VALORISATION STRATEGIES OF SPENT COFFEE GROUND AS AN INGREDIENT FOR RUMINANTS

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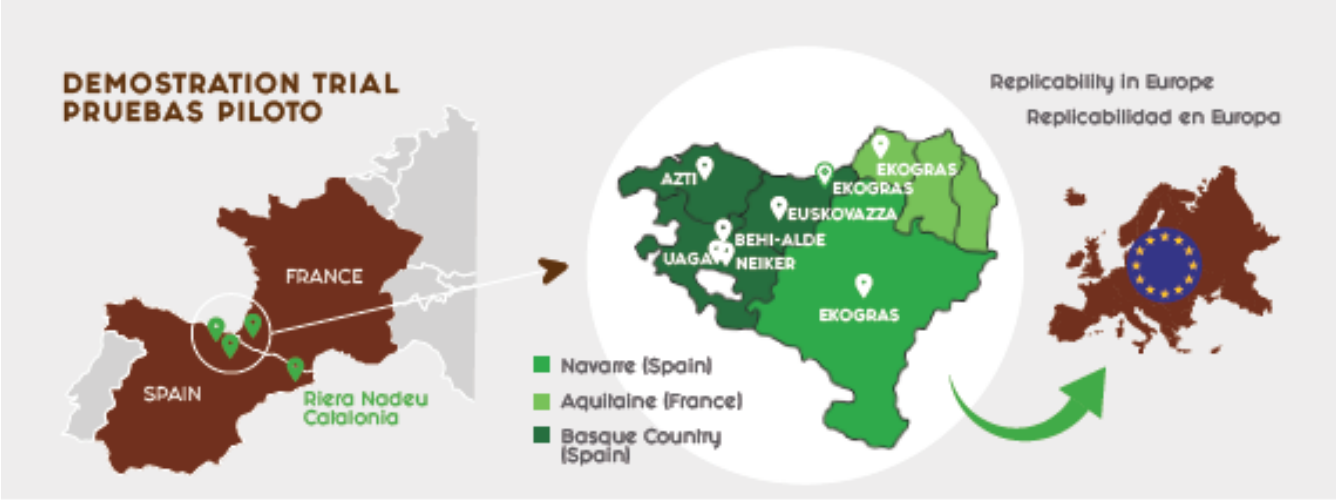
NEW STRATEGIES FOR THE COFFEE BY-PRODUCTS RECOVERY AS A NEW RAW MATERIAL FOR ANIMAL FEED

PROJECT LOCATION: North of Spain (Basque Country and Navarre) and South of France (Aquitaine)

SCHEDULE: 01 / 09 / 2019 – 31 / 03 / 2024



CONSORTIUM:

Coordinator: AZTI

Partners: BEHI-ALDE ERKOP, EKOGRAS, EUSKOVAZZA, NEIKER, Riera Nadeu, UAGA

OBJETIVES

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from coffee by-products to animal feed

General objective:

Develop, demonstrate and implement at real scale an **innovative and sustainable solution** for the recovery of **coffee by-products** and recovery for their use as an **ingredient in animal feed.**

Specific objectives:

1. Implement a value option for HORECA channel coffee grounds and Vending capsules as an ingredient for animal feed

   → **↑ sustainability and competitiveness of the coffee producer and consumer sector.**

2. Meet the growing demand for new raw materials for feed production and reduce dependence on the current market for raw materials.

   → **↑ sustainability and competitiveness of the feed sector**

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CHALLENGES

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Challenge 1: Logistic

Management protocol in point generation
Grounds and capsules collection system
Coffee capsule collection systems
Synergies with other streams

Challenge 2: Decapsulation

Separation of fractions: organic vs. inorganic

Challenge 3: Enzymatic Hydrolysis

Increased fiber digestibility

Business model

Value proposal
Investor search
Roadmap

Challenge 6: Nutritional efficiency

Nutritional value of coffee grounds
Nutritional efficiency tests: dairy cattle and sheep

Challenge 5: Pellets

Energy optimization of the drying process using pellets from coffee grounds

Challenge 4: Dehydration

Stabilization of the coffee grounds for its suitability as a feed ingredient

- Natural coffee grounds
- Hydrolyzed coffee grounds

CHALLENGE 4

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Dehydration → Stabilization of the coffee grounds for its suitability as a feed ingredient

Stabilization of the coffee grounds for its suitability as a feed ingredient

- Dehydration process to stabilize the coffee grounds over time (humidity <10%) → Thermal drying
- Trials:
  - ❑ Optimization: **1 trial of 500 kg**
  - ❑ Ingredients production: **21 tons of SCG → 9.25 tons of SCG** (about 3 months)

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CHALLENGE 4

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Dehydration → Stabilization of the coffee grounds for its suitability as a feed ingredient

Stabilization of the hydrolysed coffee grounds for its suitability as a feed ingredient

- Optimization of a dehydration process that stabilizes the hydrolyzed coffee grounds over time (humidity <10%) → Mechanic dewatering + Thermal drying
- Trials:
  - ❑ Optimization: **3 trials of 500 kg SCG + 500 kg water**
  - ❑ Ingredients production: **0.6 ton of SCG → 0.2 ton of Hydrolyzed SCG**

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CHALLENGE 5

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Pellets → Energy optimization of the drying process using pellets from coffee grounds

Energy optimization of the drying process using pellets from coffee grounds

– Optimization of a pellet production process from coffee grounds not suitable for animal feed.

