

Ammonia emission reduction in Mediterranean agriculture with innovative slurry fertigation techniques: LIFE ARIMEDA project

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LIFE ARIMEDA project aims at demonstrating innovative fertigation techniques using the liquid fraction of pig slurry and digestate in pivot and drip irrigation systems. This project develops reduction strategies of ammonia emissions in the application of organic fertilizers to the field and promotes the sustainable reuse of nutrients in Mediterranean agriculture of irrigated extensive crops.

LIFE Programme *Environment and Resource Efficiency*

Dates: 1. Sept 2017 - 30. June 2021

Total budget: 2.6 M€ (60% EC contribution)

The LIFE ARIMEDA project has received funding from the LIFE Programme of the European Union.

GOALS AND SCOPE

- To reduce ammonia emissions to the air in the application of organic fertilizers (slurry) based on:
 - Lower ammonium concentration injecting the organic fertilizer in the irrigation system.
 - Dosing and timing the nitrogen application to the crop demands.
 - Irrigation technologies that minimize the liquid-air contact surface.
- To replace synthetic nitrogen through overall crop cycle.
- To increase Nitrogen Use Efficiency backed by a nutrient plan that minimize losses.
- To increase awareness and support farmers in the implementation of fertigation techniques.

ACTIVITIES

- Development of solid/liquid prototypes.
- Demonstrate fertigation in large scale commercial plots of irrigated extensive crops in Mediterranean areas (3 harvests).
- Environmental and agronomic monitoring.
- Economic and Life Cycle Assessment of fertigation with pig slurry in Spain and digestate in Italy.
- Identification of the main drivers that limit the feasibility of fertigation.
- Support the transference of this technique to other areas.

