

7th International Nitrogen Initiative Conference, Melbourne, 2016

**Compost-N recovery:
 ^{15}N natural abundance quantitative approach**

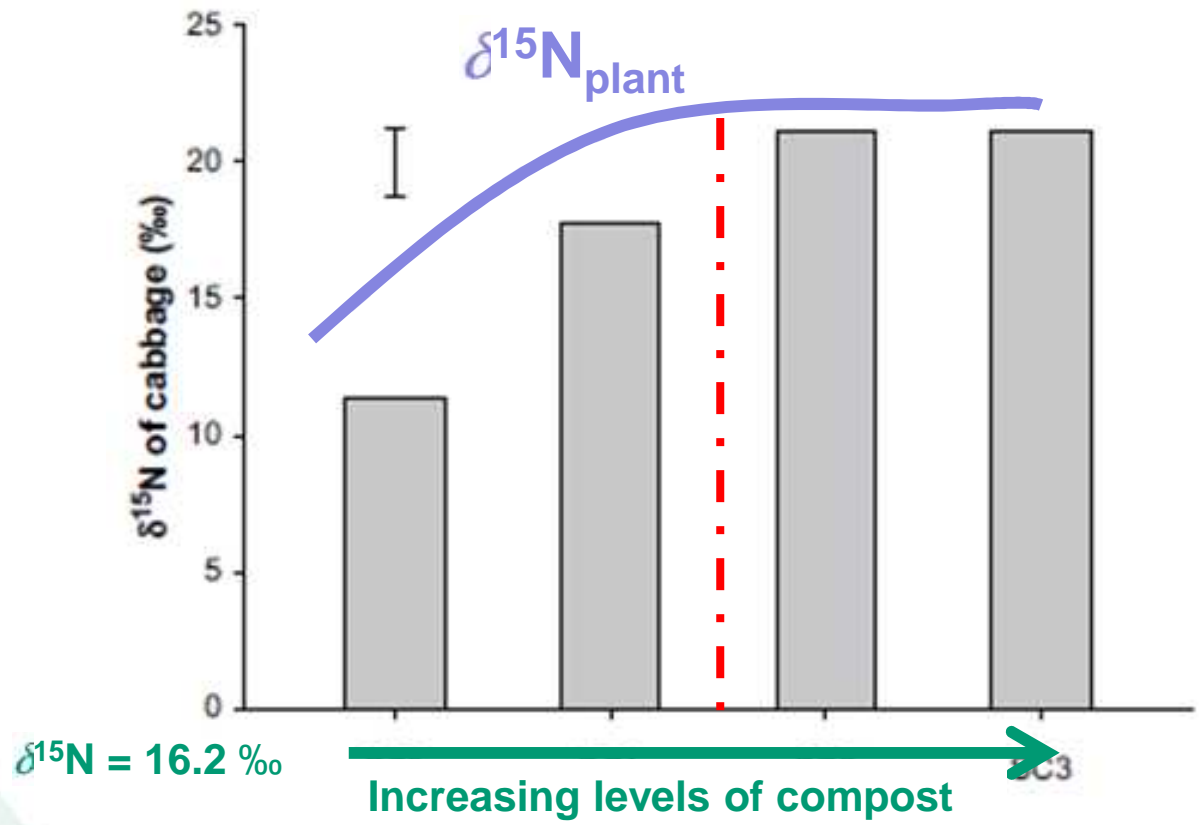
Caio T. Inácio, Segundo Urquiaga, Phillip M. Chalk