Trials:

- ❑ Optimization: **3 trials of 200 kg**

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CHALLENGE 6

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Nutritional efficiency → Nutritional value of coffee grounds

Nutritional efficiency tests: dairy cattle and sheep

Trials with dairy sheep

– Evaluation of the nutritional efficiency of ingredient prototypes in in vivo tests with animals.

Parameters to control:
- milk yield (l/d),
- milk chemical determinations: *crude protein, fat, lactose and fatty acids*
- urine determination,
- blood determinations: *IGF; NEFA; BHBA; N; glucose*
- methane production,
- rumen microbial populations
- rumen short chain volatile fatty acid contents

DAIRY SHEEPS	In NEIKER's facilities				
	1st Test				
	Control	Experimental diet 1	Experimental diet 2	Experimental diet 3	Experimental diet 4
Product	-	Hydrolysed	Dried	Dried	Dried
% Inclusion	-	10%	10%	15%	20%
Nº animals	12	12	12	12	12
Time (days)	42	42	42	42	42
Intake (Kg /day- animal)	1,98	1,98	1,98	1,98	1,98
Feed (Kg)	1.000	1000	1000	1000	1000
SCG Ingredient (kg)		100	100	150	200
Wet - SCG to collect (kg)		200	200	300	400

CHALLENGE 6

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Nutritional efficiency → Nutritional value of coffee grounds

Nutritional efficiency tests: dairy cattle and sheep

Trials with dairy sheep

- Results & Conclusions:

1. Increases dry matter intake, and as a consequence daily methane emissions
2. Decreases methane emissions per unit of DMI due to a decrease in apparent digestibility
3. Does not affect fermentation efficiency
4. Formulate coffee grounds:
   - Does not affect the productive yield of sheep and the physico-chemical quality of the milk obtained.
   - Changes milk fatty acid profile towards a healthier one
   - Reduces methane emissions of enteric origin by 19% without affecting ruminal fermentation.
   - The regular consumer of curds is not able to differentiate the curds obtained with milk from ewes fed with coffee grounds from those that have not consumed them.

→ Spent coffee grounds can be formulated up to 15% in the concentrate without impairing productive performance under commercial conditions

CHALLENGE 6

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Nutritional efficiency → Nutritional value of coffee grounds

Nutritional efficiency tests: dairy cattle and sheep

Trials with dairy cattle

– Evaluation of the nutritional efficiency of ingredient prototypes in in vivo tests with animals.

Parameters to control:
- milk yield (l/d),
- milk: *crude protein and fat*
- milk sensory analysis
- methane production,
- blood: *IGF, NEFA, BHBA, N, Glucose*
- rumen microbial populations
- rumen short chain volatile fatty acid contents

DAIRY CATTLE	In NEIKER's facilities				In BEHIALDE's facilities	
	1st Test		2nd Test		3rd Test	
	Control	Experimental diet 1	Control	Experimental diet 2	Control	Experimental diet 3
Product	-	Dried	-	Dried	-	Dried
% of inclusion	-	10%	-	10%	-	10%
Nº animals	10	10	10	10	150	150
Time (days)	56	56	56	56	42	42
Intake (Kg /day- animal)	11	11	11	11	13,5	13,5
Feed (Kg)	6160	6160	6160	6160	85050	85050
SCG Ingredient (kg)	-	616	-	616	-	8505
Wet - SCG to collect (kg)	-	1232	-	1643	-	17010

CHALLENGE 6

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Nutritional efficiency → Nutritional value of coffee grounds

Nutritional efficiency tests: dairy cattle and sheep

Trials with dairy cattle

- Results & Conclusions:

1. Reduces milk yield but does not affect milk composition or milk-fat corrected milk production.
2. Does not affect milk antioxidant capacity.
3. Does not affect ruminal fermentation or methane emissions.

→ Spent coffee grounds can be formulated up to 10% in the concentrate without impairing productive performance under commercial conditions

IMPLEMENTATION AT REAL SCALE

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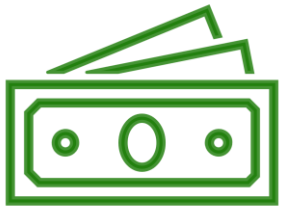

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1. TECHNICAL SIZING

Sizing of the case study (north Spain - south France)

Technical specifications of the necessary equipment

2. ECONOMIC ASSESSMENT (LCC)

15-year financial balance; Financial indicators & Economic sensitivity analysis

3. ENVIRONMENTAL ASSESSMENT (LCA)

Life Cycle Analysis → Acidification potential; Global warming, Eutrophication; Competition for land use

4. SOCIAL ASSESSMENT

Job creation and maintenance; Industry and consumer awareness; Contribution to the sustainability of the primary sector

5. BUSINESS MODEL

Value proposal; Investors; Road map; Replication to other EU regions

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