Thomas Larsen[1,2], Paul-Henning Krogh[2], Jakob Magid[1] and Antonie Gorissen[3]

[1]Plant Nutrition and Soil Fertility Laboratory
Royal Veterinary and Agricultural University
Thorvaldsensvej 40, DK–1871 Frederiksberg C, Denmark
[2]Department of Terrestrial Ecology
National Environmental Research Institute
Vejlsøvej 25, DK–8600 Silkeborg, Denmark
[3]IsoLife BV
P.O. Box 349
NL-6700 AH Wageningen, The Netherlands

IsoLife
Stable Isotope Labelled Plant Products for the Life Sciences

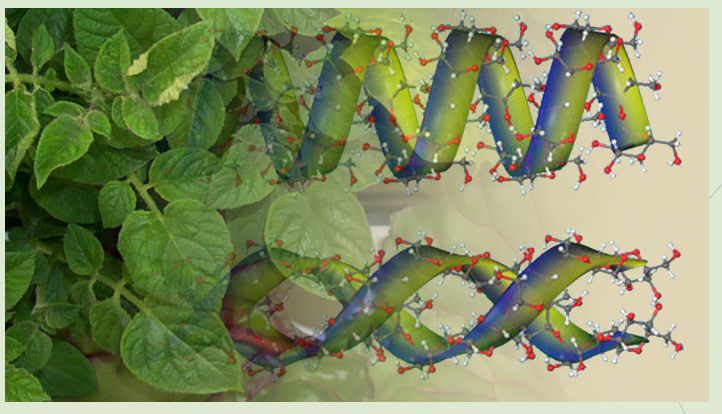
National Environmental Research Institute
Ministry of the Environment · Denmark

KVL A UNIVERSITY OF LIFE SCIENCES

Dual-labelled ($^{13}C/^{15}N$) *green manure* to differentiate between plant uptake of *organic* and *inorganic N*

Introduction

Experimental data is still lacking for determining whether plant uptake of organic nitrogen in agricultural soils contributes substantially to the total N uptake. Pulse-injection studies with dual-labelled amino acids have confirmed that non-mycorrhizal crops possess the capacity to take up organic N but failed to quantify the uptake relative to total N uptake.



Materials & Methods

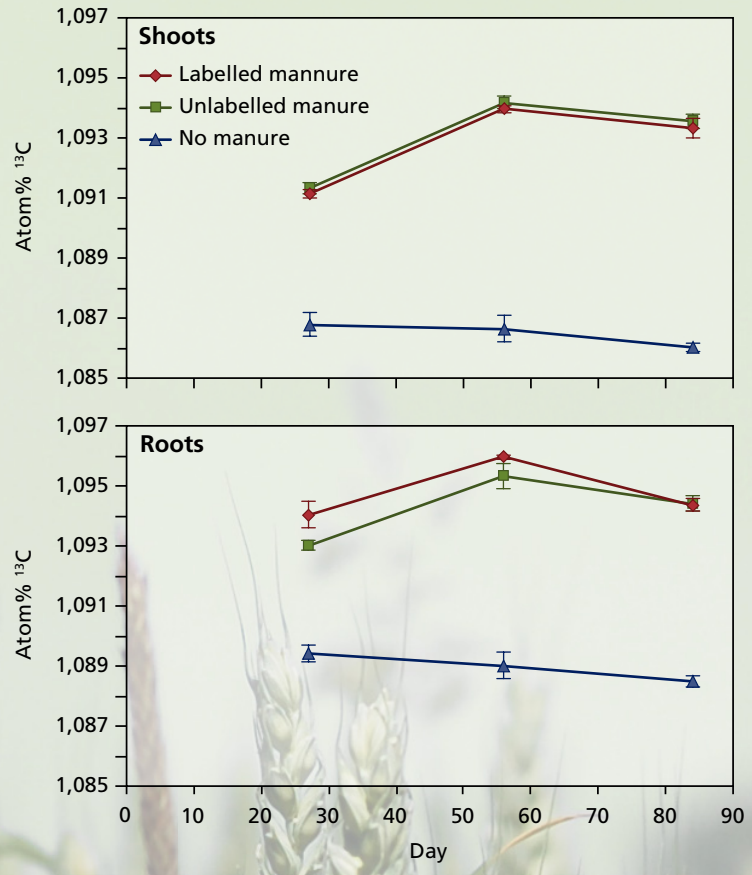
Dual-labelled $^{13}C/^{15}N$ green manure was added to soils with wheat plants. An advantage of using dual-labelled green manure as opposed to pulse injection of dual-labelled amino acids is that the amino acids in the fertilizer are released gradually and naturally, and that N dynamics and assimilation can be monitored.

Results and Discussion

The plants were harvested after 27, 56 and 84 days after sowing.

The study gave a clear indication of uptake of organic N using the ^{13}C values. A small, but significantly higher ^{13}C value was measured in roots from the labelled treatments at 27 days.

Uptake of ^{15}N derived from the green manure was for all three harvest dates 88.6% (±0.7) and 83.3% (±0.9), for shoots and roots, respectively. This significant difference might be explained by a differential assimilation of N forms in the different plant compartments. Losses of C and N from the soil-plant system occurred mainly within the initial 27 days, which suggest a pre-emptive decoupling of dual-labelled molecules.



Conclusions

The uptake of organic N was estimated at 1.5% to 4.4% of total root N. This supports the hypothesis that organic N uptake does not contribute substantially to N acquisition in plants. Nonetheless, the use of $^{13}C/^{15}N$-labelled green manure in this study gave evidence of some organic N uptake in wheat. Future studies with ^{13}C enriched green manures and other plant species are needed to reveal this more clearly.

IsoLife's goal is to supply ecological research with stable isotope labelled plant components. These products can be used in complex environments.

IsoLife produces plant components, up to uniformly labelled with stable isotopes like ^{13}C and ^{15}N. They are obtained by the cultivation of food plants and herbal species in advanced ESPAS phytotrons.

Applications

- Determining plant uptake of organic materials from e.g. green manure (Larsen *et al.*, 2006; this poster)
- Analysing the active microbes in complex eco-systems using Stable Isotope Probing (SIP) (Boschker *et al.*, 1998, Nature 392, 801–805; Radajewski *et al.*, 2000, Nature 403: 646–649)
- Tracing organic matter decomposition processes in soil
- Analyses of carbon and energy flows in complex food webs

Two product lines of unique products comprise a range of:

- unprocessed plant organs of food crops and herbal species like leaves, stems, roots etc.
- processed plant materials like purified cellulose, hemi-cellulose, lignin etc.

Important advantages are:

- a high detection sensitivity based on a stable isotope enrichment up to 98% (uniformly labelled)
- harmlessness for humans, animals and environment

Contact

Thomas Larsen
thl[a]dmu.dk
www.dmu.dk

Ton Gorissen
info[a]isolife.nl
www.isolife.nl