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## The Impact of Integrated Soil Fertility Management Practices (ISFM) on Dry Grain Yields of Teff, Wheat, Barley, Maize, Sorghum and Faba Bean of Small Scale Farmers in the Ethiopian Highlands

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### Abstract

Ethiopia's food security and economy depends on its agricultural production. Crop yields are, however, below expected values, particularly on the high degraded soils in the highlands. Cereals account for about 75% of the total area cultivated. We investigated the increased production of selected cereals along with that of the legume faba bean by using integrated soil fertility management practices restoring soil fertility and thereby increasing productivity. To reduce the impact of environmental factors, such as terrain elevation/slope, weather/climate or soil's water/nutrition availability, we used a paired data approach by splitting fields of small-scale farmers into a treatment and control plot growing the same crop with varying treatment elements.

This study examined the yield response of teff, wheat, maize, and faba bean to the individual and combined effects of multiple technologies of integrated soil fertility management practices (ISFM) under small scale farming conditions. Dry grain yields of crops in defined micro-watersheds were recorded for three years along with the information on the use of improved seed, line seeding, Lupine-based green manure, lime, organic fertiliser, blended fertiliser, urea-split dressing and Rhizobia-based biofertiliser for legumes. Yields in kg per hectare were on average for control and treatment fields for teff 1346 and 2220, wheat 2839 and 4552, maize 4879 and 8224, and faba beans 1895 and 3354, respectively. Using linear mixed models (LMM) with field code, year and woreda as random factors, we found that treatment had a significant effect on increased yields of on average +1500 kg ha<sup>-1</sup> (s.e., 186.37; d.f., 1760.9, t-value, 8.05,  $p < 0.01$ ). Since crops showed significantly varying yields alone and in combination with treatment, we analysed the various treatment practices along with total N mineral application, disaggregated for teff, maize, wheat and faba bean. For analysed crops we found that one or more integrated soil fertility management practices enhanced resulting crop yields significantly.

Our results indicate that practicing integrated soil fertility management can significantly drive yield increases of crops of small scale farmers in the highlands of Ethiopia while contribute to soil rehabilitation and sustainably improve soil health for stable yields.

**Keywords:** Ethiopia, integrated soil fertility management, iSFM, productivity increase , small-scale farming, soil fertility