Introduction

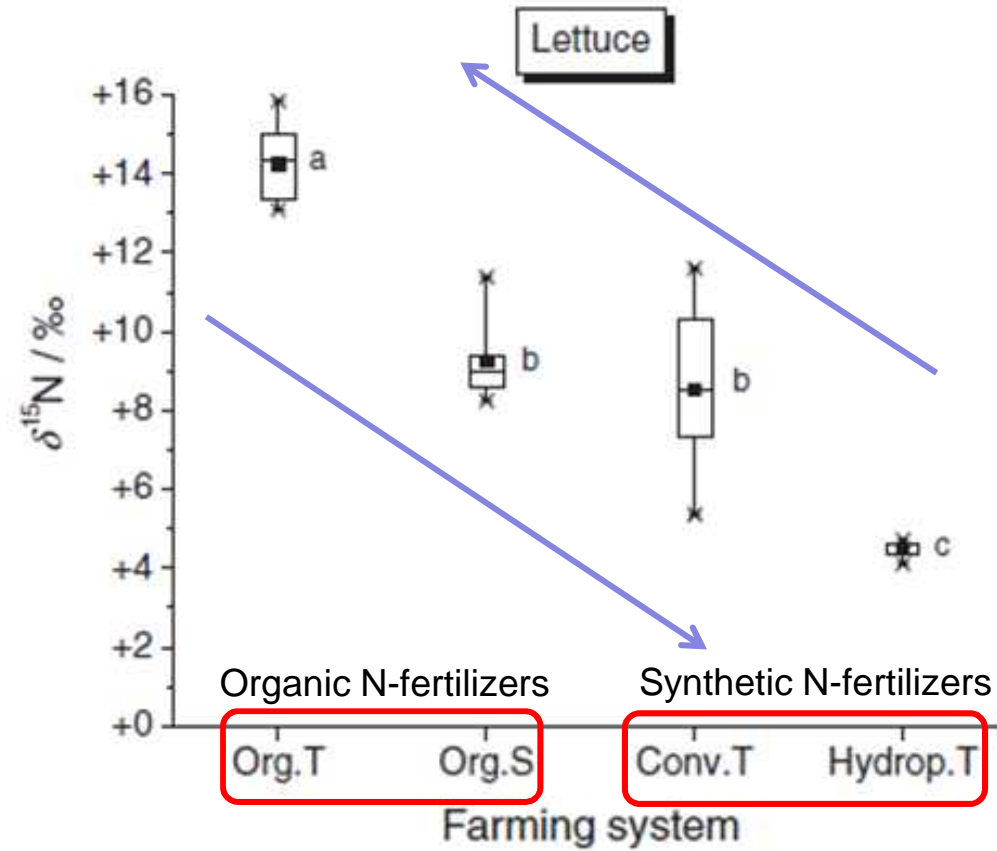
**^{15}N natural abundance of
composts or manures as a
tracer of N?**

Introduction



Yun and Ro (2009) SBB 41, 1541-1547

Introduction



Inácio et al. (2015) JFSA 95, 3025-3032

Objective

This study aimed to verify the feasibility of
using $\delta^{15}\text{N}$ value to estimate
compost-N recovery by plants.

Methods Experimental



Compost: C:N = 12.8 e N = 1.4 %

Levels

0, 5, 10, 15, 20, 25 Mg ha⁻¹

(0, 70, 140, 210, 280, 350 kg N ha⁻¹)

Randomized Complete Blocks Design

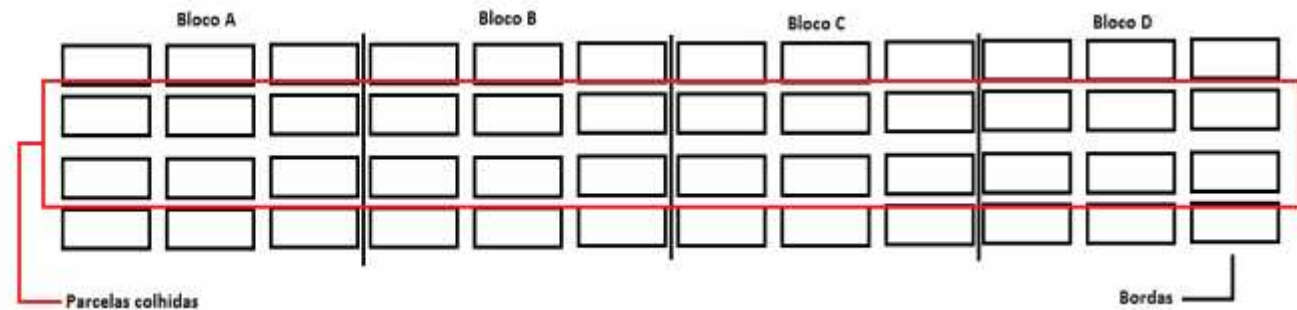
Head Lettuce



Carrot



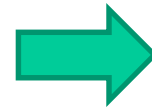
Broccoli



Methods Elemental and Isotopic Analises



Samples



40 μg N



$\delta^{15}\text{N}$ ‰
values
(± 0.2)

