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## The Contributions of Nitrogen Fixation by Field-grown Common Beans to N Balances in Agricultural Production Systems of Kakamega District

FRANCIS E.A. NGOME, FRANK MUSSGNUG, MATHIAS BECKER

*University of Bonn, Institute of Crop Science and Resource Conservation - Plant Nutrition, Germany*

### Abstract

Land use and cropping intensification without resource base conservation causes a decline in soil fertility, which limits agricultural production in Western Kenya. Widespread N and P deficiencies appear to be the main culprits of the observed declining yield trends. The common bean (*Phaseolus vulgaris* L.) is widely cultivated for subsistence by farmers on 60–80 % of their agricultural land area. This field-grown common bean is likely to contribute N by BFN which might differ between soil types and cropping or management systems. Hence, field experiments were conducted in 21 selected prototypic farmers' fields in Kakamega District, Kenya, during the short rains of 2005. The biomass, N accumulation, and the share of N derived from BNF ( $^{15}\text{N}$  natural abundance method) by common beans were determined under 7 management scenarios. The total N accumulation by common bean ranged from 6–83 kg ha<sup>-1</sup> with some 4–55 kg ha<sup>-1</sup> derived from the soil and the remainder being derived from BNF. The sole crop common bean accumulated 2 times more biomass and BFN-N compared to the intercrop, and treatments in the Alfisol accumulated only 70–80 % compared to those of the Ultisol zone (3–27 kg N ha<sup>-1</sup>). In addition, the share of N derived from the atmosphere (%Ndfa) was 20–54 and 19–50 %Ndfa for the Alfisol and Ultisol zones, respectively. Meanwhile the %Ndfa under farmers' management was only 30–39 % in the Alfisol and 21–33 % in the Ultisol. This share of biologically fixed N was larger in mixed maize-common bean than in sole crop situations. The addition of organic or of mineral N fertiliser tended to reduce %Ndfa, while improved weed control and P fertiliser application resulted in a significant increase in N accumulation and Ndfa. It may be concluded that field-grown common beans have the potential to contribute to the N pool of the cropping system of Western Kenya by BNF. However, this will largely depend on P application and weed control.

**Keywords:** Biological N<sub>2</sub> fixation, delta 15-N, Kenya, *Phaseolus vulgaris* L