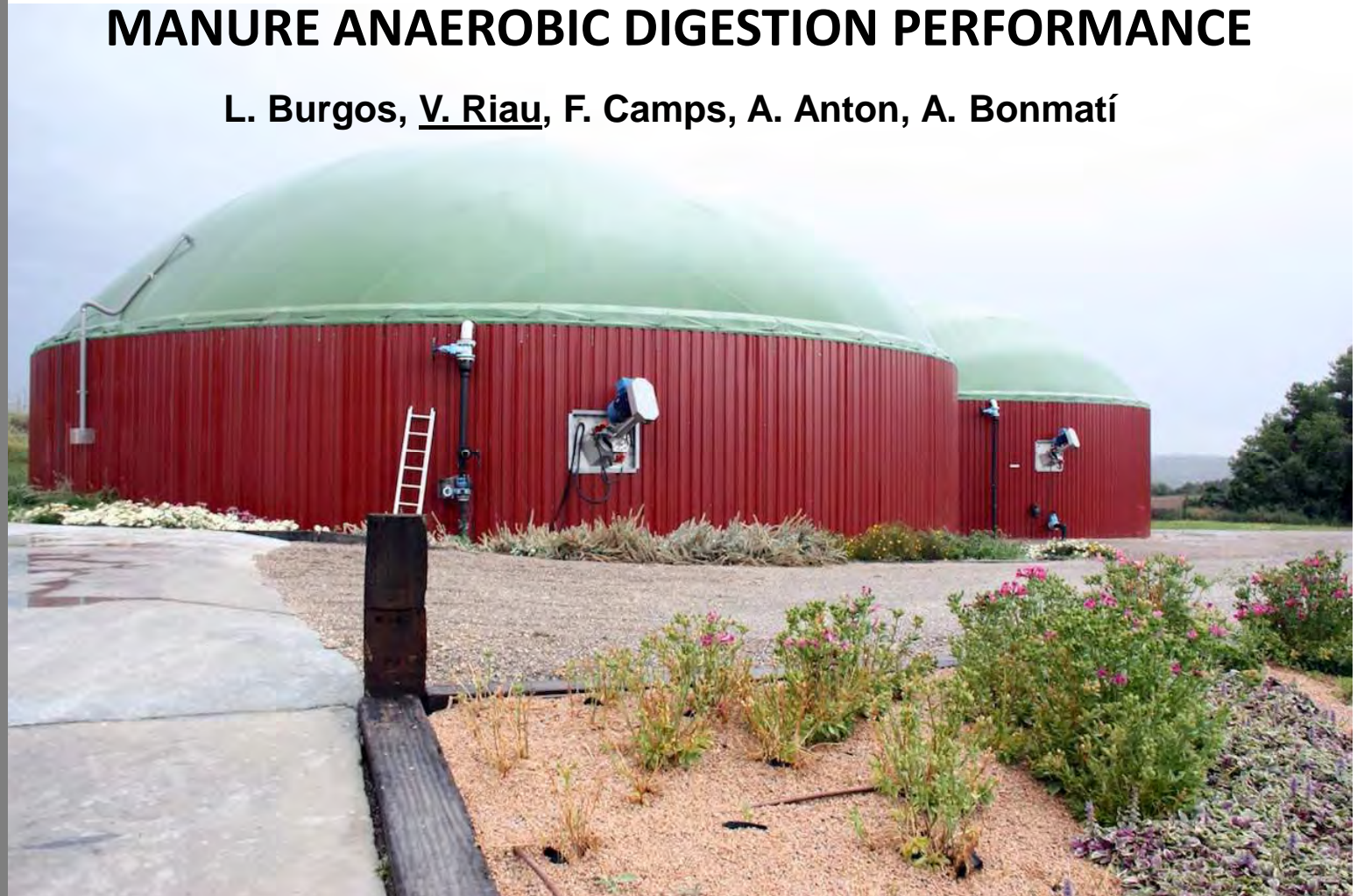


# CATCH CROPS ROTATION AS A STRATEGY TO MINIMIZE NITROGEN LEACHING AND OPTIMIZE MANURE ANAEROBIC DIGESTION PERFORMANCE

L. Burgos, V. Riau, F. Camps, A. Anton, A. Bonmatí



**ENV/ES/00647**  
**(2013-2017)**



The project **FARMS FOR THE FUTURE** (Innovation for sustainable manure management from farm to soil) aims to improve nitrogen management in areas of intensive pig farming according to different demonstrative actions related to:

- Water management and feeding on farm
- Efficiency of fertilizers on crops
- Manure treatment
- Nitrogen uptake from soils