Methods Experimental

❖ **SOIL_{0-20cm}** $\delta^{15}\text{N} = 12.3 \pm 0.4 \text{ ‰}$

❖ **COMPOST** $\delta^{15}\text{N} = 15.5 \pm 0.2 \text{ ‰}$



Results

Isotopic fractionation

$\delta^{15}\text{N}$ -values at level zero-compost (control)

Lettuce $\delta^{15}\text{N} = 12.4 \pm 0.2 \text{ ‰}$

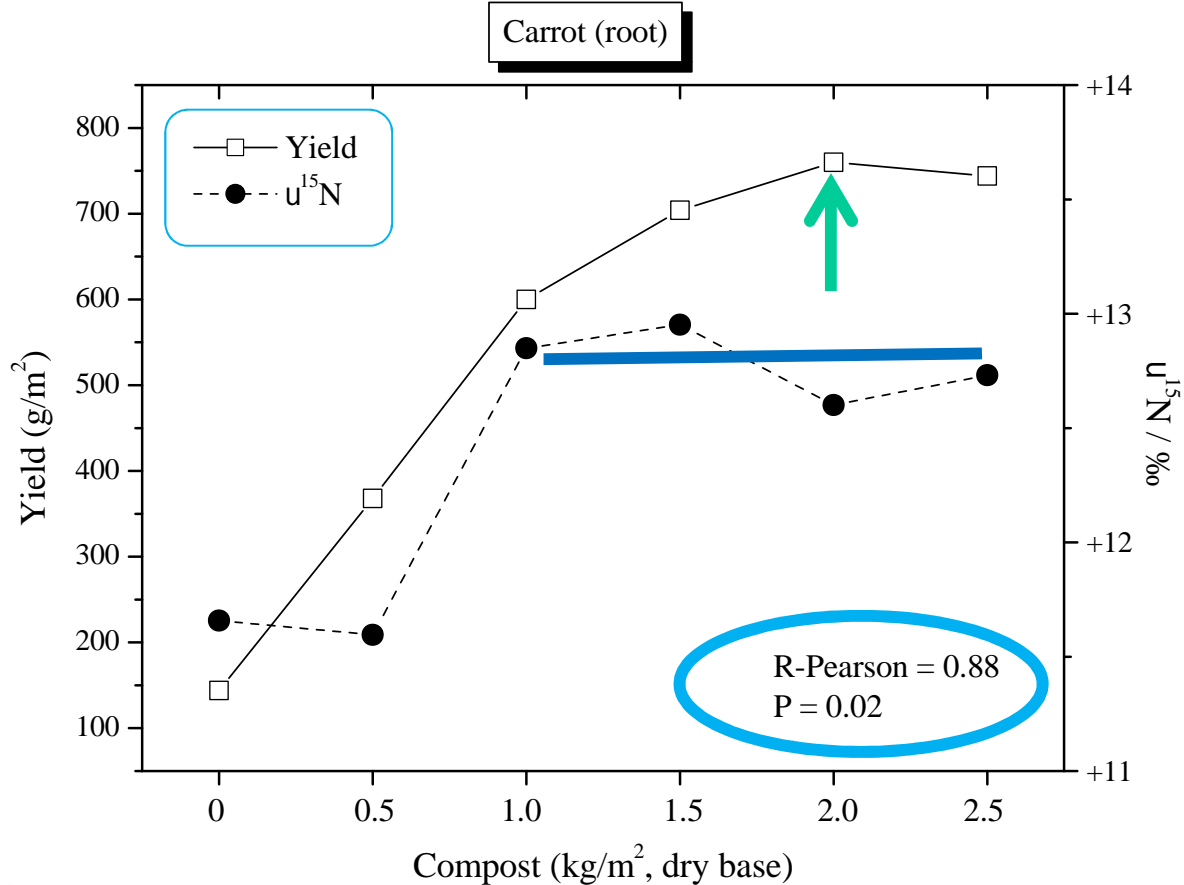
Carrot $\delta^{15}\text{N} = 11.7 \pm 0.2 \text{ ‰}$ (root) and $11.8 \pm 0.4 \text{ ‰}$ (shoot)

