

# Agronomic relevance of Extracted Organic Nitrogen



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## Introduction

- ✓ Assessing soil quality and N supply is challenging due to heterogenous character of soil N.
- ✓ Multiple Extractable Organic Nitrogen (EON) fractions have been proposed to assess labile N pools (sensitive to management) or plant availability of N during the growing season
- ✓ Size and properties of EON however strongly vary with extraction conditions and soil pretreatment and typically accounts for 0-5% of total N
- ✓ EON (extracted with weak salt solutions) are considered to be most bioavailable
- ✓ EON fractions show some variation with agroecosystem properties suggesting a value as indicator for sustainable soil and fertilizer management
- ✓ Upscaling of results among publications is hampered by strong effects of methodology

## Material & Methods

- ✓ Collect 14.500 soil samples across the Netherlands with varying soil properties
- ✓ Extract these soils with 0.01M CaCl<sub>2</sub> multi-nutrient extraction procedure to measure EON
- ✓ Analyze soil properties like pH, texture, organic matter, pH and Cation Exchange Capacity using routine soil testing procedures
- ✓ Monitor agroecosystem properties like soil depth, land use, sampling time and soil type
- ✓ Monitor weekly EON, inorganic N, temperature and moisture in arable potato field
- ✓ Statistical analysis (after log-transformation):
  - correlation tests to evaluate relationships between individual variables
  - REML-mixed models to evaluate impact of agroecosystem properties
  - PLS-regression to predict EON using chemical, physical and biological soil properties

