



# How can VFG-compost applications contribute to carbon sequestration in agricultural land: a model approach validated by long term field trial measurements

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Annually, more than 350 000 tons of compost are produced in Flanders, of which approximately 30% VFG-compost and 70% green compost. Taking into account the average carbon content and the humification coefficients of VFG- and green compost when applied to arable land, this amount corresponds to a theoretical potential carbon sequestration of 41 462 tons per year.

In agriculture, the use of VFG-compost can contribute significantly to the improvement of the soil organic carbon content in the long term and therefore to the chemical (nutrients), physical (structure) and biological (soil life) quality of the soil. The aim of this study was to quantify the effect of long-term VFG-compost application on the soil organic carbon (SOC) content in a typical arable crop rotation (including sugar beet, winter wheat, potato and carrot) and to get a better insight in its effect on soil organic matter dynamics.

Two approaches were used: a field trial approach and a model approach.



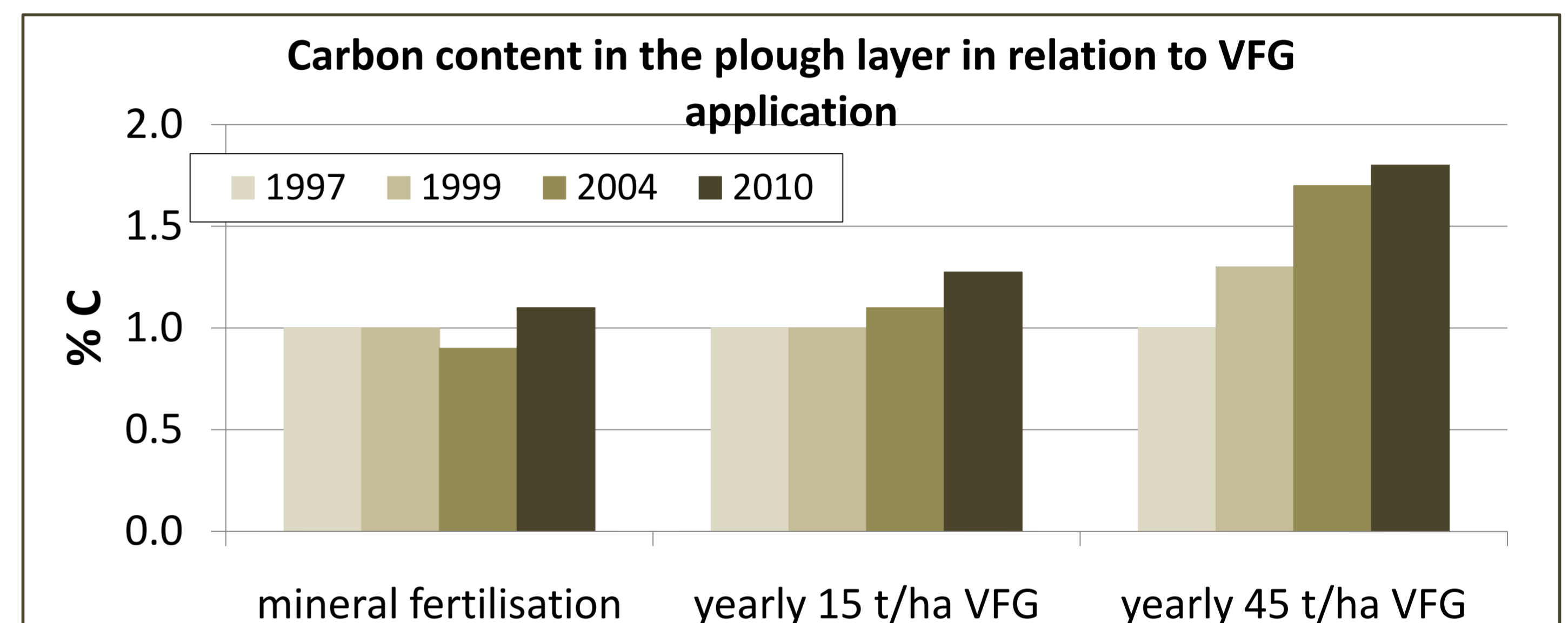
Application of VFG-compost and lime in the long-term field trial

## Field trial approach

Field data and measurements of a long-term VFG-compost trial were used. The field trial was set up by the Soil Service of Belgium in 1997 on a loamy soil.