**ENV/ES/00647**  
**(2013-2017)**



## OBJECTIVES

- Reduction of nitrogen leaching by using catch crops between successive plantings of a main crop
- Improvement of manure anaerobic digestion by using these catch crops as co-substrates in a biogas plants

**ENV/ES/00647**  
**(2013-2017)**



**CATCH CROPS: Supplementary crops grown after harvest of the main crop with the primary purpose of binding nutrients in the soil, hence diminishing pollution to the aquatic environment. Moreover, catch crops improve soil quality by reducing soil erosion, adding organic matter and reducing the need of application of fertilizer in the following growing season. (Molinuevo-Salces et al., 2013)**



INTRODUCTION

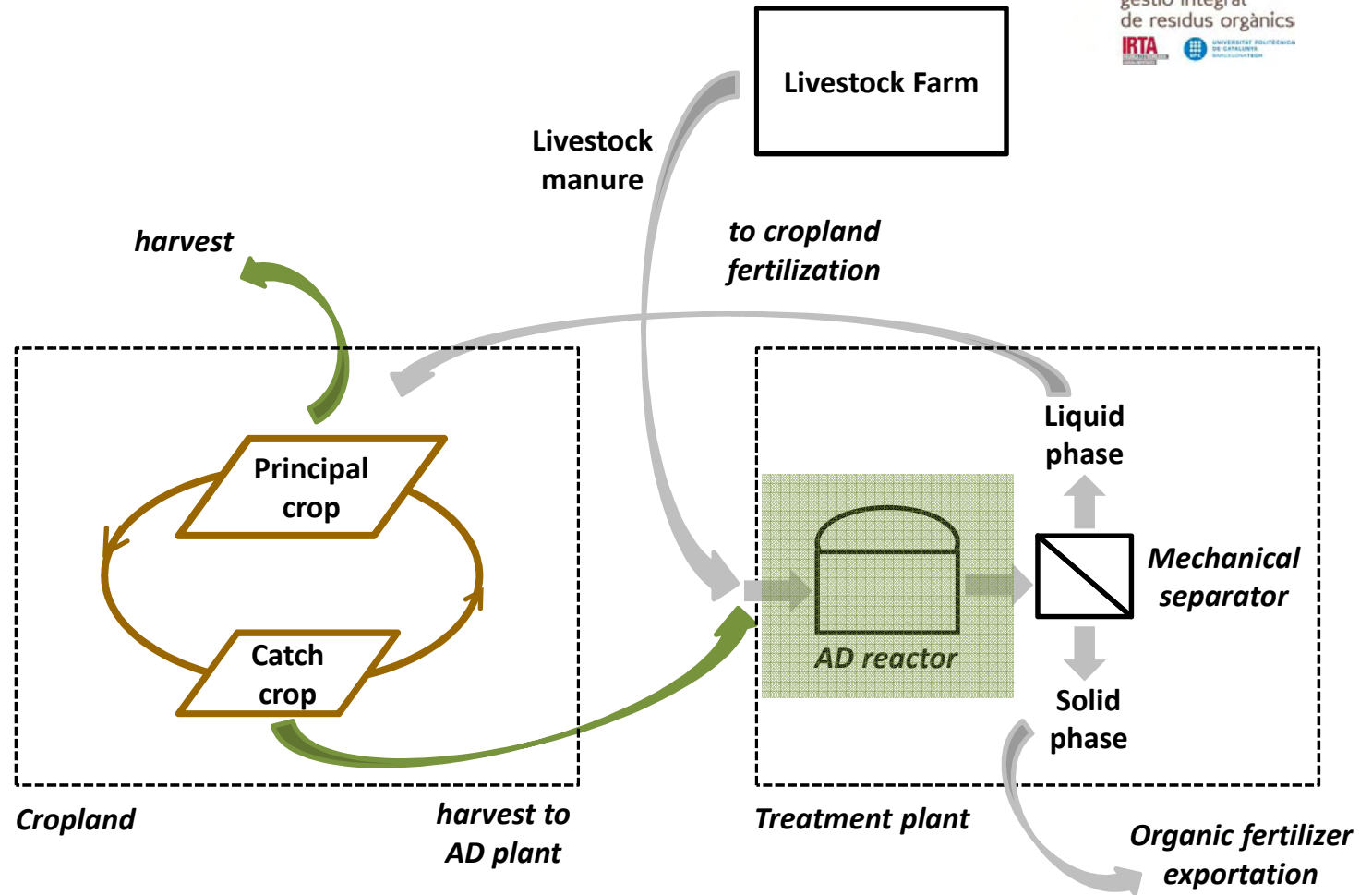
Pig production (%)		
Europe	Spain	Catalonia
100	20	28

