



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



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evropsko teritorialno sodelovanje
program čezmejnega sodelovanja
Slovenija-Italija



PROJECT:

EXPERIMENTS IN MICROCOSMOS:

CHROMIUM

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Project participants: students of ISIS "Malignani"

Cervignano

Purpose of the experiment :

To study the factors that affect the immobilization, oxidation and/or reduction of the two chromium redox states in the soil. It will be used a single type of soil, with which 12 columns will be filled to allow the comparison of chromium (Cr) transformations and mobility.

Processes that will be examined:

- cation exchange
- reduction of Cr (VI)
- oxidation of Cr (III)
- effect of sugars as a stimulus of the soil microbiological activity and with the function of "electron donors " to increase Cr (IV) reduction
- effect of humic substances as "electron carriers" in the redox processes to increase Cr (IV) reduction

Soil properties that will be examined:

- content of organic matter and total nitrogen
- cation exchange capacity (CEC)
- pH
- redox potential (Eh)
- microbial biomass carbon

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 washing/leaching with water to remove fine particles in suspension and dissolved organic matter. The eluate has been discharged

Experimental set-up and selected conditions

Condition 1: Control

Condition 2: Addition of Cr (III) – 1600 µg Cr g⁻¹ soil

Condition 3: Adding tannery containing Cr (III) - 1600 µg Cr g⁻¹ soil

Condition 4: Addition of Cr (VI) - 150 µg Cr g⁻¹ soil

Condition 5: Addition of Cr (VI) + simple sugar (glucose or sucrose) - 150 µg Cr g⁻¹ soil + 5 mg sugar g⁻¹ soil

Condition 6: Addition of Cr (VI) + humic acids - 150 µg Cr g⁻¹ soil + 5 mg humic acid g⁻¹ soil

Two replicates each

Simulation of rainfall events:

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

It will be performed an elution weekly for the first 4 weeks, afterwards fortnightly (every two weeks) for another month and finally monthly for additional two months.

Total elution water samples: 8

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

Total chromium

Cr (VI) content

pH

Total nitrogen (N)

Dissolved organic carbon (DOC)

Chemical tests on soil at the end of the experiment:

Organic C

Extractable chromium

Total chromium

Microbial biomass (FE)

Note:

Preparation of the solution containing commercial humic acids (Sigma Aldrich):

The humic acids are dissolved in 200 mL of water under stirring conditions and the pH of the solution is measured.

In the prepared solution is gradually added 0.1 M KOH adjusting the pH around 7-8 (during the solubilisation process the pH tends to decrease and is controlled by KOH addition). At the end the solution is brought up to a volume of 250 mL.

For the following mixtures: *chromium – sugar+chromium - humic acids+chromium*, distribute sugar or humic acids in solution immediately before the addition of chromium and its complete adsorption by the soil and no presence in the surface.