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

Phillip M. Chalk



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1 Short communication

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

3 Phillip M. Chalk

4 *Faculty of Veterinary and Agricultural Sciences, University of Melbourne, Parkville 3010,*
 5 *Victoria, Australia.*

6 E-mail: chalkphillip@gmail.com

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

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

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

$$21 \quad \text{NFUE} = \frac{\text{Plant N}_{(+N)} - \text{Plant N}_{(-N)}}{\text{Fertilizer N}} \quad (1)$$

22 It can also be estimated using ^{15}N labelled fertilizers, either enriched (Hauck and Bremner,
 23 1976) or depleted in ^{15}N (Chalk, 2018). For a ^{15}N enriched fertilizer source, the fraction of plant
 24 N derived from the fertilizer (Ndff) is expressed by Eq. 2, and calculated according to Eq. 3
 25 (Hauck and Bremner, 1976).

$$26 \quad \text{Ndff} = \frac{{}^{15}\text{N enrichment}_{\text{plant}}}{{}^{15}\text{N enrichment}_{\text{fertilizer}}} \quad (2)$$

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

$$28 \quad = \frac{A_{\text{plant}(+N)} - A_{\text{plant}(-N)}}{A_{\text{fertilizer}} - 0.3663} \quad (3)$$

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