Source: Eurostat (2013)

Place	Generation (kg N)			Slurry (m <sup>3</sup> )	Solid manure (Tonnes)
	Total	Slurry	Solid manure		
Catalonia	105.931.576	66.324.775	39.606.800	15.508.393	4.340.901

Source: GESFER (2009)



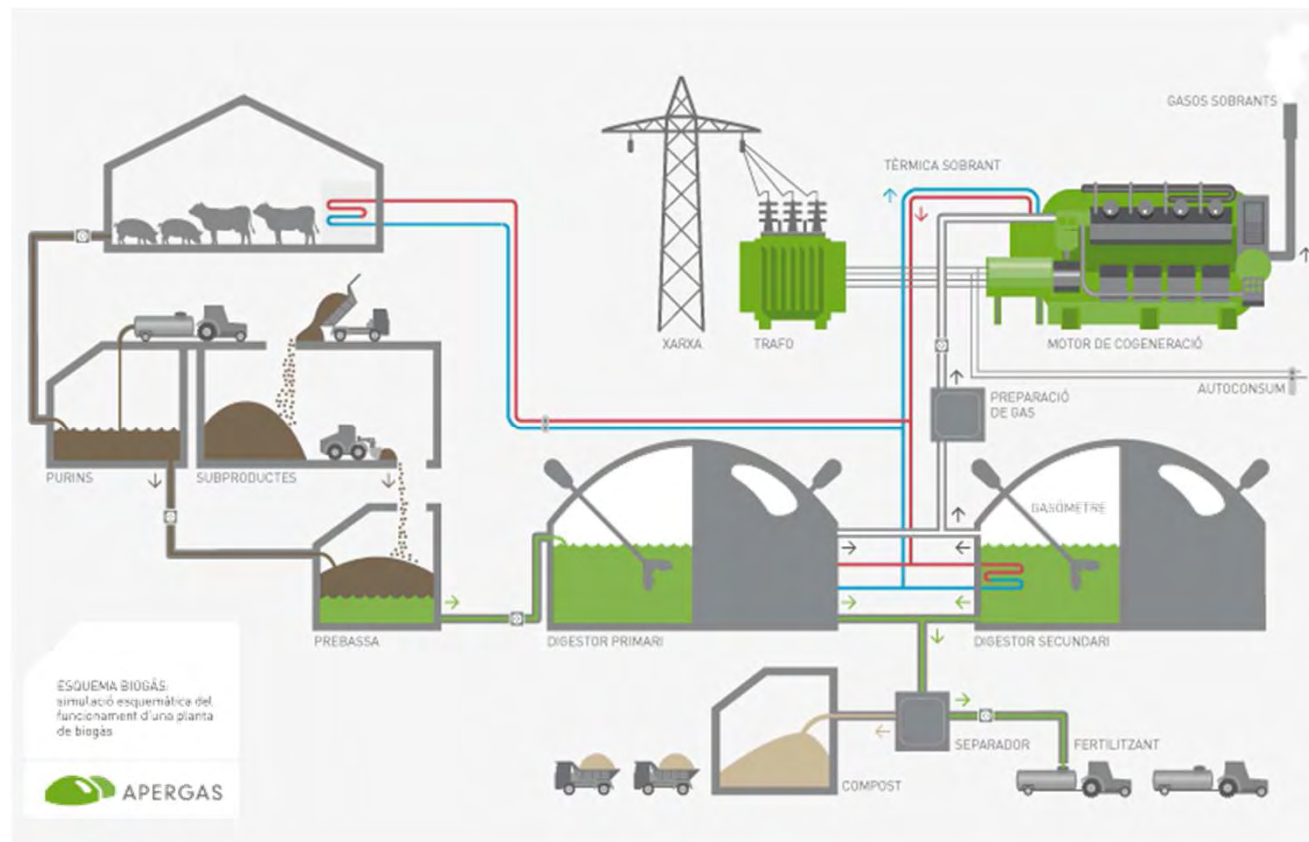




**MAS BADIA field station**  
**(La Tallada d'Empordà, Girona, Spain)**



**APERGAS biogas plant**  
**(Vilademuls, Girona, Spain)**





*Avena strigosa* (3.03 Tn DM/ha)



*Brassica napus* (3.14 Tn DM/ha)



*Lolium multiflorum* (2.69 Tn DM/ha)



