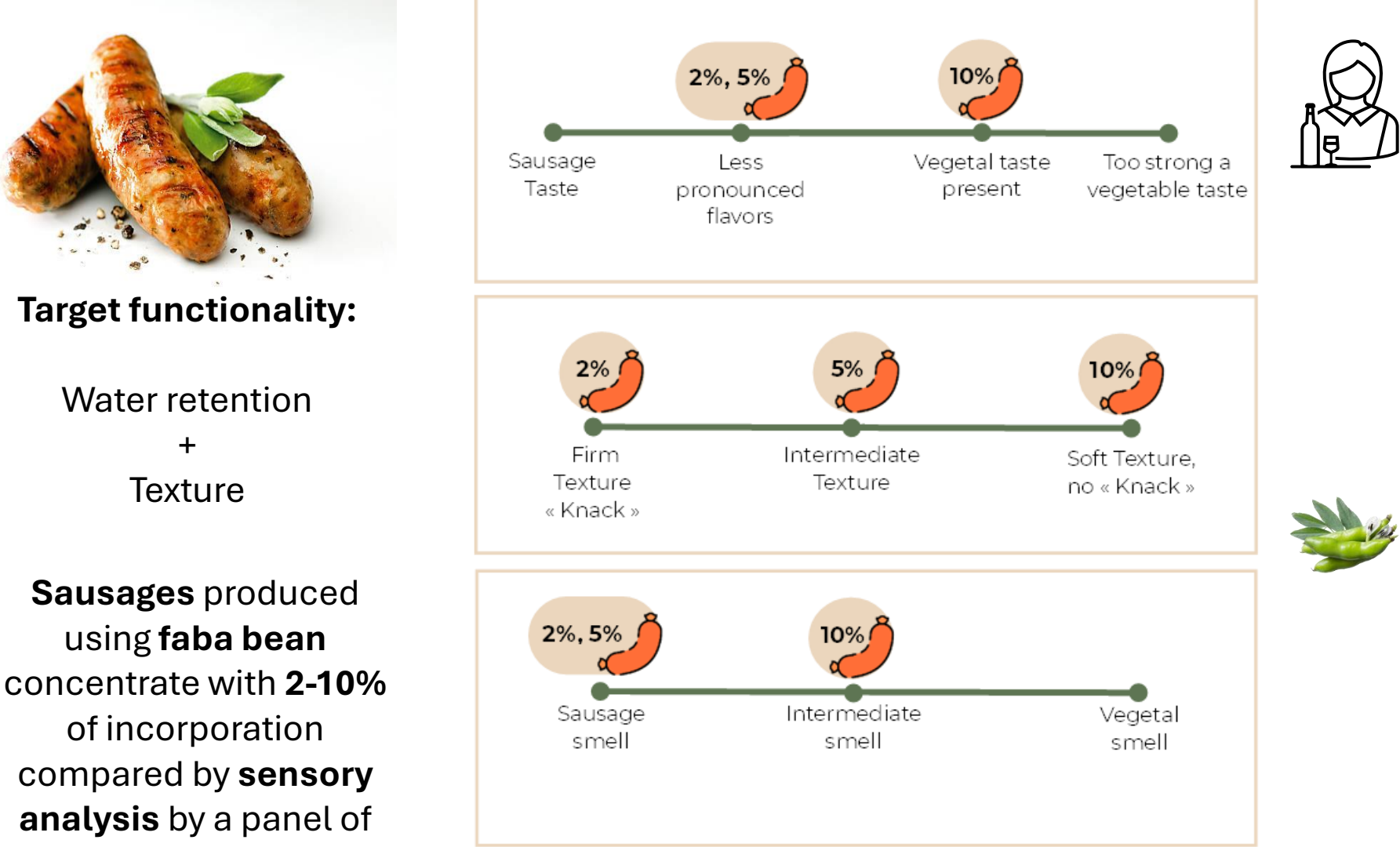
FABA BEAN CONCENTRATE
Dosage: 3.6%
Variety: TIFFANY (2024)
Taste: Vegetal taste predominant
Emulsion stability: Stable after preparation and during stockage

Interest in the food matrix choices:

- Plant-based alternatives and ingredient substitution:** Partial or total replacement of animal-derived ingredients (meat, eggs, dairy products) to reduce costs or accommodate specific dietary needs
- Nutritional fortification:** Improving the Nutri-Score and providing additional protein.
- Clean Label and “Free-From”:** Gluten-free formulations or the elimination of additives (baking powders).

Results on food matrix:

- Ice cream/ Egg-free Mayonnaise:** Formulated with vegan ingredients, presence of vegetal flavor but acceptable, but correlation between functional properties in simple and complex food matrix.
- Sausage:** Increasing protein incorporation does not simply increase functionality: beyond a certain level; ingredient-matrix interactions can become limiting for texture and sensor acceptance



Conclusions & Perspectives

- Dry fractionation provides a solvent-free solution to pulse protein enriched flours while retaining a complex composition with protein, starch, fiber, etc.
- Model systems are valuable for screening and ranking ingredients particularly according to specific functional requirements.
- Transposition to food products is matrix dependent. The same ingredient can perform differently depending on the surrounding food system and processing conditions.
- Sensory performance must be considered alongside technological functionality, especially at high incorporation levels.
- Successful pulse protein development required an application driven-approach, connecting the whole chain:



- Testing various food systems enables the confection of a guideline of plant-based ingredients use.
- It provides direction on the recommended incorporation percentages of plant-based flours or proteins for each application, taking into account both functional and sensory aspects.
- Very useful for new products development.

