Producing high-quality fertilizers from by-products generated in a biogas plant treating pig manure

V. Riau*, L. Morey*, Àngel Porta, Joan Soler***, B. Fernández***

*GIRO Program, Institute of Agrifood Research and Technology (IRTA), Torre Marimon, E08140 Caldes de Montbui, Barcelona, Catalonia, Spain. *victor.riau@irta.cat; lluis.morey@irta.cat; belen.fernandez@irta.cat.*

**Ecologic Biogás, SL. C/ Plaça Major, 12 Bajos, 25245 Vila-sana, Lleida (Spain). info@ecobiogas.es.

***EMA depuració i Enginyeria de l'Aigua, SL. Avda. Sant Jordi, 176 Bajos, 17800 Olot, Girona (Spain). adm@edepura.com.

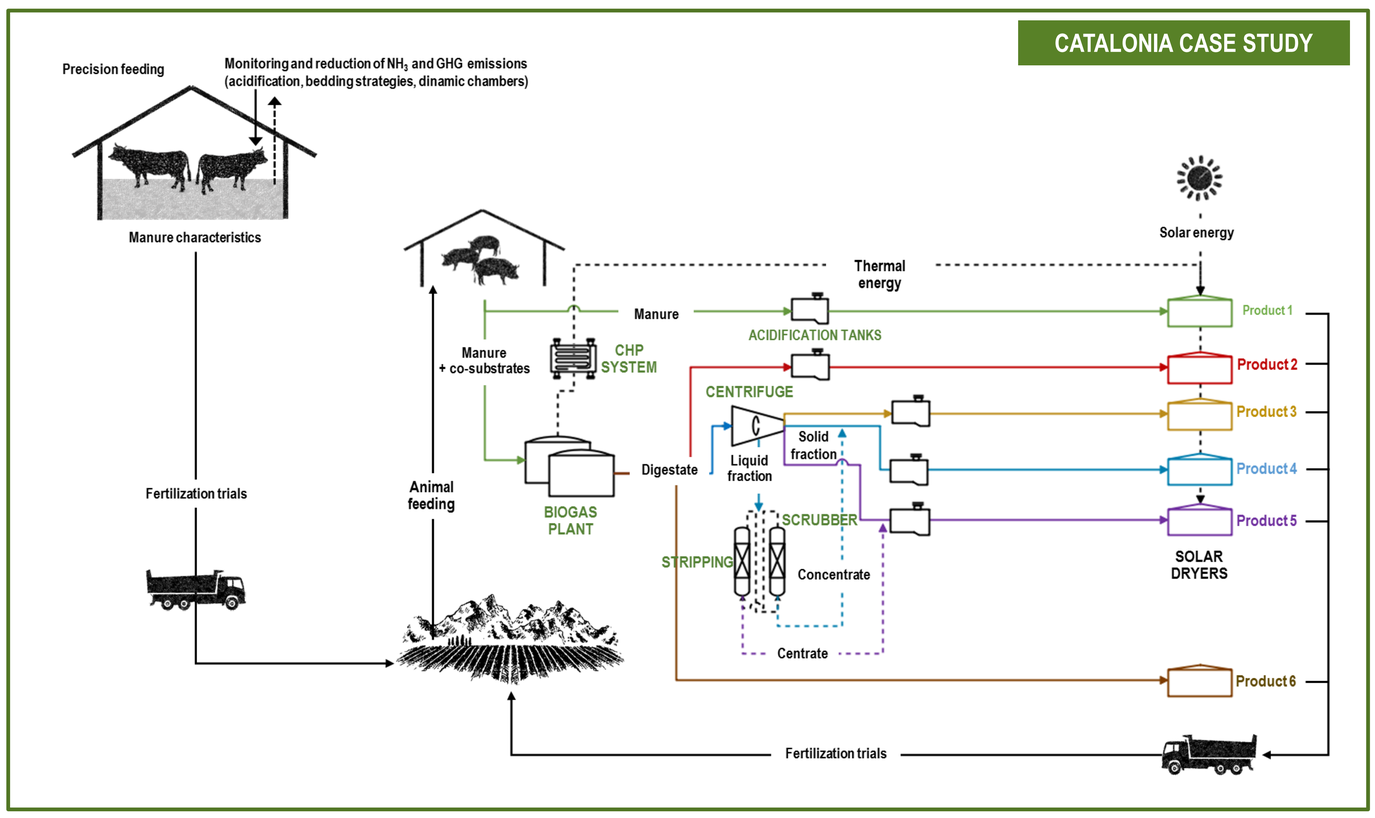
Contact: Lluís Morey. **lluis.morey@irta.cat**

