Use of $^{15}\text{N}$ Enriched Plant Material for Labelling of Soil Nitrogen in Legume Dinitrogen Fixation Experiments

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The soil nitrogen in a field plot was labelled with nitrogen-15 (15N) by incorporating labelled plant material derived from previous experiments. The nitrogen added in plant material corresponded to approx. 3% of total N present in the top soil (0-20 cm). The 15N enrichment of the plant N was approx. 1 atom % 15N. The plot was used the following 3 years for determination of the amount of N2 fixed by different leguminous plants. The atom % N excess in grains of cereals grown as reference crops was 0.20, 0.05 and 0.03 in the 3 years, respectively. In the first year the level of enrichment was adequate for estimating symbiotic nitrogen fixation. In the second and third year lack of precision in determination of the $^{15}\text{N}/^{14}\text{N}$ ratios of legume N, may have caused an error in estimates of nitrogen fixation. In the first year 77% of the nitrogen taken up in a pea crop was derived from nitrogen fixation. Four years after incorporating the labelled plant material, the 15N enrichment of the plant available soil N, released by mineralization, was 0.04. The enrichment of the inorganic N pool approached thus a stable level after 2 to 3 years. The enrichment of the total soil was, however, only 0.014 atom % 15N excess. About 23% of the labelled N was taken up by plants during the 3 years of cropping; after 4 years about 44% of the labelled N was found still to be present in the top soil. The labelling of the soil nitrogen with organic bound $^{15}\text{N}$, compared to adding mineral $^{15}\text{N}$ at sowing, is advantageous because the labelled N is released by mineralization so that the enrichment of the plant available soil N pool become more uniform during the growth season; and high levels of mineral N, which may depress the fixation process, is avoided.

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