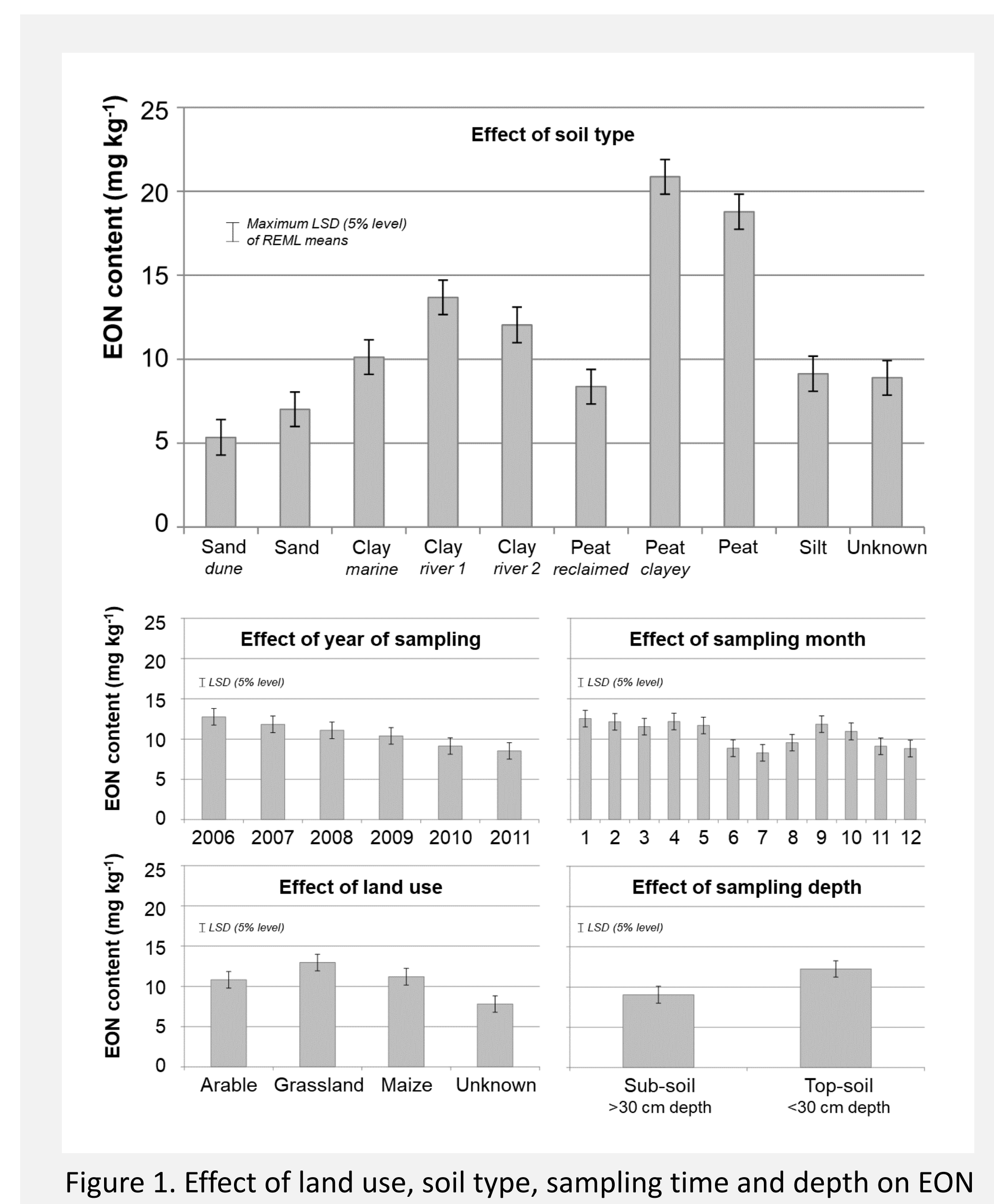


Figure 1. Effect of land use, soil type, sampling time and depth on EON

## Results & Discussion: Effect Agro-ecosystem Properties

- ✓ Land use had a significant influence on EON, with the highest levels found in grasslands likely due to differences in fertilizer history and fresh C input from rhizosphere (Figure 1).
- ✓ Soil texture had a stronger effect on EON than land use (Figure 1).
- ✓ No consistent effect of weather conditions visible in seasonal dynamics of EON.
- ✓ Daily variation in weather and fertilization had minor impact on EON (Figure 3).
- ✓ EON levels decreased over 2006 to 2011. Since this was not present for N-total, this suggests that EON is associated to changes in organic matter quality rather than quantity.

## Conclusion Agronomic Relevance

- ✓ EON mostly controlled by texture and organic matter
- ✓ EON reflects differences in management and fertilizer history
- ✓ EON has potential as predictor potential N supply
- ✓ EON is not highly dynamic bioavailable N fraction