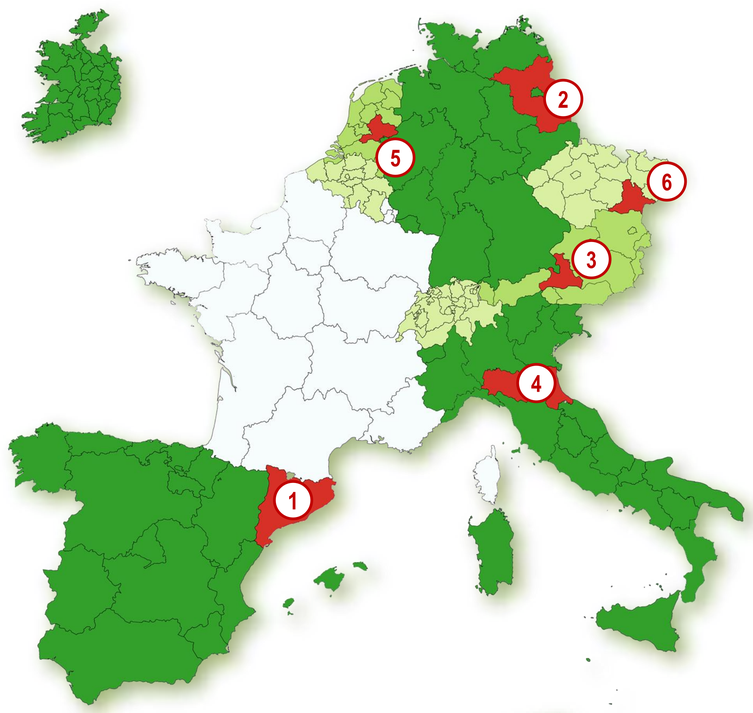
Anaerobic co-digestion of pig manure with co-substrates coming from the agri-food sector, efficient solid-liquid separation (centrifuge) and further treatments of the solid and liquid fraction (thermal/solar drying, stripping), will be applied to obtain high-value organic fertilizers and products for fertigation. Emission monitoring and minimization strategies will be performed. The fertilizer potential will be tested in field crop rotations as well as horticultural crops, and soil characteristics will be monitored. 6 different fertilizer products will be generated. The process will be flanked by an exhaustive monitoring and characterization in order to perform mass (C, N, P, K) and energy balance as well as the Life Cycle Analysis of the overall process.

This research work is being carried out in the framework of the H2020 project 'Circular Agronomics' (773649). The study is part of the Catalonia Case Study (Spain), one of the six case studies established around Europe, representing a variety of biogeographic scenarios and environmental challenges typical for the European agricultural sector (Spain, Germany, Austria, Italy, Netherlands and Czech Republic).

OBJECTIVES

1) The objective is **to close N and P cycles at farm level** by producing high-quality fertilizers through the application of **solar/thermal drying** to the combinations of the different fractions generated during the anaerobic treatment of manure (+co-substrates), the solid-liquid separation of the digestate, and the stripping of the liquid fraction.
2) Manure **acidification will be used to avoid N emissions** and will be compared with a reference process without emission control. Additionally, acidification strategies using CO_2 will be investigated as a replacement of the usual acidification reagents in order to elucidate the feasibility of using combustion gases at industrial level



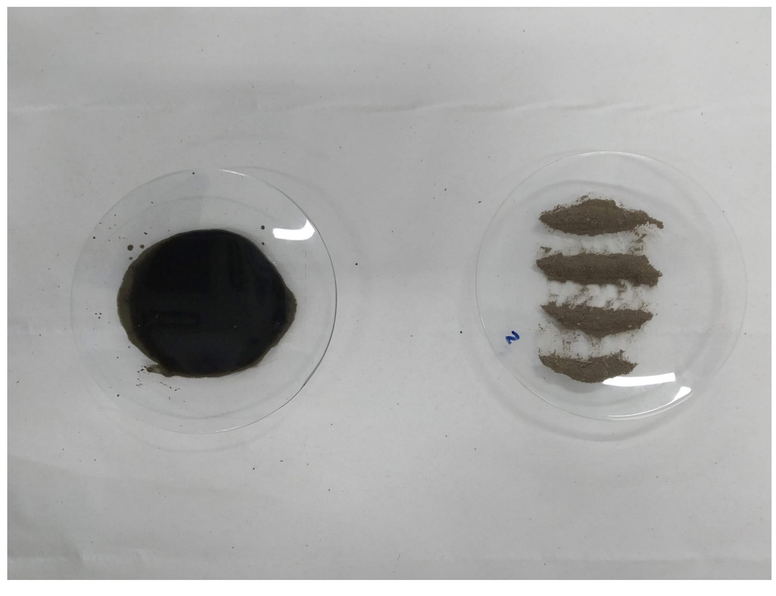


CASE STUDIES

1) **CATALONIA**, Spain (leader: **IRTA**)
2) **BRANDENBURG**, Germany (leader: **IASP**)
3) **LUNGAU**, Austria (leader: **AREC**)
4) **EMILIA-ROMAGNA**, Italy (leader: **FCSR**)
5) **GELDERLAND**, The Netherlands(leader: **WUR**)
6) **SOUTH MORAVIA**, Czech Republic (leader: **ASIO**)



Solar Dryer



Digestate vs. Dried Digestate

EXPECTED RESULTS

1) Digestate has an average of 8% of dry matter which is expected to be increased in the solid fraction to 20% after centrifugation and 80% after solar drying process. The stripping process is estimated to recover at least 75% of the remains of nitrogen in the liquid fraction. The concentrate of this process will have around 18% of N.
2) The agronomic efficiency in terms of nutrient usage will increase by 20 % compared to nowadays 15-30 % for N and 15-40 % for P in conventional farming, summing up to a total potential in avoided emission of approximately 2 Mt/yr of N and 0.2 Mt/yr of P
3) Reduction of environmental impacts in terms of GHG emissions will be achieved and will support Europe's contribution to meeting the Sustainable Development Goals
4) The inorganic ammonia, responsible for high nitrate leaching, is recovered as mineral nitrogen fertilizer, which is transportable or can be applied when an actual N demand by plants exists. This procedure will reduce nitrate emissions to receiving waters by 50 % in regions with high nitrogen surplus and by 10-15 % in European average.

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme, under Grant Agreement **No 773649**