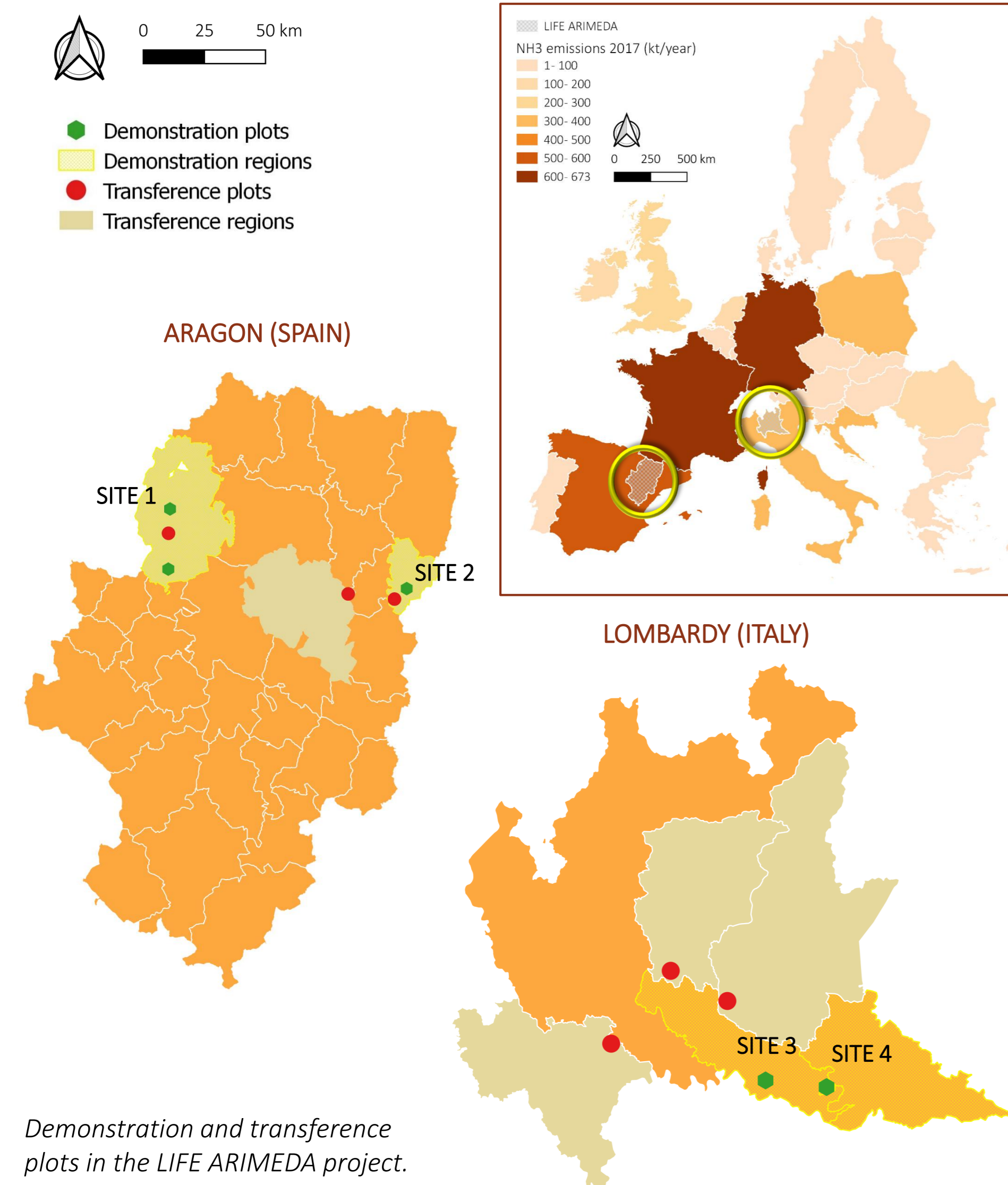
REFERENCE

Base dressing: slurry - splash plate
Side dressing: synthetic fertilizer



DEMONSTRATION AND TRANSFERENCE PLOTS

SPAIN		ITALY	
Pig slurry Grain maize		Digestate Silage maize	
SITE 1 Cinco Villas (Zaragoza)		SITE 3 Agriferr (Mantua, Lombardy)	
1	Reference (1.0 ha)	1	Reference (9.4 ha)
1	Pivot (10.4 ha)	1	Subsurface drip irrigation (9.6 ha)
1	Drip irrigation (2.0 ha)	1	Surface drip irrigation (9.5 ha)
SITE 2 La Melusa (Tamarite, Huesca)		SITE 4 Horti Padani (Cremona, Lombardy)	
1	Reference (1.2 ha)	1	Reference (7.0 ha)
1	Pivot (6.4 ha)	1	Pivot (12.4 ha)
1	Drip irrigation (2.0 ha)		



Step 1 Liquid/solid separation prototypes

- Autonomous
- Versatile
- Easy to handle
- Low energy consumption
- Portable and running without chemicals for pig slurry



Prototype for pig slurry and pivot



Prototype for digestate and pivot.



Prototype for pig slurry and drip irrigation.