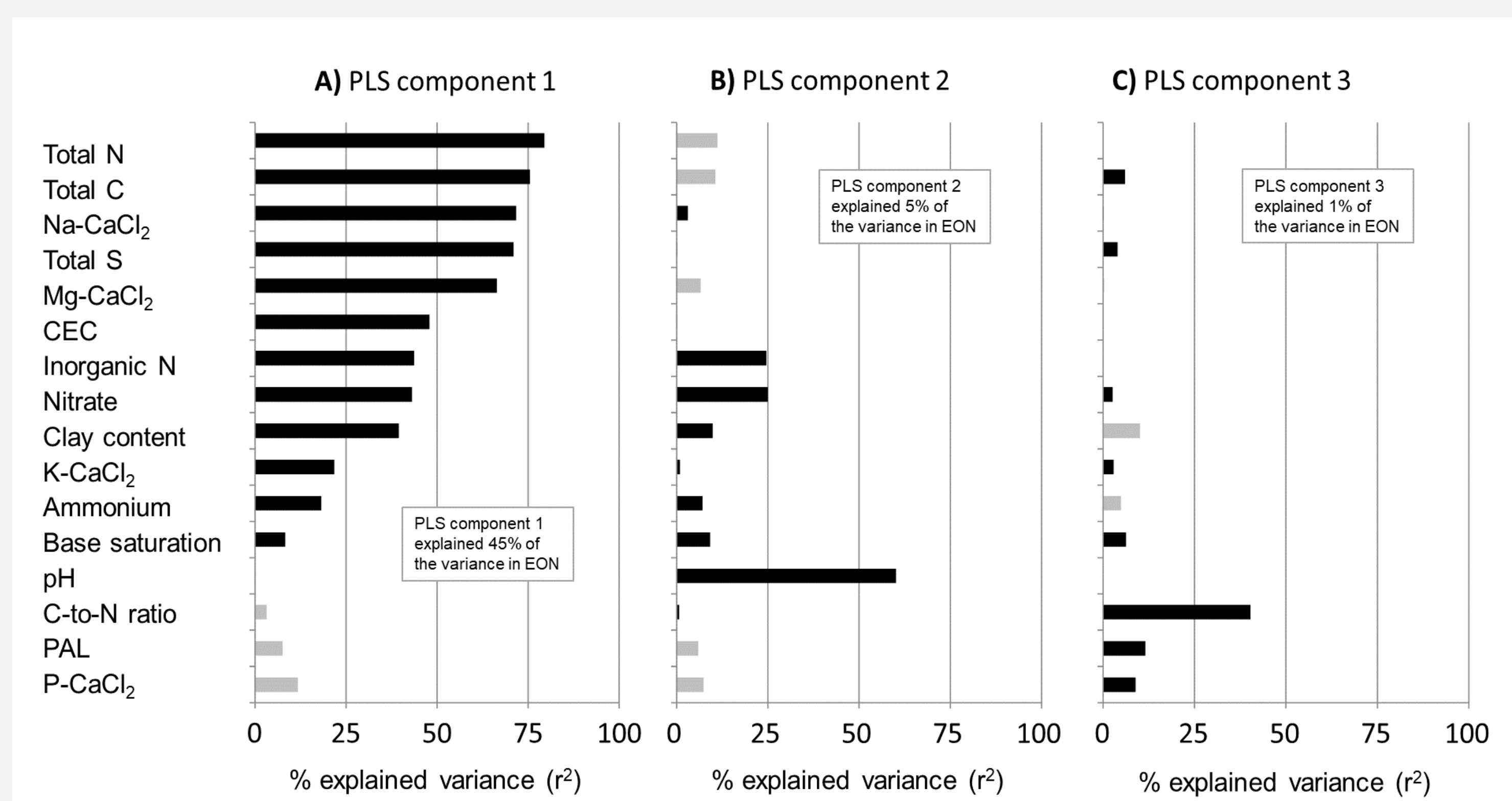


Figure 2. Explained variance for all variables in the model of EON. Bars with the same color are positively related to each other within the component (black bars are positively correlated, grey ones negatively). Variables are sorted according to the % explained variance in the first PLS component.

## Results & Discussion: Relationship with Soil Components

- ✓ EON fraction was positively related to factors associated with soil organic matter : N-total ( $r = 0.63$ ), organic C ( $r = 0.59$ ), S-total ( $r = 0.49$ ) and CEC ( $r = 0.46$ ).
- ✓ EON was negatively correlated to C-to-N ratio and pH whereas higher levels of P (reflecting higher manuring history) were associated with increased levels of EON.
- ✓ Relationship of EON with soil properties strongly controlled by a 'organic matter property' and a soil and fertilizer management related property (Figure 2).
- ✓ Organic matter and clay strongly control both chemical and physical processes driving fate of organic N in soil (Figure 2): more clay results in increased stabilization of organic N in soil. The bioavailable fraction of organic N seems to be a fixed fraction of total N, suggesting that soil mineralogy strongly controls EON and natural N-supply in soils.
- ✓ EON was positively related with potential N mineralization rates (not shown), likely due to collinearity with soil organic N and clay content.
- ✓ Relationship with actual N mineralization rates is minor due to small impact of weather and day to day management of farmers (Figure 3).