Broccoli $\delta^{15}\text{N} = 11.9 \pm 0.4 \text{ ‰}$

No statistical difference

between $\delta^{15}\text{N}$ -soil and $\delta^{15}\text{N}$ -plants

Results Yield response and $\delta^{15}\text{N}$ values



Results

Yield response and $\delta^{15}\text{N}$ values

Pearson correlation

Carrot-roots ($r = 0.88$, $P = 0.02$)

Carrot-shoots ($r = 0.76$, $P = 0.08$)

Broccoli ($r = 0.62$, $P = 0.19$)

Lettuce ($r = -0.43$, $P = 0.40$)

Results Compost-N recovery

$$\%NRec = \left[(\delta_{\text{plant}+} - \delta_{\text{plant}-}) \div (\delta_{\text{compost}} - \delta_{\text{soil}}) \right]$$

$P_{\text{co}} \times [N_{\text{harvested}} \div N_{\text{applied}}]$

Results Compost-N recovery (%)

Vegetable	Levels of compost (kg / m ² , dry base)				
	0.5	1.0	1.5	2.0	2.5
Lettuce	2	3	2	4	3
Carrot	4	9	8	4	4
Broccoli	108 ?	80 ?	9	12	18

➔ With ¹⁵N enriched range from **3.8 to 26.8 %** (from literature*)
 More common estimates range from **8 to 12 %**

The estimates depend on R-Pearson significance!

*Chalk et al. (2013) Plant Soil 362, 373-388

Conclusions

- » **Theoretical and experimental basis** of using $\delta^{15}\text{N}$ values to estimate compost-N recovery by plants. **However,...**
 - » **Difference between $\delta^{15}\text{N}$ -soil and $\delta^{15}\text{N}$ -compost should be larger !!!**
 - » **Intra-specific $\delta^{15}\text{N}$ -plant variation may be really a problem !!!**
 - » **Influence of $\delta^{15}\text{N}$ variation of inorganic N should be investigated !!!**

Forward

- » Validation by **comparing** ^{15}N natural abundance with ^{15}N enrichment techniques (**^{15}N -labeled compost**).



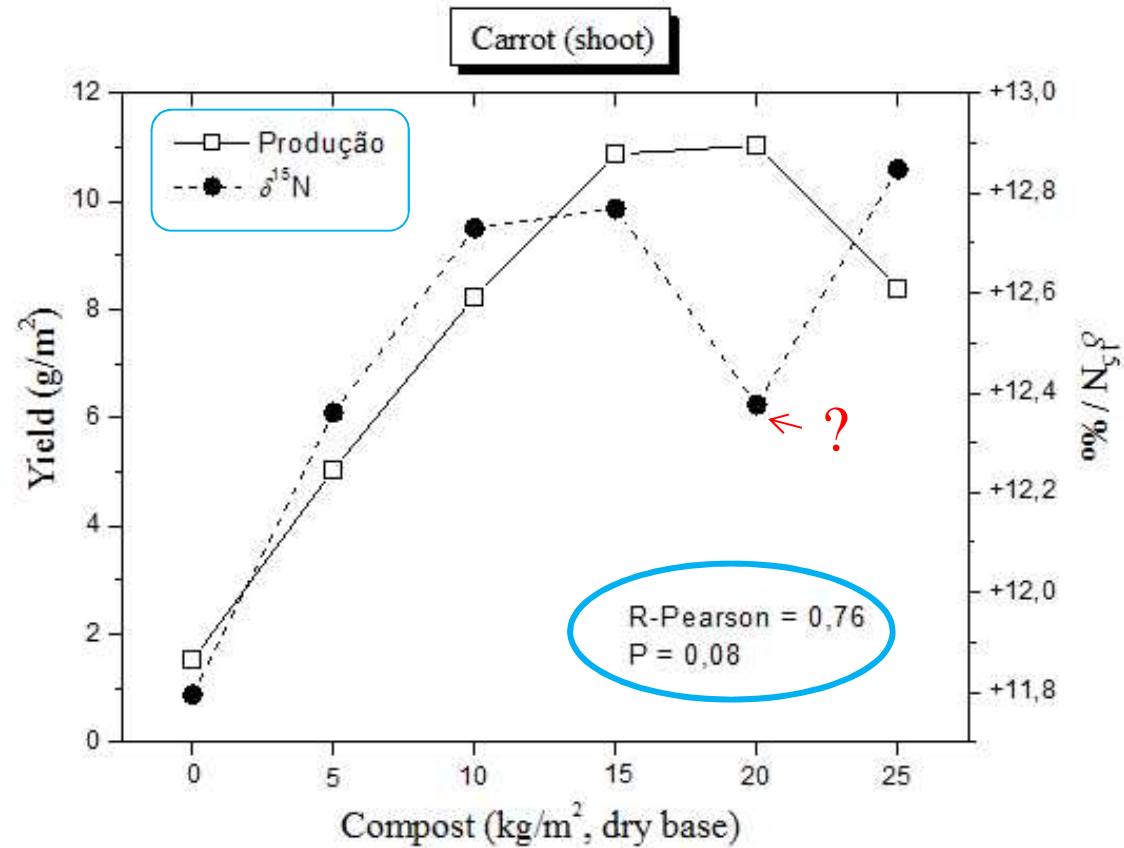
Thank you
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Botanic Garden of Rio de Janeiro, Visitor Center