*Avena strigosa*

Total COD (g/kg) = 329  
TS (%) = 18.7  
VS (%) = 16,9  
NTK (mg/kg) = 3,513



GROUND



*Brassica napus*

Total COD (g/kg) = 270  
TS (%) = 12.7  
VS (%) = 10.8  
NTK (mg/kg) = 3,472



*Lolium*  
*multiflorum*

Total COD (g/kg) = 227  
TS (%) = 20.4  
VS (%) = 17.7  
NTK (mg/kg) = 4,507



# BIODEGRADABILITY ASSAYS

## BIODEGRADABILITY ASSAYS





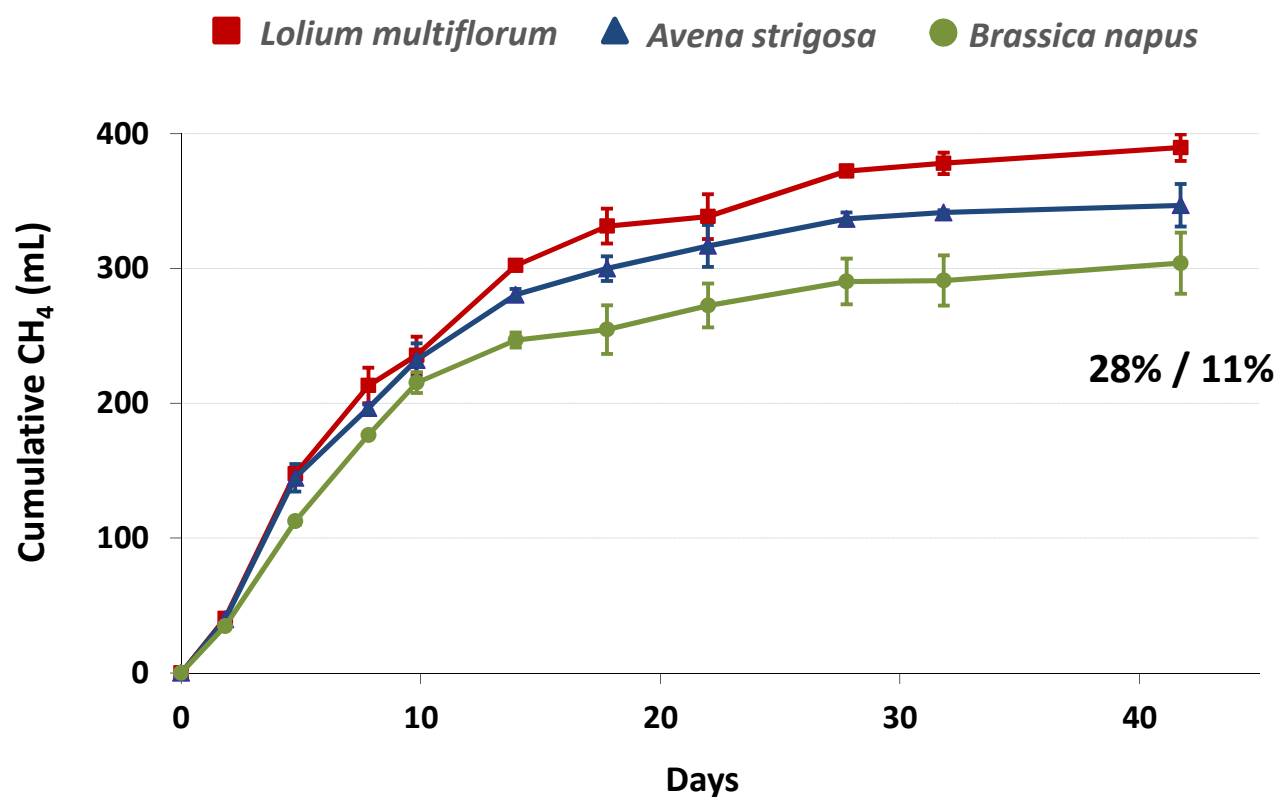
## BIODEGRADABILITY ASSAYS

### RESULTS

PARAMETER	Avena	Lolium	Brassica
Methanogenic potential (NL <sub>CH4</sub> /kg <sub>VS</sub> )	271	199	301
Methanogenic potential (NL <sub>CH4</sub> /kg <sub>COD</sub> )	139	155	120
Methanogenic potential (Nm <sup>3</sup> <sub>CH4</sub> /t)	46	35	32
Methanogenic potential (%M)	40%	34%	34%
Anaerobic biodegradability (%B)	43%	48%	37%
Methanogenic potential (Nm <sup>3</sup> <sub>CH4</sub> /ha)	740	471	803