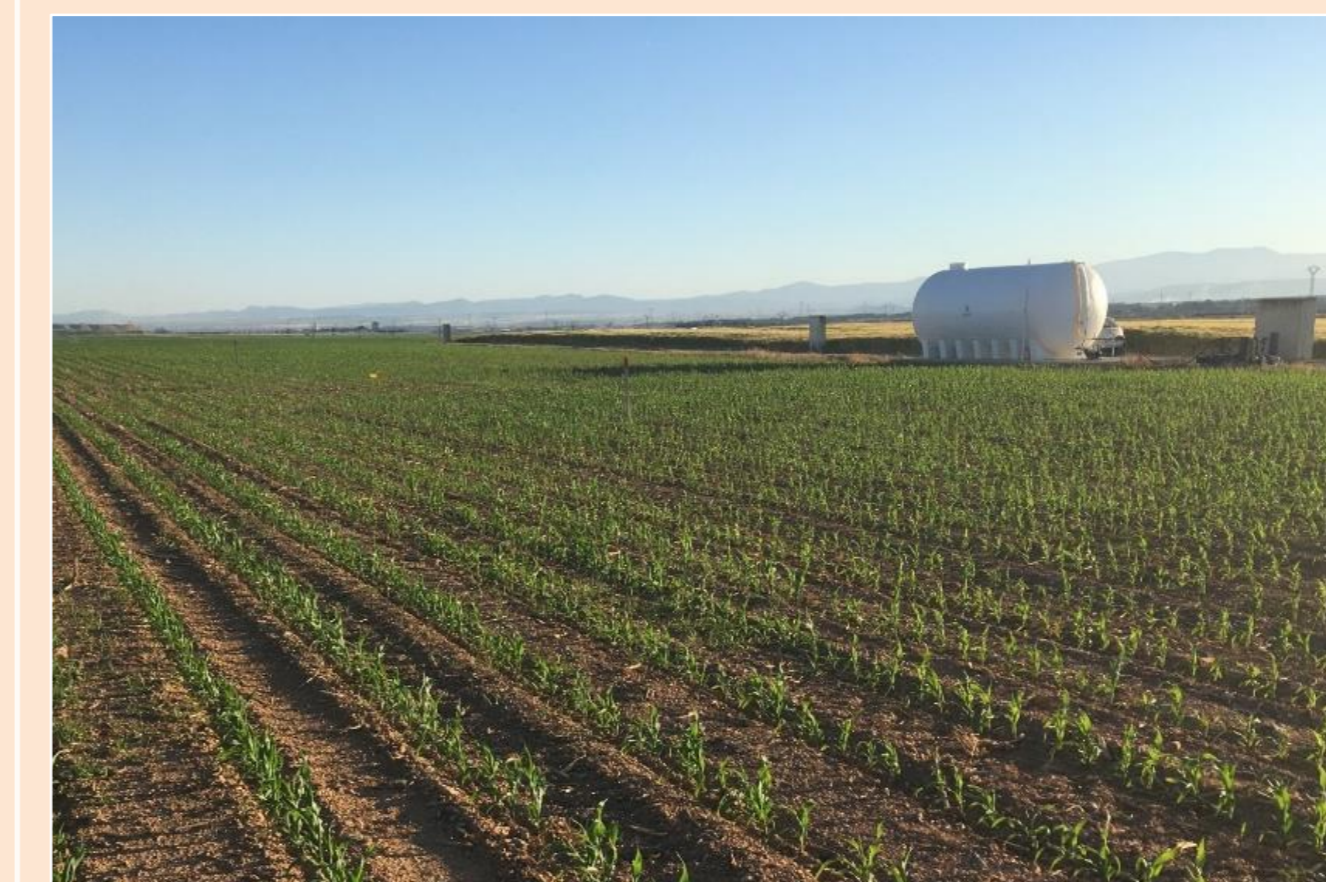


Prototype for digestate and drip irrigation.

Step 2 Adapted irrigation technology for low ammonia emission



Low-pressure pivot system. Detail of a nozzle.



Drip fertigation demonstration plot in Cinco Villas (Spain)

PIVOT

- Maximum particle size of slurry liquid fraction: 600 µm.
- Low-pressure irrigation.
- Low drift nozzles.
- Nozzles below the crop canopy.

DRIP IRRIGATION

- Maximum particle size of slurry liquid fraction: 100 µm.
- Low ammonia emission.
- Subsurface application.
- A proper irrigation handling is crucial for the growth of the crops.

ENVIRONMENTAL MONITORING

- Ammonia emissions**
ALPHA® passive samplers (CEH) + WindTrax software (Lagrangian stochastic particle model for dispersion calculations in backward mode)
- Risk of nitrate leaching**
Ceramic suction cups buried underground below crop root zone.



ALPHA samplers placed in the pivot monitored in Cinco Villas (Spain)



Sampling of water collected in suction cups.

AGRONOMIC MONITORING

- Soil sampling (nitrate and ammonium)
- Nitrogen Use Efficiency based on:
 - Crop yield
 - N applied
 - N uptake



Maize aerial biomass sampling.

Expected results: Fertigation with slurry liquid fraction...

- ...is a suitable strategy in Mediterranean areas with large surface of irrigated extensive crops.
- ...may replace synthetic nitrogen in the whole crop cycle.
- ...could increase the use efficiency of the slurry nutrients following good practices.
- ...can reduce ammonia emissions without increasing nitrate leaching risks.

Burdens:

- Feasibility is constrained by:
- Liquid fraction transport distances.
 - Nitrogen concentration in the slurry.
 - Storage capacity in every site.
 - Quality of the liquid fraction.

Outputs:

- Transference Platform.
- Guide of Good Practice of Fertigation.
- APP based on the Guide.