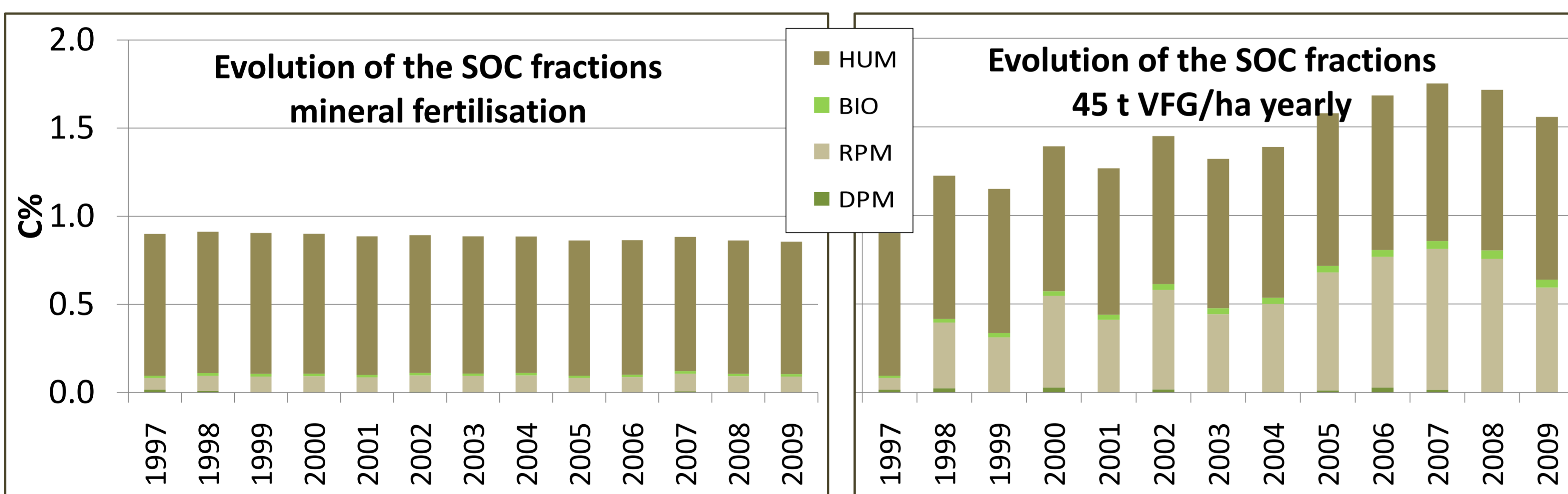
In this trial, VFG-compost was applied at different rates: 0, 15, 30 and 45 tons/ha, and with different frequencies: yearly, two-yearly and three-yearly. From 2003 on, nitrogen fertilisation was adjusted in all the treatments to the advised level with mineral fertiliser, taking into account the amount of nitrogen delivered by the VFG compost.

Measurements of the carbon content in the plough layer of the soil revealed clearly that, after 14 years, the soil carbon content increased with increasing rates and frequency of compost application. The highest carbon contents were obtained with a yearly application of 30 tons VFG/ha and 45 tons VFG/ha. When a lower dose (15 tons/ha) was applied, even yearly, the increase of the soil carbon content was limited.