## BIODEGRADABILITY ASSAYS



RESULTS

Víctor Riau Arenas  
victor.riau@irta.cat

# CONTINUOUS ASSAYS

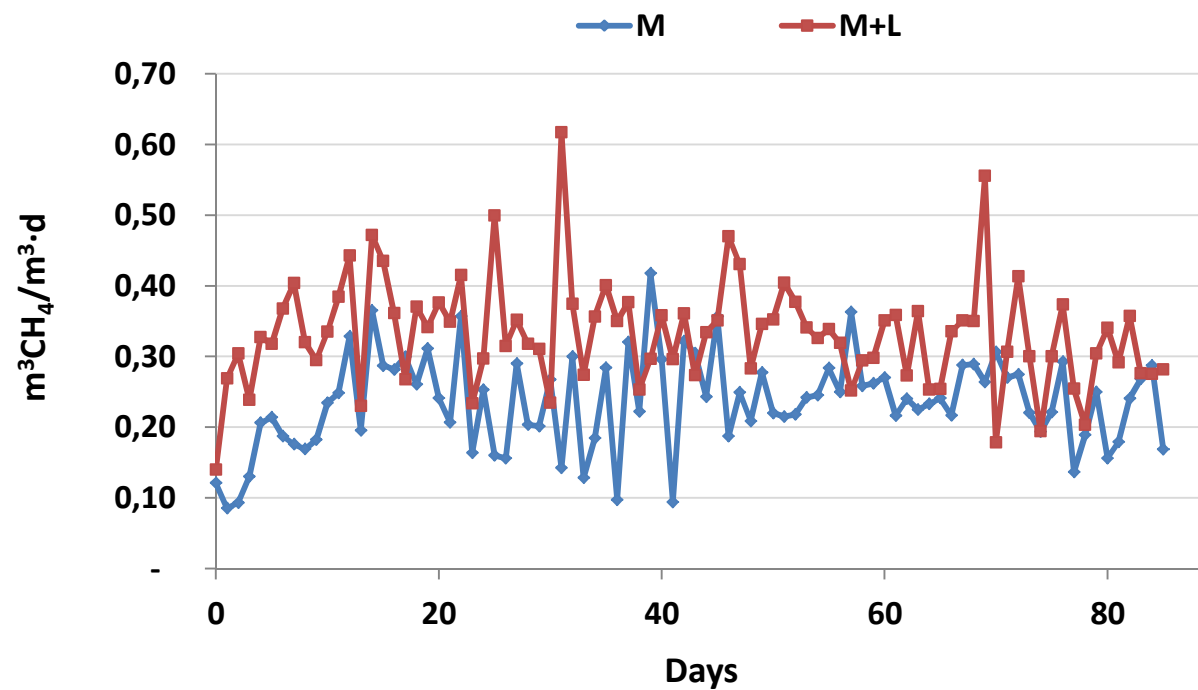
## CONTINUOUS ASSAYS



- Continuous Stirred Tank Reactor (CSTR)
- Digester volume: 6 litres
- SRT: 40 days
- Feeding: once per day (10% w/w)
- Temperature: mesophilic (37 °C)

## CONTINUOUS ASSAYS

RESULTS



## CONTINUOUS ASSAYS

### RESULTS

		MANURE	MANURE + RYEGRASS
<b>ORGANIC MATTER DEGRADATION</b>	<b>%COD</b>	57	62 (9%)
	<b>CH<sub>4</sub></b>	<b>%CH<sub>4</sub></b>	64
<b>YIELD</b>	<b>m<sup>3</sup> CH<sub>4</sub>/t<sub>waste</sub></b>	8,1	13,7 (69%)
	<b>m<sup>3</sup> biogas/t<sub>waste</sub></b>	13,1	21,8 (66%)
<b>PRODUCTION</b>	<b>m<sup>3</sup> biogas/m<sup>3</sup>·d</b>	0,3	0,5 (67%)



- All the studied catch crops showed anaerobic biodegradability higher than 35 % and methane yields higher than 199 NL<sub>CH<sub>4</sub></sub>/kg<sub>VS</sub>.
- Methane yields expressed as Nm<sup>3</sup><sub>CH<sub>4</sub></sub>/ha were 740, 471 and 803 for *Avena*, *Lolium* and *Brassica*, respectively.
- Anaerobic co-digestion of manure with *Lolium multiflorum* (10% w/w) improved the overall performance of the process.
- Anaerobic co-digestion with *Lolium multiflorum* increased methane yield and methane production by more than 65 % in comparison to the control digester.

**Thanks for your attention**