

A staggered maize–legume intercrop arrangement robustly increases crop yields and economic returns in the highlands of Central Kenya

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Abstract

Smallholder farmers in East-Africa commonly intercrop maize (*Zea mays* L.) with grain legumes to maximize utilisation of land and labour, and attain larger crop yields. Conventionally, one legume line is intercropped between each pair of maize lines. This study evaluated the potential of a modified two-by-two staggered arrangement (MBILI) to increase crop yields and economic benefits in two sites in Central Kenya with contrasting soil fertility levels during 7 consecutive seasons. Common beans (*Phaseolus vulgaris* L.), cowpea (*Vigna unguiculata* (L.) Walp.) and groundnut (*Arachis hypogaea* L.) were grown as legume intercrops.

The MBILI system resulted in increased maize yields in both sites, and increased cowpea yields in the poor site. In the fertile site, using beans as an intercrop was most profitable, and the MBILI system increased net benefits by 40%, relative to the conventional system. In the poor site, groundnut and cowpea were better adapted, and the MBILI system increased net benefit by 12–37%. Positive effects of the MBILI system were most pronounced in the poor site, but occurred independent of soil fertility level. Rainfall amounts and distribution varied widely, but the MBILI system increased yields both under conditions of ample and inadequate rainfall. N balances were negative with beans and groundnut, but neutral with cowpea as the intercrop.

A modest N fertilizer application is therefore essential to sustain yields in the long term, especially when beans or groundnuts are intercropped. In conclusion, the MBILI system, when combined with adjusted nutrient inputs, resulted in superior and robust improvements in crop yields and economic benefits, relative to the conventional intercropping system.