Strategies to prevent N leaching in vegetable cropping systems in Brittany

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Vegetable cropping systems in Brittany

Context

- « Golden belt » of Brittany ~ 30 000 ha of field vegetables
- Growers are gathered in growers' organisations (with brands)
- Network of research centres specialised on vegetable+ advisors

Characteristics

Intensive vegetables cropping systems (continuous vegetable rotations)

-> Nitrate vulnerable zone

-> High winter rainfall and high water table

-> High N mineralisation in autumn and risks of leaching

-> Loamy soils

-> Rich in P, K (focus on N especially)

Objectives

-> Adapting cropping systems to avoid Nitrogen losses towards the environment

CATE: Applied research in horticulture

Main objectives

- **Support the competitiveness of horticultural products**
- **Provide growers with references for best practices**
- **Assist the horticultural sector in adapting to consumer demand**

Expertise area

- ✓ Sustainable fertilisation practices
- ✓ Plant protection and IPM
- ✓ Cropping practices
- ✓ Varietal evaluation
- ✓ Post-harvest quality preservation
- ✓ Innovative cropping system design

Resources

- Experimental farm -> **12 ha of trial plots** and **9000 m² of glasshouses**
- Staff: 21 people (8 researchers)
- lysimetric compartments, cells for shelf-life studies, container fields, pasteurization & growth chamber, weather station, etc.

We work on

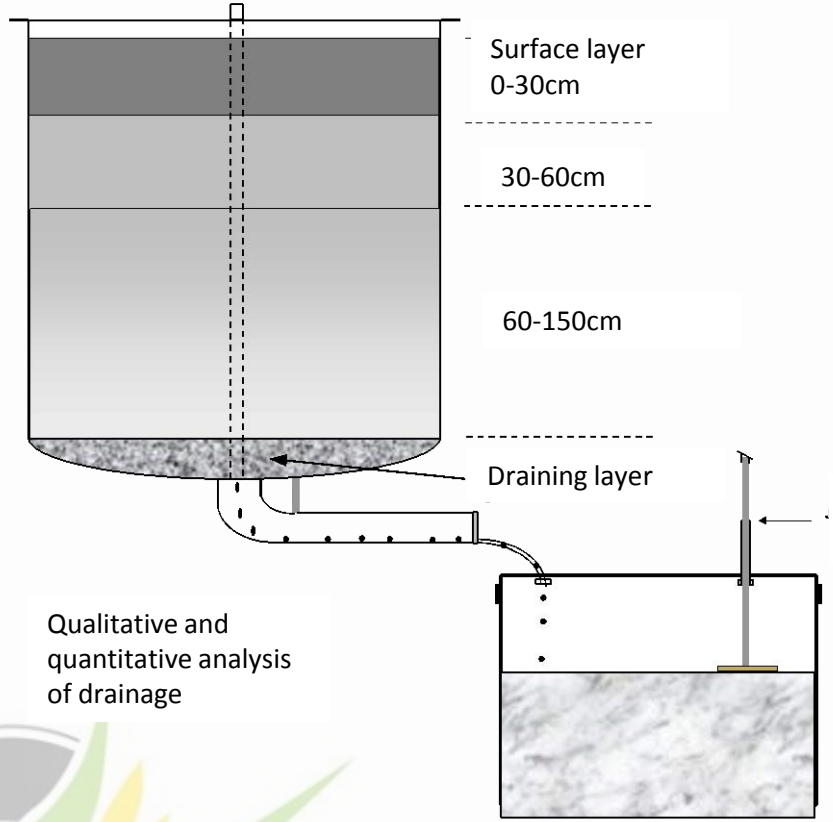
- **Fresh field vegetables :**cauliflower, artichoke, shallot, onion, chicory, broccoli, lettuce, zucchini …
- **Soilless covered crops** :tomato, strawberry…
- **Ornamentals**: nursery stock
- **Edible mushrooms**: shii-take, pleurotus…

In collaboration with:

-Terre d'Essai -> organic trial station
-Vegenov -> cell/molecular lab
-Chambre d'agriculture : advisors
-CERAFEL-> growers' organisation

Equipment to test impact of CS on N leaching

- 16 lysimetric cells on a long-term experiment (since 1983)



Suction cups placed at 30, 60, 90cm

Lysimeters

Underground corridor to collect drainage

Lysimeter with artichoke

Steps towards sustainable fertilisation practices

1982-1988 Study of cauliflower and artichoke fertilisation

-> definition of standards for local growers

1983-1991 Study on factors influencing leaching in cropping systems with lysimeters

- bare soils> cauliflower –artichoke > cauliflower-potato

N losses: ~150kgN/ha/Y ~45 kgN/ha/Y

- crop residue return
- timing of N fertilisation

1991-2001 Inclusion of crop residues in fertilisation standards

new cropping systems designs with nitrate leaching <50mg/L

1997-2004 Use of nitrogen from crop residues in cauliflower and artichoke

(with plotted N15 in crop residues) - Collaboration with INRA

after 3 years (cauliflower)

- 3% of N was leached,
- 31% was used in the 6 next crops
- 66% is still present in the soil

Steps towards sustainable fertilisation practices

2001-2009 Monitoring N nutrition status of cauliflower

Adaptation of PILazo method developed by CTIFL

2001-2012 Study of a diversity of cropping systems including cover crops

Effect of modified CS (with cover crops and green manure) vs classical CS on **N leaching**

Cauliflower-potato:
modified system> classical system
N losses: 33kgN/ha/year 17kgN/ha/year
Artichoke-cauliflower
modified system ~ classical system
N losses: ~ 35 kgN/ha/year 32 kgN/ha/year

2012-2015 Modification of cropping systems to reduce N leaching risks

Use of crops growing in autumn to absorb mineralisation and leaching peak

-sowing under cover crops, use of N catch crops as an intercropping, straw burial to limit leachable N

Steps towards sustainable fertilisation practices

2016-2019 Breizhlegum'eau : Innovating vegetable cropping systems to limit N losses in Brittany

-> trials at research centres and on-farm trials with advisors

-> references for autonomy in inputs

2017-2020 AgroecosystN : Validation of Syst'N model (INRA –ACTA) for vegetable cropping systems

To be continued

… collaboration at European level with institutions with similar interests?

… how to continue working on long-term experiments? (projects are more & more short-term oriented)

-Other topics of interest:

Relationship between organic fertilisation/ OM (type, inputs) and soil fertility /soil microbiology

Effect of cropping practices (soil management operations, etc)

Thank you for your attention!

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