



AGRI-KNOWS

KNOWLEDGE TRANSFER IN AGRICULTURE AS ADDED VALUE IN ENVIRONMENT PROTECTION

Javni razpis/ AGRI – KNOWS/ Prenos znanja v kmetijstvu kot dodana vrednost pri zaščiti okolja

Javni razpis/ AGRI - KNOWS/Trasferimento delle conoscenze in agricoltura come valore aggiunto per la tutela dell'ambiente

Public procurement/ AGRI – KNOWS/

Knowledge transfer in agriculture as added value to environment protection



2007-2013
cooperazione territoriale europea
programma per la cooperazione
transfrontaliera
Italia-Slovenia
evropsko teritorialno sodelovanje
program čezmejnega sodelovanja
Slovenija-Italija



PROJECT:

EXPERIMENTS IN MICROCOSMOS:

NITROGEN AND DIGESTATE

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Cividale del Friuli

Purpose of the experiment:

Compare the behavior of animal manure before and after anaerobic digestion and following stripping of ammoniacal nitrogen, relatively to the percolation of nitrate from soil.

Processes that will be examined :

- nitrification
- cation exchange

Soil properties that will be examined :

- organic matter and total nitrogen
- Cation Exchange Capacity
- pH

It will be used a single type of soil to fill 8 columns and allow the comparison of different soil amendments and their potential role in the release and leaching of nitrate.

Characteristics of the soil to be analysed:

Texture

Organic matter

pH

Cation Exchange Capacity (CEC)

Total nitrogen

Preparation of columns:

- dimensions: height 50 cm, internal diameter 9.4 cm, section area: 69.4 cm²
- the columns were filled to a height of 40 cm
- on the bottom of the column were prepared two layers of drainage material, coarse sand and fine sand to prevent the leaching of the soil
- after filling of the columns, the soil has been compacted to bring the apparent density to a value as close as possible to the real one in the field, it was controlled by the measurements of mass and volume of the soil
- following the 'soil filling' step, the soil has been conditioned by repeated leaching with water to remove fine particles in suspension and the dissolved organic matter discarding the collected eluate

Experimental set-up and selected amendment conditions:

Each soil was subjected to the distribution of different types of amendments corresponding to the same amount of total nitrogen equivalent to 280 kg N ha^{-1} .

Condition 1: Control

Condition 2: Mineral fertilizer (ammonium sulphate)

Condition 3: Cattle manure (indegested/unmodified)

Condition 4: Digested cattle manure (digestate)

Condition 5 : Stripped digested cattle manure

Replicates: two for organic fertilizers and one for the control and mineral fertilizer

Set-up of 8 columns as follows:

Column 1: control: 0 kg/ha N

Column 2: 280 kg/ha N as $(\text{NH}_4)_2\text{SO}_4$ dissolved in a volume of water equal to the condition 3,4,5

Column 3: 280 kg/ha N as cattle slurry/manure (unmodified)

Column 4: replicate (condition 3)

Column 5: 280 kg/ha N as digestate from anaerobic fermentation for biogas production

Column 6: replicate (condition 4)

Column 7: 280 kg/ha N as stripped digestate

Column 8: replicate condition 5

The effective amount of the product added in the columns will be calculated based on the total nitrogen concentration determined analytically in the laboratory.

Methods of distribution of fertilizers on the soil: in a single dose and incorporated at a depth of $\sim 2/3$ cm .

Simulation of rainfall events:

Simulated rainfall events, distributed over a period of 2-3 months, based on climate data found in the Friuli Venezia Giulia region and in the bordering Slovenia.

The rainy water will be distributed evenly on the soil surface, with the aid of a small watering can or equivalent helping instrument.

Simultaneously, from the tap placed in the bottom of the column, it will be collected the eluate equal to the amount of water distributed on the surface. Collected samples are then subjected to chemical analysis provided by the experimental protocols

Doses and time distribution:

Considering the data of the average spring rainfall in the region it could be considered an overall average amount of 500 mm.

For simplified calculations we assumed 10 rainfall events of 50 mm each on a weekly basis. The trial lasted 2-3 months and allowed the collection of 10 samples per column.

Total elution water samples : 8 x 10 rainfall events = 80 samples

Volumes of water to be added : $69.4 \text{ cm}^2 \times 5 \text{ cm} = 347.0 \text{ mL}$ (~350 mL)

Gradual distribution of the water, for a total time of at least 60 min, starting with an initial volume of 100 mL and successive aliquots of 50 mL every 10 minutes, in this way is allowed for water to migrate into the soil in a gradual manner .

Chemical tests on eluates

Determination of N-NO³⁻

Determination of N-NH⁴⁺

TOC (total organic carbon) or DOC (dissolved organic carbon)

Chemical tests on soil at the end of the experiment :

organic C

N-NO³⁻

N-NH⁴⁺

Microbial biomass (FE)