Novel Metabolism of Nitrogen in Plants

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Z. Naturforsch. **60 c**, 265–271 (2005)

Our previous study showed that approximately one-third of the nitrogen of ^{15}N-labeled NO_2 taken up into plants was converted to a previously unknown organic nitrogen (hereafter designated UN) that was not recoverable by the Kjeldahl method (Morikawa *et al.*, 2004). In this communication, we discuss metabolic and physiological relevance of the UN based on our newest experimental results. All of the 12 plant species were found to form UN derived from NO_2 (about 10–30% of the total nitrogen derived from NO_2). The UN was formed also from nitrate nitrogen in various plant species. Thus, UN is a common metabolite in plants. The amount of UN derived from NO_2 was greatly increased in the transgenic tobacco clone 271 (Vaucheret *et al.*, 1992) where the activity of nitrite reductase is suppressed less than 5% of that of the wild-type plant. On the other hand, the amount of this UN was significantly decreased by the overexpression of *S*-nitrosoglutathione reductase (GSNOR). These findings strongly suggest that nitrite and other reactive nitrogen species are involved in the formation of the UN, and that the UN-bearing compounds are metabolizable. A metabolic scheme for the formation of UN-bearing compounds was proposed, in which nitric oxide and peroxynitrite derived from NO_2 or endogenous nitrogen oxides are involved for nitrosation and/or nitration of organic compounds in the cells to form nitroso and nitro compounds, including *N*-nitroso and *S*-nitroso ones. Participation of non-symbiotic haemoglobin bearing peroxidase-like activity (Sakamoto *et al.*, 2004) and GSNOR (Sakamoto *et al.*, 2002) in the metabolism of the UN was discussed. The UN-bearing compounds identified to date in the extracts of the leaves of *Arabidopsis thaliana* fumigated with NO_2 include a Δ^2-1,2,3-thiadiazoline derivative (Miyawaki *et al.*, 2004) and 4-nitro-β-carotene.

Key words: Nitrogen Metabolism, Nitrogen Oxides, Reactive Nitrogen Species