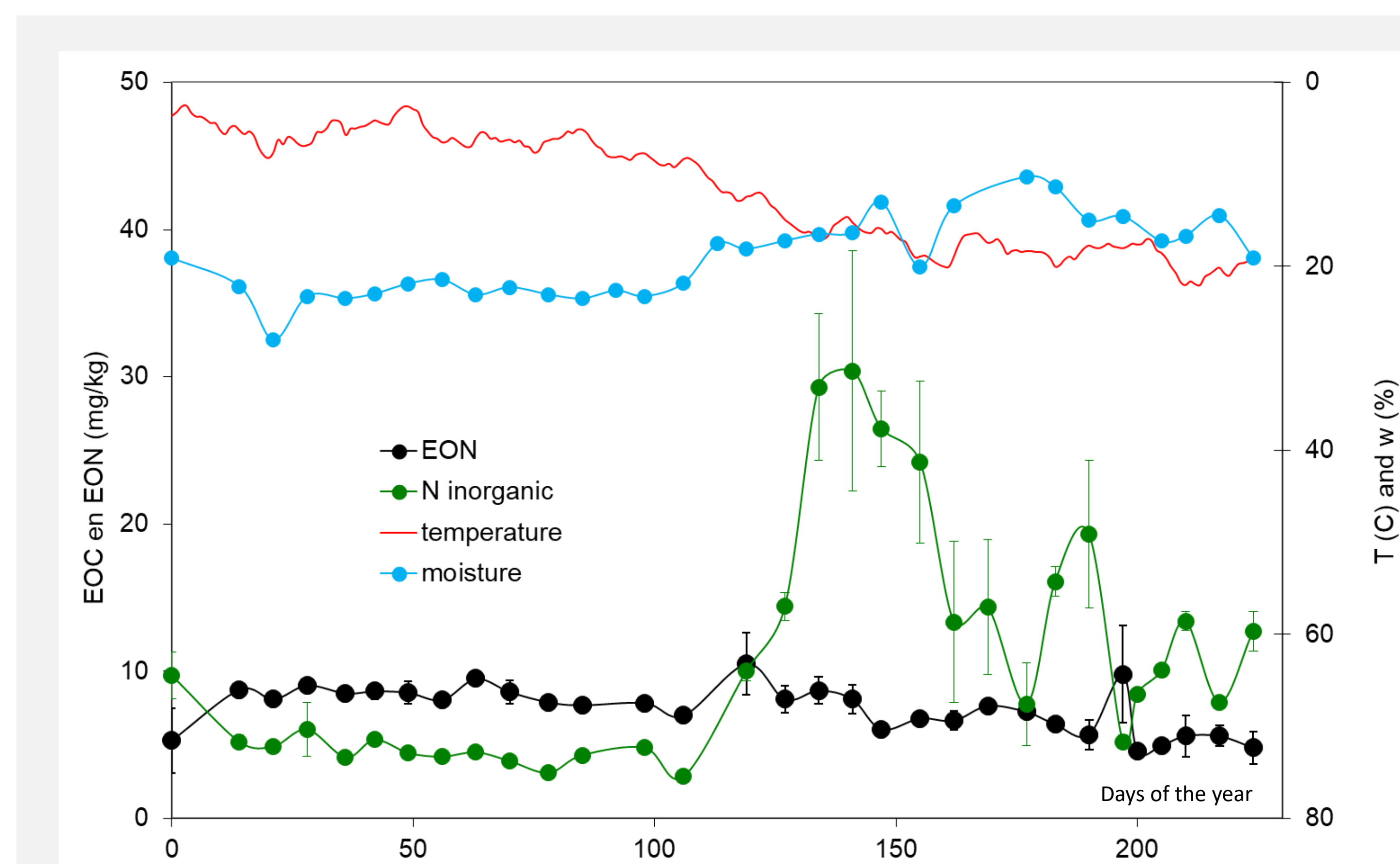


Figure 3. Weekly variation in EON, inorganic N and temperature and moisture over a year in a sandy arable potato soil