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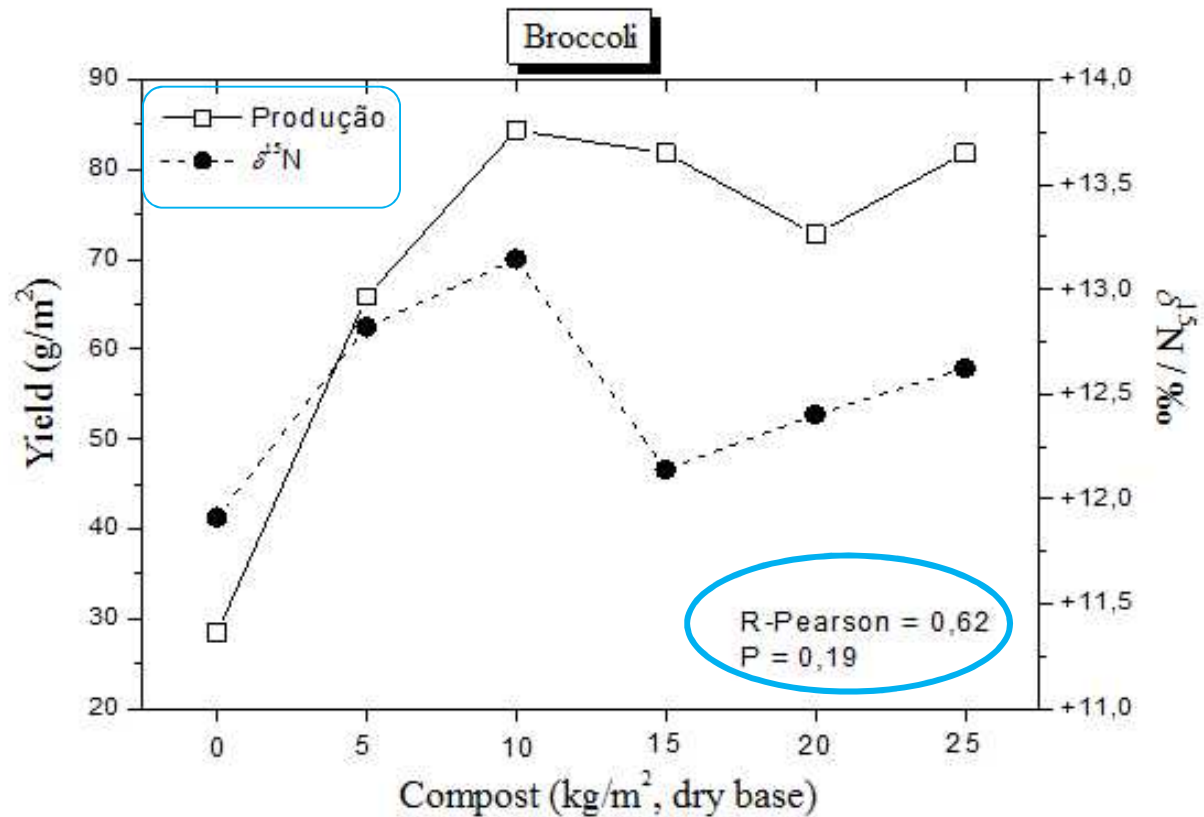
Additional slides

Results Yield response and $\delta^{15}\text{N}$ values



Results

Yield response and $\delta^{15}\text{N}$ values



Results Yield response and $\delta^{15}\text{N}$ values