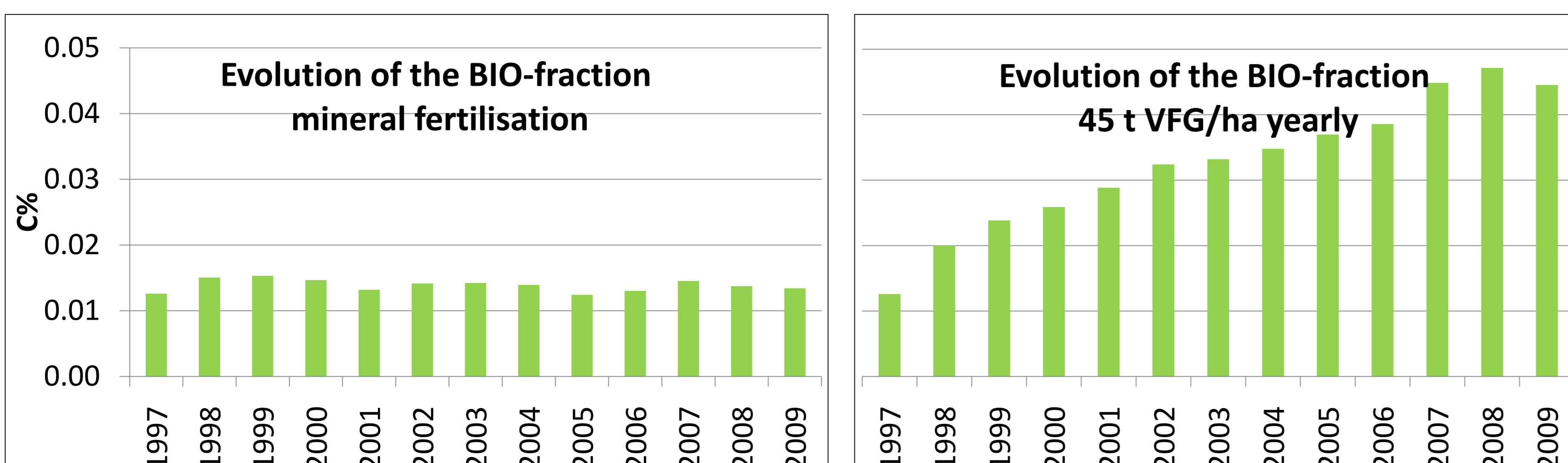
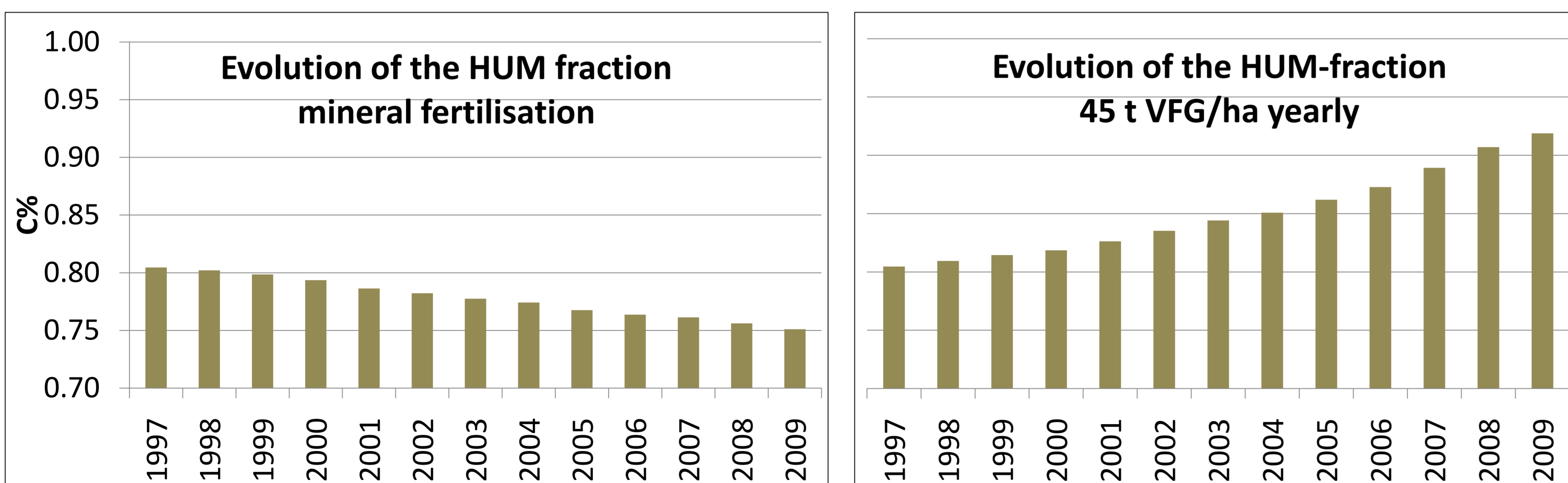


## Model approach

In a second approach, in order to gain a better insight in the organic carbon dynamics in the soil as a result of long-term VFG-compost applications, the field trial data were used as an input in the Roth-C model. This model, developed at the agricultural research centre of Rothamsted (UK), is based on the interaction between five conceptual SOC fractions: decomposable plant material (DPM), resistant plant material (RPM), microbial biomass (BIO), humified organic matter (HUM) and a small amount of inert organic matter (IOM).



The simulation results (see graphs on the left) indicate a significant difference in SOC content, but also in SOC fraction distribution, between parcels without VFG-compost application and parcels with frequent application of high amounts of VFG-compost (45 tons/ha). Long-term application of VFG-compost results in an accumulation of the more resistant SOC fractions in the soil: both the humus fraction (HUM) and the microbial biomass (BIO) increased significantly.



## Conclusion

Application of VFG-compost contributes significantly to the improvement of soil organic carbon content and to the accumulation of resistant organic carbon fractions in the soil. In the long term, this accumulation leads to increased N-mineralisation during the growing season and in autumn. As a consequence, in parcels with frequent application of high amounts of VFG-compost higher nitrate residues can be measured during autumn.