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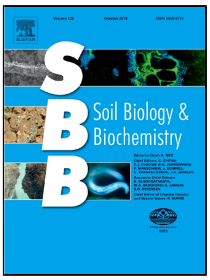

Can N fertilizer use efficiency be estimated using ^{15}N natural abundance?

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Short communication

Can N fertilizer use efficiency be estimated using ^{15}N natural abundance?

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ABSTRACT Nitrogen fertilizer use efficiency can be estimated by using ^{15}N enriched or ^{15}N depleted synthetic fertilizers. However, it has also been proposed that differences in the relative natural ^{15}N abundances ($\delta^{15}N$) of soil and fertilizer N can be used to estimate efficiency. This proposition is examined in this short communication on the basis of theory and published experimental data. The data did not support the concept that fertilizer use efficiency can be quantitatively estimated using $\delta^{15}N$ data, because of isotopic fractionation during transformations and uptake of fertilizer-derived N in the soil-plant system. Isotopic fractionation ($\delta^{15}N$, ‰) was quantified by interpolation using fertilizer use efficiency estimated by ^{15}N enrichment.

Keywords: ^{15}N natural abundance. $\delta^{15}N$. Fertilizer use efficiency. Nitrogen fertilizer

N fertilizer use efficiency (NFUE) or N fertilizer recovery (R) can be estimated by the N difference method which involves measurement of the difference in plant N uptake in treatments with (+N) and without (–N) fertilizer addition, expressed as a fraction of the fertilizer N added (Eq. 1).

$$\text{NFUE} = \frac{\text{Plant N}_{(+\text{N})} - \text{Plant N}_{(-\text{N})}}{\text{Fertilizer N}} \quad (1)$$

It can also be estimated using ^{15}N labelled fertilizers, either enriched (Hauck and Bremner, 1976) or depleted in ^{15}N (Chalk, 2018). For a ^{15}N enriched fertilizer source, the fraction of plant N derived from the fertilizer (Ndff) is expressed by Eq. 2, and calculated according to Eq. 3 (Hauck and Bremner, 1976).

$$\text{Ndff} = \frac{^{15}\text{N enrichment}_{\text{plant}}}{^{15}\text{N enrichment}_{\text{fertilizer}}} \quad (2)$$

where ^{15}N enrichment is expressed as atom % excess.

$$= \frac{A_{\text{plant}(+\text{N})} - A_{\text{plant}(-\text{N})}}{A_{\text{fertilizer}} - 0.3663} \quad (3)$$