Data sheet

Removal of excess nutrients from soils

Data sheet No. 1

ACTION B6. NITROGEN CATCH CROPS

1. What are nitrogen catch crops?

They are crops planted to reduce or minimise nitrogen loss through leaching once the main crop has been harvested. The catch crop absorbs part of the inorganic nitrogen in the soil for its development, at the same time as it protects the soil from erosive phenomena, protects from the formation of soil crust, improves microfauna habitat in the soil and occasionally increases the landscape diversity of the territory. Subsequently, the catch crop can be incorporated into the soil as green manure, or for other uses. This project aims to study its use as a co-substrate for biogas plants to increase biogas production.

2. Background

Some agricultural systems leave land fallow at times of greatest rainfall (autumn and winter) so that the inorganic nitrogen present in the soil drains away with the water to the water table or into irrigation channels and streams, in the case of superficial runoff. Using catch crops is a good agricultural practice to be considered as a way to minimise this type of situation. Nitrogen catch crops have the following features: fast growing, low water requirements, little or no need for agronomic practices, must be well adapted to the climate of the region, and provide a high rate of nitrogen capture.

Catch crops: ryegrass (left) and forage rapeseed (right)

Anaerobic digestion plants that treat livestock waste normally use co-substrates to increase biogas production, but co-substrates with high methane generation potential are restricted. The use of nitrogen catch crops is a good alternative to optimise biogas production while limiting nitrogen leaching, and aid excess nitrogen export..

3. Objectives

a) To evaluate the use of catch crops to minimise nitrogen loss when fertilising corn based on: digested slurry, undigested slurry and mineral fertiliser.
b) To compare the efficiency at minimising nitrogen loss of three catch crops: ryegrass, rapeseed and oats.
c) To verify the effects of these crops on build-up of phosphorus, copper and zinc in soil, when organic fertilisers have been used.
d) To determine the methane generation potential of nitrogen catch crops according to phenological state and method of conservation (silage).
e) To define the process variables that optimise anaerobic co-digestion of manure with nitrogen catch crops (pilot plant in laboratory and industrial plant).
f) To obtain data for life cycle analysis of the strategy proposed and assess its environmental impact.

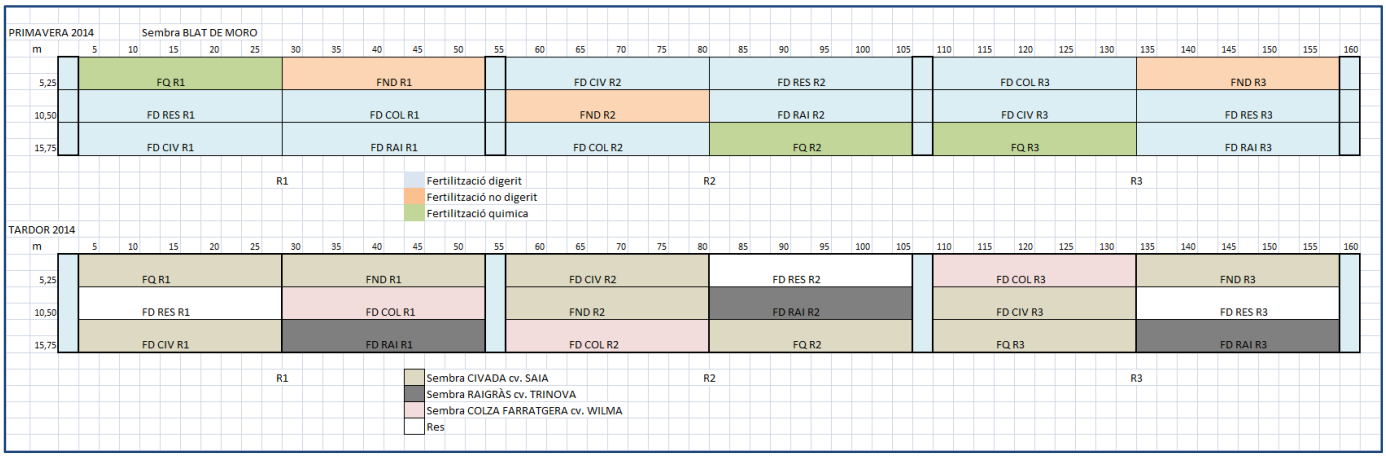
4. Partners and location

Supervisor: GIRO-IRTA
Participants: Mas Badia

Experiments with crops are developed at the Mas Badia Experimental Agricultural Station (La Tallada d'Empordà) and the biogas experiments at the Torre Marimón Centre (Caldes de Montbui), while the demonstration experiments are conducted at the SAT Sant Mer biogas plant and within a 30-km radius of the plant.

5. Experiment desing

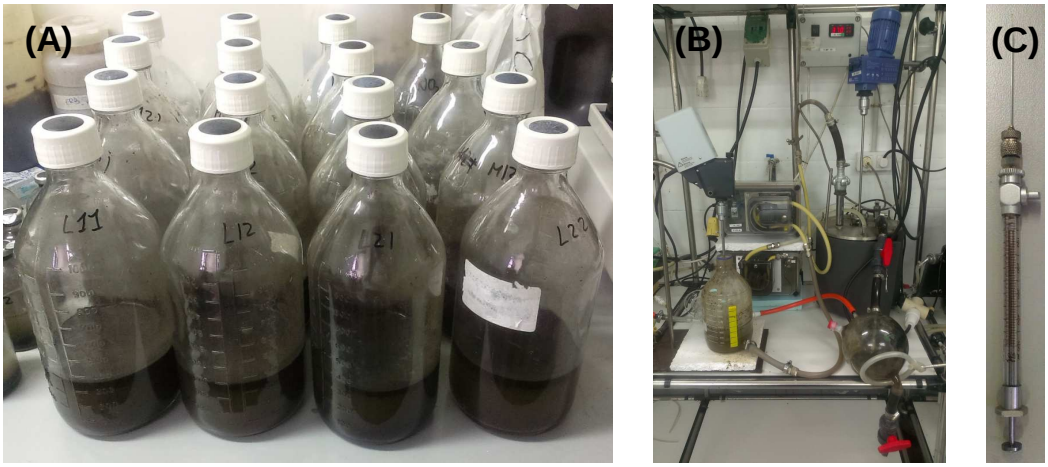
Catch crop testing: annual rotation of corn/catch crop (black oat, ryegrass, forage rapeseed).



Schema distribution of repetitions and treatments in spring (top) occupied by corn and in autumn (bottom) occupied by catch crop.

5. Experiment desing

Biogas production testing: non-continuous experiments will be carried out to determine the methane generation potential of the crops, and continuous testing in a laboratory-scale pilot plant to determine the appropiate mix and process parameters.



Schema and image of non-continuous (A) and discontinuous (B) experiment set-ups (C) Syringe for taking biogas sample

Pilot test in anaerobic digestion plant: testing will be carried out on an industrial scale to monitor biogas production, the efficiency of the various units and the quality of the digestate obtained.

Anaerobic digestion plant of the SAT Sant Mer farm

6. Follow-up and monitoring

Catch crop testing: monitoring of the agronomic and vegetative parameters of the rotation; monitoring and balance of nitrogen, phosphorus, copper and zinc in the rotation.

Biogas production testing: monitoring of biogas production, operating parameters and features of the digestate.

Demonstration experiments on catch crop production: the production and quality of crop production in experimental field condition will be determined.

Pilot test in anaerobic digestion plant: monitoring of biogas production, equipment efficiency and features of the digestate.